Kawasaki

BRUTE FORCE 750 4×4i

KVF750 4×4

All Terrain Vehicle Service Manual

Quick Reference Guide

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

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

Kawasaki

BRUTE FORCE 750 4×4i
KVF750 4×4

All Terrain Vehicle Service Manual

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LIST OF ABBREVIATIONS

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

COUNTRY AND AREA CODES

AU	Australia	GB	United Kingdom
CA	Canada	US	United States
EUR	Europe		

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 United States Environmental Protection Agency.

1. Crankcase Emission Control System
   A sealed-type crankcase emission control system is used to eliminate blow-by gases. The blow-by gases are led to the breather chamber through the crankcase. Then, it is led to the air cleaner. Oil is separated from the gases while passing through the inside of the breather chamber from the crankcase, and then returned back to the bottom of crankcase.

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

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

   The Clean Air Act, which is the Federal law covering motor vehicle pollution, contains what is commonly referred to as the Act's "tampering provisions."
   "Sec. 203(a) The following acts and the causing thereof are prohibited...

3. Evaporative Emission Control System
   The evaporative emission control system for this vehicle consists of low permeation fuel hoses and a fuel tank.

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

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

NOTE

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

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

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

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

TAMPERING WITH EMISSION CONTROL SYSTEM PROHIBITED:

Federal regulations and California State law prohibit 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 purposes of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

Do not tamper with the original emission related parts:

- Throttle body or internal parts
- Spark plugs
- Magneto ignition system
- Fuel pump/Fuel injectors
- Air cleaner element
- Electronic control unit (ECU)

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 or any internal portion of the muffler.
* Removal of the air cleaner housing or air cleaner housing cover.
* Modifications to the muffler or air intake system by cutting, drilling, or other means if such modifications result in increased noise levels.
* Modification to the air cleaner element.

Foreword

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

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

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

To get the longest life out of your vehicle:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki Vehicle parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki vehicles are introduced by the 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 symbols, heed their instructions! Always follow safe operating and maintenance practices.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

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

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

NOTE

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

● Indicates a procedural step or work to be done.

○ Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a NOTE.

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

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

General Information

Table of Contents

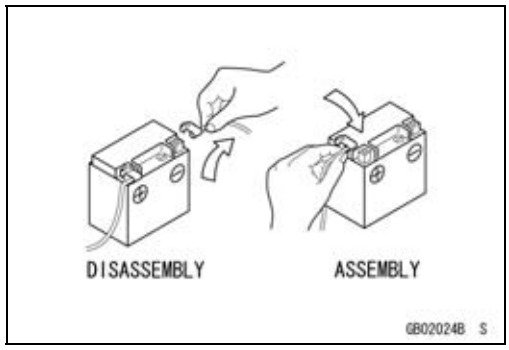
Before Servicing

Before starting to perform an inspection service or carry out a disassembly and reassembly operation on a vehicle, 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:

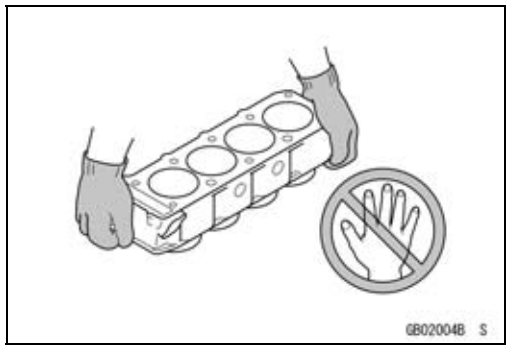
Battery Ground

Before completing any service on the vehicle, 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.



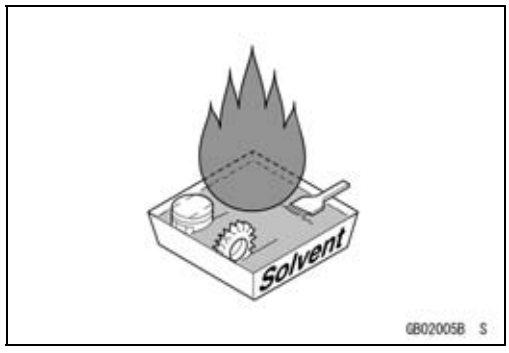
Edges of Parts

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



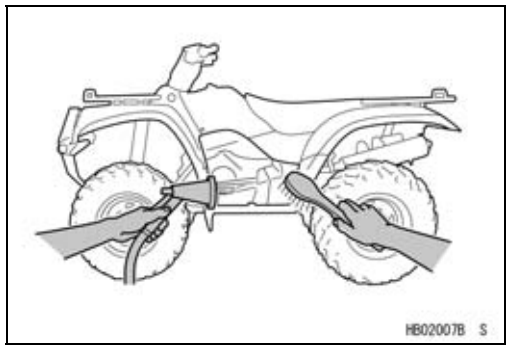
Solvent

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

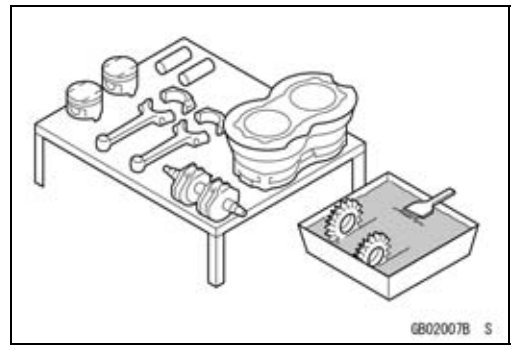
Clean the vehicle thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during vehicle disassembly can cause excessive wear and decrease performance of the vehicle.



Before Servicing

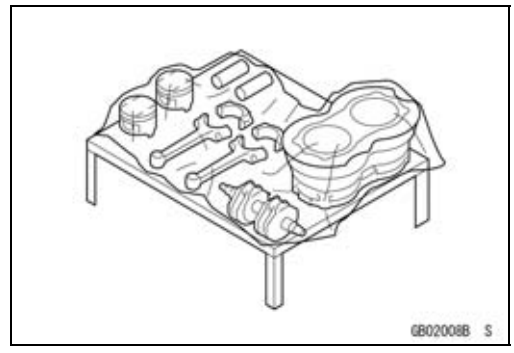
Arrangement and Cleaning of Removed Parts

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.



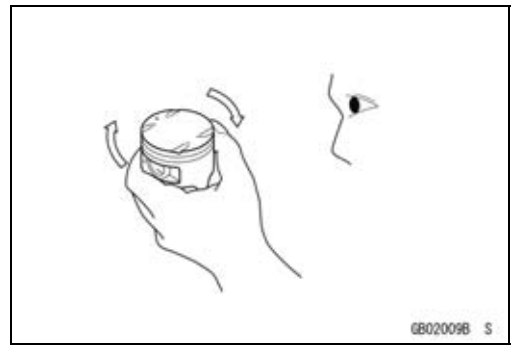
Storage of Removed Parts

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.



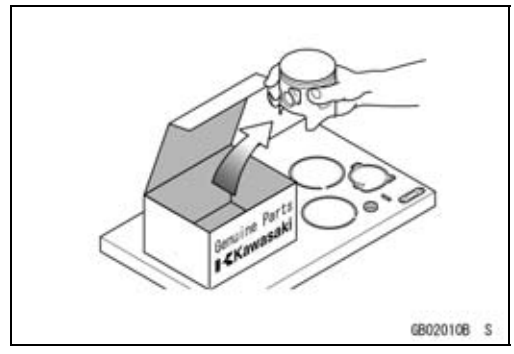
Inspection

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.



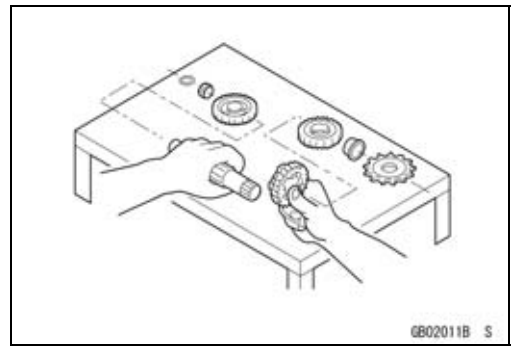
Replacement Parts

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

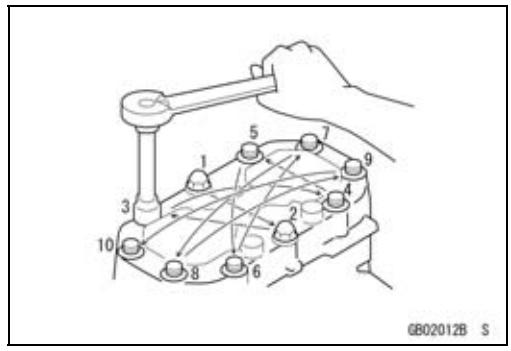
In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.



Before Servicing

Tightening Sequence

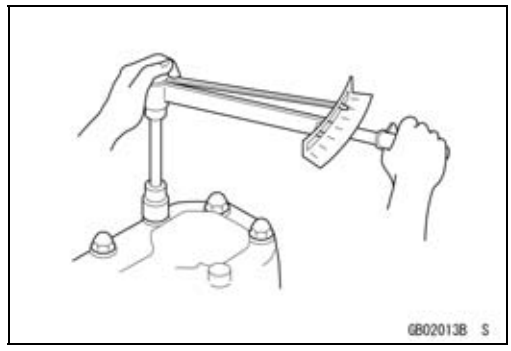
Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. Conversely when loosening the bolts, nuts, or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



Tightening Torque

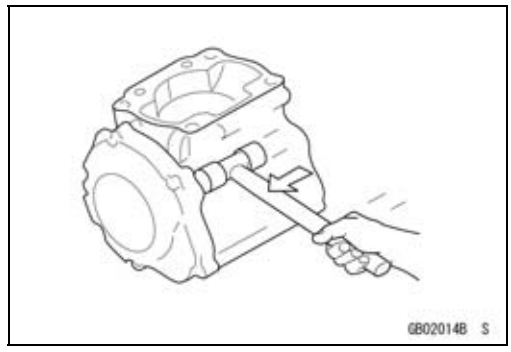
Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.

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



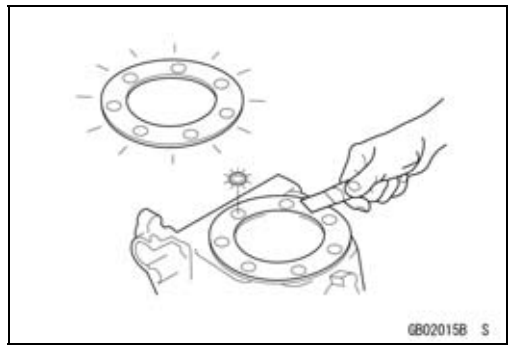
Force

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.



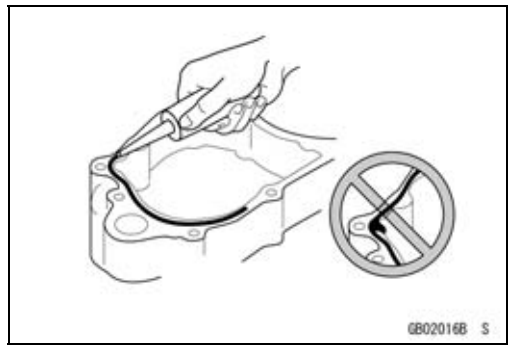
Gasket, O-ring

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

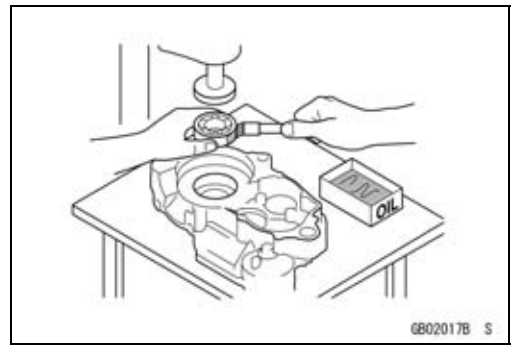
For applications that require Liquid Gasket or a Non-Permanent Locking Agent, clean the surfaces so that no oil residue remains before applying liquid gasket or locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



Before Servicing

Press

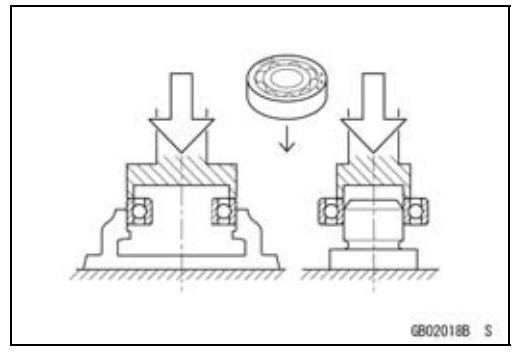
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing and Needle Bearing

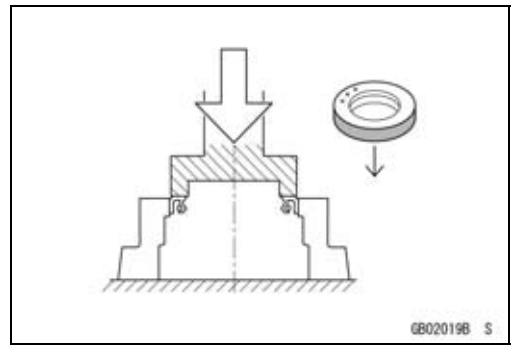
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

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

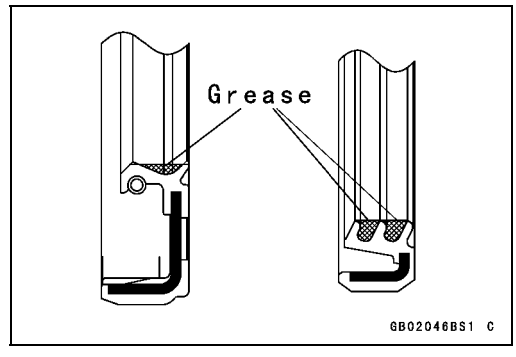


Oil Seal, Grease Seal

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.

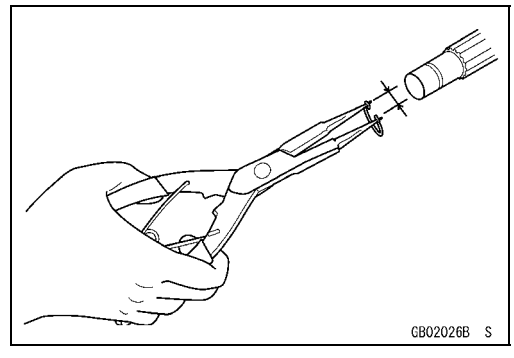


Apply specified grease to the lip of seal before installing the seal.



Circlips, Cotter Pins

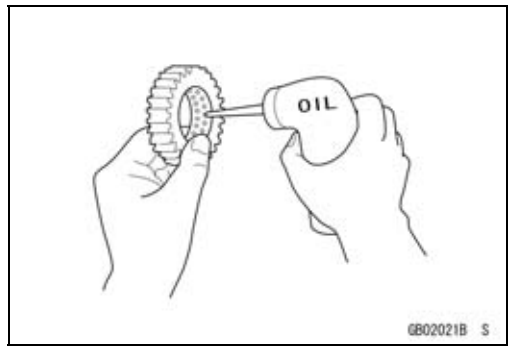
Replace circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.



Before Servicing

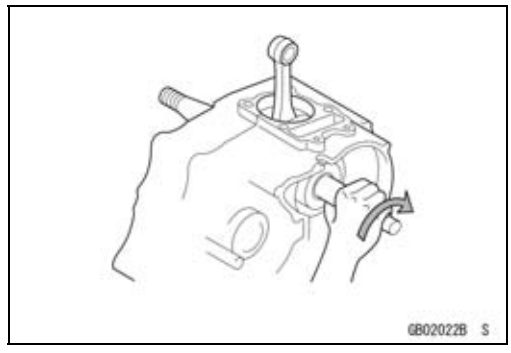
Lubrication

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.



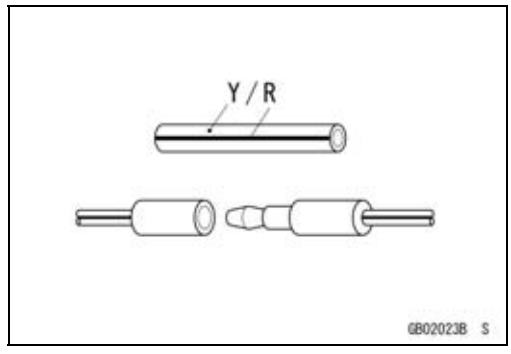
Direction of Engine Rotation

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).



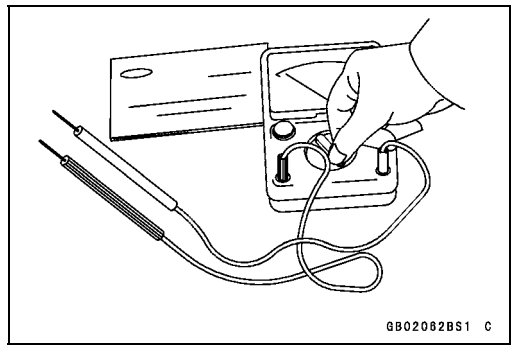
Electrical Wires

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

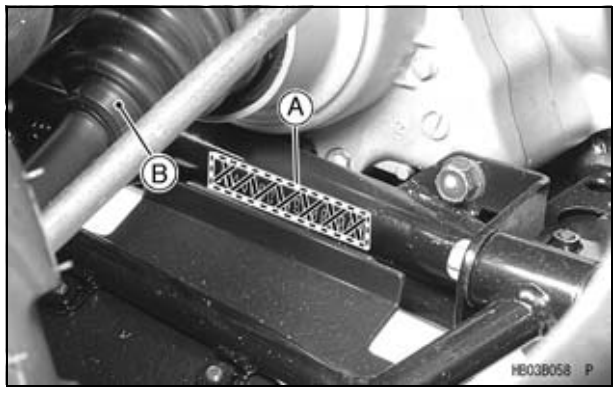
KVF750D8F Left Side View

KVF750D8F Right Side View

The KVF750E is a camouflage-surface-treated model and identical to the KVF750D, the base model, in every other aspect: controls, features, and specifications.
The KVF750F is a model with paint finish and is identical to the KVF750D in every other aspect, that is, controls, features, and specifications.

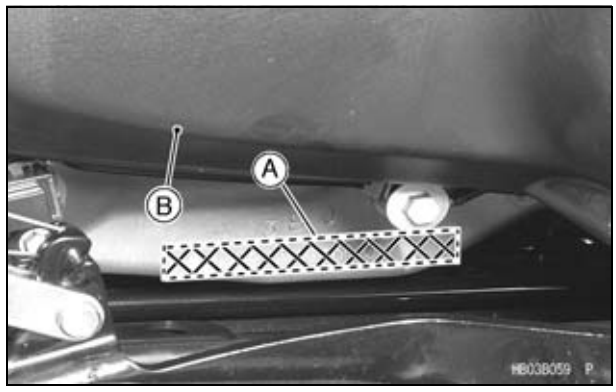
Model Identification

Frame Number



[A] Frame Number
[B] Left Front Axle

Engine Number



[A] Engine Number
[B] Torque Converter Cover

General Specifications

Items	KVF750D8F ~ DBF, E8F ~ EBF, F8F, FAF~ FBF
Dimensions	
Overall Length	2 195 mm (86.42 in.)
Overall Width	1 166 mm (45.90 in.)
Overall Height	1 233 mm (48.54 in.)
Wheelbase	1 284 mm (50.55 in.)
Ground Clearance:	247 mm (9.72 in.)
Seat Height	903 mm (35.6 in.)
Dry Mass	(KVF750D8F (US, CA, AU)/E8F/F8F) 274.5 kg (605.3 lb), (KVF750D8F (EUR)) 275 kg (606 lb)
Curb Mass:	(KVF750D9F (US, CA, AU) ~/E9F ~/FAF ~) 296 kg (653 lb), (KVF750D9F (EUR) ~) 297 kg (655 lb),
Front	(KVF750D8F (US, CA, AU)/E8F/F8F) 148.5 kg (327.4 lb) (KVF750D8F (EUR)/D9F(US, CA, AU) ~/E9F ~/FAF ~) 149 kg (328 lb) (KVF750D9F (EUR) ~) 150 kg (331 lb)
Rear	147 kg (324 lb)
Fuel Tank Capacity	19 L (5.0 US gal)
Performance	
Minimum Turning Radius	3.2 m (10.5 ft)
Engine	
Type	4-stroke, SOHC, V2-cylinders
Cooling System	Liquid-cooled
Bore and Stroke	85 × 66 mm (3.35 × 2.60 in.)
Displacement	749 cm^3 (45.7 cu in.)
Compression Ratio	8.8 : 1
Maximum Horsepower	37.1 kW (50.9 PS) @6 500 r/min (rpm), (CA), (US) – – –
Maximum Torque	59.4 N·m (6.2 kgf·m, 45 ft·lb) @4 500 r/min (rpm) (CA), (US) – – –
Carburetion System	FI (Fuel Injection) Mikuni ϕ36 × 2
Starting System	Electric Starter
Ignition System	Battery and Coil (transistorized)
Timing Advance	Electronically advanced (digital)
Ignition Timing	10° BTDC @1 100 r/min (rpm)
Spark Plug	NGK CR7E
Cylinder Numbering Method	Front to rear, 1-2
Firing Order	1-2
Valve Timing:	
Intake:	
Open	20° BTDC
Close	44° ABDC
Duration	244°

General Specifications

Items	KVF750D8F ~ DBF, E8F ~ EBF, F8F, FAF~ FBF
Exhaust:	
Open	44° BBDC
Close	20° ATDC
Duration	244°
Lubrication System	Forced lubrication (wet sump)
Engine oil:	
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1or MA2
Viscosity	SAE 10W-40
Capacity	2.6 L (2.7 US qt)
Drive Train	
Primary Reduction System:	
Type	Belt converter
Reduction Ratio	3.122 ~ 0.635
Transmission:	
Type	2-speed and reverse
Gear Ratios:	
Forward:	
High	3.098 (30/26 × 29/18 × 20/12)
Low	4.833 (36/20 × 29/18 × 20/12)
Reverse	4.028 (16/12 × 18/16 × 29/18 × 20/12)
Final Drive System:	
Type	Shaft 2WD/4WD
Reduction Ratio	4.375 (35/8)
Overall Drive Ratio:	
Forward:	
High	42.32 ~ 8.61
Low	66.02 ~ 13.43
Reverse	55.01 ~ 11.19
Front Final Gear Case Oil:	
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1or MA2
Viscosity	SAE10W-40
Capacity	0.40 L (0.42 US qt)
Rear Final Gear Case Oil:	
Type	MOBIL FLUID 424, CITGO TRANSGARD TRACTOR HYDRAULIC FLUID, or EXXON HYDRAUL 560
Capacity	0.72 L (0.76 US qt)
Frame	
Type	Double tubular
Caster (Rake Angle)	2.0°
Camber	0.6°
King Pin Angle	10.5°
Trail	12 mm (0.47 in.)

General Specifications

Items	KVF750D8F ~ DBF, E8F ~ EBF, F8F, FAF~ FBF
Tread:	
Front	930 mm (36.6 in.)
Rear	895 mm (35.2 in.)
Rim Size:	
Front	12 × 6.0
Rear	12 × 7.5
Front tire:	
Type	Tubeless
Size	AT25 × 8-12
Rear tire:	
Type	Tubeless
Size	AT25 × 10-12
Suspension:	
Front:	
Type	Double Wishbone
Wheel Travel	171 mm (6.73 in.)
Rear:	
Type	Double Wishbone
Wheel Travel	200 mm (7.87 in.)
Brake:	
Front	Disc × 2
Rear	Enclosed wet multi-plate
Parking Brake	Enclosed wet multi-plate
Electrical Equipment	
Battery	12 V 12 Ah
Headlight:	
Type	Semi-sealed beam
Bulb	12 V 40/40 W × 2
Tail/brake Light:	
Bulb	12 V 5/21 W
Reverse Light:	
Bulb	(EUR) 12 V 10 W
Alternator:	
Type	Three - phase AC
Rated Output	24.3 A, 14 V @6 000 r/min (rpm)

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

Unit Conversion Table

Prefixes for Units:

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

Units of Mass:

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume:

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

Units of Force:

N	×	0.1020	=	kg
N	×	0.2248	=	lb
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/cm²	×	98.07	=	kPa
kgf/cm²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

Units of Speed:

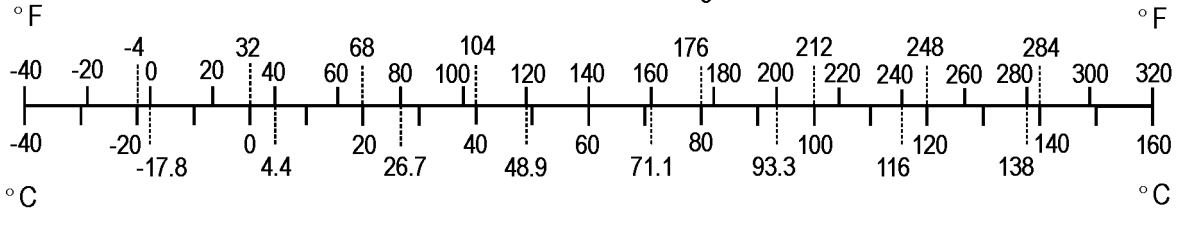
km/h	×	0.6214	=	mph

Units of Power:

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

Units of Temperature

$$\frac{9(^\circ C + 40)}{5} - 40 = {}^\circ F \qquad \frac{5(^\circ F + 40)}{9} - 40 = {}^\circ C$$



Periodic Maintenance

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Periodic Maintenance Chart

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

FREQUENCY / OPERATION	First Service	Regular Service				
	After 10 hrs. or 100 km (60 mi.) of use	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days, 1 700 km (1 100 mi.) of use or when belt indicator light turns on (100 hrs of use) whichever comes first	Every year of use	See page
ENGINE						
Converter drive belt wear-inspect*				●		2-24
Converter drive belt deflection- inspect*				●		2-25
Converter drive belt failure detection system function-inspect*				●		2-37
Engine brake control lever-inspect*				●		2-26
Air cleaner-inspect*	●	●				2-15
Throttle lever play-inspect	●	●				2-14
Idle speed-inspect			●			2-15
Valve clearance-inspect	First 1 700 km (1 100 mile); thereafter every 3 400 km (2 200 mile)					2-21
Engine oil-change*	●			●		2-26
Oil filter-replace*	●			●		2-27
Spark plug-clean and gap	●			●		2-36
Spark arrester-clean					●	2-23
Fuel hoses and connections-inspect				●		2-16
Fuel hose-replace	4 years					2-17
Radiator-clean*	●	●				2-18
Radiator hoses and connections-inspect*	●				●	2-19
Coolant-change*	2 years					2-19
CHASSIS						
Joint boots-inspect*	●	●				2-39
Rear brake pedal and lever play-inspect*	●	●				2-34
Rear brake plates-replace*	every 10 000 km (6 000 mi.)					2-34
Bolts and nuts-tighten	●	●				2-41
Front brake pad wear-inspect*	●		●			2-31
Brake light switch-inspect*	●		●			2-37
Steering-inspect	●			●		2-36
Differential control lever play-inspect	●	●				2-28
Tire wear-inspect*			●			2-28

2-4 PERIODIC MAINTENANCE

Periodic Maintenance Chart

FREQUENCY / OPERATION	First Service	Regular Service				
	After 10 hrs. or 100 km (60 mi.) of use	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days, 1 700 km (1 100 mi.) of use or when belt indicator light turns on (100 hrs of use) whichever comes first	Every year of use	See page
Front and rear final gear case oil-change	●				●	2-29
Rear propeller shaft universal joint lubrication-perform*				●		2-31
General lubrication-perform*			●			2-40
Front brake fluid level-inspect	●		●			2-32
Front brake fluid-change					●	2-33
Front brake hoses and connections-inspect				●		2-31
Front brake master cylinder piston assembly and dust cover-replace	2 years					2-34
Front brake caliper fluid seal and dust seal-replace	2 years					2-34
Front brake hose-replace	4 years					2-32

*: Service more frequently when operated in mud, dust, or other harsh riding conditions, or when carrying heavy loads or pulling a trailer.

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

Torque and Locking Agent

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

Letters used in the “Remarks” column mean:
L: Apply a non-permanent locking agent.
LB: Apply a non-permanent locking agent (Three Bond TB2471, Blue).
Lh: Left-hand Threads
MO: Apply molybdenum disulfide oil (mixture of the engine oil and molybdenum disulfide grease in a weight ratio: 10 : 1).
R: Replacement Parts
S: Follow the specific tightening sequence.
SS: Apply silicone sealant (Liquid Gasket, TB1211: 56019-120).
St: Stake the fasteners to prevent loosening.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Air Cleaner Housing Bolts	8.8	0.90	78 in·lb	
ISC Valve Mounting Bolts	8.8	0.90	78 in·lb	
Water Temperature Sensor	12	1.2	106 in·lb	
Air Cleaner Element Holder Screw	3.5	0.36	31 in·lb	
Air Cleaner Element Holder Tapping Screw	1.5	0.15	13 in·lb	
Intake Air Pressure Sensor Mounting Screw	5.0	0.51	44 in·lb	
Delivery Pipe Mounting Screws	5.0	0.51	44 in·lb	
Fuel Pump Bolts	4.0	0.41	35 in·lb	
Fuel Tank Mounting Bolts	9.8	1.0	87 in·lb	
Throttle Lever Limiter Screw	3.6	0.37	32 in·lb	
Throttle Lever Limiter Nut	3.6	0.37	32 in·lb	
Throttle Case Assembly Screws	3.6	0.37	32 in·lb	
Cooling System				
Radiator Mounting Bolts	8.8	0.90	78 in·lb	
Radiator Screen Mounting Bolts	4.0	0.40	35 in·lb	
Radiator Fan Assembly Bolts	4.9	0.50	43 in·lb	
Thermostat Housing Cover Bolts	8.8	0.90	78 in·lb	
Water Pump Cover Bolts	8.8	0.90	78 in·lb	
Coolant Drain Bolt	7.0	0.71	62 in·lb	
Water Pump Impeller	7.8	0.80	69 in·lb	
Water Pipe Joint Bolt	8.8	0.90	78 in·lb	
Reserve Tank Mounting Screws	4.0	0.40	35 in·lb	L
Air Bleeder Bolt	7.0	0.71	62 in·lb	
Engine Top End				
Rocker Case Bolts 55 mm (2.2 in.)	8.8	0.90	78 in·lb	S
Rocker Case Bolts 130 mm (5.1 in.)	9.8	1.0	87 in·lb	S
Rocker Case Bolts 30 mm (1.2 in.)	9.8	1.0	87 in·lb	S
Rocker Case Bolts 25 mm (1.0 in.)	9.8	1.0	87 in·lb	S
Cylinder Head Bolts (M10), first torque	25	2.5	18	S, MO
Cylinder Head Bolts (M10), final torque	49	5.0	36	S
Cylinder Head Bolts (M6)	9.8	1.0	87 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Valve Adjusting Cap Bolts	8.8	0.90	78 in·lb	
Rocker Shaft Bolts	22	2.2	16	
Valve Adjusting Screw Locknuts	12	1.2	106 in·lb	
Camshaft Chain Tensioner Mounting Bolts	8.8	0.90	78 in·lb	
Camshaft Chain Tensioner Cap Bolts	22	2.2	16	
Position Plate Bolts	8.8	0.90	78 in·lb	
Intermediate Shaft Chain Guide Bolts	8.8	0.90	78 in·lb	EO
Intermediate Shaft Chain Tensioner Bolts	8.8	0.90	78 in·lb	
Camshaft Sprocket Bolts	12	1.2	106 in·lb	L
Cylinder Bolts 40 mm (1.6 in.)	9.8	1.0	87 in·lb	
Cylinder Bolts 30 mm (1.2 in.)	9.8	1.0	87 in·lb	
Front Cylinder Camshaft Chain Guide Bolt	20	2.0	15	
Rear Cylinder Camshaft Chain Guide Bolt	20	2.0	15	
Coolant Drain Bolt (Cylinder)	7.0	0.71	62 in·lb	
Exhaust Pipe Cover Bolts	8.8	0.90	78 in·lb	
Exhaust Pipe Holder Nuts	17	1.7	12	
Muffler Clamp Bolt	8.8	0.90	78 in·lb	
Muffler Mounting Nuts	20	2.0	14	
Muffler Mounting Locknuts	31	3.2	23	
Muffler Cover Bolts	8.8	0.90	78 in·lb	
Converter System				
Drive Pulley Bolt	93	9.5	68	R, Lh
Driven Pulley Nut	93	9.5	68	
Drive Pulley Cover Bolt	13	1.3	115 in·lb	
Ramp Weight Nuts	6.9	0.70	61 in·lb	
Spider	275	28	203	Lh
Torque Converter Cover Bolts	8.8	0.90	78 in·lb	S
Engine Brake Actuator Mounting Bolts	8.8	0.90	78 in·lb	S
Engine Lubrication System				
Oil Filter	17.5	1.8	13	R
Oil Pressure Switch	15	1.5	11	SS
Oil Pipe Bolts	8.8	0.90	78 in·lb	
Engine Oil Drain Bolt	20	2.0	15	
Oil Pressure Relief Valve	15	1.5	11	L
Oil Pump Cover Bolts	8.8	0.90	78 in·lb	
Oil Pump Chain Guide Bolts	8.8	0.90	78 in·lb	
Oil Pump Drive Chain Tensioner Bolt	25	2.5	18	
Oil Filter Mounting Bolts	25	2.5	18	L (15 mm)
Engine Removal/Installation				
Engine Mounting Bracket Bolts	72	7.3	53	L
Engine Mounting Bolt	72	7.3	53	L
Engine Mounting Nut	100	10	74	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Crankshaft/Transmission				
Connecting Rod Big End Cap Nuts	34.3	3.5	25	MO
Engine Oil Drain Bolt	20	2.0	15	
Crankcase Bolts (M8) 75 mm (2.95 in.)	20	2.0	15	S
Crankcase Bolts (M8) 110 mm (4.33 in.)	20	2.0	15	S
Crankcase Bolt (M8) 110 mm (4.33 in.)	20	2.0	15	S, L
Crankcase Bolts (M6) 40 mm (1.57 in.)	9.8	1.0	87 in·lb	
Crankcase Bolts (M6) 65 mm (2.56 in.)	9.8	1.0	87 in·lb	
Bearing Position Plate Screws	4.9	0.50	43 in·lb	L
Rear Cylinder Camshaft Chain Guide Bolt	20	2.0	15	
Grip Holder Nut	9.8	1.0	87 in·lb	
Shift Lever Assembly Bracket Bolts	19.6	2.0	14	
Tie-rod End Front Locknut	9.8	1.0	87 in·lb	Lh
Tie-Rod End Rear Locknut	9.8	1.0	87 in·lb	
Tie-rod End Nut	19.6	2.0	14	
Shift Lever Assembly Nut	19.6	2.0	14	
Shift Lever Clamp Bolt	13.5	1.4	119 in·lb	
Tie-rod End Bolt	9.8	1.0	87 in·lb	
Shift Shaft Positioning Bolt	25	2.5	18	
Shift Shaft Spring Bolt	25	2.5	18	L
Shift Shaft Cover Bolts	8.8	0.90	78 in·lb	
Tie-rod End Locknut	19.6	2.0	14	
Neutral Position Switch	15	1.5	11	
Reverse Position Switch	15	1.5	11	
Shift Lever Guide Mounting Nut	19.6	2.0	14	
Wheel/Tires				
Tie-rod Locknuts	37	3.8	27	
Wheel Nuts (First Torque)	15	1.5	11	S
Wheel Nuts (Final Torque)	76	7.7	56	S
Front Axle Nuts	197	20	145	
Rear Axle Nuts	265	27	195	
Final Drive				
(Output Bevel Gears)				
Output Driven Bevel Gear Housing Bolts	26	2.7	20	
Output Drive Bevel Gear Housing Bolts	26	2.7	20	
Bearing Holder	250	25.5	184	L
Bevel Gear Holder Nut	200	20.4	148	L
Bearing Holder	120	12	88	L
Output Shaft Holder Nut	200	20.4	148	L
Rotor Mounting Bolts	12	1.2	106 in·lb	
Output Drive Bevel Gear Cover Bolts	8.8	0.90	78 in·lb	
Forward/Reverse Detecting Sensor Mounting Bolt	15	1.5	11	
(Front Final Gear Case)				

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Variable Differential Control Shift Shaft Lever Bolt	8.8	0.90	78 in·lb	
Front Final Gear Case Left Cover Bolts (M6)	9.8	1.0	87 in·lb	L (4), S
Ring Gear Bolts	57	5.8	42	LB
Front Final Gear Case Center Cover Bolts (M6)	9.8	1.0	87 in·lb	L
Front Final Gear Case Center Cover Bolts (M8)	24	2.4	17	L
Front Final Gear Case Oil Filler Cap	29	3.0	22	
Pinion Gear Bearing Holder Nut	127	13	94	St
Pinion Gear Bearing Holder	137	14	101	L
Front Final Gear Case Coupling Nut	25	2.5	18	
Front Final Gear Case Oil Drain Bolt	15	1.5	11	
2WD/4WD Actuator Mounting Bolts	9.8	1.0	87 in·lb	L, S
Variable Differential Control Cable Locknut	17	1.7	12	
Variable Differential Control Lever Bolt	3.4	0.35	30 in·lb	L
Front Final Gear Case Nuts	59	6.0	43	
(Rear Final Gear Case)				
Rear Final Gear Case Front Cover Bolts	24	2.4	18	
Rear Final Gear Case Gasket Screws	1.25	0.13	11 in·lb	L
Pinion Gear Bearing Holder Nut	157	16	116	L
Pinion Gear Bearing Holder	137	14	101	L
Rear Final Gear Case Right Cover Bolts (M12)	95	9.7	70	L
Rear Final Gear Case Right Cover Bolts (M10)	49	5.0	36	L
Rear Final Gear Case Right Cover Bolts (M8)	24	2.4	18	L
Rear Final Gear Case Oil Filler Cap	29	3.0	22	
Rear Final Gear Case Oil Drain Bolt	15	1.5	11	
Rear Final Gear Case Bracket Bolts	59	6.0	44	
Rear Final Gear Case Nuts	91	9.3	67	
Brakes				
Reservoir Cap Screws	1.5	0.15	13 in·lb	
Front Brake Lever Pivot Bolt	5.9	0.60	52 in·lb	
Front Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
Front Brake Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S
Front Bake Hose Banjo Bolt	34	3.5	25	
Front Brake Caliper Mounting Bolts	25	2.5	18	
Bleed Valves	7.8	0.80	69 in·lb	
Front Brake Disc Mounting Bolts	37	3.8	27	L
Front Brake Caliper Holder Shaft	17	1.7	12	Si
Front Brake Pad Mounting Bolts	17	1.7	12	
Front Brake Light Switch Mounting Screw	1.2	0.12	11 in·lb	
Rear (Parking) Brake Lever Pivot Bolt	2.2	0.22	19 in·lb	
Rear (Parking) Brake Lever Pivot Nut	3.4	0.35	30 in·lb	
Rear Brake Lock Lever Pivot Screw	2.2	0.22	19 in·lb	L
Variable Differential Control Lever Bolt	3.4	0.35	30 in·lb	L
Rear Final Gear Case Gasket Screws	1.25	0.13	12 in·lb	L

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Suspension				
Front Shock Absorber Mounting Nuts	34	3.5	25	
Front Suspension Arm Pivot Nuts	42	4.3	31	
Steering Knuckle Joint Nuts	29	3.0	21	
Rear Shock Absorber Mounting Nuts	34	3.5	25	
Stabilizer Holder Bolts	22	2.2	16	
Stabilizer Joint Nuts	46	4.7	34	
Rear Suspension Arm Pivot Nuts	46	4.7	34	
Rear Knuckle Mounting Nuts	46	4.7	34	
Steering				
Handlebar Holder Bolts	29	3.0	21	S
Steering Stem Clamp Bolts	25	2.5	18	
Tie-rod End Nuts	42	4.3	31	
Tie-rod Locknuts	37	3.8	27	
Steering Stem Bearing Joint Bolts	22	2.2	16	L
Steering Stem Bottom End Nut	62	6.3	46	
Steering Knuckle Joint Nuts	29	3.0	21	
Front Brake Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S
Left Handlebar Switch Housing Screws	3.5	0.36	31 in·lb	
Frame				
Front Guard Bolts	46	4.7	34	
Front Carrier Bolts, L = 50 mm (2.0 in.)	32	3.3	24	L
Front Carrier Bolts, L = 70 mm (2.8 in.)	32	3.3	24	L
Front Carrier Bracket Bolts	32	3.3	24	L
Rear Carrier Bolts, L = 14 mm (0.55 in.)	54	5.5	40	L
Rear Carrier Bolts, L = 41 mm (1.6 in.)	54	5.5	40	L
Rear Carrier Bracket Bolts	46	4.7	34	
Footboard Bracket Bolts	46	4.7	34	
Hitch Bracket Bolts	82	8.3	60	L
Rear Final Gear Case Mounting Bracket Bolts	59	6.0	44	L
Electrical System				
Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	
Starter Motor Cable Mounting Nut	6.8	0.69	60 in·lb	
Starter Motor Terminal Locknut	11	1.1	97 in·lb	
Starter Motor Through Bolts	5.0	0.51	44 in·lb	
Starter Motor Clutch Bolts	34	3.5	25	L
Alternator Stator Bolts	13.5	1.4	119 in·lb	
Crankshaft Sensor Mounting Bolts	5.9	0.60	52 in·lb	
Alternator Cover Plugs	17.5	1.8	13	
Alternator Rotor Bolt	127	13	94	
Alternator Cover Bolts	8.8	0.90	78 in·lb	
Alternator Outer Cover Bolts	5.9	0.60	52 in·lb	
Harness Clamp Bolt	8.8	0.90	78 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Spark Plugs	13	1.3	115 in·lb	
2WD/4WD Actuator Mounting Bolts	9.8	1.0	87 in·lb	L, S
Engine Brake Actuator Mounting Bolts	8.8	0.90	78 in·lb	S
Forward/Reverse Detecting Sensor Mounting Bolt	15	1.5	11	
Speed Sensor Mounting Bolt	8.8	0.90	78 in·lb	
Neutral Position Switch	15	1.5	11	
Reverse Position Switch	15	1.5	11	
Ignition Coil Mounting Bolts	5.9	0.60	52 in·lb	
Ignition Coil Bracket Mounting Bolts	5.9	0.60	52 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Oil Pressure Switch Terminal Bolt	1.5	0.15	13 in·lb	
Regulator/Rectifier Mounting Bolts	8.8	0.90	78 in·lb	
Tail/Brake Light Lens Screws	1.0	0.10	88 in·lb	

The tables 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 of Engine Parts

Threads dia. mm (in.)	Mark of bolt head	Torque		
		N·m	kgf·m	ft·lb
5 (0.20)	4T	2.2 ~ 2.6	0.22 ~ 0.27	19 ~ 23 in·lb
6 (0.24)	9T	12 ~ 15	1.2 ~ 1.5	104 ~ 130 in·lb
6 (0.24)	7T	7.8 ~ 9.8	0.8 ~ 1.0	69 ~ 87 in·lb
6 (0.24)	4T	3.9 ~ 4.9	0.4 ~ 0.5	35 ~ 43 in·lb
8 (0.31)	7T	18 ~ 22	1.8 ~ 2.2	13 ~ 16
8 (0.31)	4T	10 ~ 14	1.0 ~ 1.4	87 ~ 122 in·lb
10 (0.39)	7T	39 ~ 44	4.0 ~ 4.5	29 ~ 33
10 (0.39)	4T	20 ~ 24	2.0 ~ 2.4	14 ~ 17

Basic Torque for General Fasteners of Frame Parts

Threads dia. mm (in.)	Torque		
	N·m	kgf·m	ft·lb
5 (0.20)	3.4 ~ 4.9	0.35 ~ 0.5	30 ~ 43 in·lb
6 (0.24)	5.9 ~ 7.8	0.6 ~ 0.8	52 ~ 69 in·lb
8 (0.31)	14 ~ 19	1.4 ~ 1.9	10.0 ~ 13.5
10 (0.39)	25 ~ 34	2.6 ~ 3.5	19 ~ 25
12 (0.47)	44 ~ 61	4.5 ~ 6.2	33 ~ 45
14 (0.55)	73 ~ 98	7.4 ~ 10.0	54 ~ 72
16 (0.63)	115 ~ 155	11.5 ~ 16.0	83 ~ 115
18 (0.71)	165 ~ 225	17.0 ~ 23.0	125 ~ 165
20 (0.79)	225 ~ 325	23.0 ~ 33.0	165 ~ 240

Specifications

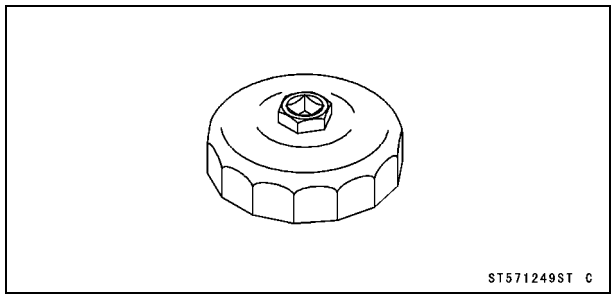
Item	Standard	Service Limit
Fuel System		
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	– – –
Idle Speed	1 100 ±50 r/min (rpm)	– – –
Air Cleaner Element Oil	High-quality foam air filter oil	– – –
Cooling System		
Coolant:		
Type (Recommended)	Permanent type antifreeze	– – –
Color	Green	– – –
Mixed Ratio	Soft water 50%, Coolant 50%	– – –
Freezing Point	−35°C (−31°F)	– – –
Total Amount	2.2 L (2.3 US qt)	– – –
Engine Top End		
Valve Clearance:		
Exhaust	0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)	– – –
Intake	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	– – –
Converter System		
Belt Width	29.7 ~ 30.3 mm (1.17 ~ 1.19 in.)	28.0 mm (1.10 in.)
Belt Deflection	22 ~ 27 mm (0.87 ~ 1.06 in.)	– – –
Actuator Lever Guide Shoe Wear	– – –	6 mm (0.24 in.)
Engine Lubrication System		
Engine Oil:		
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2	– – –
Viscosity	SAE10W-40	– – –
Capacity	2.1 L (2.2 US qt) (When filter is not removed)	– – –
	2.2 L (2.3 US qt) (When filter is removed)	– – –
	2.6 L (2.7 US qt) (When engine is completely dry)	– – –
Wheels/Tires		
Tire Tread Depth:		
Front	13.0 mm (0.51 in.)	3 mm (0.12 in.)
Rear	14.5 mm (0.57 in.)	4 mm (0.16 in.)
Standard tire:		
Front	AT 25 × 8-12	– – –
	DUNLOP, KT191, Tubeless	– – –
Rear	AT 25 × 10-12	– – –
	DUNLOP, KT195, Tubeless	– – –
Final Drive		
Front Final Gear Case:		
Gear Case Oil:		
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2	– – –
Viscosity	SAE 10W-40	– – –

Specifications

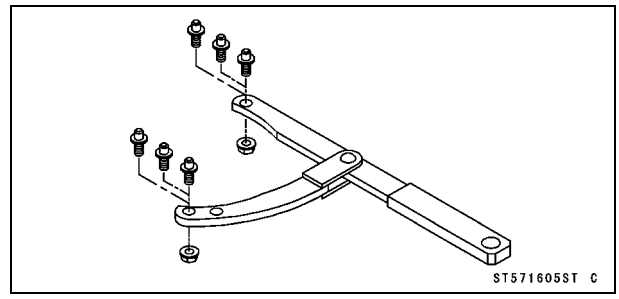
Item	Standard	Service Limit
Oil Level	Filler opening bottom	– – –
Capacity	0.40 L (0.42 US qt)	– – –
Rear Final Gear Case:		
Gear Case Oil:		
Type	MOBIL Fluid 424, CITGO TRANSGARD TRACTOR HYDRAULIC FLUID, or EXXON HYDRAUL 560	– – –
Oil Level	Filler opening bottom	– – –
Capacity	0.72 L (0.76 US qt)	– – –
Brakes		
Front Brake Fluid:		
Type	DOT 3 or DOT 4	– – –
Front Disc Brake:		
Pad Lining Thickness	4 mm (0.16 in.)	1 mm (0.04 in.)
Rear Brake Lever, Pedal and Cables:		
Rear Brake Lever Free Play	1 ~ 2 mm (0.04 ~ 0.08 in.)	– – –
Brake Pedal Free Play	15 ~ 25 mm (0.6 ~ 1.0 in.)	– – –
Electrical System		
Spark Plug Gap	0.7 ~ 0.8 mm (0.028 ~ 0.032 in.)	– – –
Rear Brake Light Switch Timing	ON after 10 mm (0.4 in.) of pedal travel	– – –

Special Tools

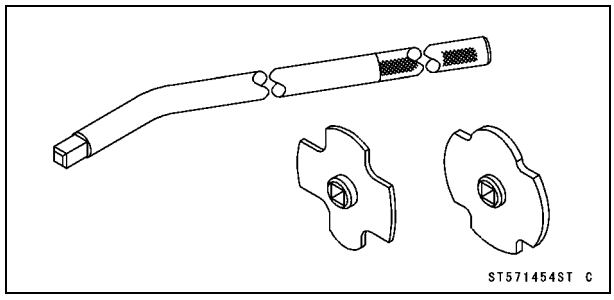
Oil Filter Wrench:
57001-1249



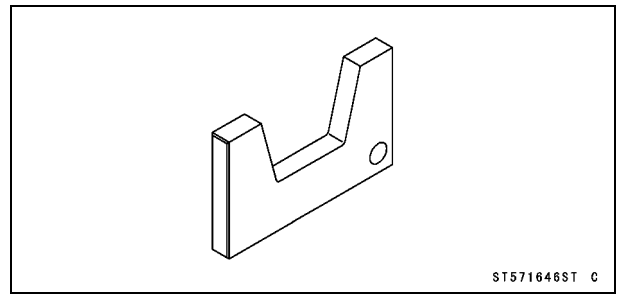
Flywheel & Pulley Holder:
57001-1605



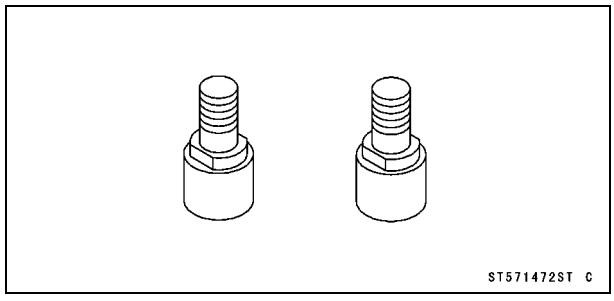
Filler Cap Driver:
57001-1454



Belt Measuring Gauge:
57001-1646



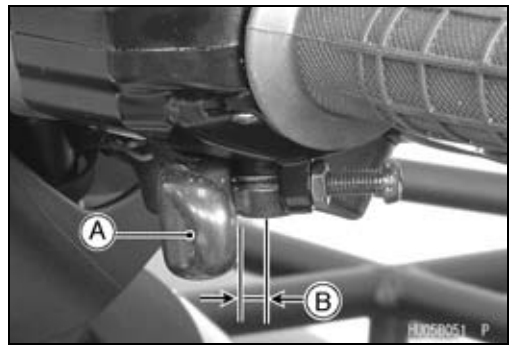
Pulley Holder Attachment:
57001-1472



Periodic Maintenance Procedures

Fuel System

Throttle Lever Free Play Inspection



- Check that the throttle lever [A] moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.

★If the throttle lever does not return properly, check the throttle cable routing, lever free play, and cable damage. Then lubricate the throttle cable.

- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.

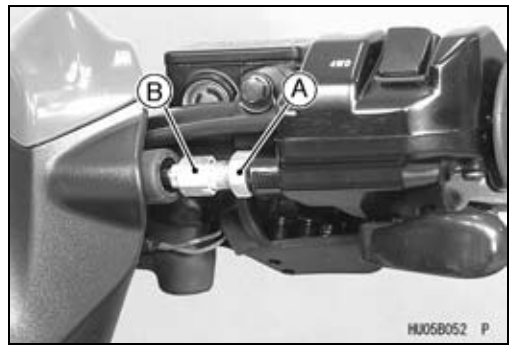
★If the idle speed increases, check the throttle lever free play and the cable routing.

- Stop the engine and check the throttle lever free play [B].

★If the free play is not within the specified range, adjust the cable.

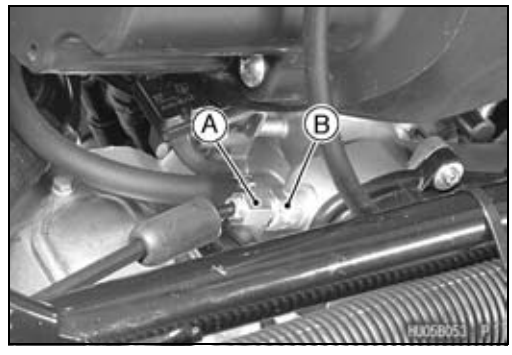
Throttle Lever Free Play
Standard: 2 ~ 3 mm (0.08 ~ 0.12 in.)

Throttle Lever Free Play Adjustment



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

★If the free play cannot be adjusted by using the upper cable adjuster, remove the left side cover (see Left Side Cover Removal in the Frame chapter) and then use the cable adjusting nut [A] and locknut [B] at the lower end of the throttle cable and make the necessary free play.



Periodic Maintenance Procedures

Idle Speed Inspection

- Start the engine and warm it up thoroughly.
- With the engine idling, turn the handlebar to both sides to check for any changes in the idle speed.

★If handlebar movement changes the idle speed, the throttle cable may be improperly adjusted, incorrectly routed, or damaged. Be sure to correct any of these conditions before riding.

⚠ WARNING

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

- Check idle speed with a suitable tachometer.

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

Idle Speed
Standard: 1 100 ±50 r/min (rpm)

Idle Speed Adjustment

NOTE

○*Idle speed adjustment is best performed by ECU, so idle speed cannot be adjusted.*

Air Cleaner Element Cleaning and Inspection

NOTE

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

○*After riding through rain or muddy terrains, the element should be cleaned immediately.*

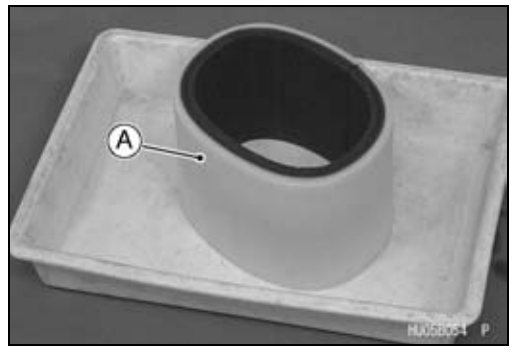
○*Also, if there is a break in the element material or any other damage to the element, replace the element with a new one.*

⚠ WARNING

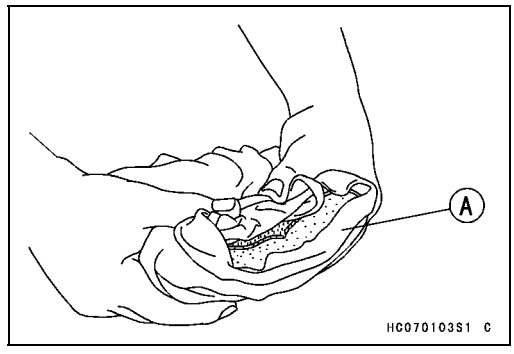
Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the element in a well ventilated area, and take care that there is no spark or flame anywhere near the working areas. Do not use gasoline or low-flash point solvents to clean the element.

Periodic Maintenance Procedures

● Remove the air cleaner element (see Air Cleaner Element Removal in the Fuel System (DFI) chapter).
● Clean the element [A] in a bath of high-flash point solvent.

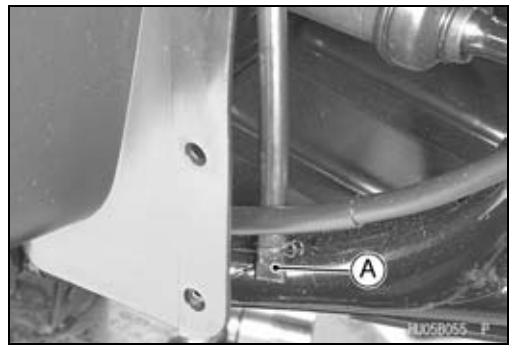


● Squeeze it dry in a clean towel [A]. Do not wring the element or blow it dry; the element can be damaged.
● Inspect the element for damage.
★If it is torn, punctured, or hardened, replace it.
● After cleaning, saturate the element with a high-quality foam-air-filter oil, squeeze out the excess oil, then wrap it in a clean rag and squeeze it as dry as possible. Be careful not to tear the element.



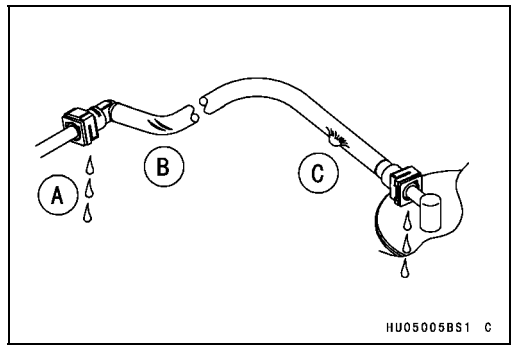
Air Cleaner Draining

● If any water or oil accumulates in the tube, drain it by taking off the tube plug [A]. After draining, be sure to install the tube plug and clamp firmly.

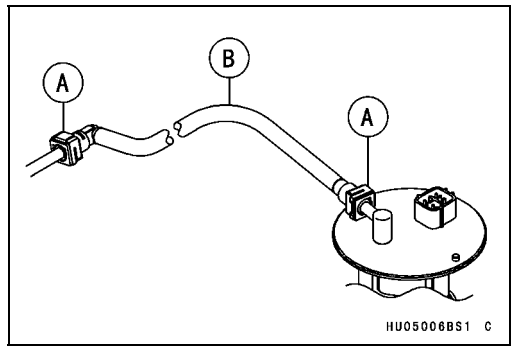


Fuel Hose Inspection (fuel leak, damage, installation condition)

○The fuel hose is designed to be used throughout the vehicle's life without any maintenance. However, if the vehicle is not properly handled, the high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter) and check the fuel hose.
★Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.

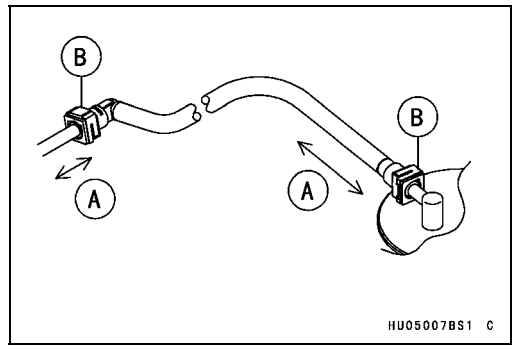


● Check that the hoses are routed according to Cable, Wire, and Hose Routing section in the Appendix chapter.
★Replace the hose if it has been sharply bent or kinked.
Hose Joints [A]
Fuel Hose [B]



Periodic Maintenance Procedures

● Check that the hose joints are securely connected.
○Push and pull [A] the hose joint [B] back and forth more than two times, and make sure it is locked.
★If it does not locked, reinstall the hose joint.



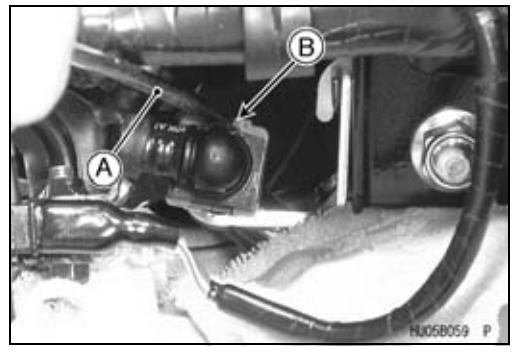
⚠ WARNING

Leaking fuel can cause a fire or explosion resulting in serious burns. Make sure the hose joint is installed correctly on the delivery pipe by sliding the joint.

Fuel Hose Replacement

⚠ WARNING

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

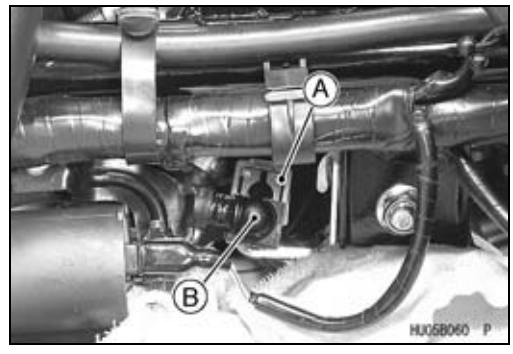


NOTICE

When removing and installing the fuel hose joint, do not apply strong force to the outlet pipe on the fuel pump and delivery pipe on the throttle body assy. The fuel pump pipe made from resin could be damaged.

● Disconnect the fuel hose from the fuel pump (see Fuel Pump Removal in the Fuel System (DFI) chapter).
● Be sure to place a piece of cloth around the fuel hose joint.
● Insert a minus screwdriver [A] into the slit [B] on the joint lock.

● Twist the screwdriver to disconnect the joint lock [A].
● Pull the fuel hose joint [B] out of the delivery pipe.

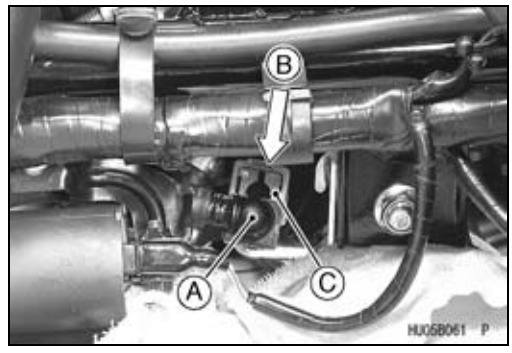


⚠ WARNING

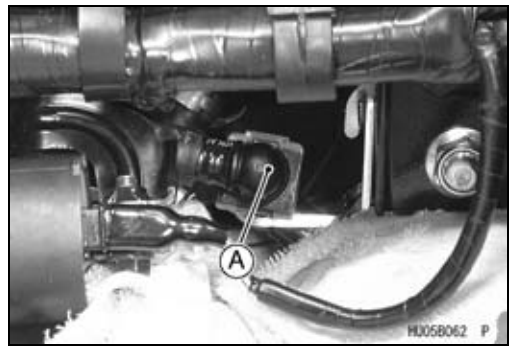
Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe. Cover the hose connection with a clean shop towel to prevent fuel spillage.

Periodic Maintenance Procedures

- Install the new fuel hose.
- Insert the fuel hose joint [A] straight onto the delivery pipe until the hose joint clicks.
- Push [B] the joint lock [C].



- Push and pull the fuel hose joint [A] back and forth more than two times and make sure it is locked and doesn't come off.



⚠ WARNING

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

★If it comes off, reinstall the hose joint.

- Run the fuel hose correctly (see Cable, Wire and Hose Routing section in the Appendix chapter).
- Install the removed parts (see appropriate chapters).
- Start the engine and check the fuel hose for leaks.

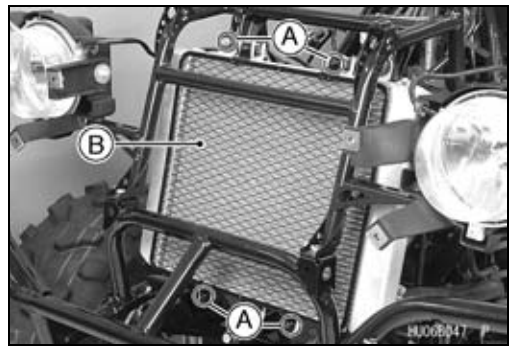
Cooling System

Radiator Cleaning

NOTICE

Clean the radiator screen and the radiator in accordance with the Periodic Maintenance Chart. In dusty areas, they should be cleaned more frequently than the recommended interval. After riding through muddy terrains, the radiator screen and the radiator should be cleaned immediately.

- Remove:
  Front Guard Cover (see Front Guard Removal in the Frame chapter)
  Front Fender (see Front Fender Removal in the Frame chapter)
  Headlight Cover (see Headlight Cover Removal in the Frame chapter)
  Radiator Screen Mounting Screws [A]
  Radiator Screen [B]
- Clean the radiator screen in a bath of tap water, and then dry it with compressed air or by shaking it.

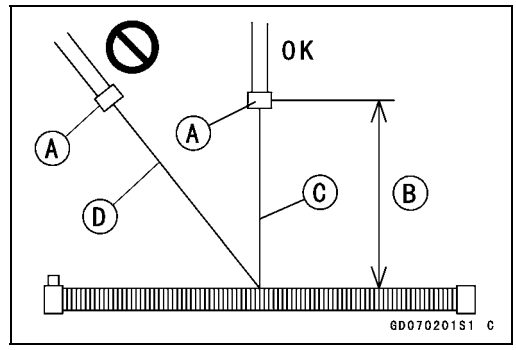


Periodic Maintenance Procedures

● Clean the radiator.

NOTICE

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 (20 in.) [B] from the radiator core.
Hold the steam gun perpendicular [C] (not oblique [D]) to the core surface.
Run the steam gun following the core fin direction.

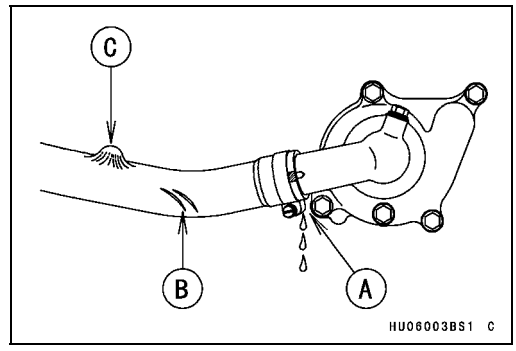


Water Hoses and Connections Inspection

○The high pressure inside the water 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.



Coolant Change

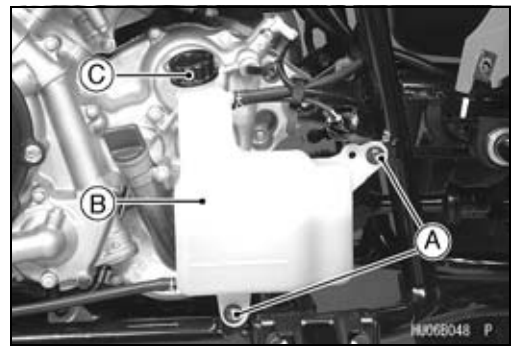
⚠ WARNING

Coolant can be extremely hot and cause severe burns, is toxic and very slippery. Do not remove the radiator cap or attempt to change the coolant when the engine is hot; allow it cool completely. Immediately wipe any spilled coolant from tires, frame, engine or other painted parts. Do not ingest coolant.

● Remove:
Radiator Cover (see Radiator Cover Removal in the Frame chapter)

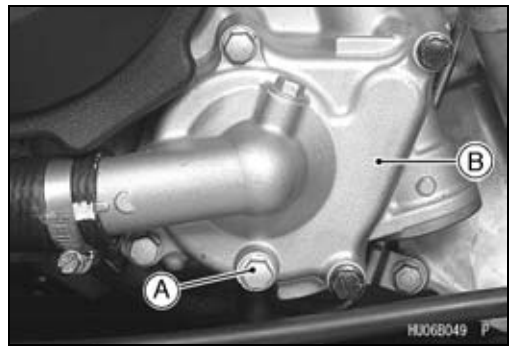
● Remove:
Reserve Tank Screws [A]
Reserve Tank [B] with Hose

● Remove the reserve tank cap [C], and pour the coolant into a container.

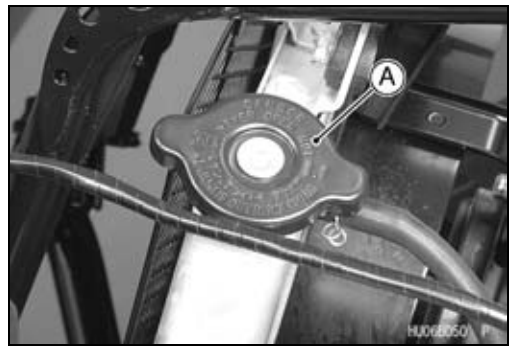


Periodic Maintenance Procedures

- Place a container under the drain bolt [A] at the bottom of the water pump cover [B], then remove the drain plug.

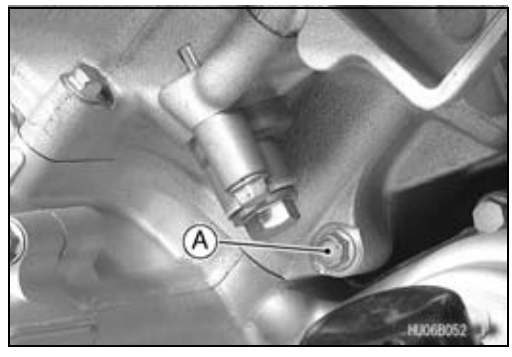


- Remove the radiator cap [A] in two steps. First turn the cap counterclockwise to the first step. Then push and turn it further in the same direction and remove the cap.
- The coolant will drain from the radiator and engine.



- Place a container under the drain bolt [A] at the front cylinder, then remove the drain bolt.

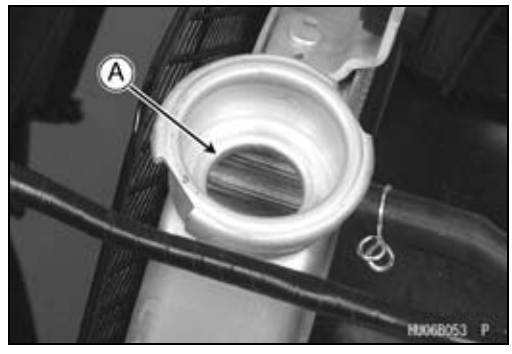
- Place a container under the drain bolt [A] at the rear cylinder, then remove the drain bolt.



- Tighten:

  Torque - Coolant Drain Bolt: 7.0 N·m (0.71 kgf·m, 62 in·lb)

- Support the vehicle on a stand or the jack so that the front wheels are off the ground. This makes air bleeding easier.
- Fill the radiator up to the radiator filler neck [A] with coolant.



NOTE

○*Pour in the coolant slowly so that the air in the engine and radiator can escape.*

Periodic Maintenance Procedures

NOTICE

Soft or distilled water must be used with the antifreeze in the cooling system.
If hard water is used in the system, it causes scale accumulation in the water passages, considerably reducing the efficiency of the cooling system.

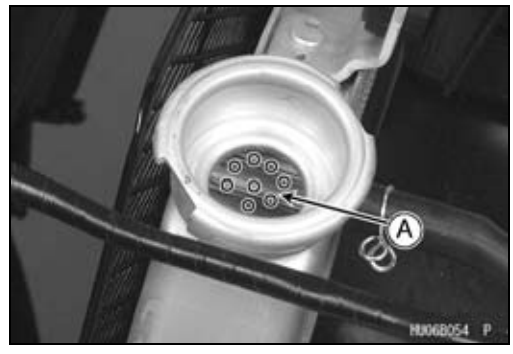
Water and Coolant Mixture Ratio (when shipping)

Soft Water:	**50%**
Coolant:	**50%**
Freezing Point:	**−35°C (−31°F)**
Total Amount:	**2.2 L (2.3 US qt)**

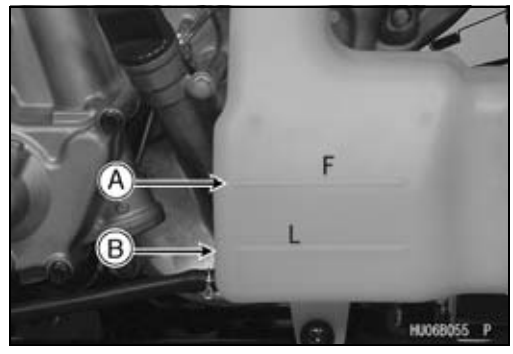
NOTE

○*Choose a suitable mixture ratio by referring to the coolant manufacturer's directions.*

● Bleed the air from the cooling system as follows.
○Start the engine with the radiator cap removed and run it until no more air bubbles [A] can be seen in the coolant.
○Tap the radiator hoses to force any air bubbles caught inside.
○Stop the engine and add coolant up to the radiator filler neck.
● Install the radiator cap.



● Remove the reserve tank cap.
● Fill the reserve tank up to the F mark [A] with coolant and install the cap.
● Start the engine, warm it up thoroughly until the radiator fan turns on and then stop the engine.
● Check the coolant level in the reserve tank after the engine cools down.
★If the coolant level is lower than the low level line [B], add coolant to the full level line.



NOTICE

Do not add more coolant above the full level line.

Engine Top End

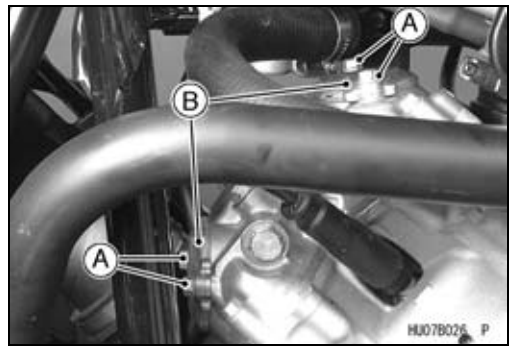
Valve Clearance Inspection

NOTE

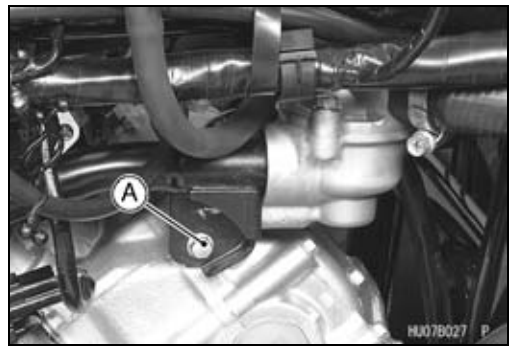
○*Check the valve clearance only when the engine is cold (at room temperature).*

Periodic Maintenance Procedures

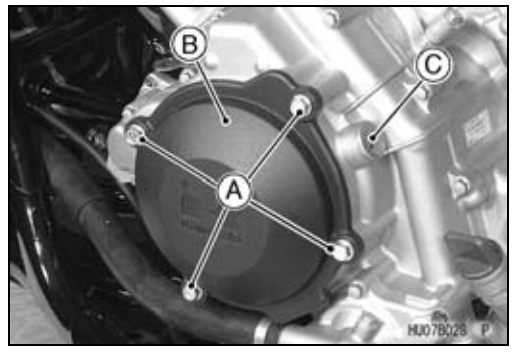
● Remove:
Front Fender (see Front Fender Removal in the Frame chapter)
Battery Case
Valve Adjusting Cap Bolts [A]
Valve Adjusting Caps [B]



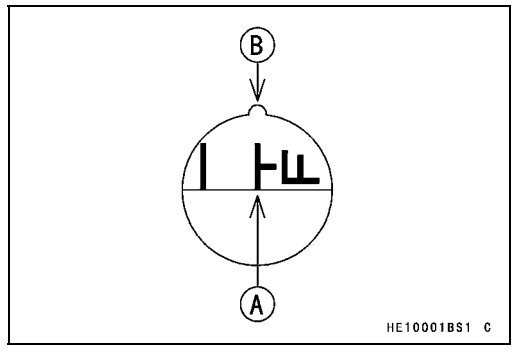
● Remove the right water pipe bolt [A], if necessary.



● Remove:
Bolts [A]
Alternator Outer Cover [B]
● Remove the timing inspection plug [C].
Special Tool - Filler Cap Driver: 57001-1454



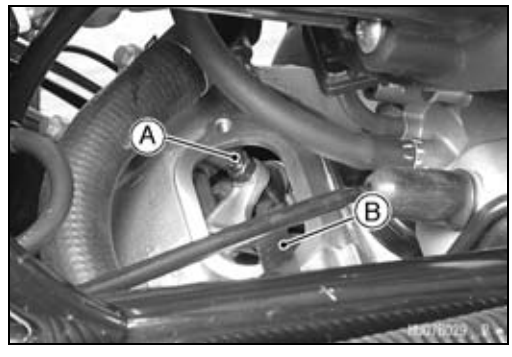
● Turn the crankshaft **counterclockwise** with a wrench on the alternator rotor bolt until “T-F” mark [A] on the alternator rotor aligns with the notch [B] as shown: the end of the compression stroke in the front cylinder head.



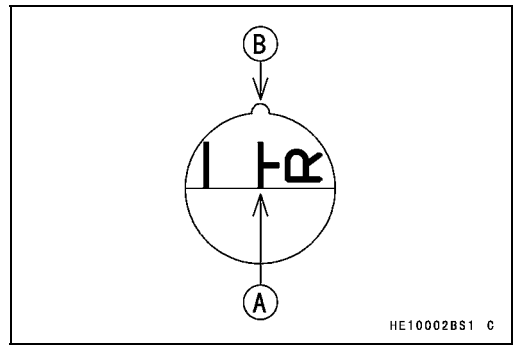
● Measure the clearance for all four valves, one at a time between the end of the valve stem and the adjusting screw [A] with the thickness gauge [B].

Valve Clearance (when cold)
Exhaust 0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)
Intake 0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)

★If the valve clearance is not correct, adjust it (see Valve Clearance Adjustment).



Periodic Maintenance Procedures



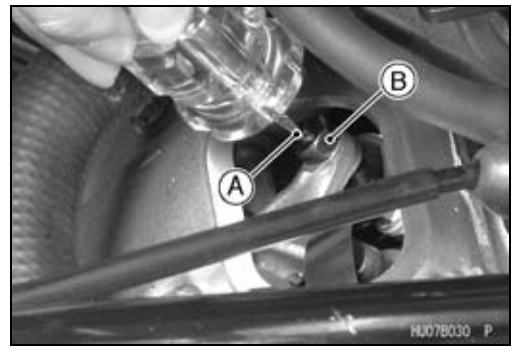
- Then, turn the crankshaft **counterclockwise** with a wrench on the alternator rotor bolt until "T-R" mark [A] on the alternator rotor aligns with the notch [B] as shown: the end of the compression stroke in the rear cylinder head.
- Measure the clearance for all four valves, one at a time between the end of the valve stem and the adjusting screw with the thickness gauge.

Valve Clearance (when cold)

Exhaust	**0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)**
Intake	**0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)**

★If the valve clearance is not correct, adjust it (see Valve Clearance Adjustment).

Valve Clearance Adjustment



- Remove the valve adjusting caps.
- Loosen the locknut and turn the adjusting screw until the clearance is correct.
- Hold the adjusting screw [A] from turning and tighten the locknut [B].

Torque - Valve Adjusting Screw Locknuts: 12 N·m (1.2 kgf·m, 106 in·lb)

- Recheck the clearance.

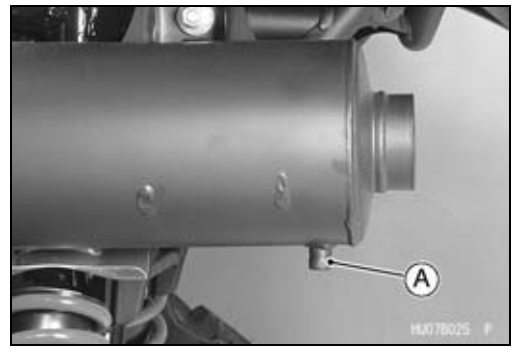
★If the clearance is incorrect, repeat the adjustment procedure.

★If the clearance is correct, perform the adjustment procedure on the other valve.

Spark Arrester Cleaning

⚠ WARNING

The muffler can become extremely hot during normal operation and cause severe burns. Since the engine must be running during this procedure, wear heat-resistant gloves while cleaning the spark arrester.



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

⚠ DANGER

Exhaust gas contains carbon monoxide, a colorless, odorless poisonous gas. Inhaling carbon monoxide can cause serious brain injury or death. DO NOT run the engine in enclosed areas. Operate only in a well-ventilated area.

- Stop the engine.
- Install the drain plug.

Periodic Maintenance Procedures

Converter System

Converter Drive Belt Wear Inspection

Inspection of the drive belt is required at least every 90 days of vehicle use (average 12 mile/day) not to exceed 1 700 km (1 100 mile) or belt indicator light turn on (100 hours of use) counted by the hour meter. More frequent inspection is necessary if the vehicle is subjected to hard usage.

⚠ WARNING

Neglect, abuse, or failure to maintain the transmission can result in a severely worn or damaged drive belt locking up the transmission and wheels. This can cause the operator to lose control and have an accident resulting in injury or death. Maintain according to periodic maintenance chart.

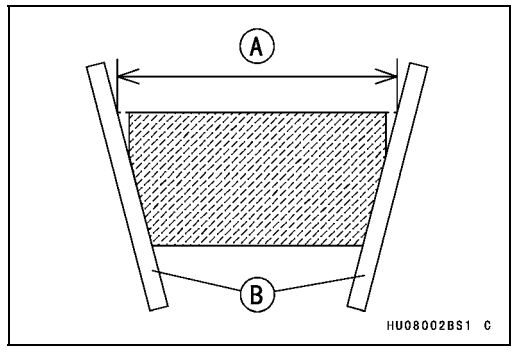
- Remove the torque converter cover (see Torque Converter Cover in the Converter System chapter).
- Measure the width [A] of the belt at several locations with a pair of suitable straightedges [B] as shown.

★If any measurements exceed the service limit, replace the belt.

Belt Width

Standard: 29.7 ~ 30.3 mm (1.17 ~ 1.19 in.)

Service Limit: 28.0 mm (1.10 in.)



NOTE

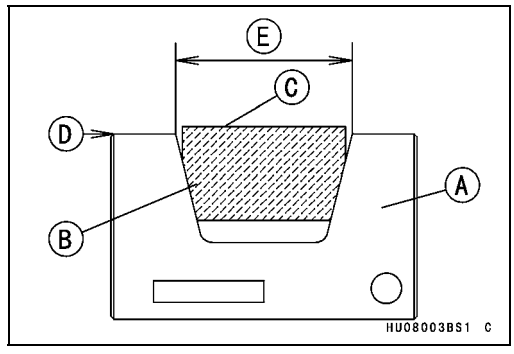
○*Use the belt measuring gauge [A] in order to make easy to inspect the drive belt width.*

Special Tool - Belt Measuring Gauge: 57001-1646

- Fit the drive belt [B] into the belt measuring gauge.

★If the upper surface [C] of the belt lowers than the upper surface [D] of the gauge, replace the belt.

[E] 28 mm (1.10 in.)

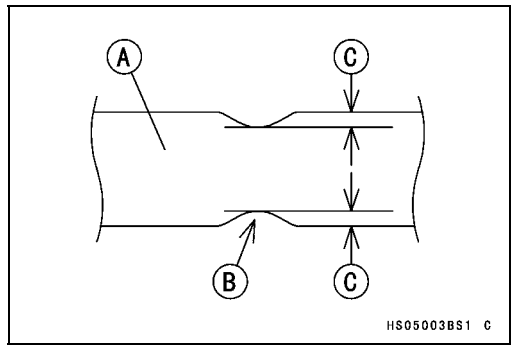


- Check the belt [A] for abnormal wear [B].

○Measure the width [C] of the belt at abnormal wear point.

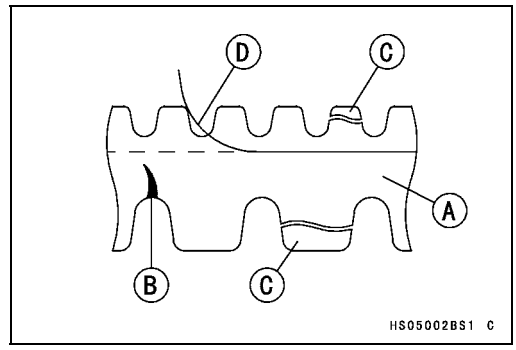
★If any measurements exceed 0.5 mm (0.02 in.), replace the belt.

○When using the belt of large abnormal wear, the drive belt failure detection switch could be activated.



Periodic Maintenance Procedures

● Check the belt for cracks, breaks, or peeling.
★If necessary, replace the belt with a new one.
Belt [A]
Crack [B]
Broken [C]
Peeling [D]



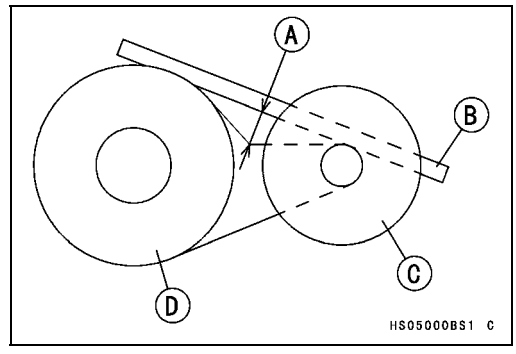
NOTE

○*Whenever the belt is replaced, inspect the drive and the driven pulleys.*

Converter Drive Belt Deflection Inspection

● Remove the torque converter cover (see Torque Converter Cover Removal in the Converter System chapter).
● Put the transmission in neutral and rotate the driven pulley by hand to make sure the belt is shifted all the way to the top of the driven pulley.

● Measure the belt deflection [A] as shown:
○Place a straightedge [B] on top of the belt between the drive pulley [C] and the driven pulley [D].
○Use a ruler to push the belt away from the straightedge. Push hard, but with no more force than 59 N (6 kgf, 13 lb).

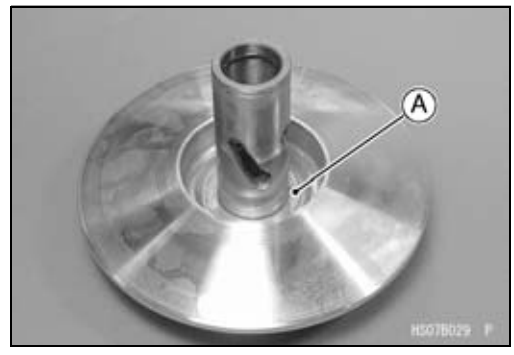


Belt Deflection
Standard: 22 ~ 27 mm (0.87 ~ 1.06 in.)

★If the belt deflection is not within the specified range, adjust the deflection by adding or removing spacers on the fixed sheave of the driven pulley.
● When adjusting the deflection, less is better than more. Less deflection will maintain better performance for more time as the belt width decreases by normal wear, which causes the deflection to increase with usage.

Converter Drive Belt Deflection Adjustment

● Disassemble the driven pulley (see Driven Pulley Disassembly in the Converter System chapter).
★If the belt deflection is more than 27 mm (1.06 in.), remove the spacers to decrease it.
○The rule-of-thumb is: 0.1 mm (0.004 in.) change in spacer thickness equals about 1.3 mm (0.051 in.) change in belt deflection.
★If the adjustment cannot be done within the specified range even if the shim is removed, replace the drive belt.
★If the belt deflection is less than 22 mm (0.87 in.), add the spacers [A] to increase it.
○The rule-of-thumb is: 0.1 mm (0.004 in.) change in spacer thickness equals about 1.6 mm (0.063 in.) change in belt deflection.



NOTE

○*When using the plural spacers, install the thick spacer to the movable sheave side and thin spacer to the fixed sheave side.*

Periodic Maintenance Procedures

Spacers

Part No.	Thickness
92026-0034	0.3 mm (0.012 in.)
92026-1569	0.6 mm (0.024 in.)
92026-1617	0.8 mm (0.032 in.)
92026-1565	1.0 mm (0.039 in.)
92026-1570	1.4 mm (0.055 in.)

- Assemble the driven pulley (see Driven Pulley Assembly in the Converter System chapter).

- With the transmission in neutral, rotate the driven pulley to allow the belt to return to the top of the sheaves before measuring the belt deflection.
- Measure the belt deflection again and repeat the above procedures until it is within the standard range.
- Using the flywheel & pulley holder and pulley holder attachment, tighten the driven pulley nut.

Special Tools - Flywheel & Pulley Holder: 57001-1605
Pulley Holder Attachment: 57001-1472

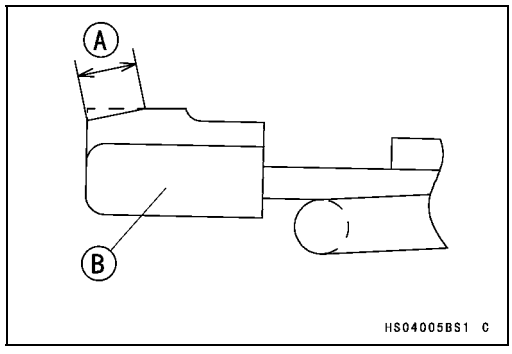
Torque - Driven Pulley Nut: 93 N·m (9.5 kgf·m, 69 ft·lb)

Actuator Lever (Engine Brake Control Lever) Assembly Inspection

- Measure the width [A] of the plastic guide shoe [B] of the actuator lever assembly.

★If the guide contact area width is greater than the service limit, replace the actuator lever assembly.

Actuator Lever Guide Shoe
Service Limit: 6 mm (0.24 in.)



Engine Lubrication System

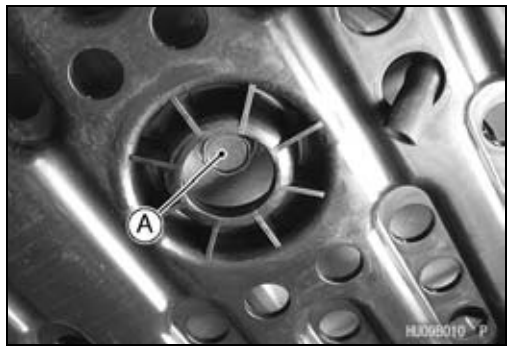
Engine Oil Change

- Support the vehicle so that it is level, both side to side and front to rear after warming up the engine.
- Remove the engine oil drain bolt [A] to drain the oil.

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

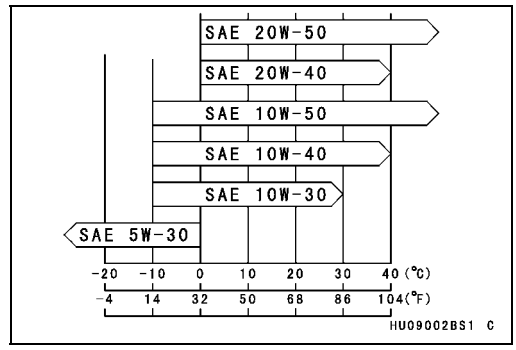
- Replace the oil drain bolt gasket with a new one.
- Tighten:

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



Periodic Maintenance Procedures

● Pour in the specified type and amount of oil.



Engine Oil

Type:	**API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2**
Viscosity:	**SAE 10W-40**
Amount:	**2.1 L (2.2 US qt)**
	(When filter is not removed)
	2.2 L (2.3 US qt)
	(When filter is removed)
	2.6 L (2.7 US qt)
	(When engine is completely dry)

NOTE

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

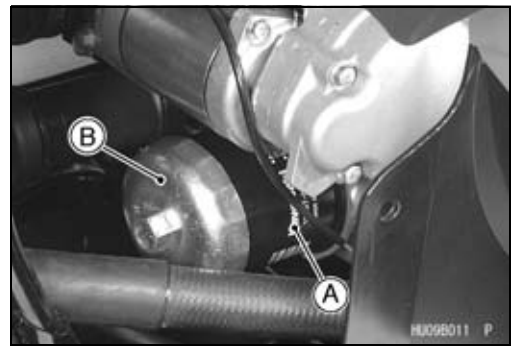
○*Although 10W-40 engine oil is the recommended oil for most conditions, the oil viscosity may need to be changed to accommodate atmospheric conditions in your riding area.*

Oil Filter Replacement

● Drain the engine oil.

● Remove the oil filter [A] with the oil filter wrench [B].

Special Tool - Oil Filter Wrench: 57001-1249



● Replace the filter with a new one.

● When installing the oil filter, be careful of the following.

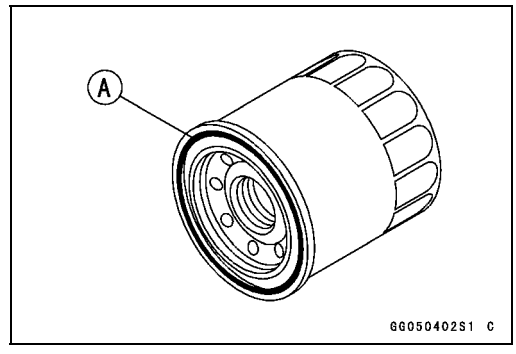
○Apply oil to the gasket [A] before installation.

○Tighten the filter with the oil filter wrench.

Special Tool - Oil Filter Wrench: 57001-1249

Torque - Oil Filter: 17.5 N·m (1.8 kgf·m, 13 ft·lb)

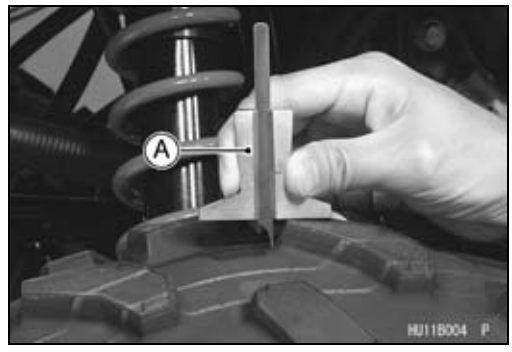
○Pour in the specified type and amount of oil.



Periodic Maintenance Procedures

Wheels/Tires

Tire Inspection



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

Tire Tread Depth
Service Limit:

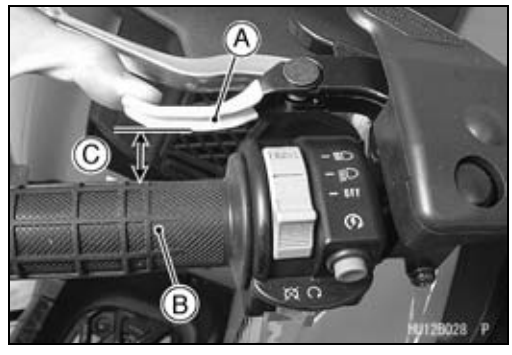
Front	**3 mm (0.12 in.)**
Rear	**4 mm (0.16 in.)**

Standard Tire

Front:	**AT 25 × 8 - 12**
	DUNLOP, KT191, Tubeless
Rear:	**AT 25 × 10 - 12**
	DUNLOP, KT195, Tubeless

Final Drive

Variable Differential Control Lever Play Inspection



- ● Pull the variable differential control lever [A] towards the handlebar grip [B] with a spring scale until it reads 30 N (3 kgf, 7 lb) of force.
- ○The differential control in the front final gear case must be locked, then the clearance [C] between the control lever and grip should be 20 mm (0.8 in.).
- ★If the clearance is not the specified length, adjust the cable.

Differential Control Lever Lock Position Length

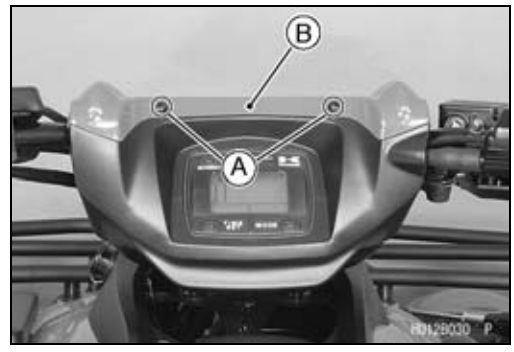
Standard:	**20 mm (0.8 in.)**

Variable Differential Control Lever Play Adjustment

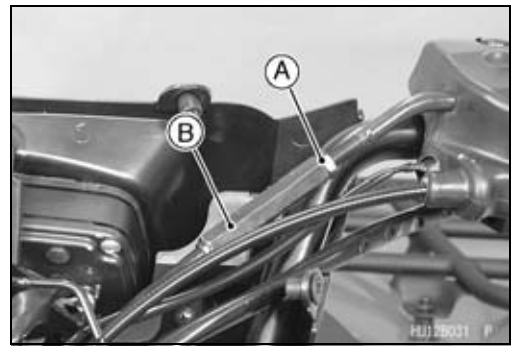
- ● Remove:
  Handlebar Cover Screws [A]

Periodic Maintenance Procedures

● Remove:
Handlebar Cover Screws [A]
Handlebar Cover Front [B]



● Loosen the locknut [A] of the differential control cable.
● Turn the adjuster [B] until the cable has proper amount of play.
● Tighten the locknut securely.



Front Final Gear Case Oil Change

● Warm up the oil by running the vehicle so that the oil will pick up any sediment and drain easily. Then stop the vehicle.
● Park the vehicle so that it is level, both side-to-side and front-to-rear.
● Remove the right side cover (see Right Side Cover Removal in the Frame chapter).
● Place an oil pan beneath the front final gear case and remove the oil drain bolt [A].

⚠ WARNING

Oil on tires can cause loss of traction and an accident resulting in serious injury or death. When draining or filling the final gear case, do not spill oil the tire or rim. Clean any oil that may spill with a high-flash point solvent.

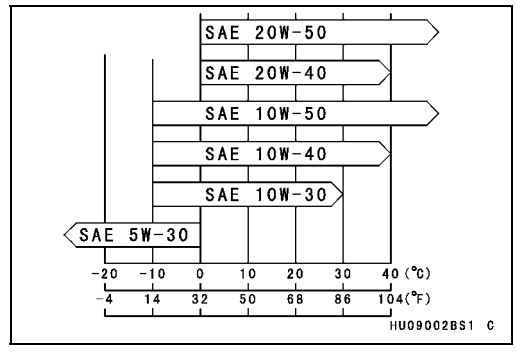
● After the oil has completely drained out, install the oil drain bolt with a new aluminum gasket, and tighten it.

Torque - Front Final Gear Case Oil Drain Bolt: 15 N·m (1.5 kgf·m, 11 ft·lb)

● Fill the gear case up to the bottom of filler opening with the oil specified below.

Front Final Gear Case Oil

Type:	**API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2**
Viscosity:	**SAE 10W-40**
Capacity:	**0.40 L (0.42 US qt)**



NOTE

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

Periodic Maintenance Procedures

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

○Apply grease to the O-ring.

Torque - Front Final Gear Case Oil Filler Cap: 29 N·m (3.0 kgf·m, 22 ft·lb)

Rear Final Gear Case Oil Change

● Warm up the oil by running the vehicle so that the oil will pick up any sediment and drain easily. Then stop the vehicle.

● Park the vehicle so that it is level, both side-to-side and front-to-rear.

● Place an oil pan beneath the rear final gear case and remove the oil drain bolt [A].

⚠ WARNING

Oil on tires can cause loss of traction and an accident resulting in serious injury or death. When draining or filling the final gear case, do not spill oil the tire or rim. Clean any oil that may spill with a high-flash point solvent.

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

Torque - Rear Final Gear Case Oil Drain Bolt: 15 N·m (1.5 kgf·m, 11 ft·lb)

● Fill the final gear case up to the bottom of filler opening with the oil specified below.

Rear Final Gear Case Oil

Type: **MOBIL FLUID 424, CITGO TRANSGARD TRACTOR HYDRAULIC FLUID or EXXON HYDRAUL 560**

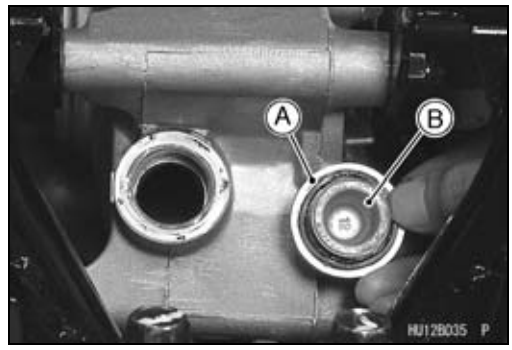
Capacity: **0.72 L (0.76 US qt)**

○Do not use mixing the above oils.

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

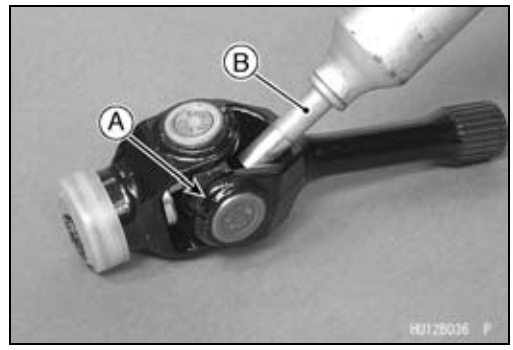
○Apply grease to the O-ring.

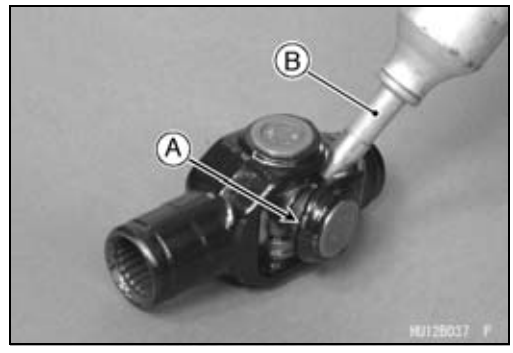
Torque - Rear Final Gear Case Oil Filler Cap: 29 N·m (3.0 kgf·m, 22 ft·lb)



Periodic Maintenance Procedures

Universal Joint Lubrication

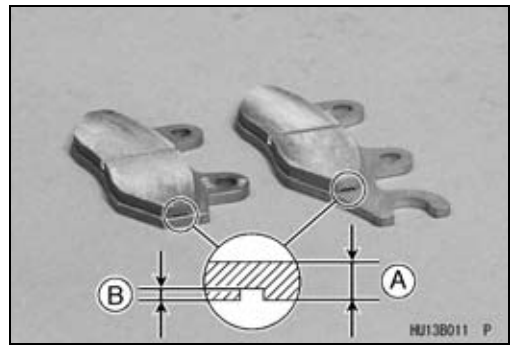




- Remove:
  Rear Propeller Shaft (see Rear Propeller Shaft Removal in the Final Drive chapter)
- Force grease into the grease nipples [A] until the grease comes out from the nipple, and wipe off any excess grease.
  [B] Grease Gun

Brakes

Front Brake Pad Wear Inspection



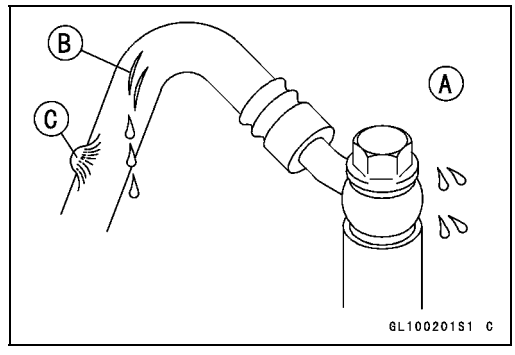
- Check the lining thickness [A] of the pads in each caliper.

★If the lining thickness of either pad is less than the service limit [B], replace both pads in the caliper as a set.

Pad Lining Thickness

Standard:	**4 mm (0.16 in.)**
Service Limit:	**1 mm (0.04 in.)**

Front Brake Hoses and Connections Inspection



- Inspect the brake hose and fittings for deterioration, cracks and signs of leakage.

○The high pressure inside the brake line can cause fluid to leak [A] or the hose to burst if the line is not properly maintained. Bend and twist the rubber hose while examining it.

★Replace the hose if any cracks [B] or bulges [C] are noticed.

- Tighten any loose fittings.

Periodic Maintenance Procedures

Front Brake Hose Replacement

- Pump the brake fluid out of the line as explained in the Brake Fluid Change.
- Remove the banjo bolts at both ends of the brake hose, and pull the hose off the vehicle.
- Immediately wipe up any brake fluid that spills.

NOTICE

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

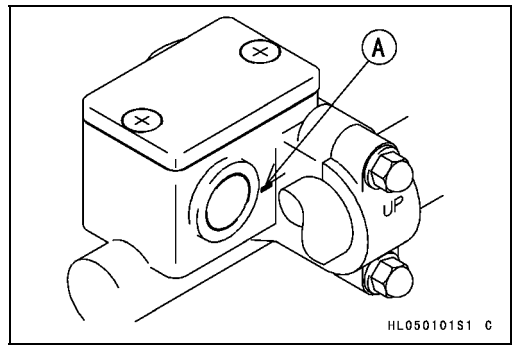
- Use a new flat washer for each side of the hose fittings.
- Install the new brake hose in its place, and tighten the banjo bolts.

Torque - Brake Hose Banjo Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

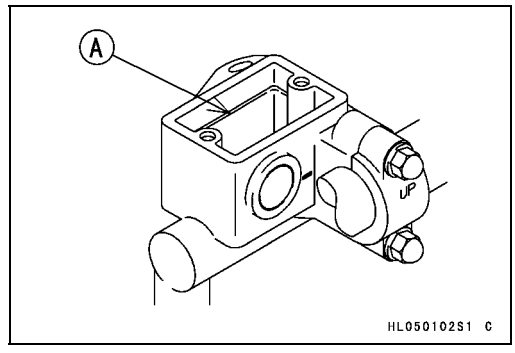
Front Brake Fluid Level Inspection

- Position the reservoir horizontal, and check that the fluid level in the reservoir is higher than the lower level line [A].

★If the fluid level is lower than the lower level line, check for fluid leakage of the brake line, and add the fluid as follows:



○Remove the reservoir cap, and fill the reservoir to the upper level line [A] in the reservoir with the same type and brand of the fluid that is already in the reservoir. And then install the reservoir cap.



⚠ WARNING

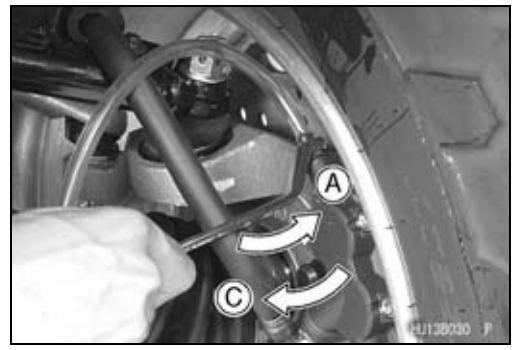
Mixing brands and types of brake fluid can reduce the brake system's effectiveness and cause an accident resulting in injury or death. Do not mix two brands of brake fluid. Change the brake fluid in the brake line completely if the brake fluid must be refilled but the type and brand of the brake fluid that is already in the reservoir are unidentified.

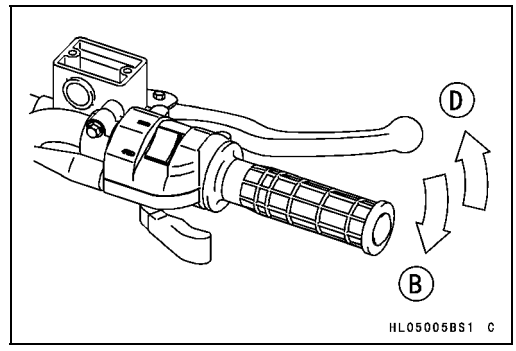
- Tighten:

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

Periodic Maintenance Procedures

Front Brake Fluid Change





- Remove the reservoir cap and the rubber cap on the bleed valve.
- Attach a clear plastic hose to the bleed valve on the caliper, and run the other end of the hose into a container.
- Fill the reservoir with new brake fluid.
- Change the brake fluid as follows:

○Open the bleed valve [A].
○Apply the brake lever and hold it [B].
○Close the bleed valve [C].
○Release the brake lever [D].

- Check the fluid level in the reservoir often, replenishing it as necessary.

NOTE

○*If the fluid in the reservoir runs completely out any time during fluid changing, air will enter the line, and the system must be bled.*

- Repeat this operation until fresh brake fluid comes out into the plastic hose or the color of the fluid changes.

⚠ WARNING

Mixing brands and types of brake fluid can reduce the brake system's effectiveness and cause an accident resulting in injury or death. Do not mix two brands of brake 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.

- Tighten:

Torque - Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Apply the brake lever forcefully for a few seconds, and check for fluid leakage around the fittings.

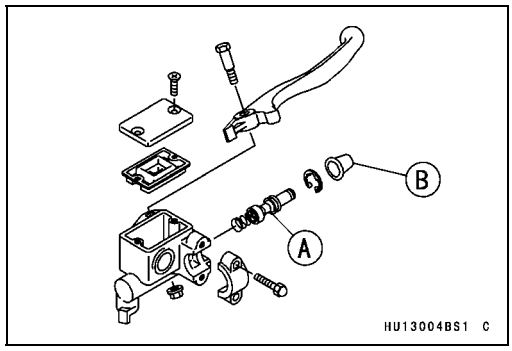
★If necessary, bleed the air from the brake line (see Brake Line Air Bleeding section in the Brakes chapter).

⚠ WARNING

Air in the brake lines diminish braking performance and can cause an accident resulting in injury or death. If the brake lever has a soft or "spongy" feeling mushy when it is applied, there might be air in the brake lines or the brake may be defective. Do not operate the vehicle and service the brake system immediately.

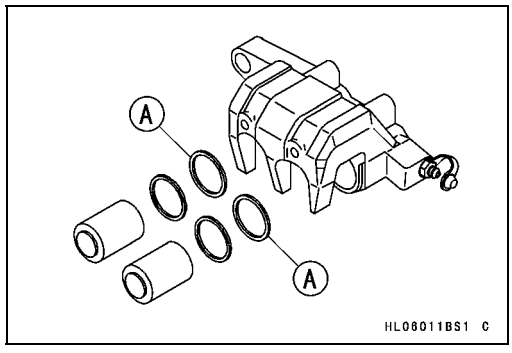
Periodic Maintenance Procedures

Front Brake Master Cylinder Piston Assembly and Dust Cover Replacement



- Disassemble the master cylinder (see Front Brake Master Cylinder Disassembly in the Brakes chapter).
- Replace the piston assembly [A] and dust cover [B] under following condition:
  a)Primary and secondary cups are worn, damaged, softened (rotted) or swollen.
  b)Fluid leakage is noted at the brake lever,
  c)Dust cover is broken or swollen.

Front Brake Caliper Fluid Seal Replacement

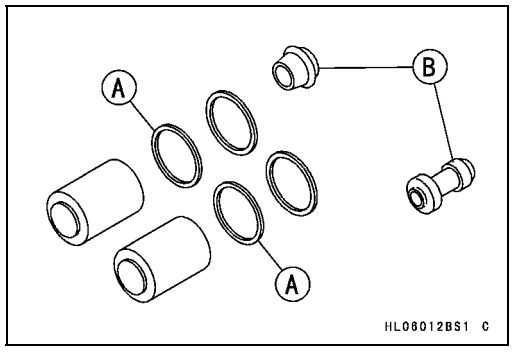


The fluid seals [A] around the piston maintain the proper pad/disc clearance. If the seals are not satisfactory, pad wear will increase, and constant pad drag on the disc will raise brake and brake fluid temperature.

- Replace the fluid seals in accordance with the Periodic Maintenance Chart or under any of the following conditions: (a) fluid leakage around the pad; (b) brakes overheat; (c) there is a large difference in inner and outer pad wear; (d) the seal is stuck to the piston.

★If the fluid seal is replaced, replace the dust seal as well. Also, replace all seals every other time the pads are changed.

Front Brake Caliper Dust Seal and Friction Boot Replacement



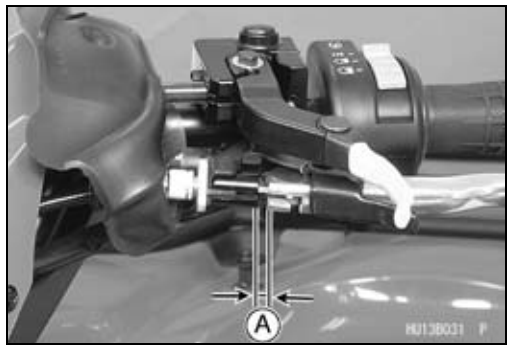
- Replace the dust seals [A] in accordance with the Periodic Maintenance Chart or check that the dust seals and rubber boots [B] are not cracked, worn swollen, or otherwise damaged.

★If they show any damage, replace them.

Rear Brake Plates Replacement

- Replace the steel plates and friction plates in accordance with the specified interval (see Rear Final Gear Case section in the Final Drive chapter).

Rear Brake Lever Free Play Inspection



- Check the rear brake lever free play [A].

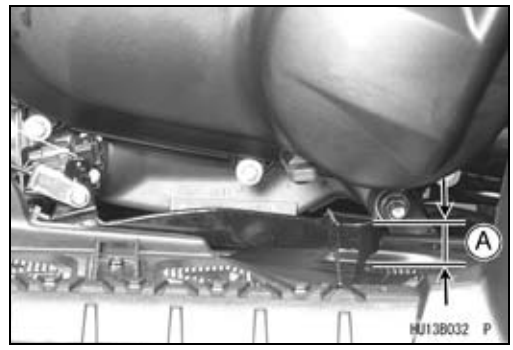
○Pull the rear brake lever lightly until the brake is applied.

★If the play is incorrect, adjust it.

Rear Brake Lever Free Play
Standard: 1 ~ 2 mm (0.04 ~ 0.08 in.)

Periodic Maintenance Procedures

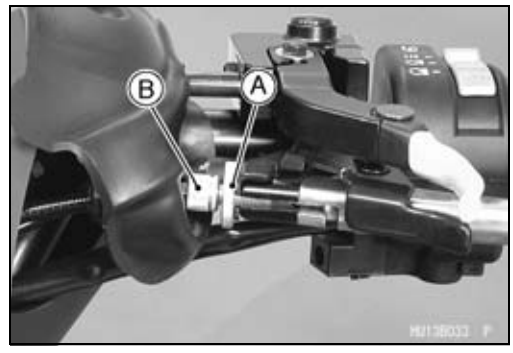
Rear Brake Pedal Free Play Inspection



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

Brake Pedal Free Play
Standard: 15 ~ 25 mm (0.6 ~ 1.0 in.)

Rear Brake Lever and Pedal Free Play Adjustment



NOTE

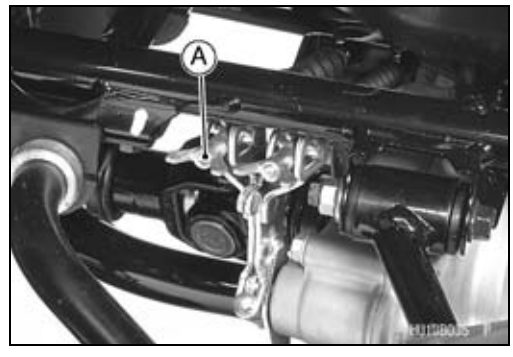
○*Since the rear brake lever and pedal free play adjustments affect each other, make them at the same time.*

Rear Brake Lever

● Loosen the knurled locknut [A] and turn the adjuster [B] at the rear brake lever in as far as it will go.
● Tighten the locknut.

● Turn the brake lever adjuster [A] at the rear end of the brake cable until the rear brake lever has the correct amount of play.

Rear Brake Pedal



● Turn the brake pedal adjuster [A] at the rear end of the brake cable until the brake pedal has the correct amount of play.

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

Periodic Maintenance Procedures

Steering

Steering Inspection

● Turn the handlebar left and right, and check the steering action.

★If the steering action is not smooth, or if the steering binds or catches before the stop, lubricate the steering stem bearing.

NOTE

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

● Check the steering action again.

★If steering stem bearing lubrication does not remedy the problem, inspect the steering stem for straightness, steering stem clamps, and tie-rod bearings.

★If you feel looseness, or if the steering rattles as it turns, check the tightness of the steering bolts and nuts.

● Tighten loose bolts and nuts to the specified torque (see Steering chapter), and check the steering action again.

★If the steering action does not change by tightening the bolts and nuts, inspect the steering stem clamps, steering stem bearings, tie-rod bearings, and steering knuckle joints.

Electrical System

Spark Plug Cleaning/Inspection

● Remove the spark plug (see Spark Plug Removal in the Electrical System chapter).

● Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a wire brush or other suitable tool.

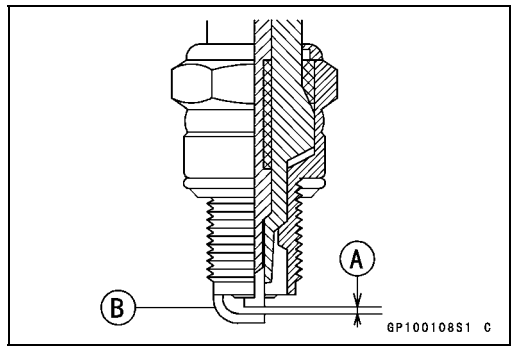
★If the spark plug electrodes are corroded or damaged, or if the insulator is cracked, replace the plug. Use the standard spark plug or its equivalent.

Spark Plug Gap Inspection

● Measure the gap [A] with a wire-type thickness gauge.

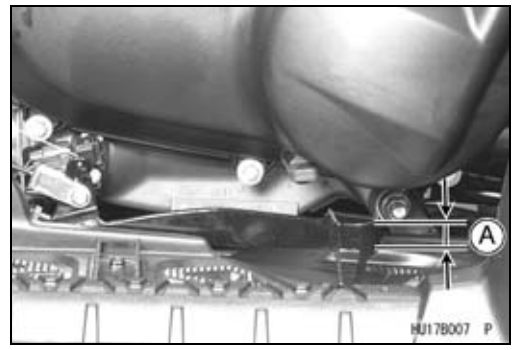
★If the gap is incorrect, carefully bend the side electrode [B] with a suitable tool to obtain the correct gap.

Spark Plug Gap
0.7 ~ 0.8 mm (0.028 ~ 0.032 in.)



Periodic Maintenance Procedures

Rear Brake Light Switch Inspection



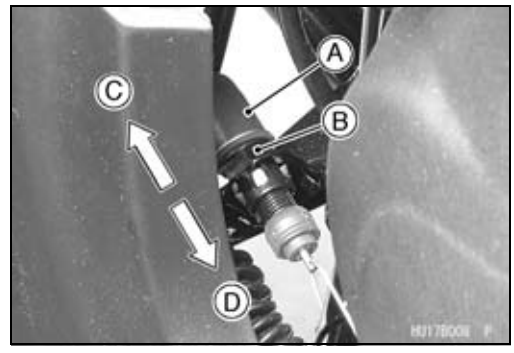
- Turn on the ignition switch.
- Check the operation of the rear brake light switch by depressing the brake pedal.

★If it does not as specified, adjust the brake light timing.

Brake Light Timing

Standard: On after about 10 mm (0.4 in.) of pedal travel [A]

Rear Brake Light Timing Adjustment



- Adjust the brake light switch [A] up or down. To change the switch position, turn the adjusting nut [B].
  Light sooner as the body rises [C]
  Light later as the body lowers [D]

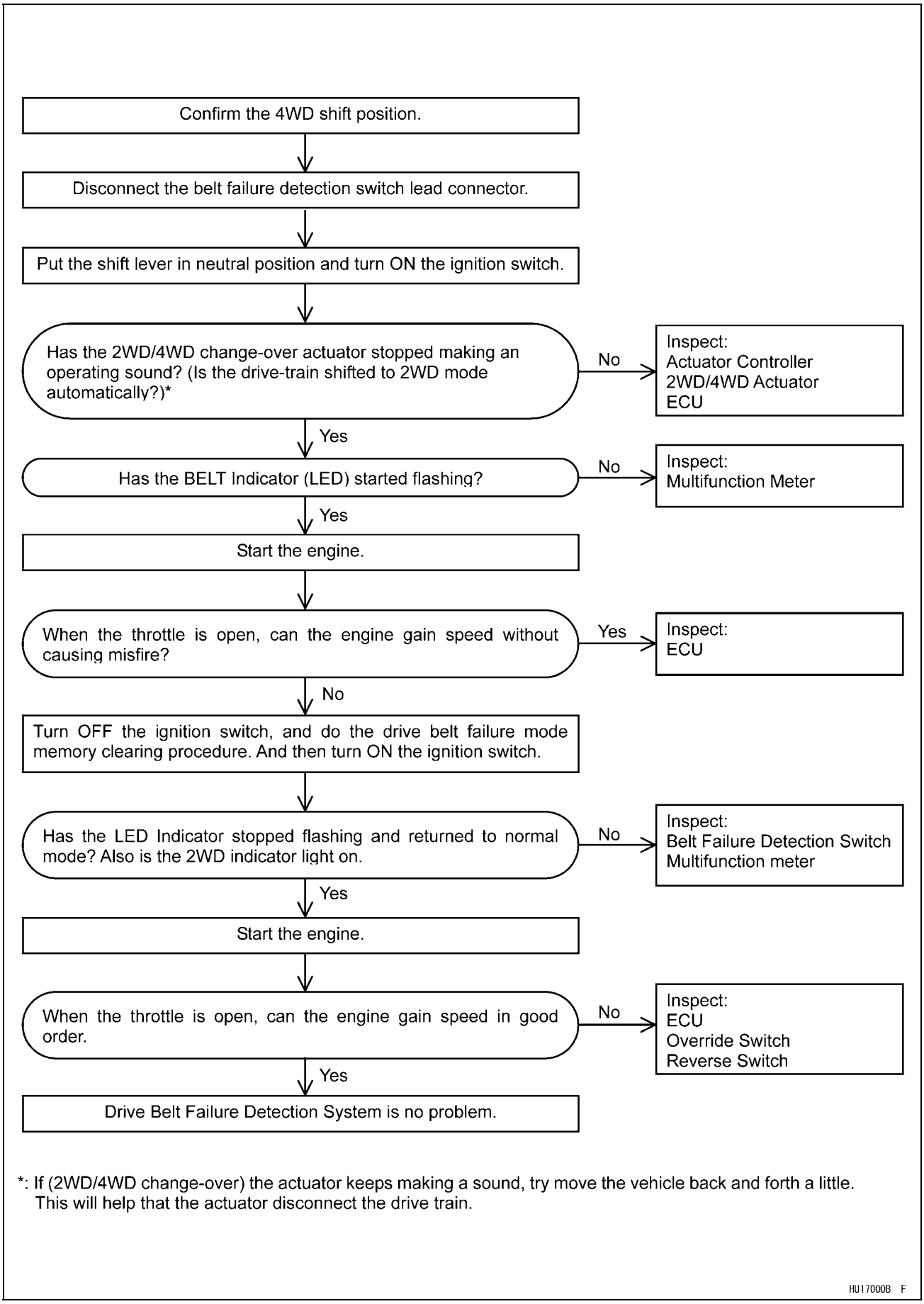
NOTICE

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

Converter Drive Belt Failure Detection System Inspection

- Remove:
  Seat (see Seat Removal in the Frame chapter)
- Check the drive belt failure detection system according to following chart in the next page.

Periodic Maintenance Procedures



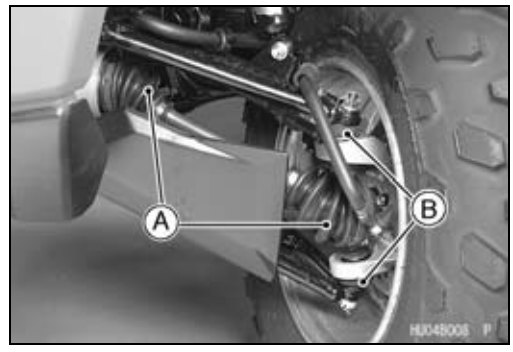
*: If (2WD/4WD change-over) the actuator keeps making a sound, try move the vehicle back and forth a little. This will help that the actuator disconnect the drive train.

HU17000B F

Periodic Maintenance Procedures

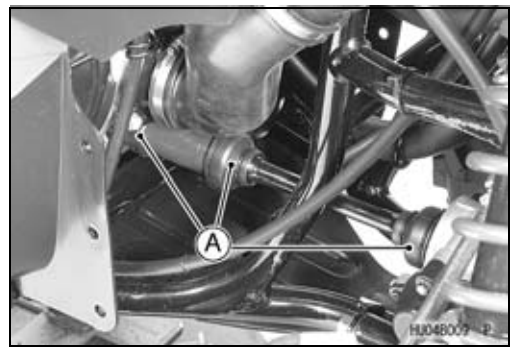
Joint Boots Inspection

Front Axle/Steering Knuckle Joint Boots Inspection



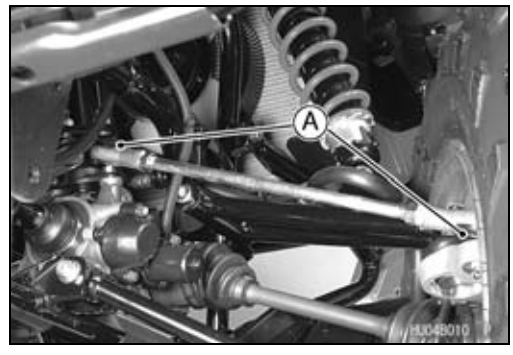
- Visually inspect the front axle joint boots [A].
- ★If the joint boot is torn, worn, deteriorated, or leaks grease, replace the joint boot or front axle assembly (see Front Axle Joint Boot Replacement in the Final Drive chapter).
- Visually inspect the knuckle joint boots [B].
- ★If the joint boot is torn, worn, deteriorated, or leaks grease, replace the knuckle (see Steering Knuckle section in the Steering chapter).

Front Propeller Shaft Joint Boots Inspection



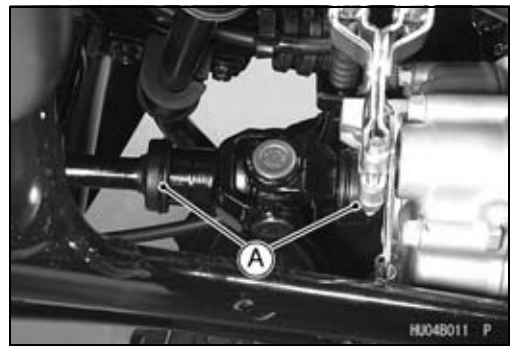
- Visually inspect the boots [A] of the front propeller shaft.
- ★If damage, tear or deterioration is found, replace the boots (see Front Propeller Shaft section in the Final Drive chapter).

Tie-rod End Boots Inspection



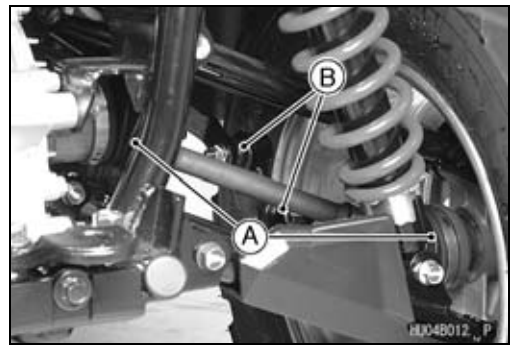
- Visually inspect the tie-rod end boots [A] of the tie-rods.
- ★If the boot is torn, worn, deteriorated, or leaks grease, replace the tie-rod end (see Tie-Rod End Removal in the Steering chapter).

Rear Propeller Shaft Joint Boots Inspection



- Visually inspect the boots [A] of the rear propeller shaft.
- ★If the joint boot is torn, worn, or deteriorated, replace the joint boot and check the propeller shaft (see Rear Propeller Shaft section in the Final Drive chapter).

Rear Axle/Stabilizer Joint Boots Inspection



- Visually inspect the rear axle joint boots [A].
- ★If the joint boot is torn, worn, deteriorated, or leaks grease, replace the joint boot or rear axle assembly (see Rear Axle Joint Boot Replacement in the Final Drive chapter).
- Visually inspect the stabilizer joint boots [B].
- ★If the joint boot is torn, worn, deteriorated, or leaks grease, replace the stabilizer joint (see Stabilizer Removal in the Suspension chapter).

Periodic Maintenance Procedures

General Lubrication

Lubrication

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

NOTE

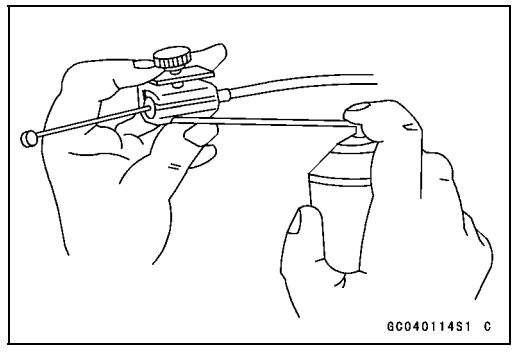
○*Whenever the vehicle has been operated under wet or rainy conditions, or especially after using a high-pressure spray water, perform the general lubrication.*

Cables: Lubricate with Cable Lubricant

Rear Brake Inner Cable
Throttle Inner Cable
Variable Differential Control Inner Cable

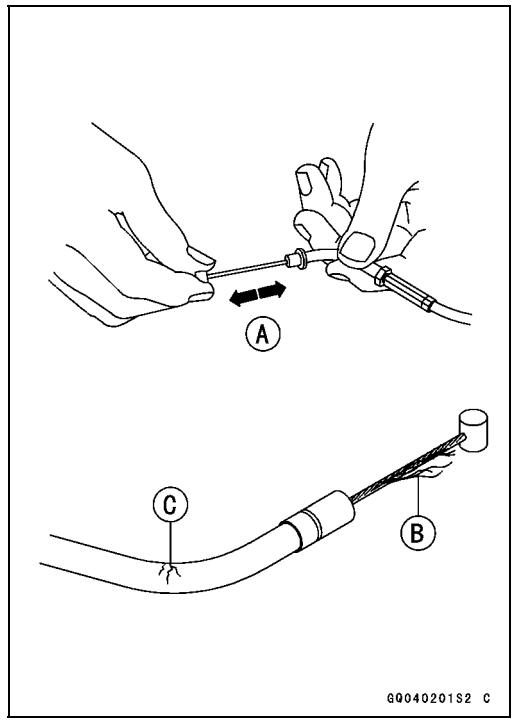
- Lubricate the cables by seeping the oil between the cable and housing.

○The cable may be lubricated by using a pressure cable luber with an aerosol cable lubricant.



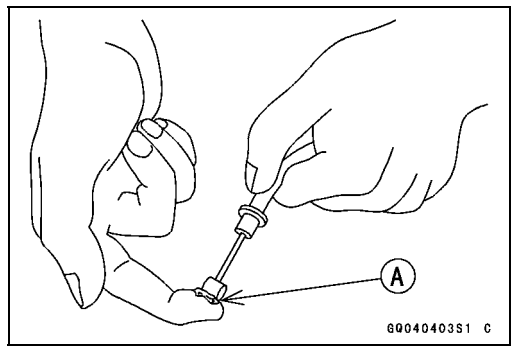
- With the cable disconnected at the both ends, the cable should move freely [A] within the cable housing.

★If cable movement is not free after lubricating, if the cable is frayed [B], or if the cable housing is kinked [C], replace the cable.



Points: Lubricate with Grease.

Throttle Inner Cable Upper End [A]
Brake Cable Upper End
Variable Differential Control Cable Ends



Periodic Maintenance Procedures

Slide Points: Lubricate with Grease.
Brake Lever
Brake Pedal Pivot Shaft
Throttle Lever Shaft

Bolts and Nuts Tightening

Tightness Inspection

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

★ If there are loose fasteners, retorque them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not listed in the appropriate chapter, see the Basic Torque Table (see Torque and Locking Agent). For each fastener, first loosen it by 1/2 turn, then tighten it.

★ If cotter pins are damaged, replace them with new ones.

Bolts, Nuts, and Fasteners to be checked

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

Brakes:
Front Brake Master Cylinder Clamp Bolts
Brake Lever Pivot Bolt
Brake Lever Pivot Bolt Locknut
Front Brake Caliper Mounting Bolts
Brake Pedal Cotter Pin

Steering/Suspension:
Handlebar Holder Bolts
Steering Stem Clamp Bolts
Steering Stem Bearing Joint Bolts
Tie-rod End Nuts and Cotter Pins
Tie-rod Locknuts
Shock Absorber Mounting Nuts
Front Suspension Arm Pivot Nuts
Rear Suspension Arm Pivot Nuts
Steering Knuckle Joint Nuts and Cotter Pins

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

Final Drive:
Rear Final Gear Case Bracket Bolts

Others:
Footboard Mounting Bolts
Throttle Case Screws
Carrier Bolts

Fuel System (DFI)

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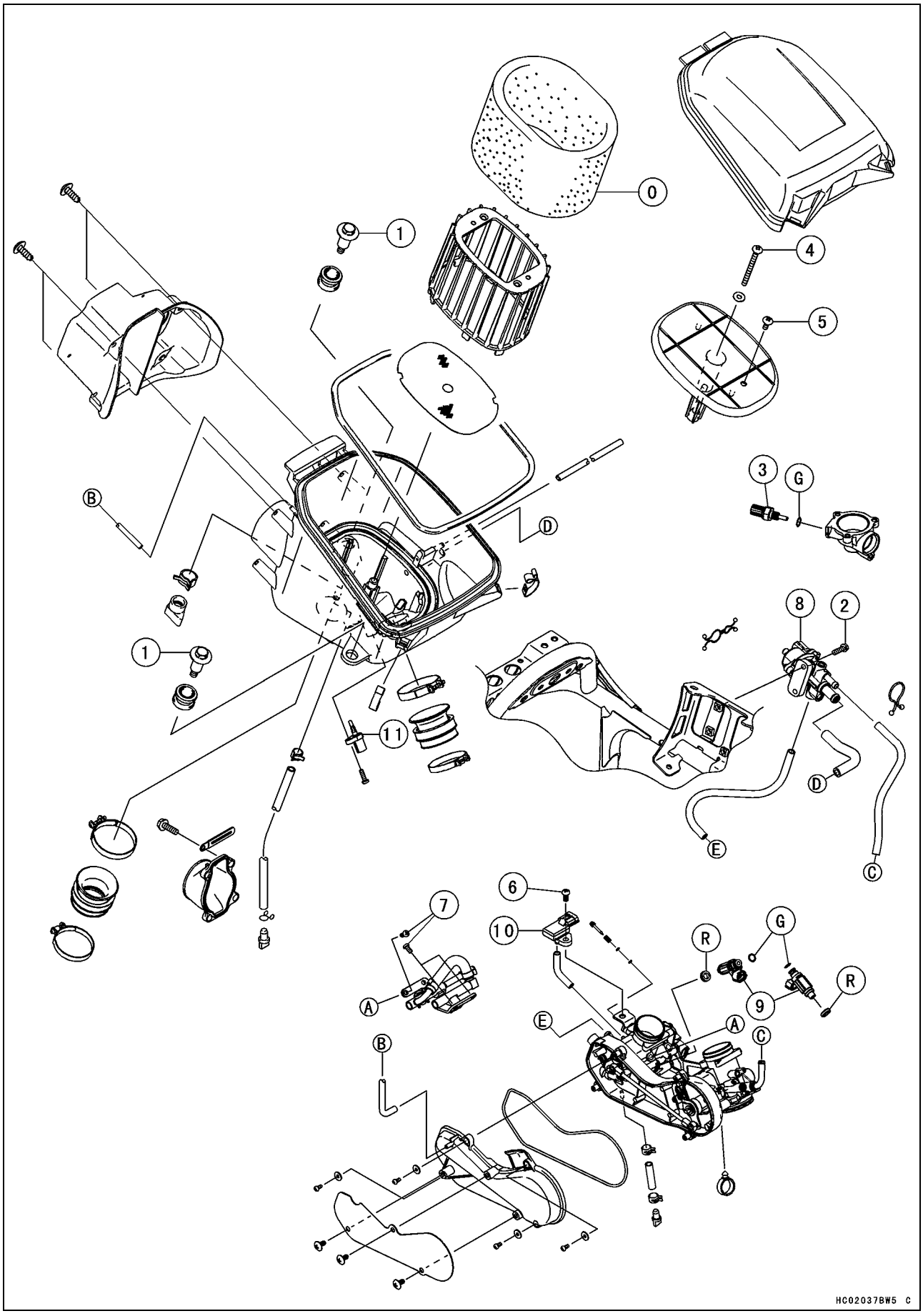
Exploded View



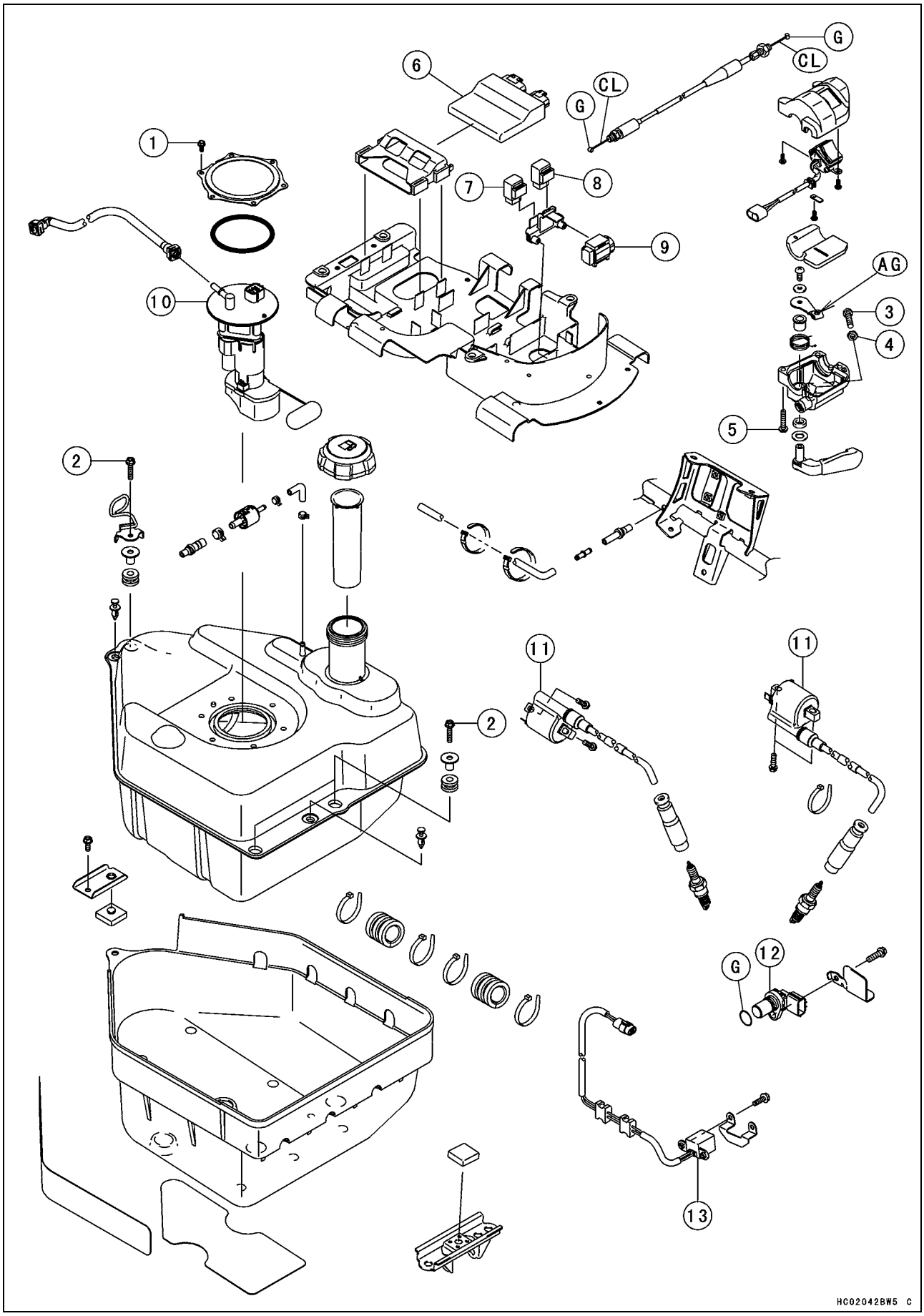
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Cleaner Housing Bolts	8.8	0.90	78 in·lb	
2	ISC Valve Mounting Bolts	8.8	0.90	78 in·lb	
3	Water Temperature Sensor	12	1.2	106 in·lb	
4	Air Cleaner Element Holder Screw	3.5	0.36	31 in·lb	
5	Air Cleaner Element Holder Tapping Screw	1.5	0.15	13 in·lb	
6	Intake Air Pressure Sensor Mounting Screw	5.0	0.51	44 in·lb	
7	Delivery Pipe Mounting Screws	5.0	0.51	44 in·lb	

8. ISC Valve
9. Fuel Injectors
10. Intake Air Pressure Sensor
11. Intake Air Temperature Sensor

G: Apply grease.
O: Apply high-quality foam air filter oil.

Exploded View



Exploded View

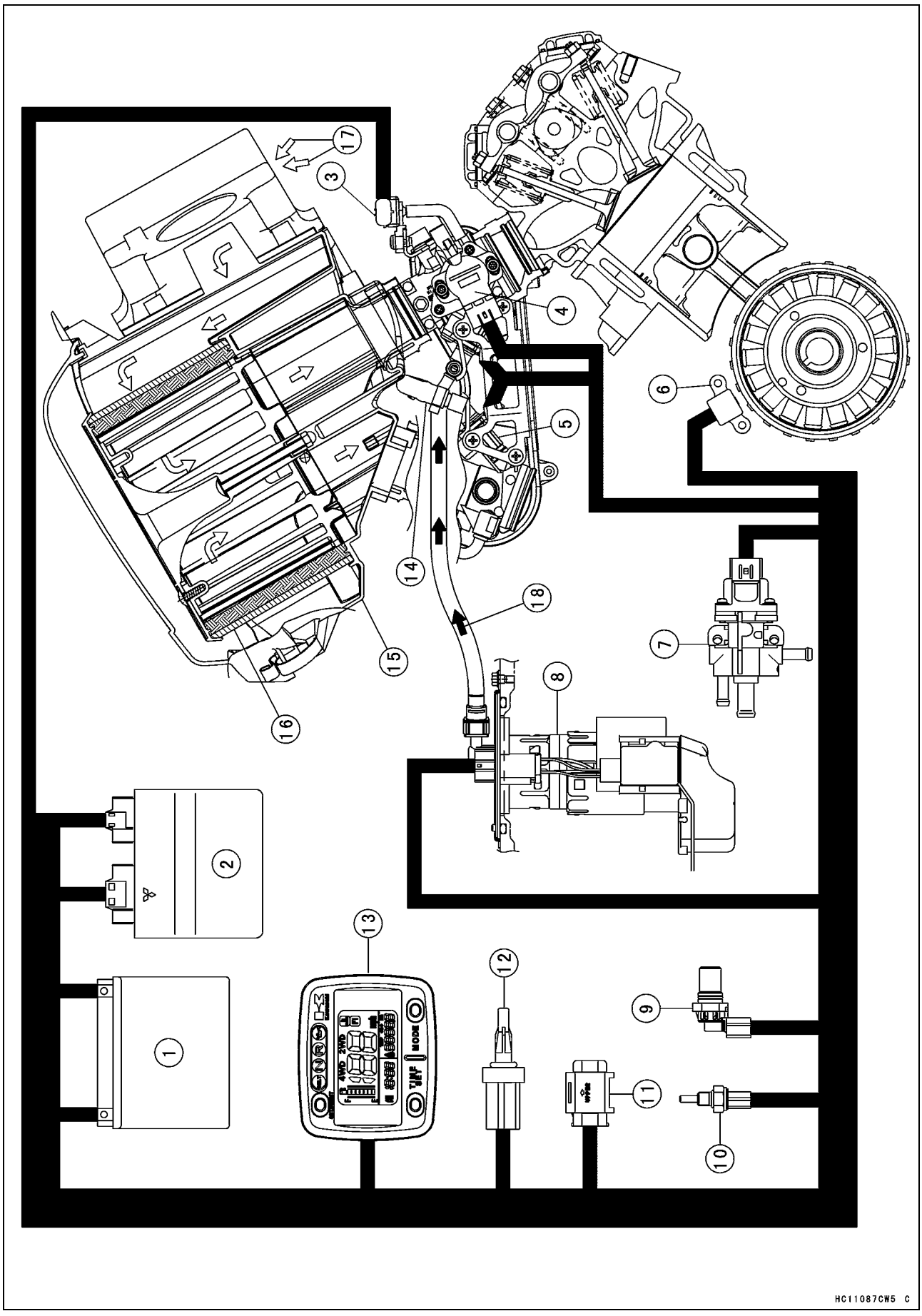
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Fuel Pump Bolts	4.0	0.41	35 in·lb	
2	Fuel Tank Mounting Bolts	9.8	1.0	87 in·lb	
3	Throttle Lever Limiter Screw	3.6	0.37	32 in·lb	
4	Throttle Lever Limiter Nut	3.6	0.37	32 in·lb	
5	Throttle Case Assembly Screws	3.6	0.37	32 in·lb	

6. ECU (Electronic Control Unit)
7. Fuel Pump Relay
8. Radiator Fan Relay
9. Vehicle-down Sensor
10. Fuel Pump
11. Ignition Coils
12. Speed Sensor
13. CrankShaft Sensor

AG: Apply grease (Chevron Black Pearl Grease EP)
G: Apply grease.
CL: Apply cable lubricant.

DFI System

DFI System

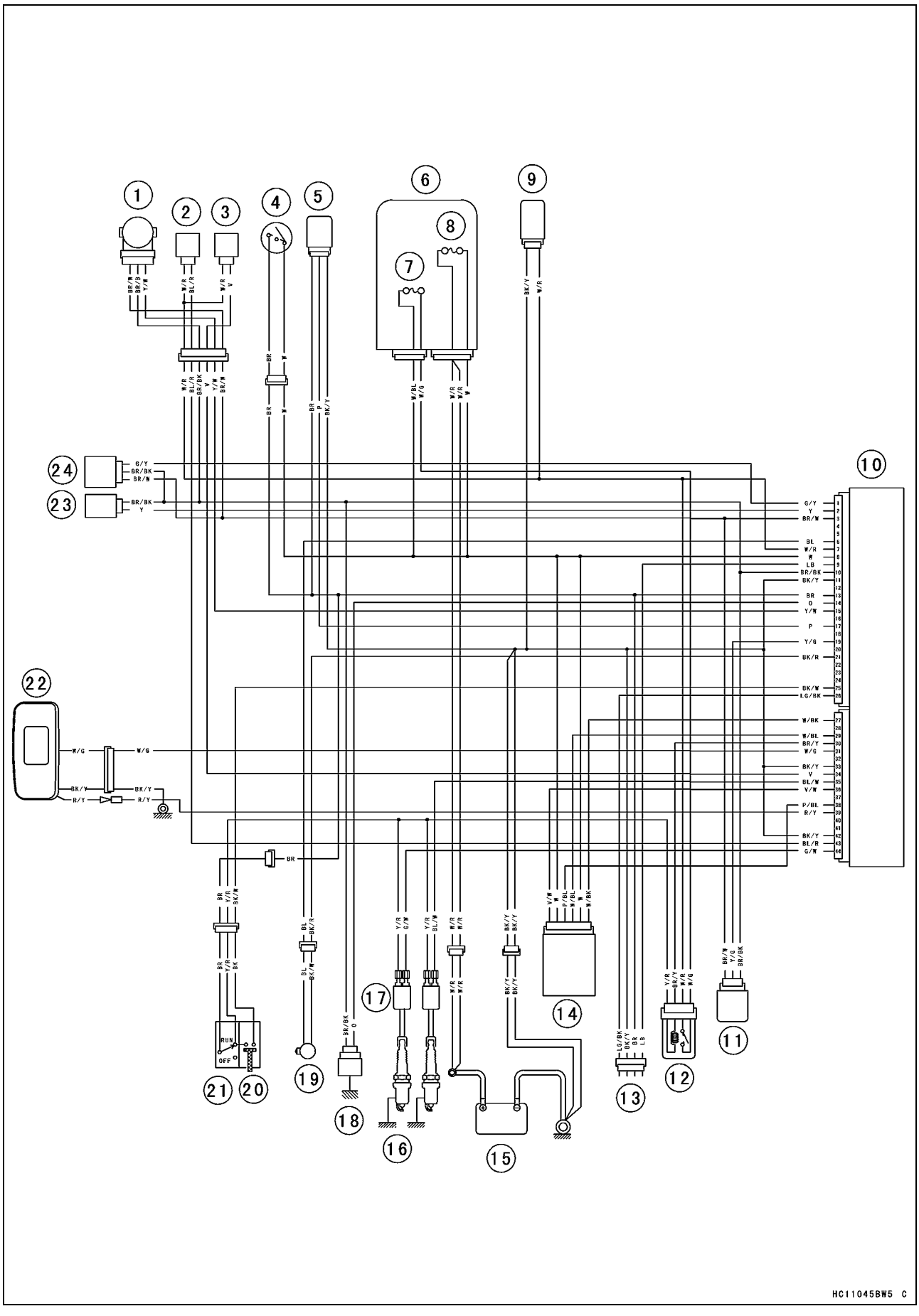


DFI System

1. Battery 12 V 12 Ah
2. ECU (Electronic Control Unit)
3. Intake Air Pressure Sensor
4. Throttle Sensor
5. Injectors
6. Crankshaft Sensor
7. ISC Valve
8. Fuel Pump
9. Speed Sensor
10. Water Temperature Sensor
11. Vehicle-down Sensor
12. Intake Air Temperature Sensor
13. Multifunction Meter
14. Delivery Pipe
15. Air Cleaner Housing
16. Air Cleaner Element
17. Air Flow
18. Fuel Flow

DFI System

DFI System Wiring Diagram

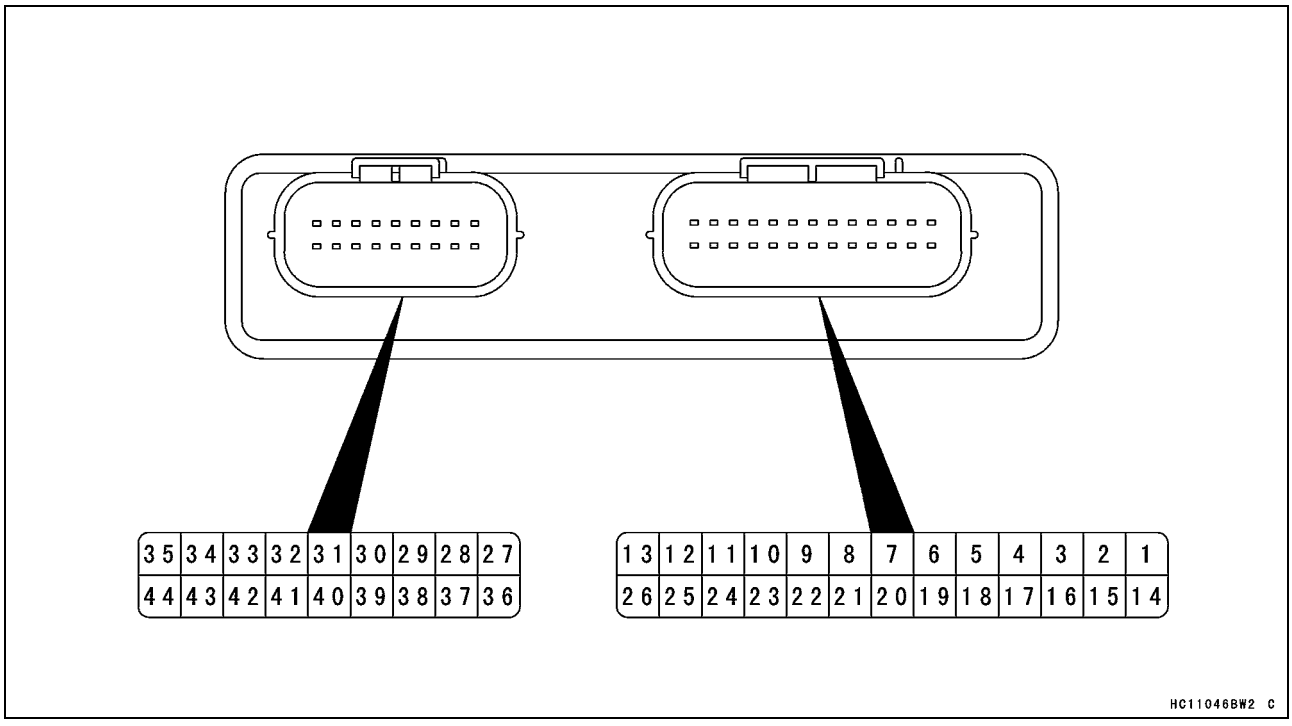


DFI System

Part Name

1. Throttle Sensor
2. Fuel Injector #1
3. Fuel Injector #2
4. Ignition Switch
5. Speed Sensor
6. Fuse Box
7. Fuel Pump Fuse 10 A
8. Main Fuse 30 A
9. Fuel Pump
10. ECU (Electronic Control Unit)
11. Vehicle-down Sensor
12. Fuel Pump Relay
13. Kawasaki Diagnostic System Connector
14. ISC Valve
15. Battery 12 V 12 Ah
16. Spark Plugs
17. Ignition Coils
18. Water Temperature Sensor
19. Crankshaft Sensor
20. Starter Button
21. Engine Stop Switch
22. Multifunction Meter
23. Intake Air Temperature Sensor
24. Intake Air Pressure Sensor

DFI System

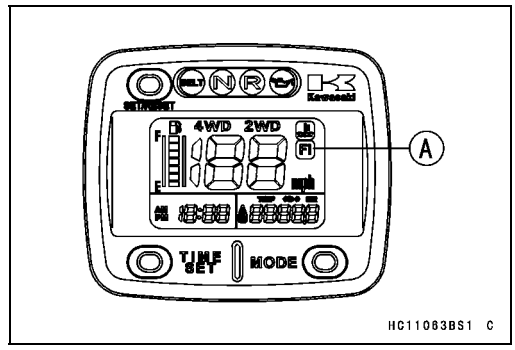


Terminal Names

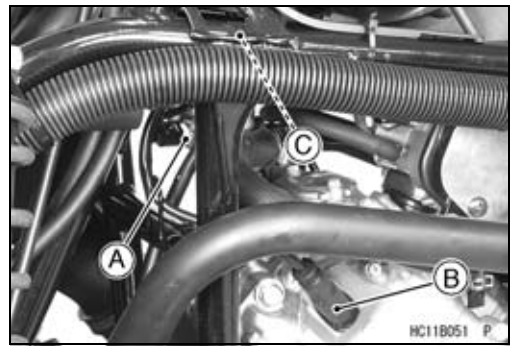
1. Intake Air Pressure Sensor Signal
2. Intake Air Temperature Sensor Signal
3. Power Supply to Sensors
4. Reverse Switch Signal
5. Reverse Power Assist Switch Signal
6. Crankshaft Sensor (–) Signal
7. Battery Monitor
8. Power Supply to ECU (from Battery)
9. External Communication Line (KDS)
10. Ground for Sensors
11. Ground for Control System
12. Unused
13. Ignition Switch Signal
14. Water Temperature Sensor Signal
15. Throttle Sensor Signal
16. Unused
17. Speed Sensor Signal
18. Signal Neutral Switch Signal
19. Vehicle-down Sensor Signal
20. Unused
21. Crankshaft Sensor (+) Signal
22. Drive Belt Failure Detecting Switch Signal
23. Communication Line B
24. Communication Line A
25. Starter Button Signal
26. Diagnosis Terminal
27. ISC Valve Signal #4
28. Drive Belt Failure Detecting Reset
29. ISC Valve Signal #2
30. Fuel Pump Relay Signal
31. Water Temperature Warning Indicator (LCD) Signal
32. Radiator Fan Relay Signal
33. Ground for Engine
34. Injector #2 Signal
35. Ignition Coil #2 Signal
36. ISC Valve Signal #1
37. 2WD/4WD Shift Switch Signal
38. ISC Valve Signal #3
39. FI Indicator (LCD) Signal
40. Drive Belt Check Indicator Light (LED) Signal
41. Unused
42. Ground for Engine
43. Injector #1 Signal
44. Ignition Coil #1 Signal

DFI Parts Location

FI Indicator Light (LCD) [A]

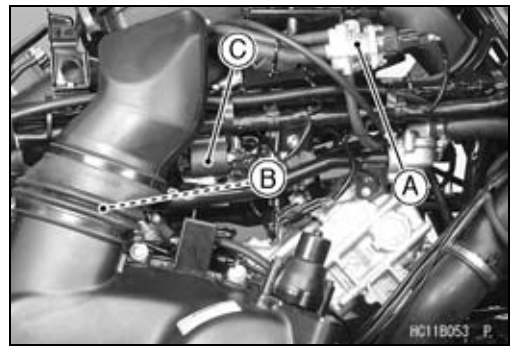


Water Temperature Sensor [A]
Spark Plug (Front) [B]
Ignition Coil (Front) [C]

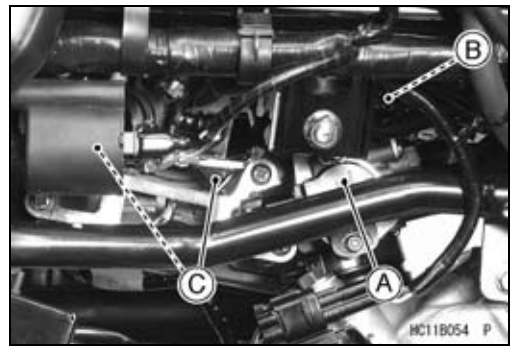


Crankshaft Sensor [A]

ISC Valve [A]
Spark Plug (Rear) [B]
Ignition Coil (Rear) [C]

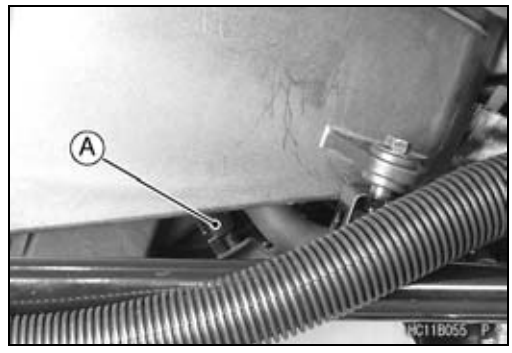


Throttle Sensor [A]
Intake Air Pressure Sensor [B]
Fuel Injectors [C]

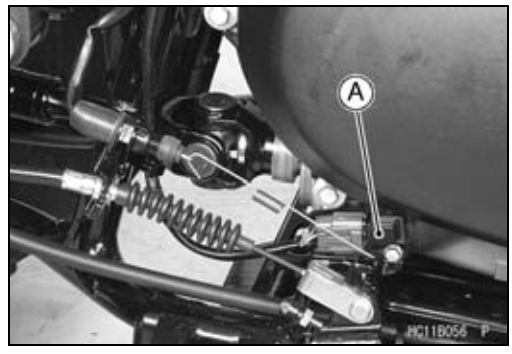


DFI Parts Location

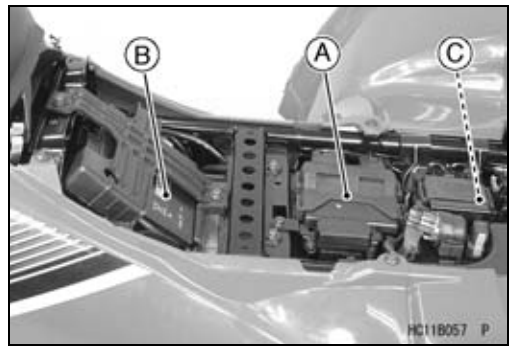
Intake Air Temperature Sensor [A]



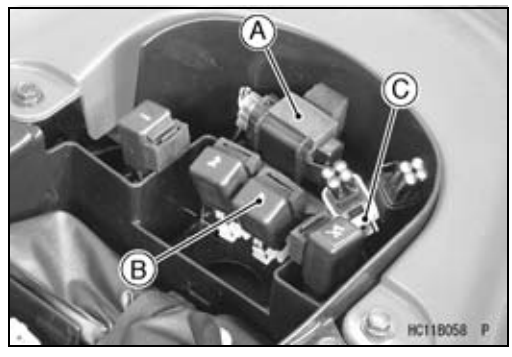
Speed Sensor [A]



ECU (Electronic Control Unit) [A]
Battery 12V 12Ah [B]
Fuel Pump [C]



Vehicle-down Sensor [A]
Fuel Pump Relay [B]
Kawasaki Diagnostic System Connector [C]



Specifications

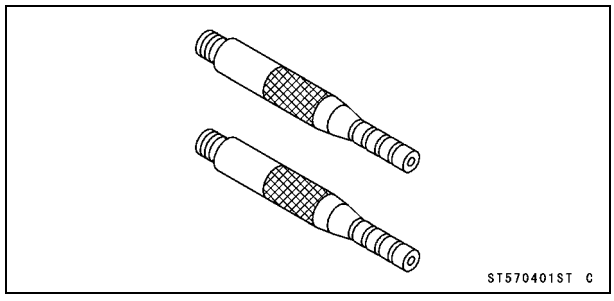
Item	Standard
Digital Fuel Injection System	
Idle Speed	1 100 ±50 r/min (rpm)
Throttle Body Assy:	
Type	Two barrel type
Bore	ϕ38 mm (1.50 in.)
ECU (Electronic Control Unit):	
Make	Mitsubishi Electric
Type	Digital memory type, with built in IC igniter, sealed with resin
Usable Engine Speed	100 ~ 8 700 r/min (rpm)
Fuel Pressure (High Pressure Line):	
With Engine Idling	294 kPa (3.0 kgf/cm², 43 psi) with fuel pump running
Fuel Pump:	
Type	In-tank friction pump
Discharge	50 mL (1.7 US oz.) or more for 3 seconds
Fuel Injectors:	
Type	INP-250
Nozzle Type	One spray type with 4 holes
Resistance	About 11.7 ~ 12.3 Ω at 20°C (68°F)
Throttle Sensor:	Non-adjustable and non-removable
Input Voltage	DC 4.75 ~ 5.25 V between BR/W and BR/BK leads
Output Voltage at Idle Throttle Opening	DC 1.00 ~ 1.24 V between Y/W and BR/BK leads
Output Voltage at Full Throttle Opening	DC 4.0~ 4.4 V between Y/W and BR/BK leads
Resistance	4 ~ 6 kΩ
Intake Air Pressure Sensor:	
Input Voltage	DC 4.75 ~ 5.25 V between BR/W and BR/BK leads
Output Voltage	DC 3.80 ~ 4.20 V at standard atmospheric pressure (see this text for details)
Intake Air Temperature Sensor:	
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) 0.29 ~ 0.39 kΩ at 80°C (176°F)
Output Voltage at ECU	About 2.26 ~ 2.50 V at 25°C (77°F)
Water Temperature Sensor:	
Resistance	see Electrical System chapter
Output Voltage at ECU	About 2.24 ~ 2.48 V at 25°C (77°F)
Vehicle-down Sensor:	
Detection Method	Magnetic flux detection method
Detection Angle	more than 15 ~ 35° for each bank
Output Voltage	with the sensor tilted 15 ~ 35° or more: 0.4 ~ 1.4 V with sensor arrow mark pointed up: 3.7 ~ 4.4 V
ISC Valve:	
Resistance	28.8 ~ 31.2 Ω at 20° (68°F)
Engine Vacuum	29.6 ±1.3 kPa (222 ±9.8 mmHg) at Idle Speed

Specifications

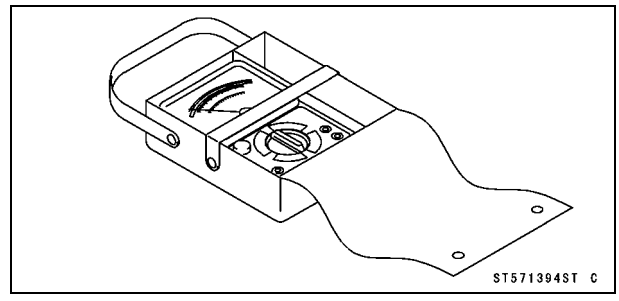
Item	Standard
Speed Sensor:	
Input Voltage	Battery Voltage at ignition Switch ON
Output Voltage	less than CD 0.8 Vor over than DC 4.8 V at ignition Switch ON and 0 km/h
Throttle Lever and Cable	
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)
Air Cleaner	
Air Cleaner Element Oil	High quality form air filter oil

Special Tools and Sealant

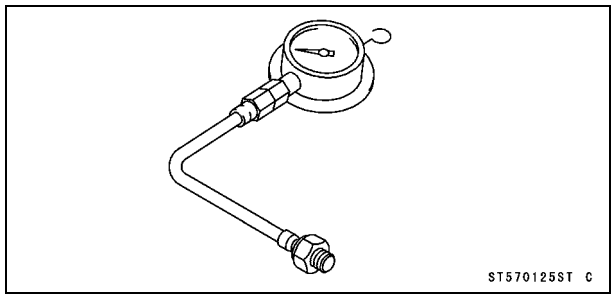
Vacuum Gauge Adapter:
57001-401



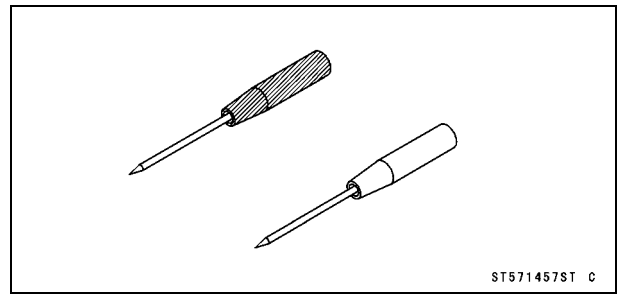
Hand Tester:
57001-1394



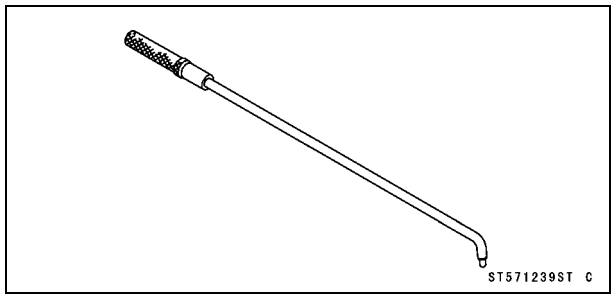
Oil Pressure Gauge, 5 kgf/cm²:
57001-125



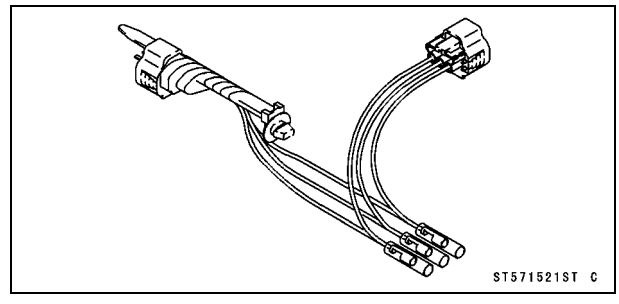
Needle Adapter Set:
57001-1457



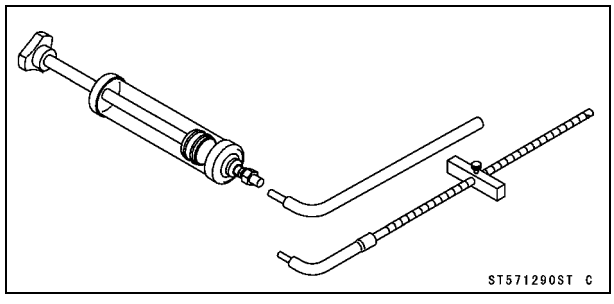
Pilot Screw Adjuster, A:
57001-1239



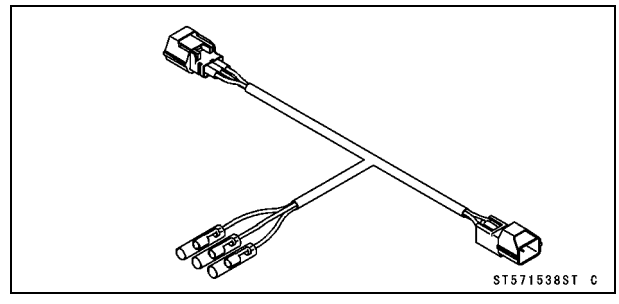
Throttle Sensor Setting Adapter:
57001-1521



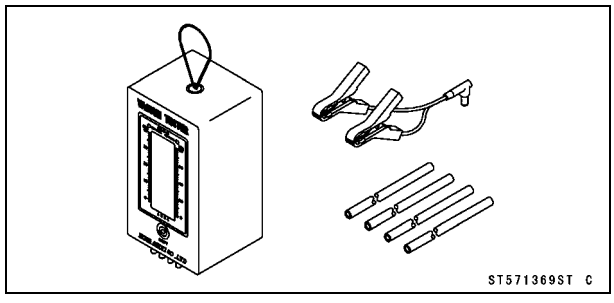
Fork Oil Level Gauge:
57001-1290



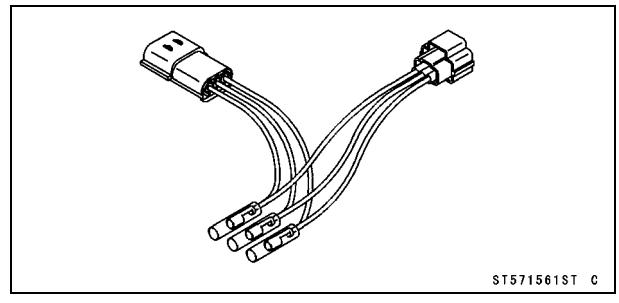
Throttle Sensor Setting Adapter:
57001-1538



Vacuum Gauge:
57001-1369

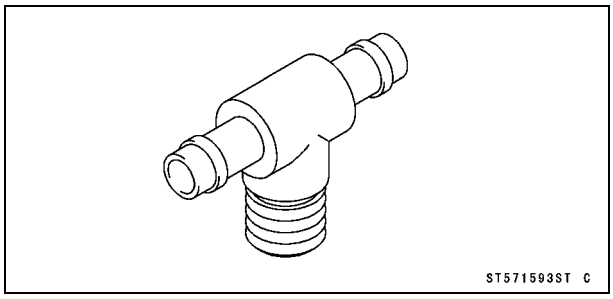


Sensor Harness Adapter:
57001-1561

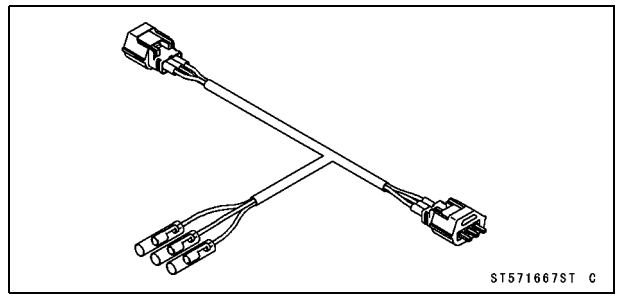


Special Tools and Sealant

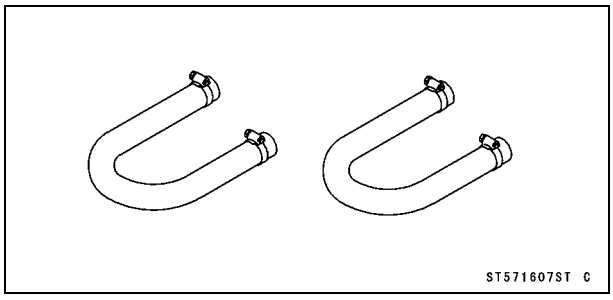
Fuel Pressure Gauge Adapter:
57001-1593



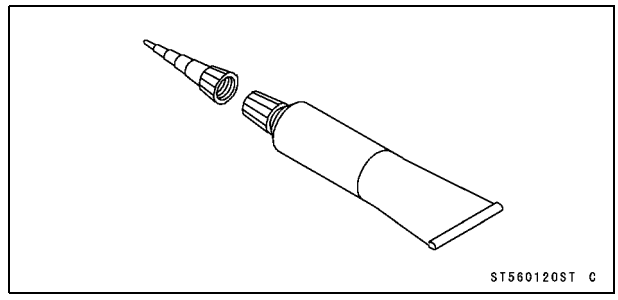
Speed Sensor Measuring Adapter:
57001-1667



Fuel Hose:
57001-1607



Liquid Gasket, TB1211:
56019-120



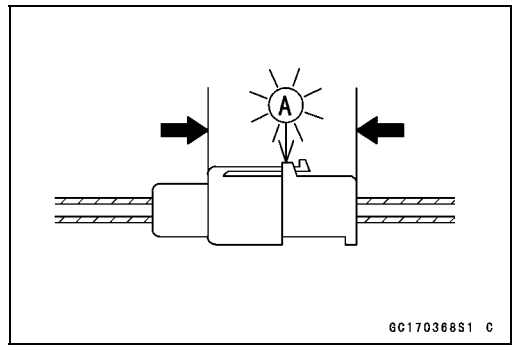
DFI Servicing Precautions

DFI Servicing Precautions

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

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on or while the engine is running.
- Take care not to short the cables that are directly connected to the battery positive (+) terminal to the chassis ground.
- When charging, remove the battery from the vehicle. This is to prevent ECU damage by excessive voltage.
- Do not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- Do not spray water on the electrical parts, DFI parts, connectors, leads, and wiring.

- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition switch, and disconnect the battery (–) terminal. Do not pull the lead, only the connector. Conversely, make sure that all the DFI electrical connections are firmly reconnected before starting the engine.
- Connect these connectors until they click [A].



- If a transceiver is installed on the vehicle, make sure that the operation of the DFI system is not influenced by electric wave radiated from the antenna. Check operation of the system with the engine at idle. Locate the antenna as far as possible away from the ECU.
- When any fuel hose is disconnected, fuel may spout out by residual pressure in the fuel line. Cover the hose joint with a piece of clean cloth to prevent fuel spillage.
- When 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.
- Do not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- Before removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- To prevent corrosion and deposits in the fuel system, do not add to fuel any fuel antifreeze chemicals.

DFI Servicing Precautions

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

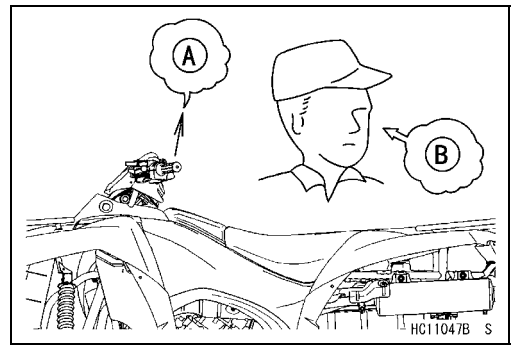
Troubleshooting the DFI System

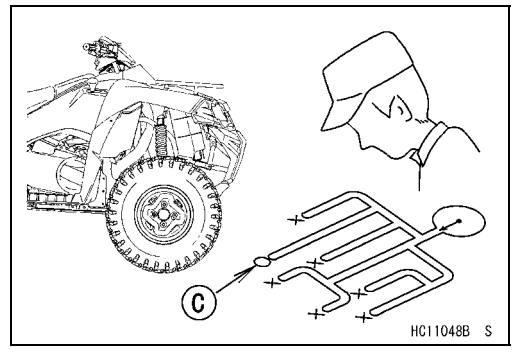
Outline

When an abnormality in the DFI system occurs, the FI indicator light (LCD) goes on to alert the rider on the meter panel. In addition, the condition of the problem is stored in the memory of the ECU (electronic control unit). With the engine stopped and turned in the self-diagnosis mode, the service code [A] is indicated by the number of times the FI indicator light (LCD) blinks.

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

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



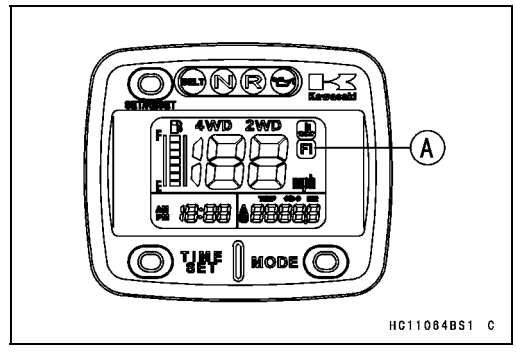


Even when the DFI system is operating normally, the FI indicator light (LCD) [A] may light up under strong electrical interference. No repair needed. Turn the ignition switch OFF to stop the indicator light.

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

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

When the vehicle is down, the vehicle-down sensor is turned OFF and the ECU shuts off the fuel injector and ignition system. The FI indicator light (LCD) blinks but the service code cannot be displayed. The ignition switch is left ON. If the starter button is pushed, the electric starter turns but the engine doesn't start. To start the engine again, raise the vehicle, turn the ignition switch OFF, and then ON. The vehicle-down sensor is turned ON and the light goes OFF.

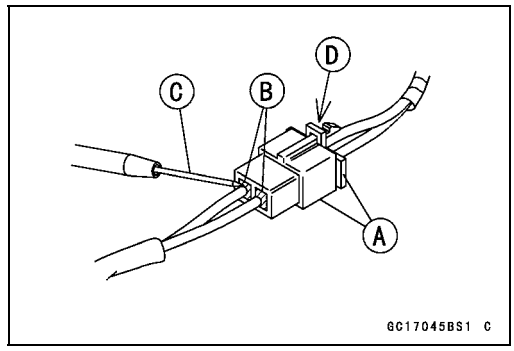


Troubleshooting the DFI System

○The DFI part connectors [A] have seals [B], including the ECU.

● Join the connector and insert the needle adapters [C] inside the seals [B] from behind the connector until the adapter reaches the terminal.

Special Tool - Needle Adapter Set: 57001-1457



NOTICE

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

● Make sure that measuring points are correct in the connector, noting the position of the lock [D] and the lead color before measurement. Do not reverse connections of 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.

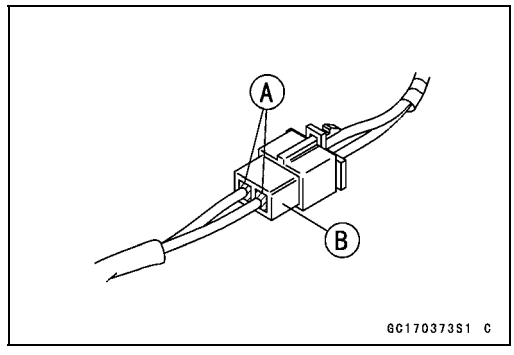
● Turn the ignition switch ON and measure the voltage with the connector joined.

NOTICE

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

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

Sealant - Liquid Gasket, TB1211: 56019-120



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

● Trouble may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the problem. If the problem was caused by some other item or items, they too must be repaired or replaced, or the new replacement part will soon fail again.

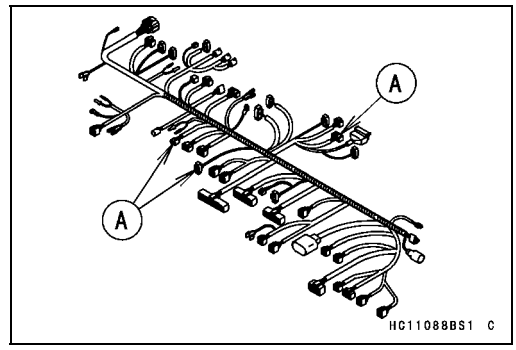
● Measure coil winding resistance when the DFI part is cold (at room temperature).

● Make sure all connectors in the circuit are clean and tight, and examine 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.

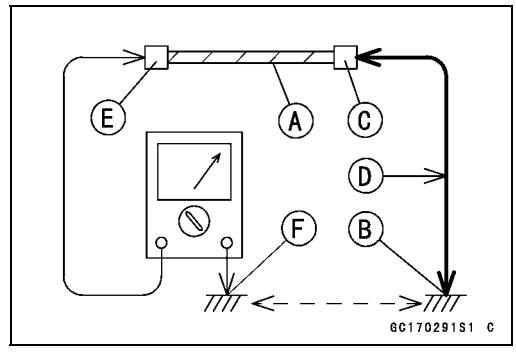
★If any wiring is deteriorated, replace the wiring.

Troubleshooting the DFI System

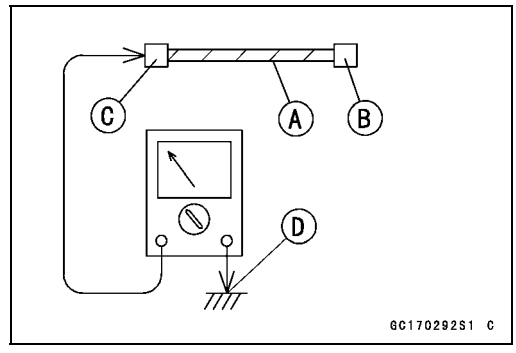
● Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it. Connect the connectors securely.
● Check the wiring for continuity.
○Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
○Connect the hand tester between the ends of the leads.
○Set the tester to the × 1 Ω range, and read the tester.
★If the tester does not read 0 Ω, the lead is defective. Replace the lead or the main harness or the sub harness.



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



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



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

○Lead 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

Troubleshooting the DFI System

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

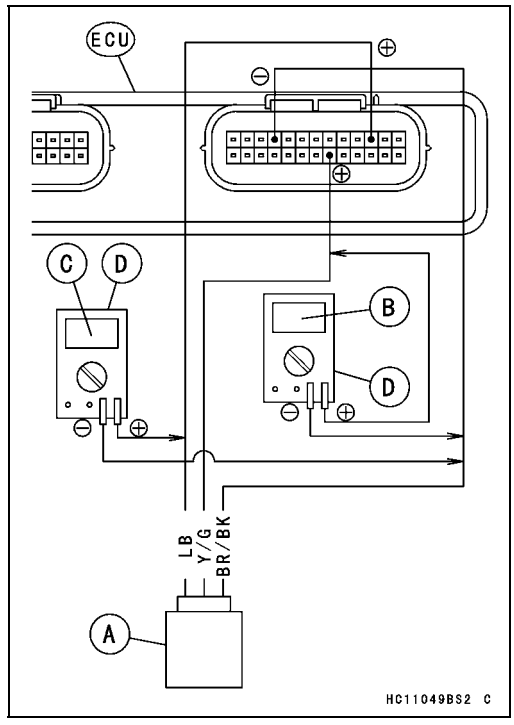
(Voltage Check Method)

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

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

● Refer to each sensor inspection section for detail in this chapter.

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



(Resistance Check Method)

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

● Turn the ignition switch OFF and disconnect the connectors.

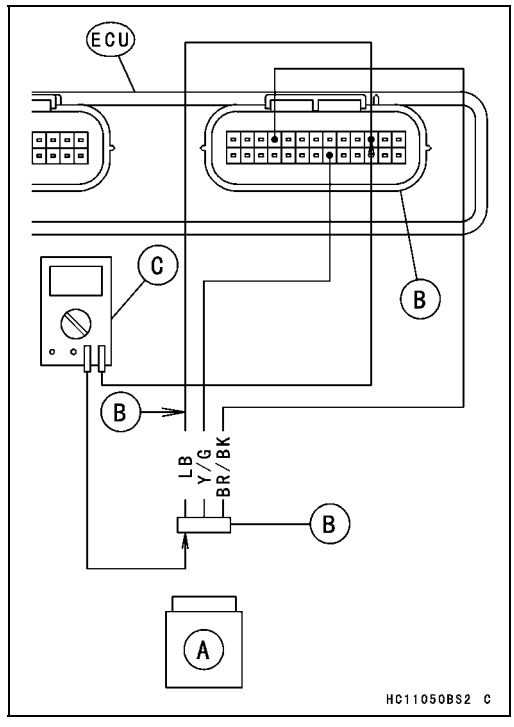
● Inspect the sensor resistance, using a digital meter (see each sensor inspection).

● Inspect the wiring and connectors [B] for continuity, using the hand tester [C] (analog tester) rather than a digital meter.

Special Tool - Hand Tester: 57001-1394

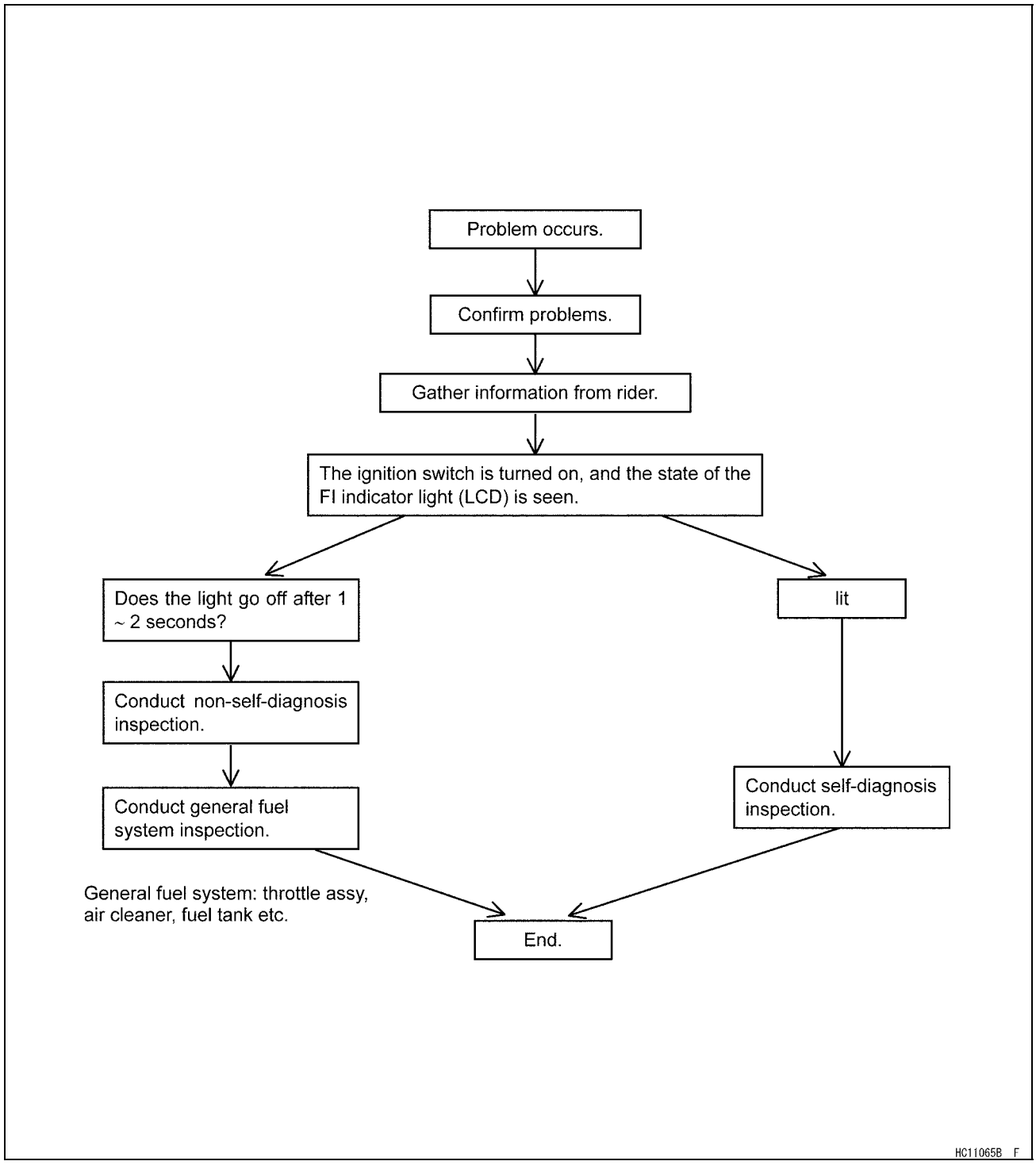
★If the sensor, the wiring and connections are good, inspect the ECU for its ground and power supply (see ECU Power Supply Inspection).

★If the ground and power supply are good, the ECU is suspect. Replace the ECU.



Troubleshooting the DFI System

DFI Diagnosis Flow Chart



Inquiries to Rider

○Each rider reacts to problems in different ways, so it is important to confirm what kind of symptoms the rider has encountered.

○Try to find out exactly what problem occurred under exactly what conditions by asking the rider; knowing this information may help you reproduce the problem.

○The following sample diagnosis sheet will help prevent you from overlooking any areas, and will help you decide if it is a DFI system problem, or a general engine problem.

Troubleshooting the DFI System

Sample Diagnosis Sheet

Rider name:	**Registration No. (license plate No.):**
Year of initial registration:	**Model:**
Engine No.:	**Frame No.:**
Date problem occurred:	**Mileage:**
Environment when problem occurred.	
Weather	☐fine, ☐cloudy,☐rain, ☐snow, ☐always, ☐other:
Temperature	☐hot, ☐warm, ☐cold, ☐very cold, ☐always
Problem frequency	☐chronic, ☐often, ☐once
Road	☐street, ☐mountain road (☐uphill, ☐downhill), ☐bumpy, ☐pebble
Altitude	☐normal, ☐high (about 1 000 m or more)
Vehicle conditions when problem occurred.	
FI indicator light (LCD)	☐light up immediately after ignition switch ON, and goes off after 1 ~ 2 seconds (normal)
	☐lights blinks immediately after ignition switch ON, and stays on (DFI problem)
	☐lights up immediately after ignition switch ON, but goes off after about 10 seconds (DFI problem)
	☐unlights (light, ECU or its wiring fault)
	☐sometimes lights up (probably wiring fault)
Starting difficulty	☐starter motor not rotating
	☐starter motor rotating but engine doesn't turn over
	☐starter motor and engine don't turn over
	☐no fuel flow (☐no fuel in tank, ☐no fuel pump sound)
	☐engine flooded (do not crank engine with throttle opened, which promotes engine flooding)
	☐no spark
	☐other
Engine stops	☐right after starting
	☐when opening throttle lever
	☐when closing throttle lever
	☐when moving off
	☐when stopping the vehicle
	☐when cruising
	☐other
Poor running at low speed	☐very low idle speed, ☐very high idle speed, ☐rough idle speed
	☐battery voltage is low (charge the battery)
	☐spark plug loose (tighten it)
	☐spark plug dirty, broken, or gap maladjusted (remedy it)
	☐backfiring
	☐afterfiring
	☐hesitation when acceleration
	☐engine oil viscosity too high
	☐brake dragging
	☐engine overheating
	☐clutch slipping

Troubleshooting the DFI System

	☐other
Poor running or no power at high speed	☐spark plug loose (tighten it)
	☐spark plug dirty, broken, or gap maladjusted (remedy it)
	☐spark plug incorrect (replace it)
	☐knocking (fuel poor quality or incorrect)
	☐brake dragging
	☐clutch slipping
	☐engine overheating
	☐engine oil level too high
	☐engine oil viscosity too high
	☐other

DFI System Troubleshooting Guide

NOTE

○*This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

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

Engine 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 fuse blown	Inspect and replace (see chapter 16).
Starter motor rotating but engine doesn't turn over:	
Starter clutch trouble	Inspect (see chapter 16).
Starter idle gear trouble	Inspect (see chapter 16).
Engine won't turn over:	
Valve 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).
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	Replace (see chapter 2).
Starting technique faulty	When flooded, don't crank engine with throttle fully opened.
No spark or spark weak:	
Ignition and engine stop switches not ON	Turn both switches ON .

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Symptoms or possible Causes	Actions (chapter)
Brake lever or pedal not pulled in and gear not in neutral	Pull the brake lever or pedal in.
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	Replace (see chapter 2).
Ignition coil trouble	Inspect ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (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).
Ignition switch shorted	Inspect and replace (see chapter 16).
Engine stop switch shorted	Inspect and repair or replace (see chapter 2).
Starter system wiring shorted or open	Inspect and repair or replace (see chapter 16).
Main 30A 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 plug	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).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Intake 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).
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).
No valve clearance	Adjust (see chapter 2).
Valve guide worn	Inspect and replace (see chapter 5).

DFI System Troubleshooting Guide

Symptoms or possible Causes	Actions (chapter)
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).

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	Replace (see chapter 2).
Ignition coil trouble	Inspect the ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (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 2, 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).
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).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Unstable (rough) idling:	
ISC valve trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 3).
Throttle valves not synchronizing	Inspect (see chapter 2).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Water temperature 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).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Fuel injector trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
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).
No valve clearance	Adjust (see chapter 2).
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).
Hesitation:	
Too low fuel pressure	Inspect (see chapter 3).
Clogged fuel line	Inspect and repair (see chapter 3).
Cracked or obstructed intake 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).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Loose injector connectors	Remedy (see chapter 3).
Crankshaft sensor trouble	Inspect or replace (see chapter 16).
Ignition coil trouble	Inspect or replace (see chapter 16).
Loose terminal of battery (–) cable or engine ground lead	Inspect and repair (see chapter 16).
Delay of ignition timing	Inspect crankshaft sensor and IC igniter in ECU (see chapter 16).
Poor acceleration:	

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
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 or pump screen	Inspect and replace fuel pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Ignition coil trouble	Inspect and replace (see chapter 16).
Engine oil level to high	Repair (see chapter 7).
Spark plug dirty, broken or gap maladjusted	Replace (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).
Intake 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	Replace (see chapter 2).
Too low fuel pressure	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
After fire:	
Crankshaft sensor trouble	Inspect (see chapter 16).
Spark plug burned or gap maladjusted	Replace (see chapter 2).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Intake 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 stop switch trouble	Inspect and repair or replace (see chapter 2).
Fuel injector trouble	Inspect (see chapter 3).
Loose terminal of battery (–) cable or ECU ground lead	Inspect and repair (see chapter 16).
Carbon accumulating on valve seating surface	Repair (see chapter 5).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Engine overheating	(see Overheating of Troubleshooting Guide, see chapter 17)
Other:	
Engine 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).
Engine overheating	(see Overheating of Troubleshooting Guide, see chapter 17)
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).

Poor Running or No Power at High Speed:

Symptoms or Possible Causes	Actions (chapter)
Firing incorrect:	
Spark plug dirty, broken or maladjusted	Replace (see chapter 2).
Ignition coil trouble	Inspect ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (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:	
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).
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).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Throttle sensor trouble	Inspect (see chapter 3).
Intake air pressure sensor trouble	Inspect (see chapter 3).
Cracked or obstructed intake 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).
No valve clearance	Adjust (see chapter 2).
Cylinder, piston worn	Inspect and replace (see chapter 5).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
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).
Knocking:	
Carbon built up in combustion chamber	Repair (see chapter 5).
Fuel poor quality or incorrect (Use the 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).
Intake air temperature sensor trouble	Inspect (see chapter 3).
Miscellaneous:	
Throttle valve 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).
Engine overheating - Water temperature sensor or crankshaft sensor trouble	(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 2).
Camshaft cam worn	Inspect and replace (see chapter 5).
Exhaust Smokes Excessively:	
(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).
Too high fuel pressure	Inspect (see chapter 3).
Injector stuck open	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect and replace (see chapter 3).
Intake air temperature sensor trouble	Inspect and replace (see chapter 3).
(Brown smoke)	
Air cleaner duct loose	Reinstall (see chapter 3).
Air cleaner O-ring damaged	Replace (see chapter 3).
Too low fuel pressure	Inspect fuel line and fuel pump (see chapter 3).
Water temperature sensor trouble	Inspect and replace (see chapter 3).
Intake air temperature sensor trouble	Inspect and replace (see chapter 3).

Self-Diagnosis

Self-diagnosis Outline

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

User Mode (Frame No.: ~ JKAVFDD1 8B507293, ~ JKAVFDE1 8B502729, ~ JKAVFDF1 8B502422, ~ JKAVF750DDB601280)

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

User Mode (Frame No.: JKAVFDD1 8B507294 ~, JKAVFDE1 8B502730 ~, JKAVFDF1 8B502423 ~, JKAVF750DDB601281 ~)

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

Dealer Mode

The ECU generate service code(s) to show the problem(s) which the DFI system, and ignition system have at the moment of diagnosis.

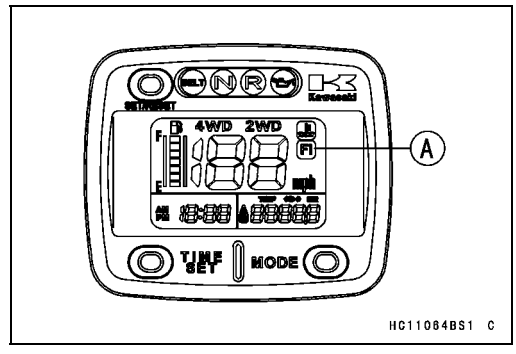
Self-diagnosis Procedures

○When a problem occurs with the DFI system and ignition system, the FI indicator light (LCD) [A] flashes.

NOTE

○*Use a fully charged battery when conducting self-diagnosis.*

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



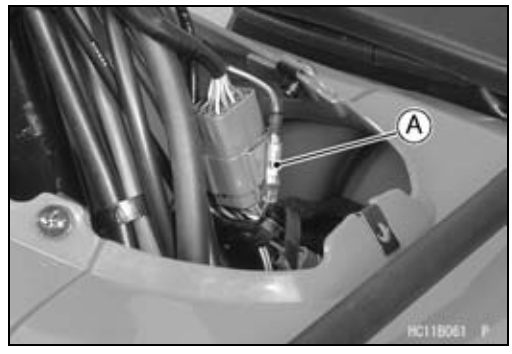
Frame No.: ~ JKAVFDD1 8B507293, ~ JKAVFDE1 8B502729, ~ JKAVFDF1 8B502422, ~ JKAVF750DDB601280

● Remove: (see Upper Cover Removal in the Frame chapter).
Seat (see Seat Removal in the Frame chapter)
Middle Cover (see Middle Cover Removal in the Frame chapter)

Self-Diagnosis

● Remove the connector cap [A].

● Disconnect the FI indicator light (LCD) connector [A]

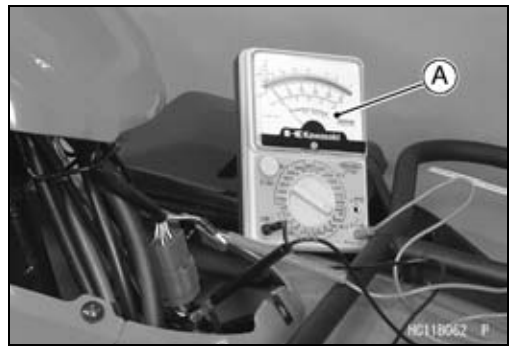


● Connect the hand tester [A] as shown.
● Set the tester to 5 mA range.

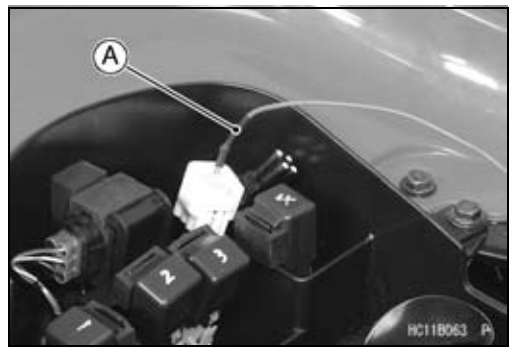
Special Tool - Hand Tester: 57001-1394

Connections:

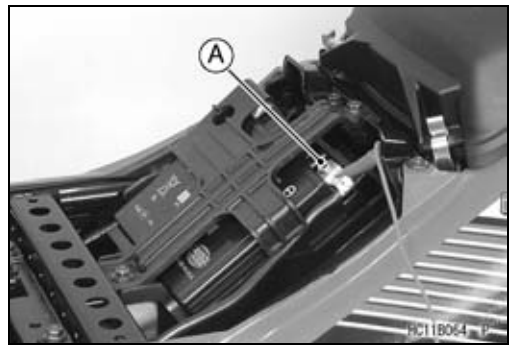
		Adapter		Hand Tester
Meter Side	←	**Red**	→	**(+)**
Main Harness Side	←	**Black**	→	**(–)**



● Ground the self-diagnosis terminal to the battery (–) terminal or battery (–) lead connector, using a wire.
● Turn on the ignition switch.
● Connect an auxiliary lead [A] to the LG/BK terminal for grounding.



● To enter the self-diagnosis dealer mode, ground the self -diagnosis indicator terminal [A] to the battery (–) terminal for more than 2 seconds, and then keep it grounded continuously.
○Count the flicks of the hand tester to read the service code. Keep the auxiliary lead ground until you finish reading the service code.



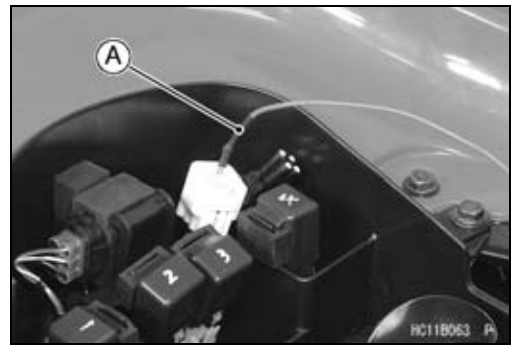
Self-Diagnosis

● Remove: (see Upper Cover Removal in the Frame chapter).
Seat (see Seat Removal in the Frame chapter)
Middle Cover (see Middle Cover Removal in the Frame chapter)

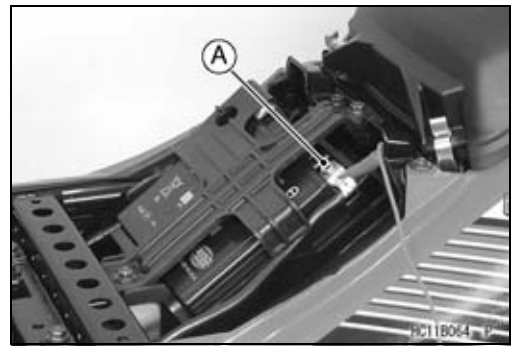
Frame No.: JKAVFDD1 8B507294 ~, JKAVFDE1 8B502730 ~, JKAVFDF1 8B502423 ~, JKAVF750DDB601281 ~

● Remove the connector cap [A].

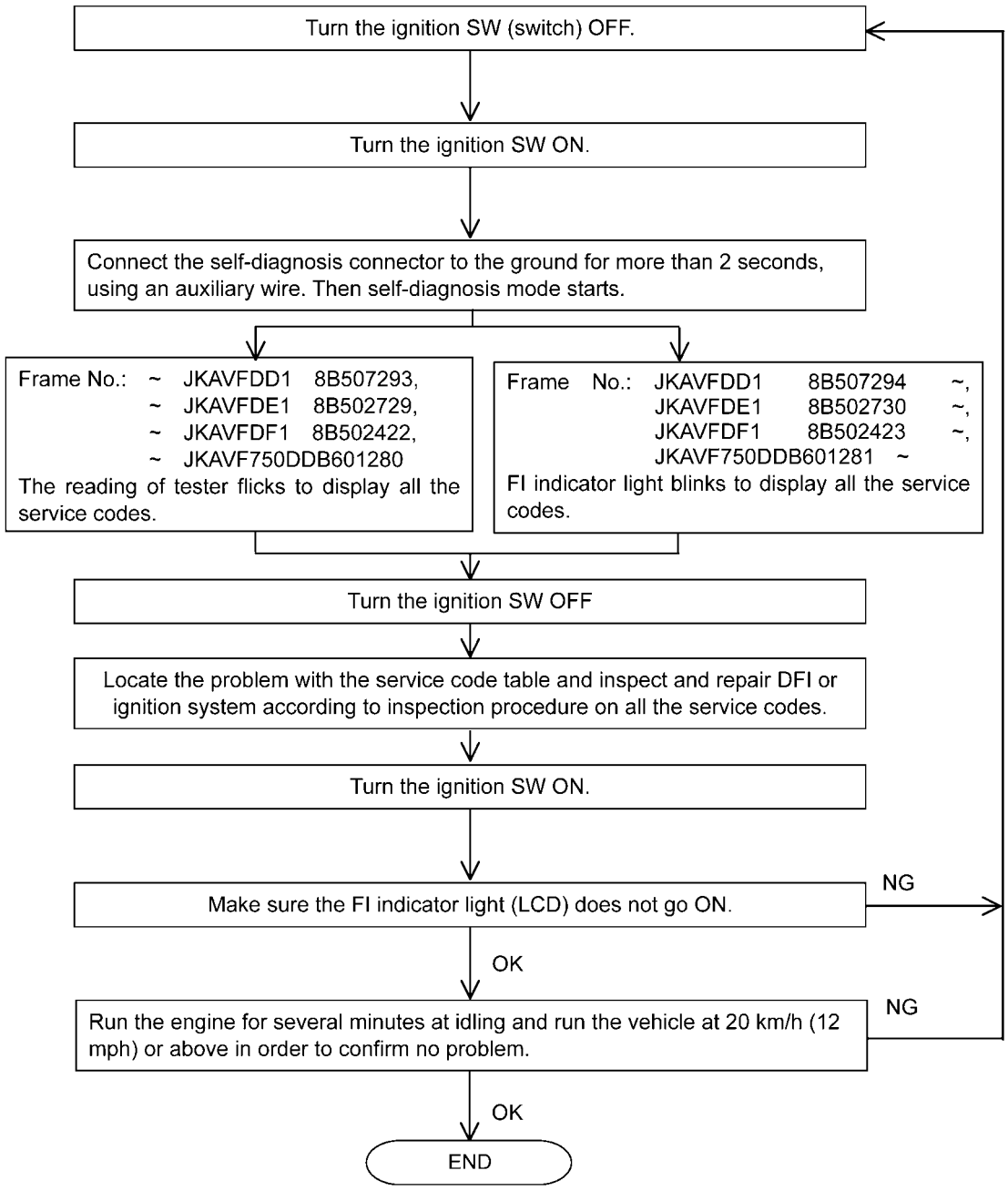
● Ground the self-diagnosis terminal to the battery (–) terminal or battery (–) lead connector, using a wire.
● Turn on the ignition switch.
● Connect an auxiliary lead [A] to the LG/BK terminal for grounding.



● To enter the self-diagnosis dealer mode, ground the self-diagnosis indicator terminal [A] to the battery (–) terminal for more than 2 seconds, and then keep it grounded continuously.
○Count the blinks of the FI indicator light to read the service code. Keep the auxiliary lead ground until you finish reading the service code.



Self-Diagnosis



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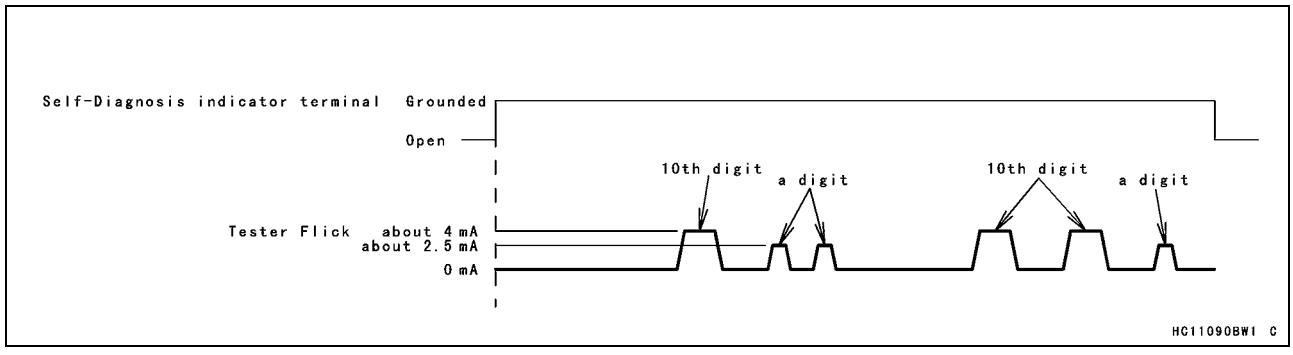
Self-Diagnosis

How to Read Service Codes

Frame No.: ~ JKAVFDD1 8B507293, ~ JKAVFDE1 8B502729, ~ JKAVFDF1 8B502422, ~ JKAVF750DDB601280

○Service codes are shown by a series of long and short flicks of the tester as shown below.
○Read 10th digit and unit digit as the tester flicks.
○When there are a number of problems, all the service codes can be stored and the display will begin starting from the lowest number service code in the numerical order. Then after completing all codes, the display is repeated until the self-diagnosis indicator terminal is open.
○If there is no problem, no code and unlight.
○For example, if two problems occurred in the order of 21, 12, the service codes are displayed from the lowest number in the order listed.
(12 → 21) → (12 → 21) → · · · (repeated)

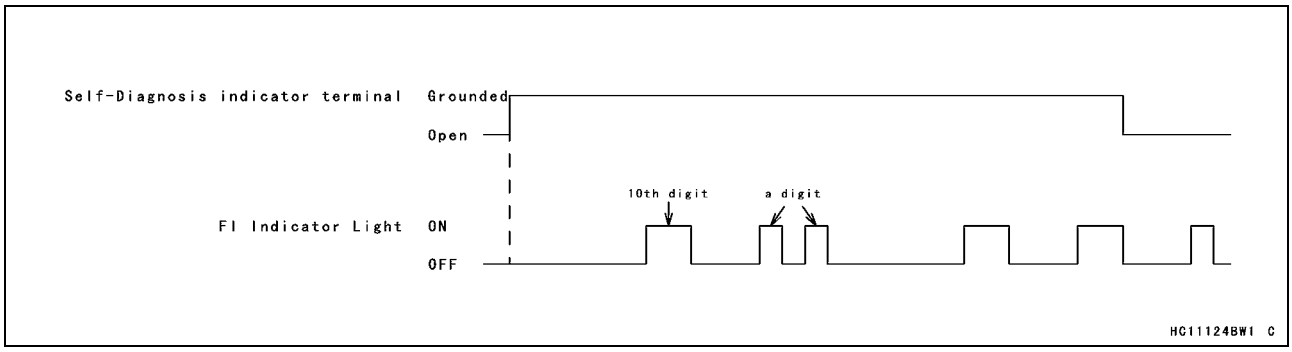


○If the problem is with the following parts, the ECU cannot memorize these problems, the tester doesn't flick, and no service codes can be displayed.
FI Indicator Light (LCD)
Fuel Pump
ECU Main Relay
ECU Power Source Wiring and Ground Wiring (see ECU Inspection)
Fuel Injectors
ISC Valve

Frame No.: JKAVFDD1 8B507294 ~, JKAVFDE1 8B502730 ~, JKAVFDF1 8B502423 ~, JKAVF750DDB601281 ~

○Service codes are shown by a series of long and short blinks of the FI indicator light as shown below.
○Read 10th digit and unit digit as the FI indicator light blinks.
○When there are a number of problems, all the service codes can be stored and the display will begin starting from the lowest number service code in the numerical order. Then after completing all codes, the display is repeated until the self-diagnosis indicator terminal is open.
○If there is no problem, no code and unlight.
○For example, if two problems occurred in the order of 21, 12, the service codes are displayed from the lowest number in the order listed.
(12 → 21) → (12 → 21) → · · · (repeated)

Self-Diagnosis



○If the problem is with the following parts, the ECU cannot memorize these problems, the FI indicator light doesn't go on, and no service codes can be displayed.
FI Indicator Light (LCD)
Fuel Pump
ECU Main Relay
ECU Power Source Wiring and Ground Wiring (see ECU Inspection)
Fuel Injectors
ISC Valve

How to Erase Service Codes

○Even if the ignition switch is turned OFF, the battery or the ECU are disconnected or the problem is solved, all service codes remain in the ECU.

Service Code Table

Frame No.: ~ JKAVFDD1 8B507293, ~ JKAVFDE1 8B502729, ~ JKAVFDF1 8B502422, ~ JKAVF750DDB601280

Service Code	Flicks of Tester	Problems
11		Throttle sensor malfunction, wiring open or short
12		Intake air pressure sensor malfunction, wiring open or short
13		Intake air temperature sensor malfunction, wiring open or short
14		Water temperature sensor malfunction, wiring open or short
21		Crankshaft sensor malfunction, wiring open or short
24		Speed sensor malfunction, wiring open or short
31		Vehicle-down sensor, malfunction, wiring open or short
46		Fuel pump relay malfunction, relay is stuck
51		Ignition coil #1 malfunction, wiring open or short
52		Ignition coil #2 malfunction, wiring open or short

Self-Diagnosis

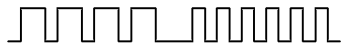
Notes:

○The ECU may be involved in these problems. If all the parts and circuits are checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked out good, replace the ECU.

○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.

Service Code Table

Frame No.: JKAVFDD1 8B507294 ~, JKAVFDE1 8B502730 ~, JKAVFDF1 8B502423 ~, JKAVF750DDB601281 ~

Service Code	FI Indicator Light	Problems
11		Throttle sensor malfunction, wiring open or short
12		Intake air pressure sensor malfunction, wiring open or short
13		Intake air temperature sensor malfunction, wiring open or short
14		Water temperature sensor malfunction, wiring open or short
21		Crankshaft sensor malfunction, wiring open or short
24		Speed sensor malfunction, wiring open or short
31		Vehicle-down sensor, malfunction, wiring open or short
46		Fuel pump relay malfunction, relay is stuck
51		Ignition coil #1 malfunction, wiring open or short
52		Ignition coil #2 malfunction, wiring open or short

Notes:

○The ECU may be involved in these problems. If all the parts and circuits are checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked out good, replace the ECU.

○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.

Self-Diagnosis

Backups

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

Service Codes	Parts	Output Signal Usable Range or Criteria	Backups by ECU
11	Throttle Sensor	Throttle Sensor Output Voltage 0.2 ~ 4.8 V	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 opened throttle position and sets the DFI in the D-J method. Also, the throttle sensor system and intake air pressure sensor fails, the ECU locks ignition timing into the ignition timing at opened throttle position and sets the DFI in the α-N method.
12	Intake Air Pressure Sensor	Intake Air Pressure Sensor Output Voltage 0.2 ~ 4.8 V	If the intake 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.
13	Intake Air Temperature Sensor	Intake Air Temperature Sensor Output Voltage 0.2 ~ 4.6 V	If the intake air temperature sensor fails (the signal is out of the usable range, wiring short or open), the ECU sets Ta at 30°C.
14	Water Temperature Sensor	Water Temperature Sensor Output Voltage 0.2 ~ 4.6 V	If the water temperature sensor system fails (the signal is out of the usable range, wiring short or open), the ECU sets Tw at 80°C.
21	Crankshaft Sensor	Crankshaft sensor must send 22 signals (output signal) to the ECU at the one cranking.	If crankshaft sensor does not generate signals, the engine stops by itself.
24	Speed Sensor	Speed sensor must send 20 signals (output signal) to the ECU at the one rotation of the output driven bevel gear.	If the speed sensor system fails (no signal, wiring short or open), the speedometer shows 0.
31	Vehicle-down Sensor	Vehicle-down Sensor Output Voltage Vd = 0.2 ~ 4.6 V	If the vehicle-down sensor system has failures (the output voltage Vd is more than usable range, wiring open), the ECU shuts off the fuel pump.
46	Fuel Pump Relay	When the relay ON condition, battery monitor voltage 5 V or more	If the relay fails, battery monitor voltage 12 V.
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) D-J Method and α - N Method: When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (intake air pressure sensor output voltage) and engine speed (crankshaft sensor output voltage). This method is called D-J method (low-speed mode). As the engine speed increases, and the engine load turns middle

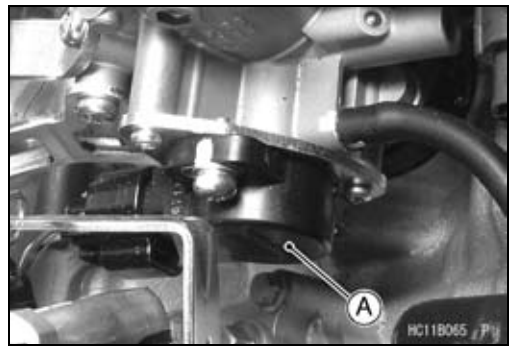
to heavy, the ECU determines the injection quantity by calculating from the throttle opening (throttle sensor output voltage) and the engine speed. This method is called α - N method (high-speed mode).

Throttle Sensor (Service Code 11)

Throttle Sensor Removal/Adjustment

NOTICE

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

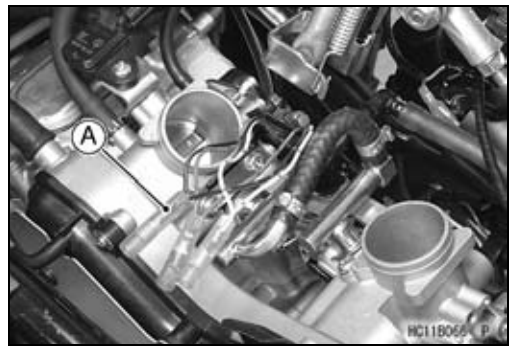


Throttle Sensor Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

● Turn the ignition switch OFF.
● Disconnect the throttle sensor connector with the needle nose pliers and connect the harness adapter [A] between these connectors.



○In this photo, the air cleaner has been removed for clarity.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521

● Connect a digital meter to the harness adapter lead.

Throttle Sensor Input Voltage
Connections to Adapter

Meter (+) → BL (sensor BR/W) lead

Meter (–) → BK/BL (sensor BR/W) lead

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

Input Voltage at Sensor
Standard: DC 4.75 ~ 5.25 V

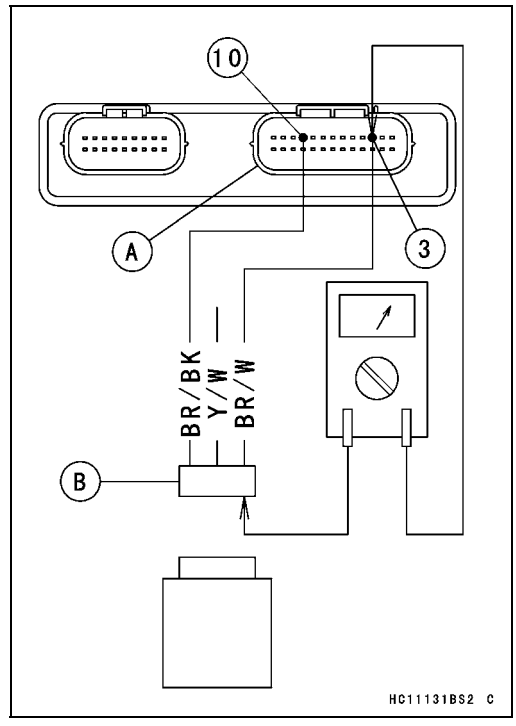
● Turn the ignition switch OFF.
★If the input voltage is normal, check the output voltage.

Throttle Sensor (Service Code 11)

★If the input voltage is less than the standard, remove the ECU and check the wiring between these connectors.
○Disconnect the ECU and sensor connectors.

Wiring Connection
ECU Connector [A] ←→
Throttle Sensor Connector [B]
BR/W lead (ECU terminal 3)
BR/BK lead (ECU terminal 10)

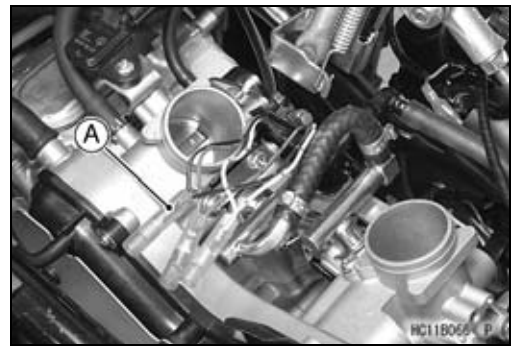
★If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).



Throttle Sensor Output Voltage Inspection

● Measure the output voltage at the throttle sensor in the same way as input voltage inspection, Note the following.
○Disconnect the throttle sensor connector and connect the harness adapter [A] between these connectors.
○In this photo, the air cleaner has been removed for clarity.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521



Throttle Sensor Output Voltage
Connections to Adapter
Meter (+) → Y/W (sensor Y/W) lead
Meter (–) → BK/BL (sensor BR/BK) lead

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

Idle Speed
Standard: 1 100 ±50 r/min (rpm)

★If the idle speed is out of the specified range, adjust it (see Idle Speed Inspection in the Periodic Maintenance chapter).
● Turn the ignition switch OFF.
● Measure the output voltage with the engine stopped, and with the connector joined.
● Turn the ignition switch ON.

Output Voltage at Sensor
Standard: DC 1.00 ~ 1.24 V (at idle throttle opening)
DC 4.0 ~ 4.4 V (at full throttle opening)

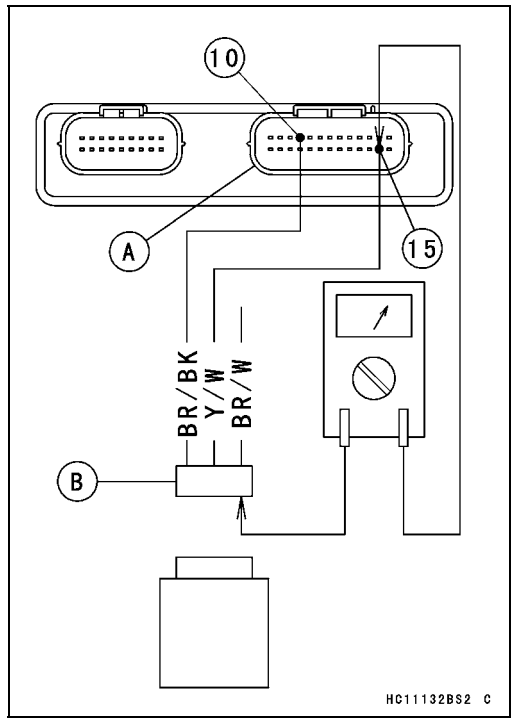
● Turn the ignition switch OFF.
★If the output voltage is out of the standard, inspect the throttle sensor resistance (see Throttle Sensor Resistance Inspection).

Throttle Sensor (Service Code 11)

★If the output voltage is normal, check the wiring for continuity.
○Disconnect the ECU and sensor connectors.

Wiring Connection
ECU Connector [A] ←→
Throttle Sensor Connector [B]
Y/W lead (ECU terminal 15)
BR/BK lead (ECU terminal 10)

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

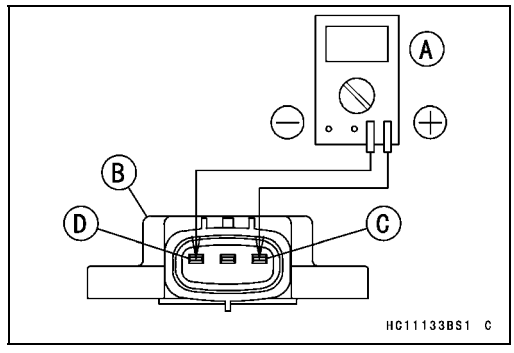


Throttle Sensor Resistance Inspection

- 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.

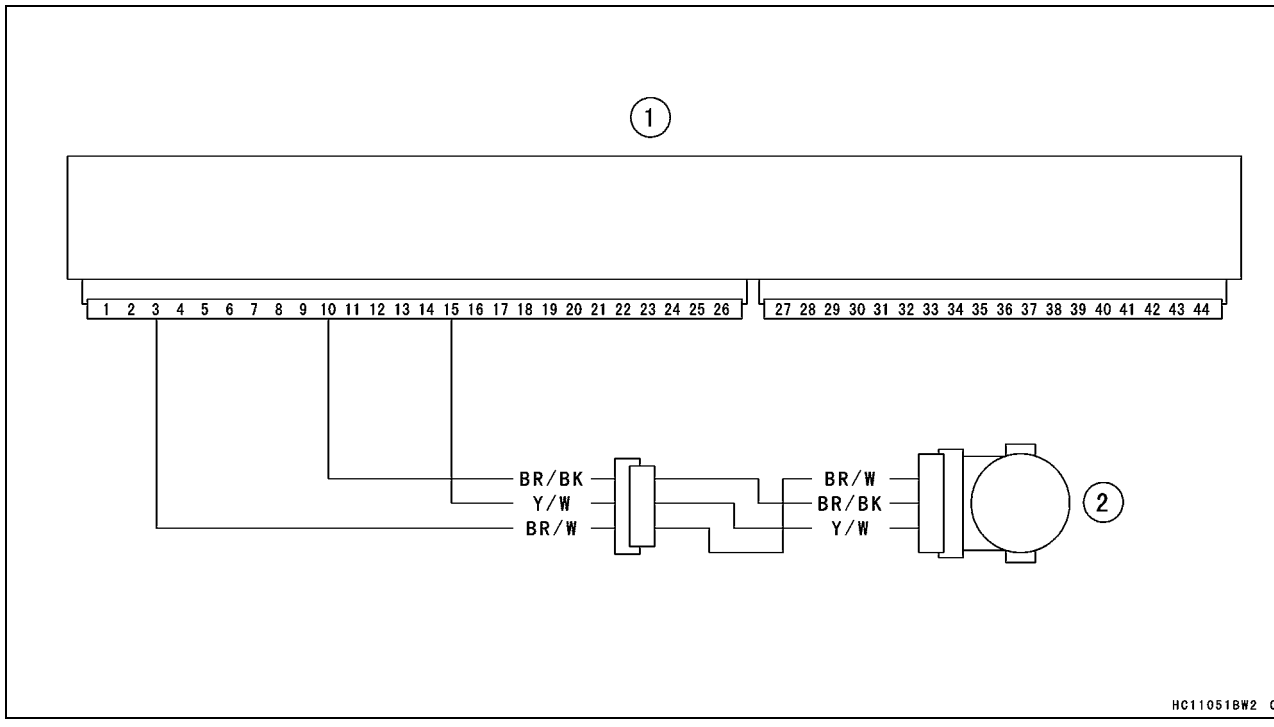
Throttle Sensor Resistance
Connections: BR/W lead [C] ←→ BR/BK lead [D]
Standard: 4 ~ 6 kΩ

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



Throttle Sensor (Service Code 11)

Throttle Sensor Circuit



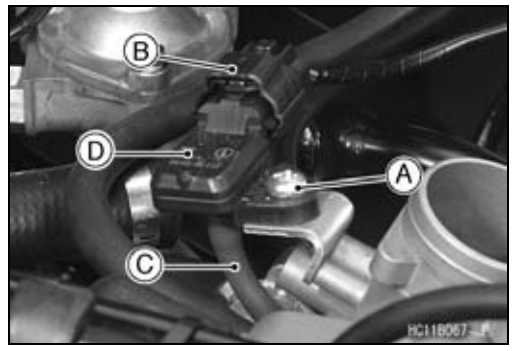
1. ECU (Electronic Control Unit)
2. Throttle Sensor

Intake Air Pressure Sensor (Service Code 12)

NOTICE

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

Intake Air Pressure Sensor Removal



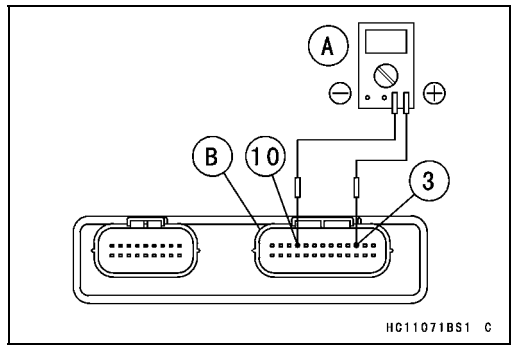
- Remove:
  Air Cleaner (see Air Cleaner Housing Removal)
  Screw [A]
- Disconnect the intake air pressure sensor connector [B] and the vacuum hose [C].
- Remove the intake air pressure sensor [D].

Intake Air Pressure Sensor Installation

- Installation is the reverse of removal.

Torque - Intake Air Pressure Sensor Mounting Screw: 5.0 N·m (0.51 kgf·m, 44 in·lb)

Intake Air Pressure Sensor Input Voltage Inspection



NOTE

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

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal).

○Do not disconnect the ECU connectors.

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

Special Tool - Needle Adapter Set: 57001-1457

Intake Air Pressure Sensor Input Voltage
Connections to ECU Connector
Meter (+) → BR/W lead (terminal 3)
Meter (–) → BR/BK lead (terminal 10)

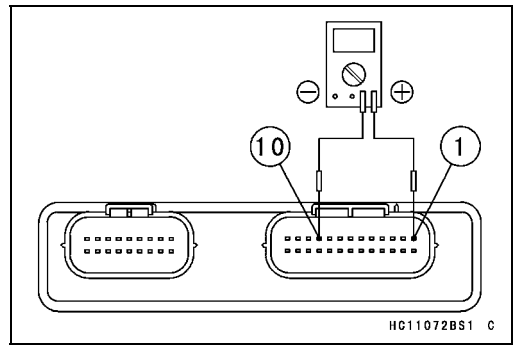
- Measure the input voltage with the engine stopped, and with the connectors joined.
- Turn the ignition switch ON.

Input Voltage at ECU
Standard: DC 4.75 ~ 5.25 V

★If the reading is within the standard range, check the output voltage.
★If the reading is less than the standard range, remove the ECU and check the wiring between these connectors.
★If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

Intake Air Pressure Sensor (Service Code 12)

Intake Air Pressure Sensor Output Voltage Inspection



NOTE

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

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

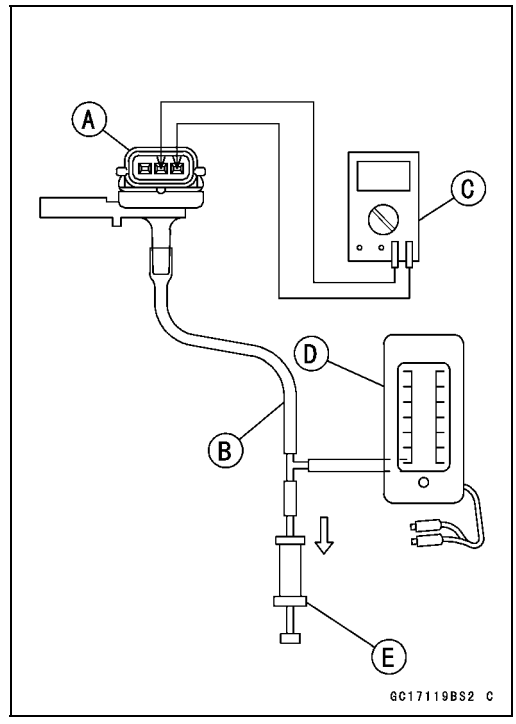
Special Tool - Needle Adapter Set: 57001-1457

Intake Air Pressure Sensor Output Voltage
Connections to ECU Connector
Meter (+) → G/Y lead (terminal 1)
Meter (–) → BR/BK lead (terminal 10)

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

● Turn the ignition switch OFF.
★If the output voltage is within the usable range, check the ECU for its ground, and power supply (see ECU Power Supply Inspection).
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).
★If the output voltage is out of the usable range, check the wiring.

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



Special Tools - Fork Oil Level Gauge: 57001-1290
Sensor Harness Adapter: 57001-1561

Intake Air Pressure Sensor Output Voltage
Connections to Adapter
Meter (+) → G/W (sensor G/Y) lead
Meter (–) → BK (sensor BR/BK) lead

● Turn the ignition switch ON.
● Measure the output voltage from various vacuum readings, while pulling the handle of the fork oil level gauge.
★If the output voltage for various vacuum is normal, check the ECU for its ground, and power supply (see ECU Power Supply Inspection).
● Check the output voltage, using the following formula and chart.

Intake Air Pressure Sensor (Service Code 12)

Suppose:
Pg: Vacuum Pressure (gauge) to Sensor
Pl: Local Atmospheric Pressure (absolute) measured by a barometer
Pv: Vacuum Pressure (absolute) to Sensor
Vv: Sensor Output Voltage (V)

then
Pv = Pl – Pg

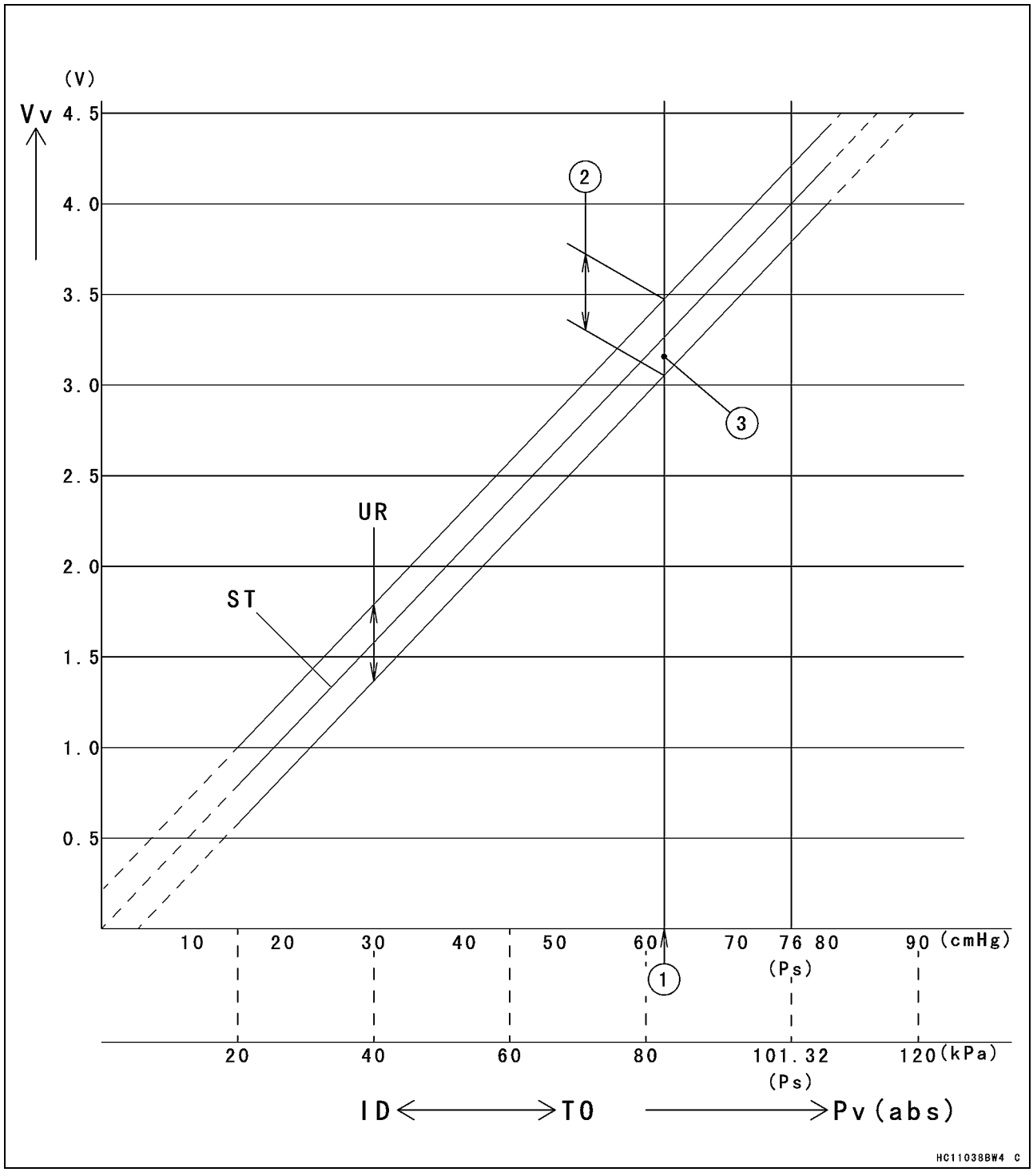
For example, suppose the following data is obtained:
Pg = 8 cmHg (Vacuum gauge reading)
Pl = 70 cmHg (Varometer reading)
Vv = 3.2 V (Digital meter reading)

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. → Point [3].
Results: In the chart, Vv is within the usable range and the sensor is normal.

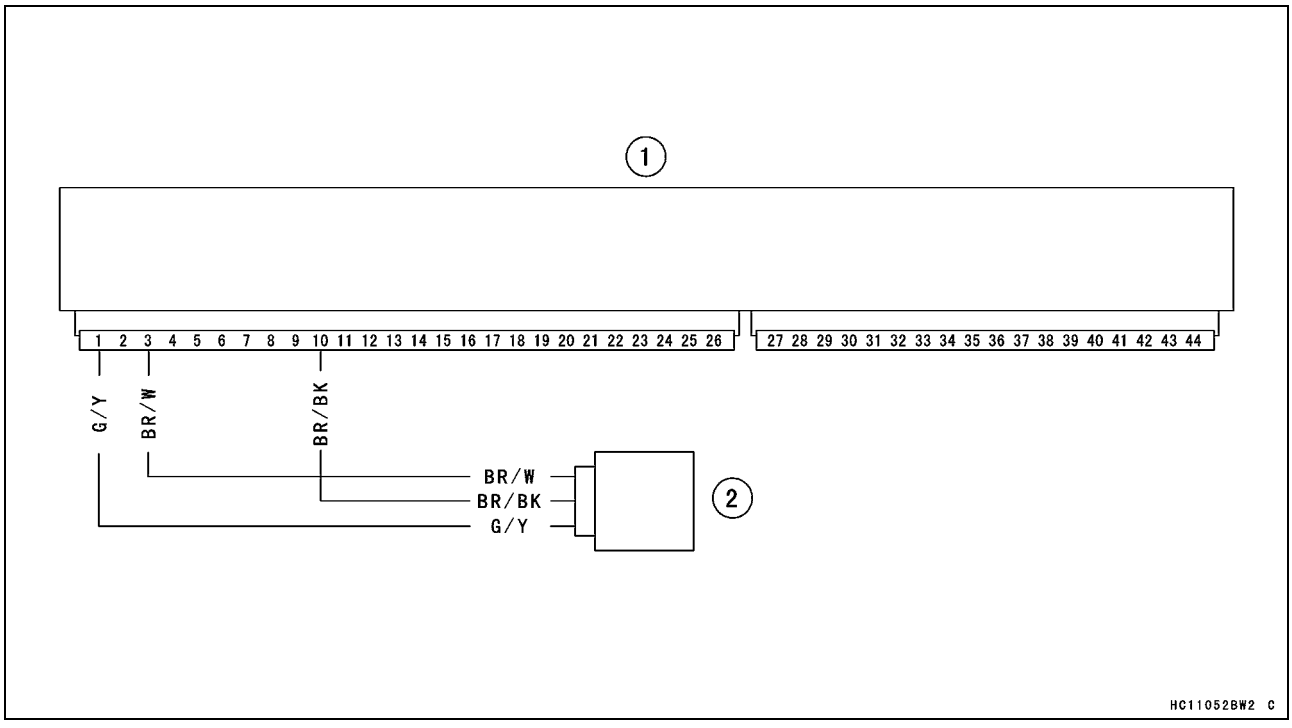
Intake Air Pressure Sensor (Service Code 12)



ID: Idling
Ps: Standard Atmospheric Pressure (Absolute)
Pv: Throttle Vacuum Pressure (Absolute)
ST: Standard of Sensor Output Voltage (V)
TO: Throttle Full Open
UR: Usable Range of Sensor Output Voltage (V)
Vv: Intake Air Pressure Sensor Output Voltage (V) (Digital Meter Reading)

Intake Air Pressure Sensor (Service Code 12)

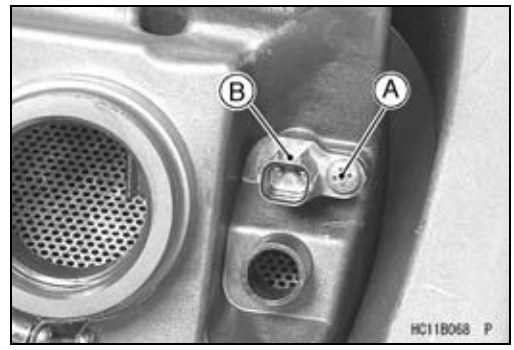
Intake Air Pressure Sensor Circuit



1. ECU (Electronic Control Unit)
2. Intake Air Pressure Sensor

Intake Air Temperature Sensor (Service Code 13)

Intake Air Temperature Sensor Removal/Installation

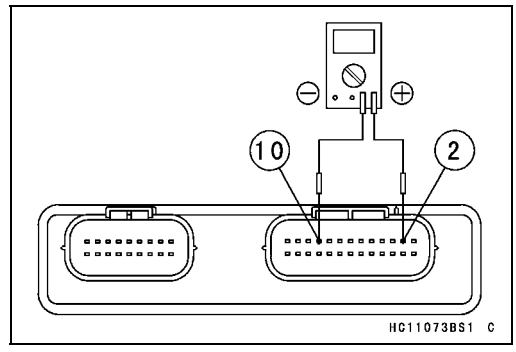


NOTICE

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

- Remove the air cleaner (see Air Cleaner Housing Removal).
- Remove the screw [A].
- Pull out the intake air temperature sensor [B].
- Put the intake air temperature sensor into the air cleaner housing.
- Tighten the screw securely.

Intake Air Temperature Sensor Output Voltage Inspection



NOTE

○*Be sure the battery is fully charged.*
○*The output voltage changes according to the intake air temperature.*

- Remove the ECU (see ECU Removal).

○Do not disconnect the ECU connectors.

- Connect a digital meter to the ECU connector, using needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Intake Air Temperature Sensor Output Voltage
Connections to ECU Connector
Meter (+) → Y lead (terminal 2)
Meter (–) → BR/BK lead (terminal 10)

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

Output Voltage at ECU
Standard: About 2.26 ~ 2.50 V at intake air temperature 25°C (77°F)

- Turn the ignition switch OFF.

★If the output voltage is out of the standard, check the wiring.

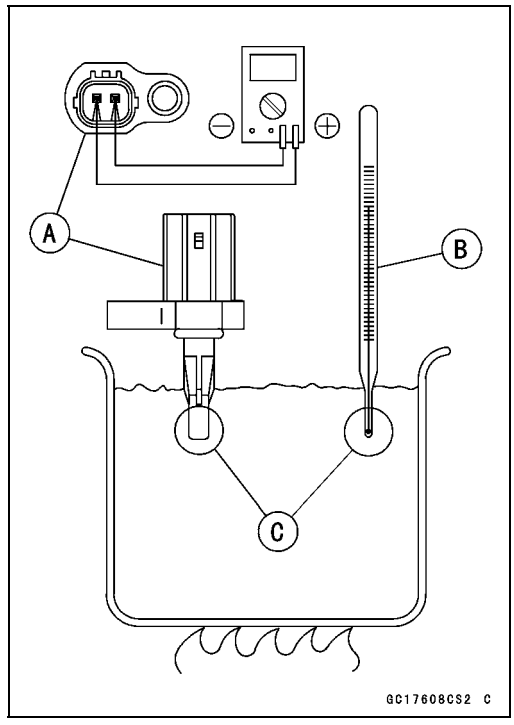
★If the wiring is good, check the sensor resistance (see Intake Air Temperature Sensor Resistance).

★If the output voltage is within the standard, check the ECU for its ground, and power supply (see ECU Power Supply Inspection).

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

Intake Air Temperature Sensor (Service Code 13)

Intake Air Temperature Sensor Resistance Inspection



- Remove the intake air temperature sensor (see Intake Air Temperature Sensor Removal/Installation).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion is submerged.
- Suspend a thermometer [B] with the heat-sensitive portions [C] located in almost the same depth with the sensor.

NOTE

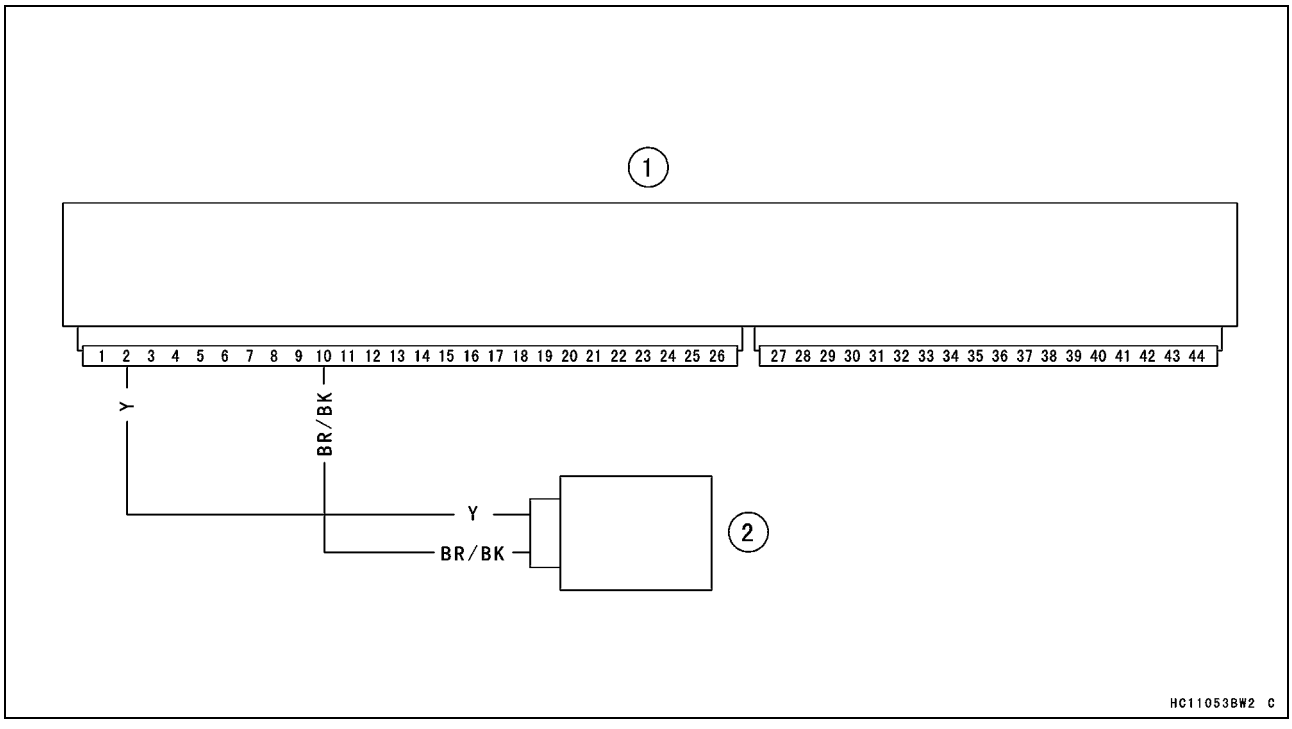
○*The sensor and thermometer must not touch the container side or bottom.*

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

Intake Air Temperature Sensor Resistance
Standard: 5.4 ~ 6.6 kΩ at 0°C (32°F)
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, replace the ECU (see ECU Removal/Installation).

Intake Air Temperature Sensor Circuit

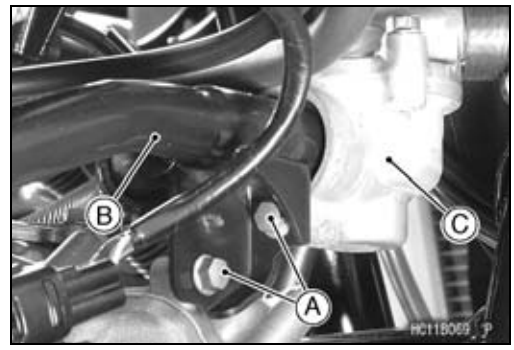


1. ECU (Electronic Control Unit)
2. Intake Air Temperature Sensor

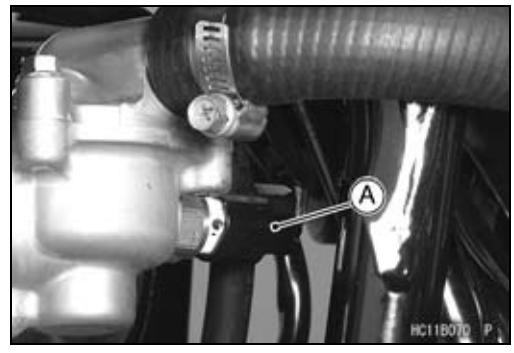
Water Temperature Sensor (Service Code 14)

Water Temperature Sensor Removal/Installation

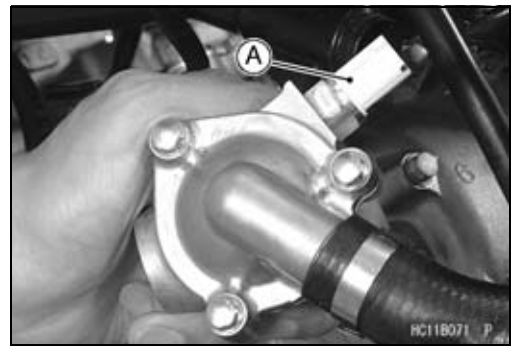
NOTICE
Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.



- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Remove:
  Bolts [A]
- Disconnect the water pipe [B] from the thermostat housing [C].



- Disconnect the sensor connector [A].

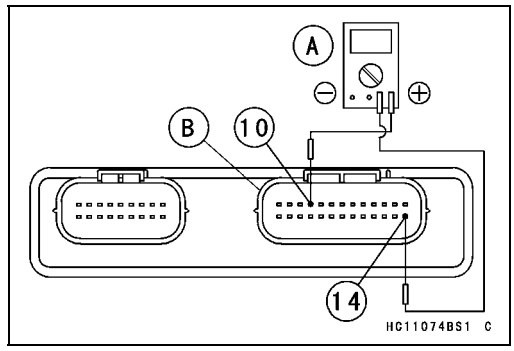


- Remove the water temperature sensor [A].

- Apply grease to new O-ring on the water temperature sensor.
- Install the water temperature sensor.
- Fill the engine with coolant and bleed the air from the cooling system (see Coolant Change in the Periodic Maintenance chapter).

Water Temperature Sensor (Service Code 14)

Water Temperature Sensor Output Voltage Inspection



NOTE

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

● Remove the ECU (see ECU Removal).
○Do not disconnect the connectors.
● Connect a digital meter [A] to the ECU connector [B] with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage
Connections to ECU Connector
Meter (+) → O lead (terminal 14)
Meter (–) → BR/BK lead (terminal 10)

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

Output Voltage at ECU

Standard: About 2.24 ~ 2.48 V at 25°C (77°F)

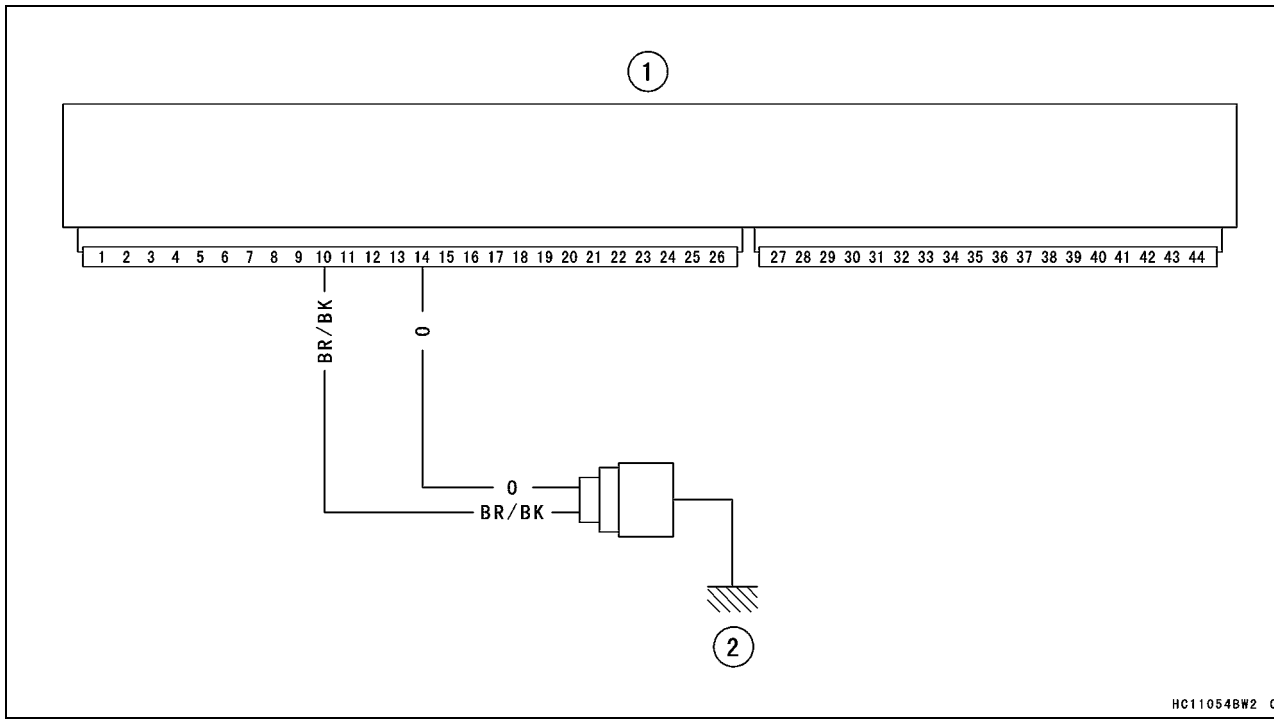
● Turn the ignition switch OFF.
★If the output voltage is within the standard, check the ECU for its ground, and power supply (see ECU Power Supply Inspection).
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).
★If the output voltage is out of the standard, check the wiring.
★If the wiring is good, check the water temperature sensor resistance (see Water Temperature Sensor Resistance Inspection in the Electrical System chapter).

Water Temperature Sensor Resistance Inspection

● Refer to the Water Temperature Sensor Inspection in the Electrical System chapter.

Water Temperature Sensor (Service Code 14)

Water Temperature Sensor Circuit



1. ECU (Electronic Control Unit)
2. Water Temperature Sensor

Crankshaft Sensor (Service Code 21)

Start the engine and switch the diagnosis mode to Dealer 1 mode to know all the problem that the DFI system has at the time of self-diagnosis. If the engine cannot be started, the self-diagnosis system does not detect dynamic condition of the crankshaft sensor. In this case, turn off the ignition switch and turn it on again to enter the Dealer 2 mode. In this mode, the system tells all the troubles which the DFI system had in both static and dynamic conditions.

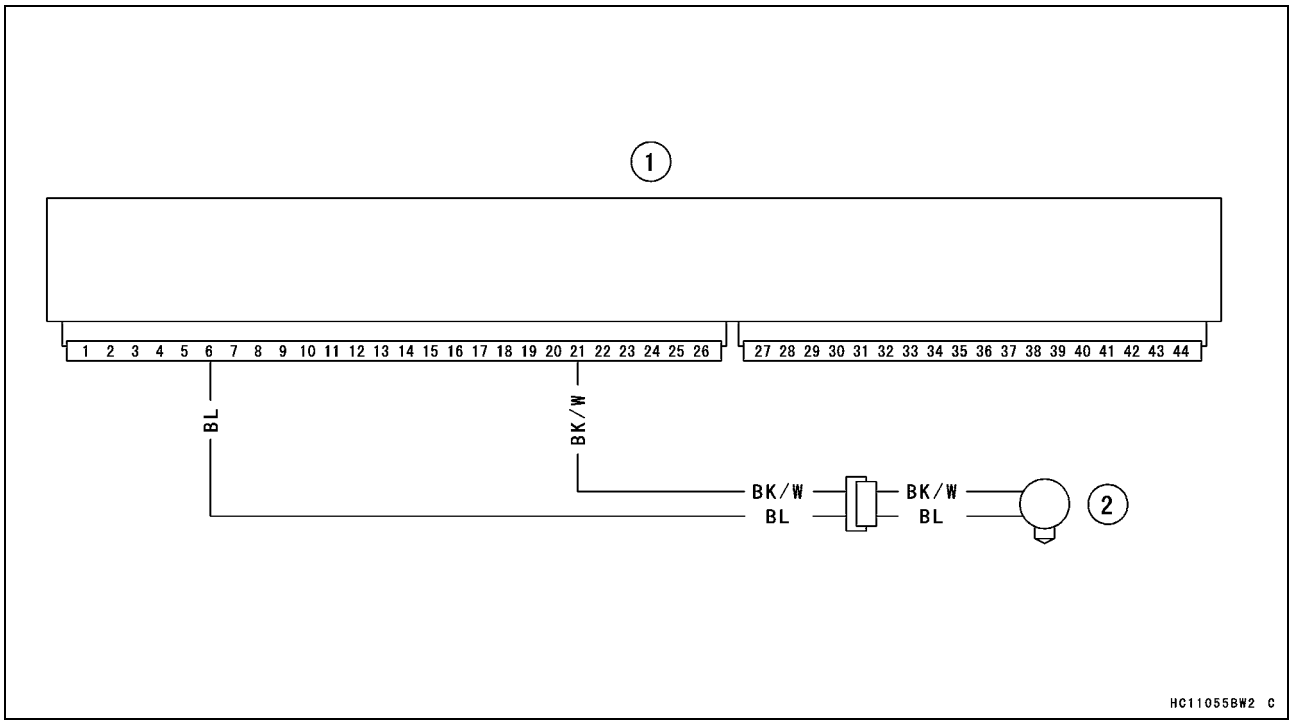
Crankshaft Sensor Removal/Installation

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

Crankshaft Sensor Inspection

- ○The crankshaft sensor has no power source, and when the engine stops, the crankshaft sensor generates no signals.
- Cranking the engine and measure the peak voltage of the crankshaft sensor (see Crankshaft Sensor Inspection in the Electrical System) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.

Crankshaft Sensor Circuit



1. ECU (Electronic Control Unit)
2. Crankshaft Sensor

Speed Sensor (Service Code 24)

Speed Sensor Removal

● Refer to the Speed Sensor Removal in the Electrical System chapter.

Speed Sensor Installation

● Refer to the Speed Sensor Installation in the Electrical System chapter.

Speed Sensor Inspection

● Refer to the Speed Sensor Inspection in the Electrical System chapter.

Input Voltage Inspection

● Remove:
Right Footboard (see Right Footboard Removal in the Flame chapter)

NOTE

○*Be sure the battery is fully charged.*

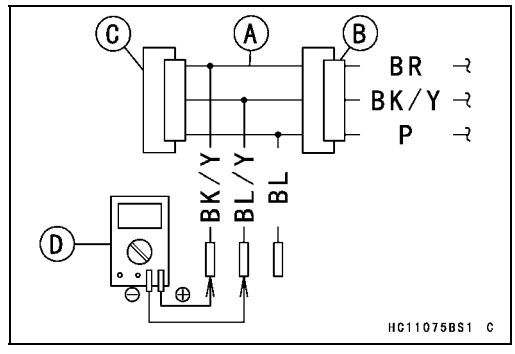
● Turn the ignition switch OFF.
● Disconnect the speed sensor connector.

● Connect the measuring adapter [A] between the harness connector [B] and speed sensor connector [C].

Special Tool - Speed Sensor Measuring Adapter: 57001 -1667

● Connect a digital meter [D] to the measuring adapter lead connectors.

Speed Sensor Input Voltage
Connections to Adapter
Meter (+) → BK/Y (sensor BR) lead
Meter (−) → BL/Y (sensor BK/Y) lead



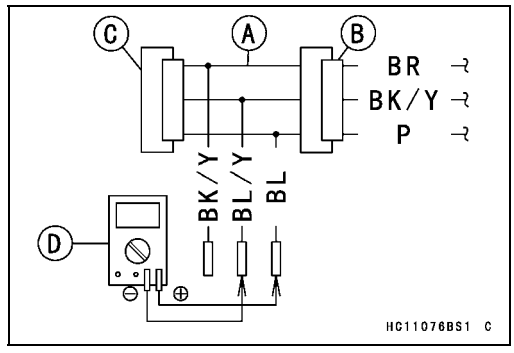
● Measure the input voltage with the engine stopped, and with the connectors joined.
● Turn the ignition switch ON.

Input Voltage at Sensor
Standard: Battery Voltage

★If the reading is out of the range, check the wiring.
★If the reading is good, check the output voltage.
● Turn the ignition switch OFF.

Speed Sensor (Service Code 24)

Output Voltage Inspection



● Before this inspection, inspect the input voltage (see Input Voltage Inspection in the Speed Sensor section).

NOTE

○*Be sure the battery is fully charged.*

● Turn the ignition switch OFF.
● Using the jack, raise the rear wheel off the ground.

Special Tool - Jack: 57001-1238

● Remove the speed sensor (see Speed Sensor Removal in the Electrical System chapter).
● Connect the measuring adapter [A] between the harness connector [B] and speed sensor connector [C].

Special Tool - Speed Sensor Measuring Adapter: 57001 -1667

● Reinstall the speed sensor with the measuring adapter connected.
● Connect a digital meter [D] to the measuring adapter lead connectors.

Speed Sensor Output Voltage
Connections to Adapter

Meter (+) → BL (sensor P) lead

Meter (–) → BL/Y (sensor BK/Y) lead

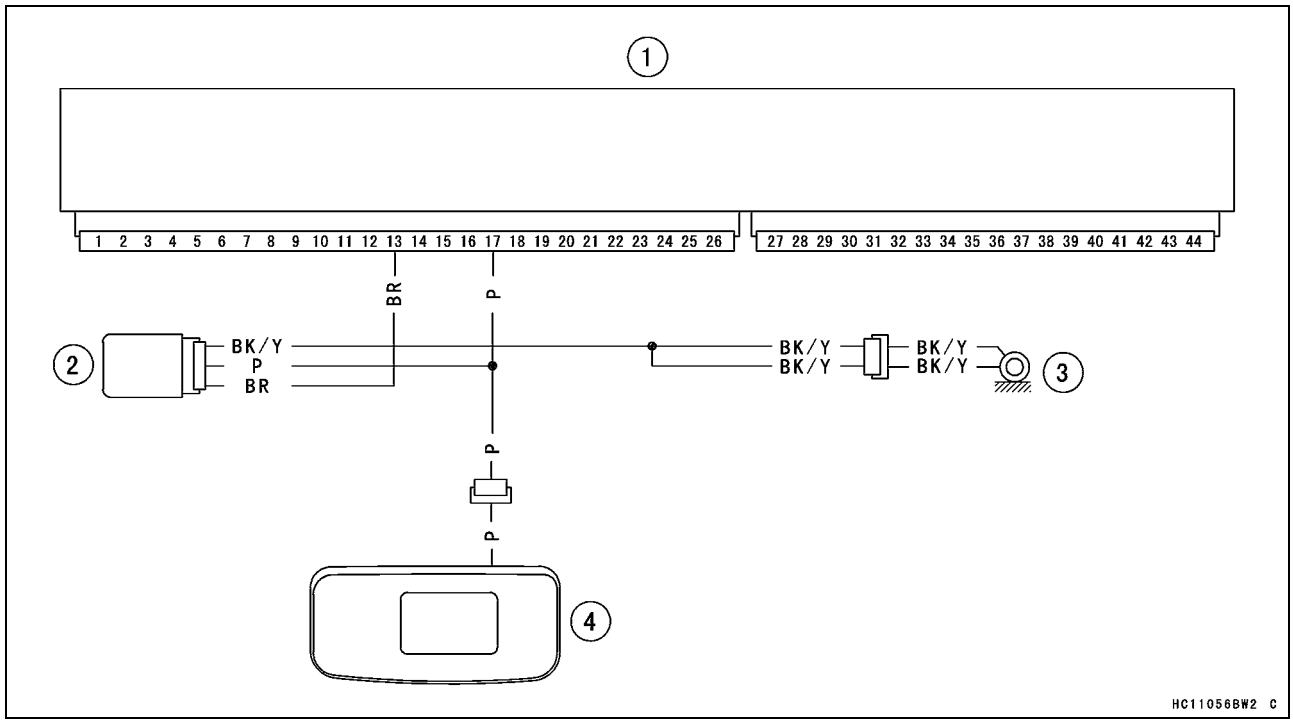
● Measure the output voltage with the engine stopped, and with the connectors joined.
● Turn the ignition switch ON.

Output Voltage at Sensor
Standard: less than DC 0.8 V or over than DC 4.8 V

● Rotate the rear wheel by hand, confirm the output voltage will be raise or lower.
★If the reading is out of the range, replace the speed sensor (see Switch and Sensors section in the Electrical System chapter) and check the wiring to ECU (see next diagram).
★If the reading, speed sensor and wiring are good, replace the ECU (see ECU section).
● Turn the ignition switch OFF.

Speed Sensor (Service Code 24)

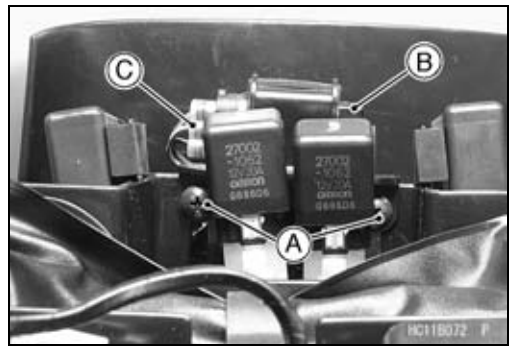
Speed Sensor Circuit



1. ECU (Electronic Control Unit)
2. Speed Sensor
3. Engine Ground
4. Multifunction Meter

Vehicle-down Sensor (Service Code 31)

Vehicle-down Sensor Removal

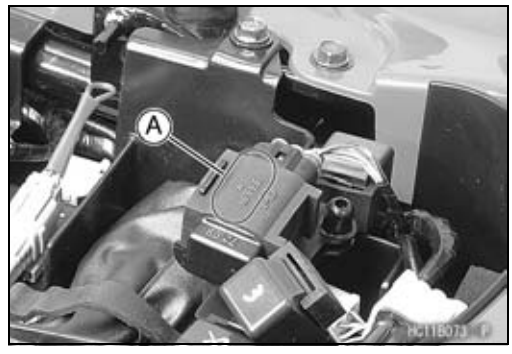


NOTICE

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

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

Vehicle-down Sensor Installation

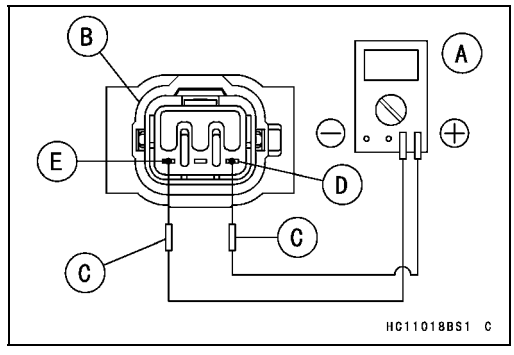


- The UPPER mark [A] of the sensor should face upward.

⚠ WARNING

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

Vehicle-down Sensor Inspection



NOTE

○*Be sure the battery is fully charged.*

- Connect a digital meter [A] to the connector [B] of the vehicle-down sensor with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Power Source Voltage
Connections to Sensor Connector

Meter (+) → LB lead [D]

Meter (–) → BR/W lead [E]

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

Input Voltage at Sensor
Standard: DC 4.75 ~ 5.25 V

- Turn the ignition switch OFF.

★If the reading of input voltage is less than the standard, check the ECU for its ground, power supply and wiring.

★If the power source is normal, check the output voltage.

Vehicle-down Sensor (Service Code 31)

● Remove the vehicle-down sensor (see Vehicle-down Sensor Removal).
○Do not disconnect the sensor connector.
● Connect a digital meter [A] to the connector [B] with needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Output Voltage
Connections to Sensor Connector
Meter (+) → Y/G lead [D]
Meter (–) → BR/BK lead [E]

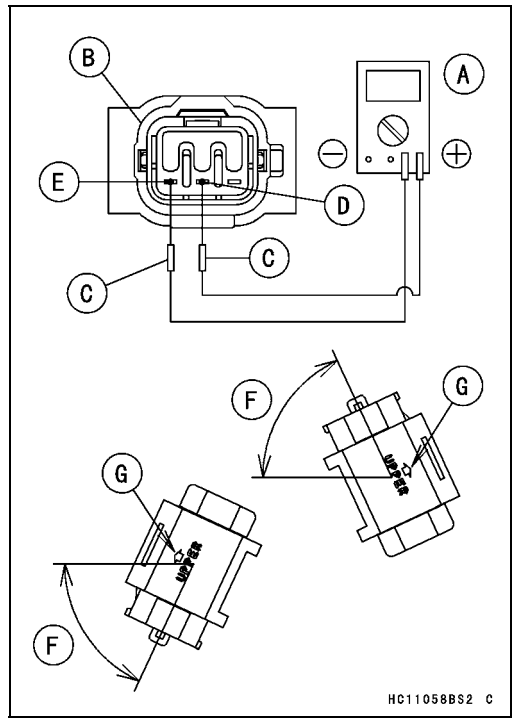
● Hold the sensor vertically.
● Turn the ignition switch ON, and measure the output voltage with the connector joined.
○Tilt the sensor 55~ 75° or more [F] right or left, then hold the sensor almost vertical with the arrow mark [G] pointed up, and measure the output voltage.

Output Voltage at Sensor
Standard: with sensor tilted 55~ 75° or more right or left: 3.7 ~ 4.4 V
with sensor arrow mark pointed up: 0.4 ~ 1.4 V

NOTE

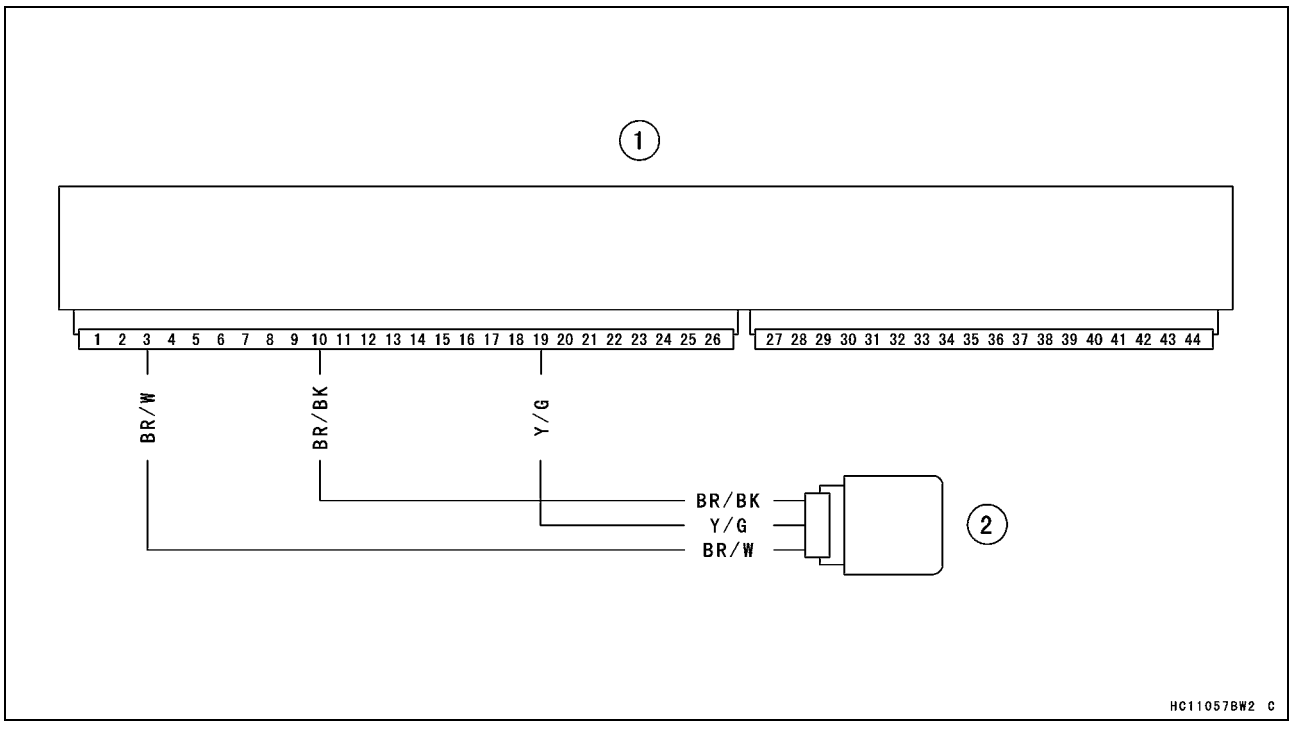
○*If you need to test again, turn the ignition switch OFF, and then ON.*

● Turn the ignition switch OFF.
★If the output voltage is normal, check the wiring.
★If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).
★If the output voltage is out of the specified, replace the vehicle-down sensor.



Vehicle-down Sensor (Service Code 31)

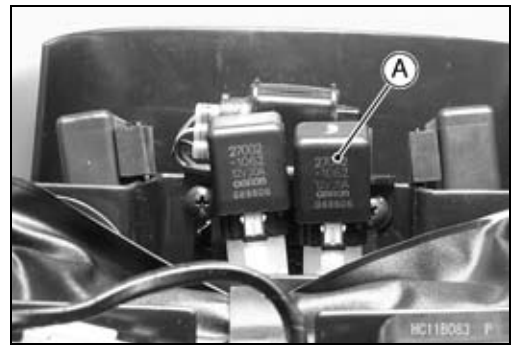
Vehicle-down Sensor Circuit



1. ECU (Electronic Control Unit)
2. Vehicle-down Sensor

Fuel Pump Relay (Service Code 46)

Fuel Pump Relay Removal



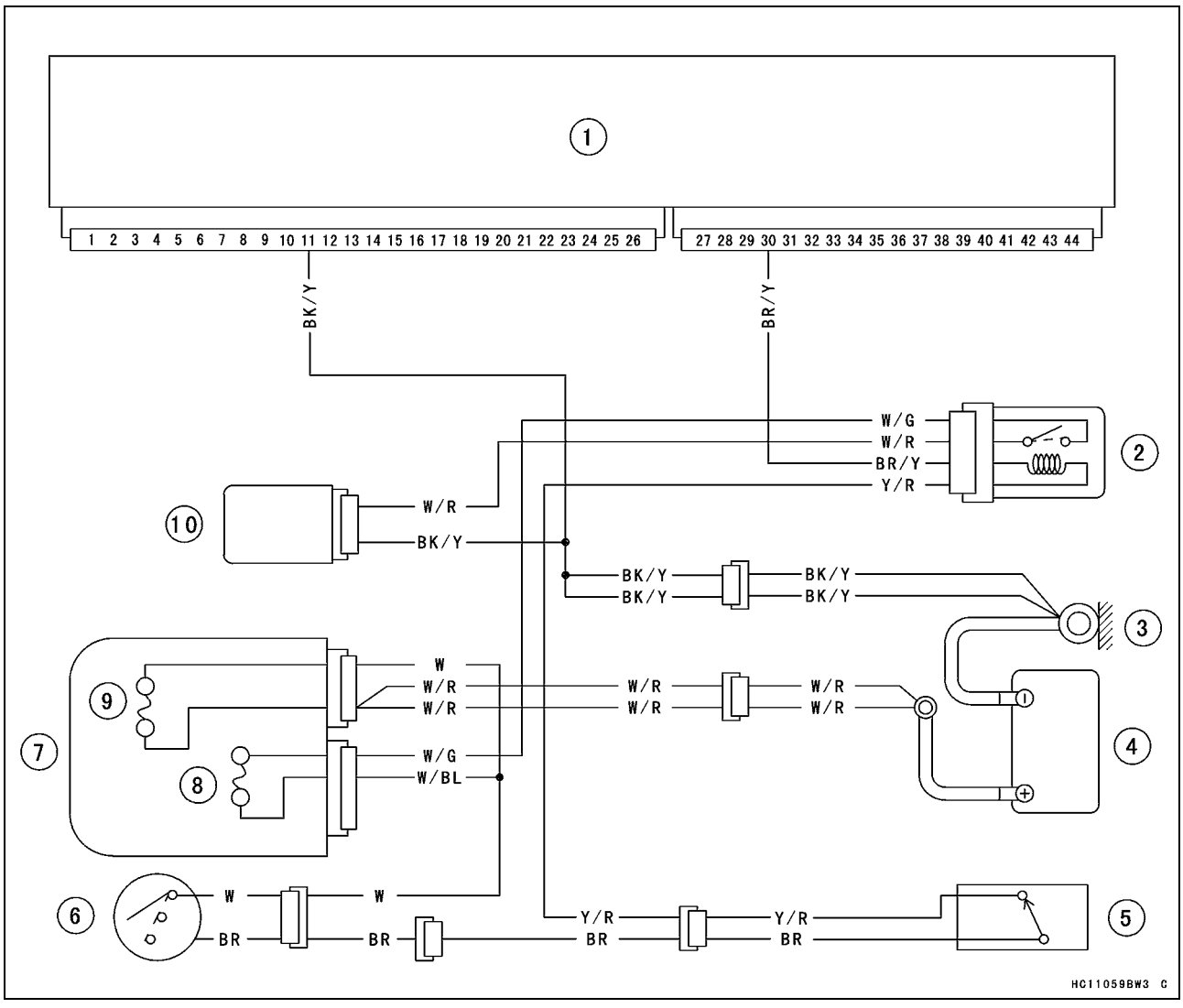
- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Fuel Pump Relay [A]

Fuel Pump Relay Inspection

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

Fuel Pump Relay (Service Code 46)

Fuel Pump Relay Circuit



1. ECU (Electronic Control Unit)
2. Fuel Pump Relay
3. Engine Ground Terminal
4. Battery 12 V 12 Ah
5. Engine Stop Switch
6. Ignition Switch
7. Fuel Box
8. Fuel Pump Fuse 10 A
9. Main Fuse 30 A
10. Fuel Pump

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)

Ignition Coil Removal/Installation

NOTICE
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 and Installation in the Electrical System chapter.

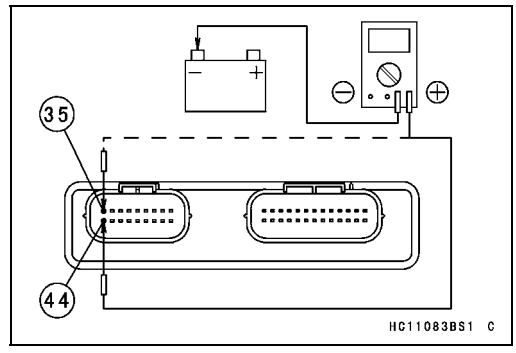
Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

● Turn the ignition switch OFF.
● Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
● Connect a digital voltmeter as shown, using two needle adapters.

Special Tool - Needle Adapter Set: 57001-1457



○Measure 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 (+) → G/W lead (terminal 44)
Meter (–) → Battery (–) Terminal
Connections for Ignition Coil #2
Meter (+) → BL/W lead (terminal 35)
Meter (–) → Battery (–) Terminal

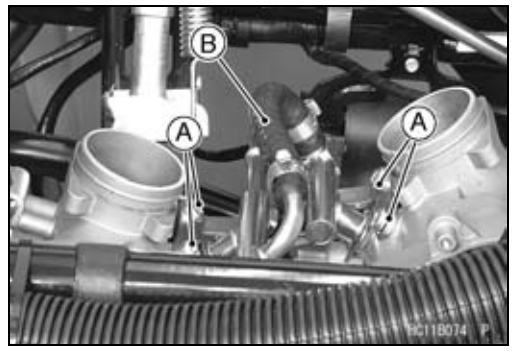
Standard: Battery Voltage (12.8 V or more)

★If the reading is out of the standard, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
★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 Ignition Coil Primary Peak Voltage Inspection in the Electrical System chapter) in order to check the primary coils.

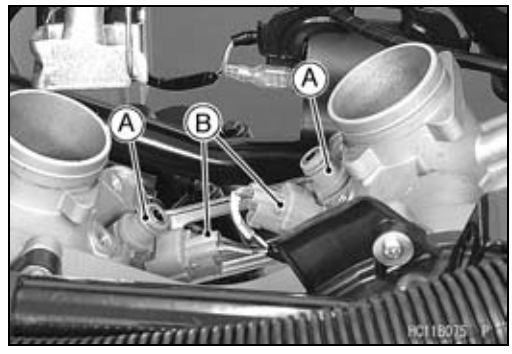
Fuel Injectors

Fuel Injector Removal

● Remove:
Air cleaner (see Air cleaner Housing Removal)
Screw [A]
Fuel Hose (from the Delivery Pipe)
Delivery Pipe [B]

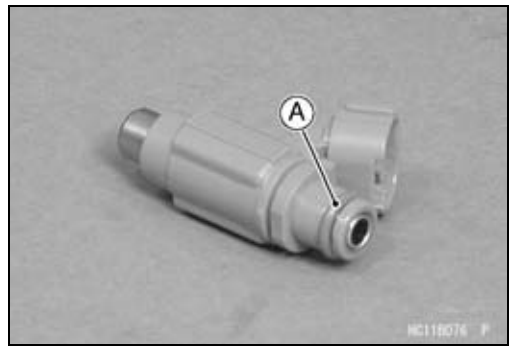


● Remove:
Fuel Injectors [A]
Connectors [B]

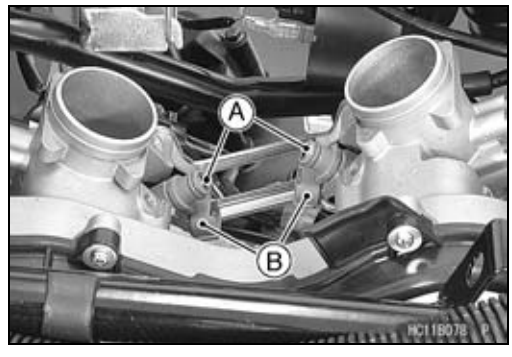


Fuel Injector Installation

● Replace the O-rings [A] and seals [B] with a new one.
○Before installation, blow away dirt or dust from the delivery pipe by applying compressed air.
● Apply grease to the O-ring of the injectors.



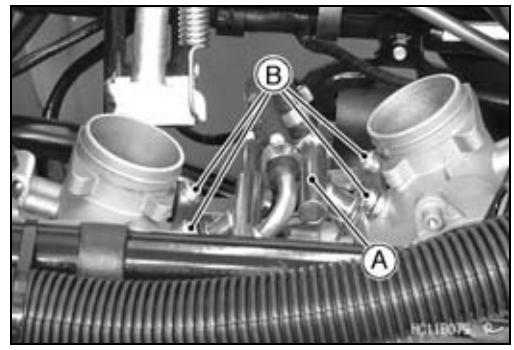
● Install the injector [A] to the throttle body assy so that the connector [B] faces downward.



Fuel Injectors

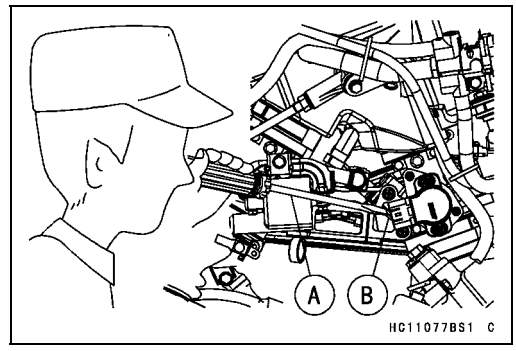
● Install the delivery pipe [A] on the throttle body assy.
● Tighten:

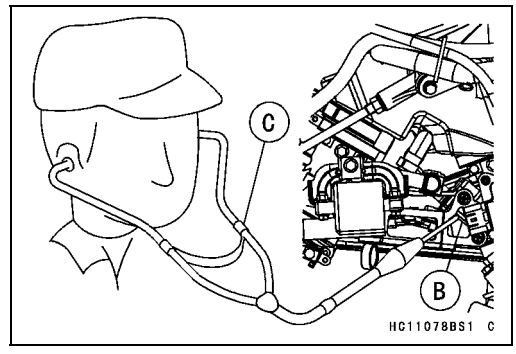
Torque - Delivery Pipe Mounting Screws [B]: 5.0 N·m (0.51 kgf·m, 44 in·lb)



Audible Inspection

● Start the engine.
● Apply the tip of a screwdriver [A] to the injector [B]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
○A sound scope [C] can also be used.
● Do the same for the other injectors.
★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 Pressure Inspection).
○The click interval becomes shorter as the engine speed rises.
★If any injector(s) doesn't click, the DFI circuit or the injector is suspect. Perform "Fuel Injector Power Source Voltage Inspection", first.





Fuel Injector Power Source Voltage Inspection

● Disconnect the injector connector [A] and connect the insulated auxiliary leads [B] between injector [C] and injector connector.

NOTICE
Do not short each terminals.

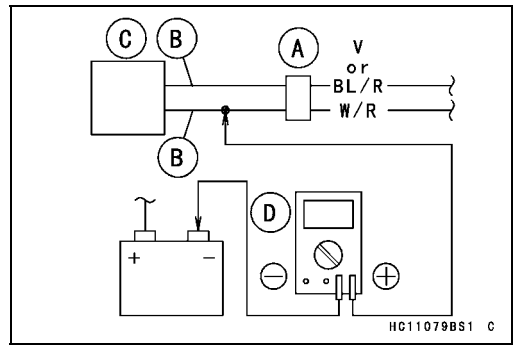
● Connect a digital meter [D] as shown.

Injector Power Source Voltage
Connections to injector
Meter (+) → W/R lead
Meter (–) → Battery (–) Terminal

● Measure the power source voltage with the engine stopped, and with the connector joined.
● Turn the engine stop switch to run position.
● Turn the ignition switch ON.

Power Source Voltage at Injector
Standard: Battery Voltage for 3 second, and then 0 V

● Turn the ignition switch OFF.



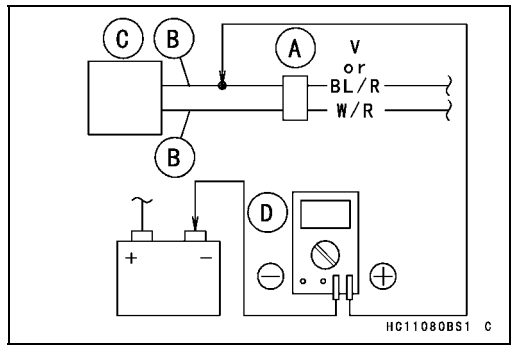
Fuel Injectors

★If the meter doesn't read as specified, check the following.
Main Fuse 30 A (see Fuse Inspection in the Electrical System chapter)
Fuel Pump Relay (see Relay Circuit Inspection in the Electrical System chapter)
Power Source Wiring (see wiring diagram below)

★If the power source voltage is normal, check the output voltage of the injectors.

Fuel Injector Output Voltage Inspection

● Disconnect the injector connector [A] and connect the insulated auxiliary leads [B] between injector [C] and injector connector.



NOTICE
Do not short each terminals.

● Connect a digital meter [D] as shown.

Injector Output Voltage
Connections to injector (#1)
Meter (+) → BL/R lead
Meter (–) → Battery (–) Terminal

Connections to injector (#2)
Meter (+) → V lead
Meter (–) → Battery (–) Terminal

● Turn the engine stop switch to run position.
● Turn the ignition switch ON.

Output Voltage at Injector
Standard: Battery Voltage for 3 second, and then 0 V

● Turn the ignition switch OFF.

★If the output voltage is normal, perform "Injector Signal Test".

★If the output voltage is out of the standard, remove the ECU (see ECU Removal/Installation), and check the injector wiring for continuity.

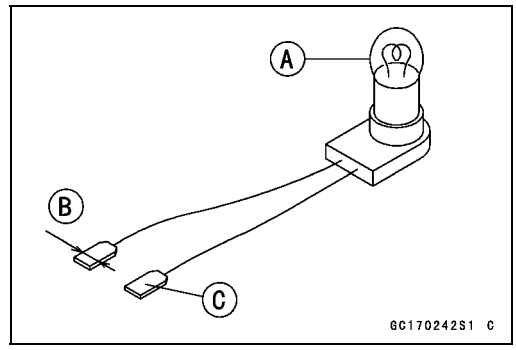
Injector Wiring Inspection

ECU Connector		Injector Connectors
Terminal 43	→	Injector (#1) Terminal (BL/R)
Terminal 34		Injector (#2) Terminal (V)

★If the wiring is good, inspect the resistance of the injectors (see Injector Resistance Inspection).

Fuel Injectors

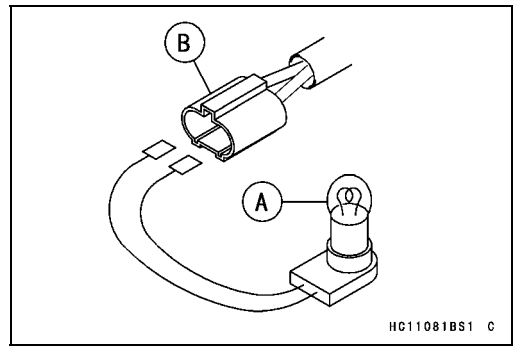
Injector Signal Test



● Prepare two test light sets with terminals as shown.
Rating of Bulb [A]: 12 V × (3 ~ 3.4) W
Terminal Width [B]: 1.8 mm (0.071 in.)
Terminal Thickness [C]: 0.8 mm (0.031 in.)

NOTICE

Do not use larger terminals than specified above. A larger terminal could damage the injector main harness connector, 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.



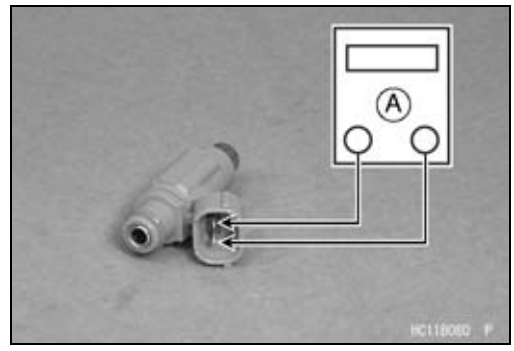
● Remove:
Fuel Injector (see Fuel Injector Removal)
● Connect each test light set [A] to the injector harness connector [B].
● Turn the ignition switch ON.
● While cranking the engine with the starter motor, watch the test lights.
★If the test lights flicker at regular intervals, the injector circuit in the ECU, and the wiring are good. Perform the “Injector Resistance Inspection”.

○Injector signals can be also confirmed by connecting the hand tester (× AC 10 V) instead of the test light set to the injector main harness connector. Crank the engine with the starter motor, and check to see if the hand 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, replace the ECU (see ECU Removal/Installation).

Injector Resistance Inspection



● Remove:
Fuel Injector (see Fuel Injector Removal)
● Measure the injector resistance with the hand tester [A].

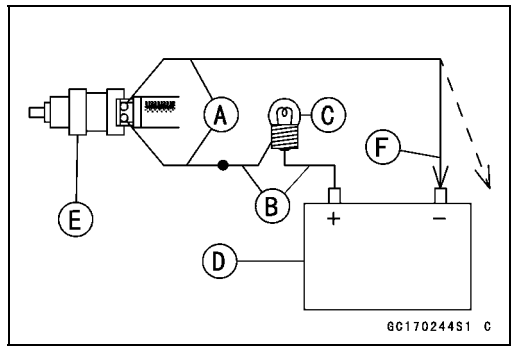
Special Tool - Hand Tester: 57001-1394

Injector Resistance
Connections to Injector Connector
Standard: About 11.7 ~ 12.3 Ω 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

Injector Unit Test



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

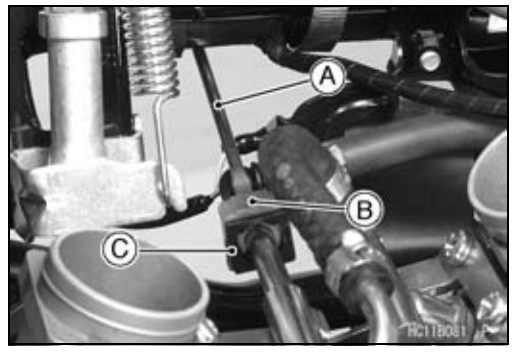
NOTICE

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.

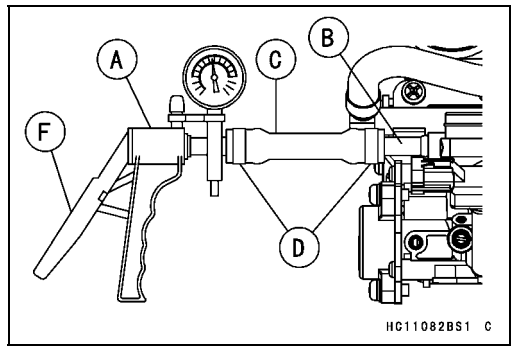
- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the lead to the battery (–) terminal repeatedly. The injector should click.

★If the injector does not click, replace the injector.

Injector Fuel Line Inspection



- Remove the air cleaner (see Air Cleaner Housing Removal).
- Be sure to place a piece of cloth around the fuel hose joint and the delivery pipe.
- Insert a minus screwdriver [A] into the slit on the joint lock [B].
- Turn the driver to disconnect the joint lock.
- Pull the fuel hose joint [C] out of the delivery pipe.



- Check the injector fuel line for leakage as follows.

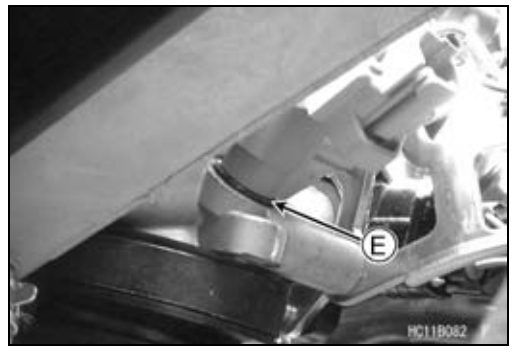
○Connect a commercially available vacuum/pressure pump [A] to the nipple of the delivery pipe [B] with a high-pressure fuel hose [C] (both ends connected with the clamps [D]) as shown.

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

○Apply soap and water solution to the areas [E] as shown.

○Watching the pressure gauge, squeeze the pump lever [F], and build up the pressure until the pressure reaches the maximum pressure.

Injector Fuel Line Maximum Pressure
Standard: 300 kPa (3.06 kgf/cm², 43.5 psi)



NOTICE

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

- Watch the gauge for at least 6 seconds.

★If the pressure holds steady, the system is good.

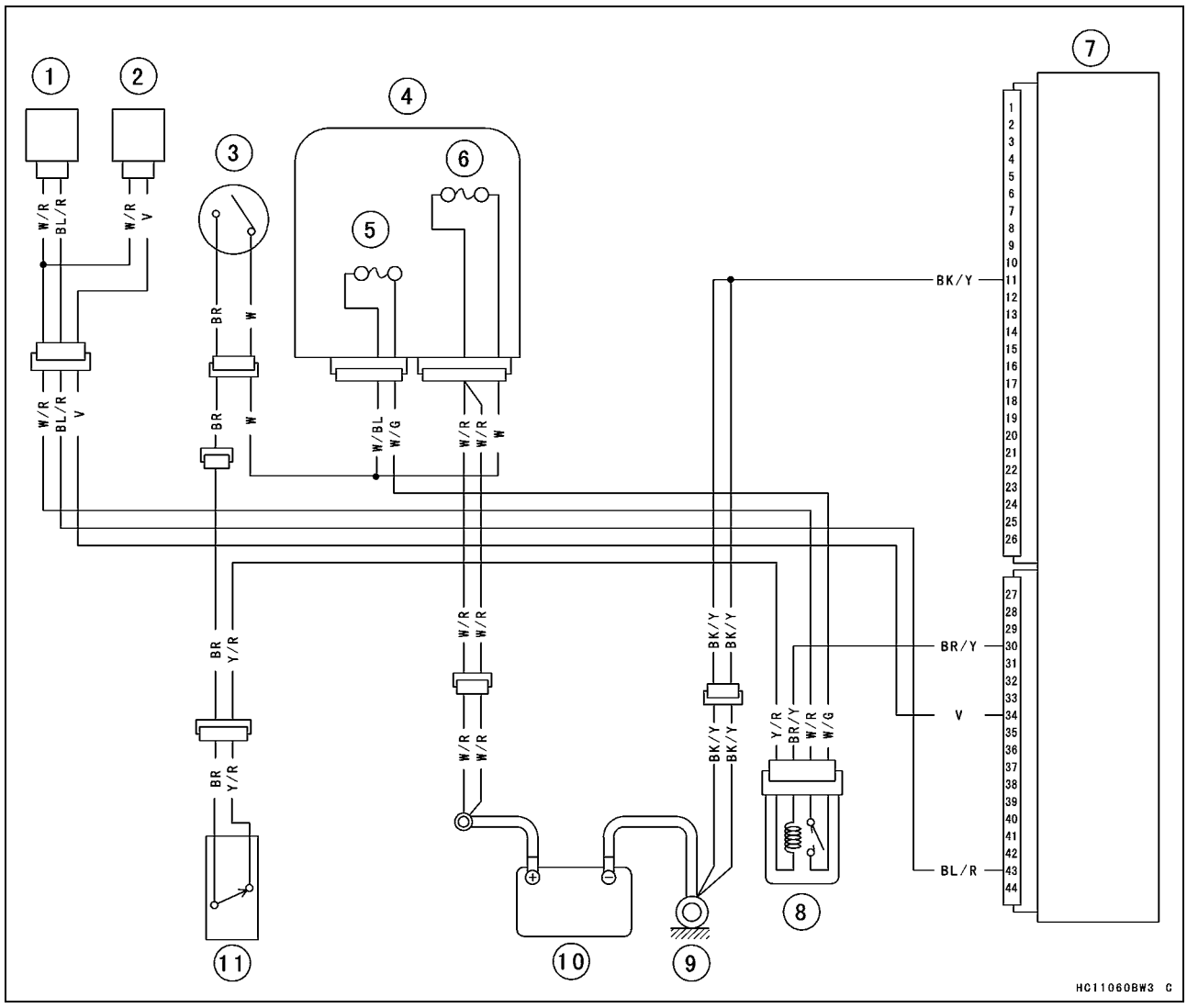
★If the pressure drops at once or if bubbles are found in the area, the line is leaking. Replace the delivery pipe, injectors and related parts.

○Repeat the leak test, and check the fuel line for no leakage.

- Run the hoses correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).

Fuel Injectors

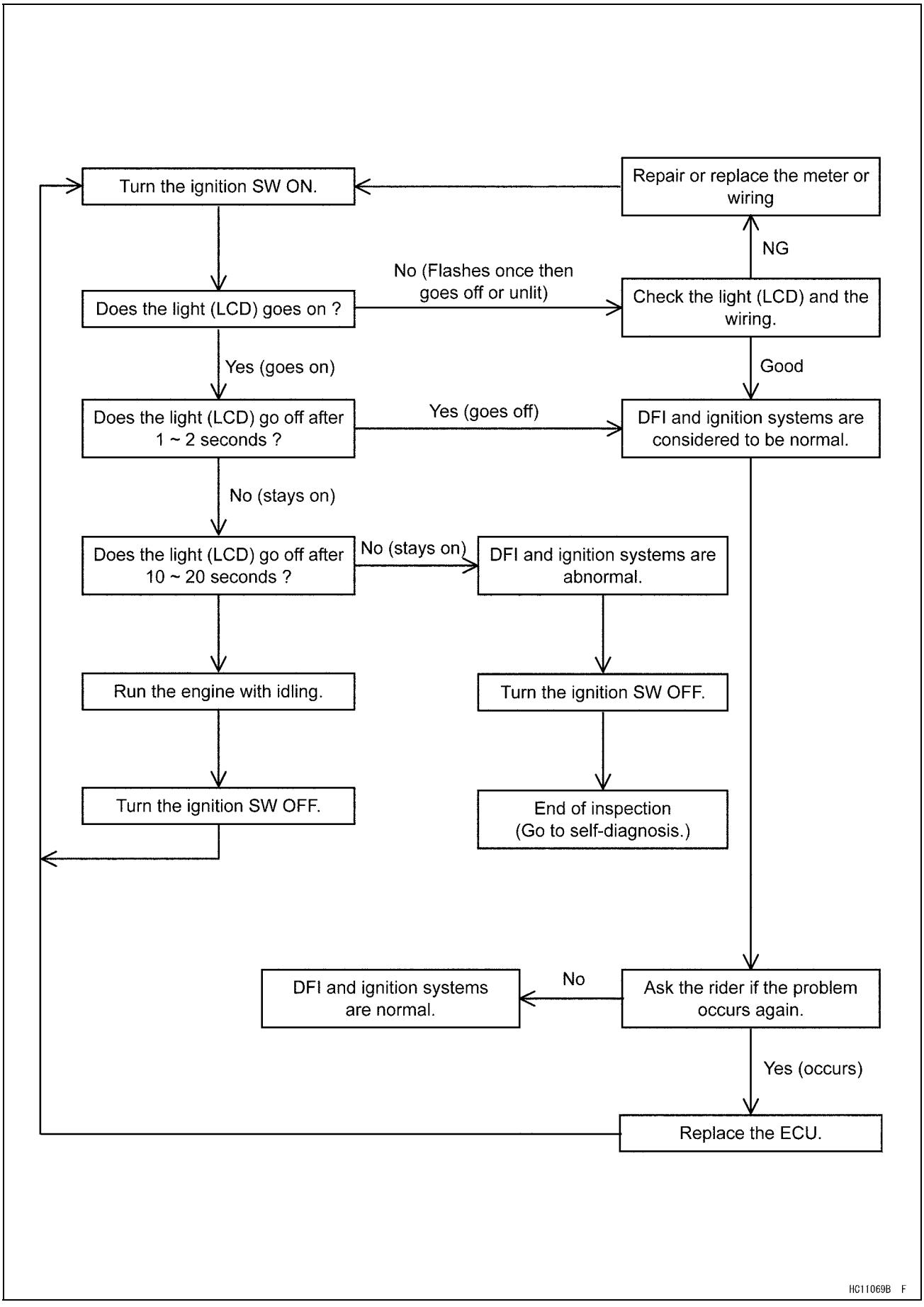
Fuel Injector Circuit



1. Fuel Injector #1
2. Fuel Injector #2
3. Ignition Switch
4. Fuse Box
5. Fuel Pump Fuse 10 A
6. Main Fuse 30 A
7. ECU (Electronic Control Unit)
8. Fuel Pump Relay
9. Engine Ground Terminal
10. Battery 12 V 12 Ah
11. Engine Stop Switch

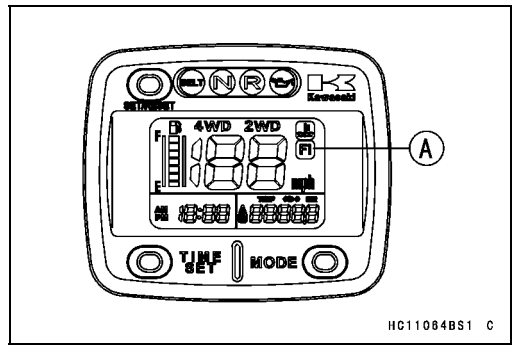
FI Indicator Light (LCD)

Inspection Flow Chart



FI Indicator Light (LCD)

Light Inspection



○The FI indicator light (LCD) [A] goes ON when the ignition switch is turned ON and the FI indicator light (LCD) goes OFF when the engine oil pressure is high enough (the engine is running). This is to ensure that the FI indicator light (LCD) has not burned out and the DFI system and the ignition system function properly.

● Refer to the Multifunction Meter Unit Inspection in the Electrical System chapter for FI indicator light (LCD) Inspection.

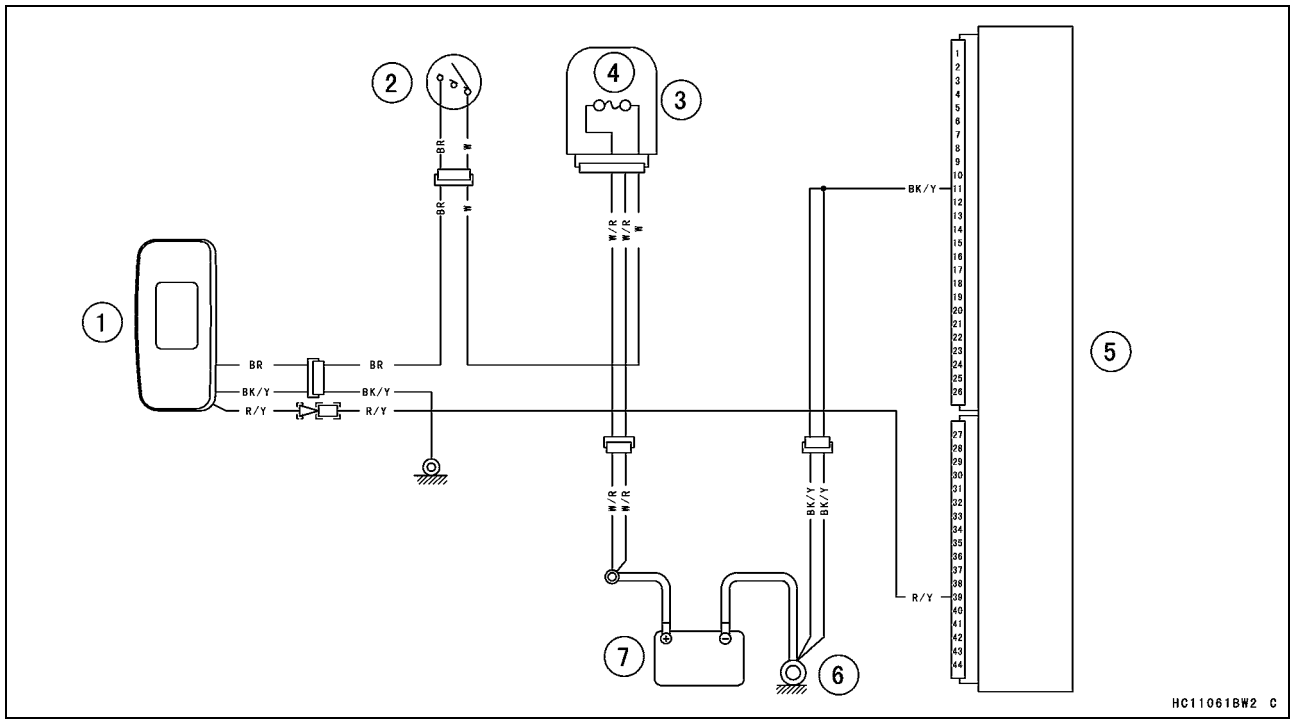
⚠ WARNING

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

★If the FI indicator light (LCD) is abnormal, replace the meter unit.

★If the FI indicator light (LCD) 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 Power Supply Inspection).

FI Indicator Light (LCD) Circuit



1. Multifunction Meter
2. Ignition Switch
3. Fuse Box
4. Main Fuse 30 A
5. ECU (Electronic Control Unit)
6. Engine Ground Terminal
7. Battery 12 V 12 Ah

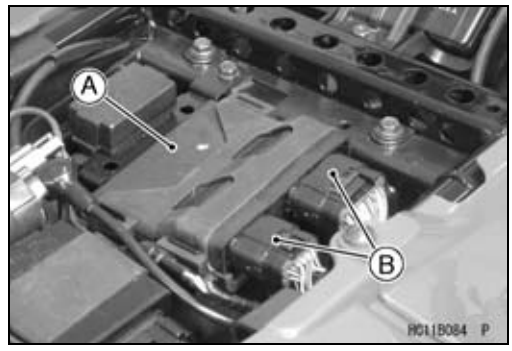
ECU

NOTICE

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

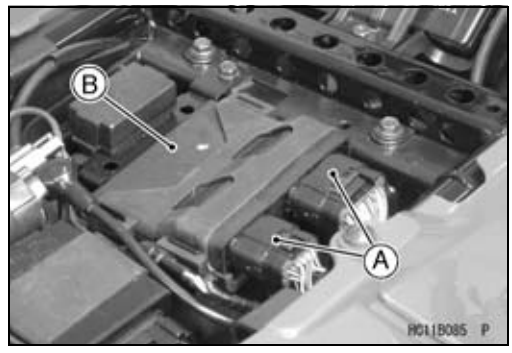
ECU Removal

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  ECU [A]
- Disconnect the ECU connectors [B].



ECU Installation

- Connect the ECU connectors [A] to the ECU [B].
- Install the ECU to the electrical parts case.



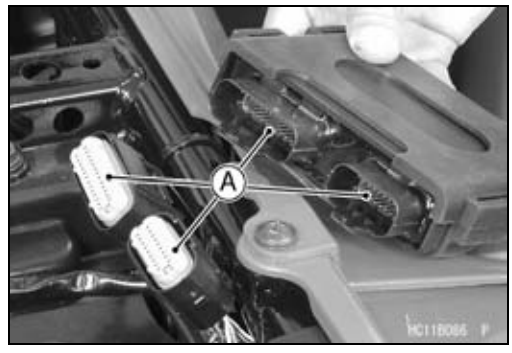
ECU Power Supply Inspection

- Visually inspect the terminals [A] of the ECU connectors.

★If the connector is clogged with mud or dust, blow it off with compressed air.

★Replace the main harness if the terminals of the main harness connectors are cracked, bent, or otherwise damaged.

★Replace the ECU if the terminals of the ECU connectors are cracked, bent, or otherwise damaged.

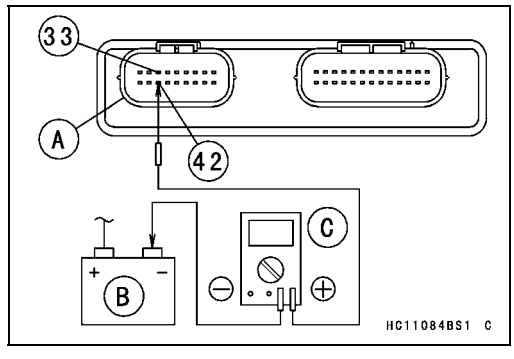


- With the ECU connector [A] connected, check the following ground lead for continuity with the ignition switch OFF, using a digital meter and needle adapter set.
  Battery [B]
  Digital Meter [C]

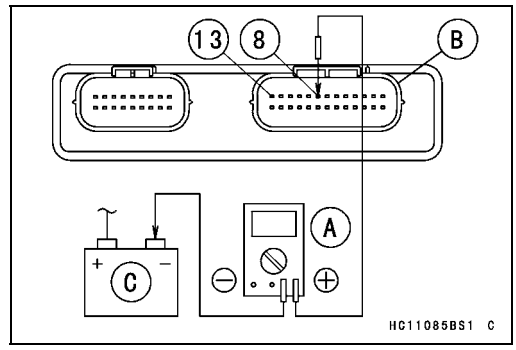
  Special Tool - Needle Adapter Set: 57001-1457

  ECU Grounding Inspection
  33 or 42 (BK/Y) Terminal ←→ Battery (–) Terminal: 0 Ω
  Engine Ground ←→ Battery (–) Terminal: 0 Ω

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



ECU



● Check the ECU power source voltage with a digital meter [A].

○Position the terminal in accordance with terminal numbers of ECU connector [B] in this chapter figure.

Battery [C]

ECU Power Source Inspection

Meter Connections:

Between Terminal 8 (W) and Battery (–) Terminal

Between Terminal 13 (BR) and Battery (–) Terminal

Ignition Switch OFF:

Terminal 8 (W): 0 V

Terminal 13 (BR): Battery Voltage

Ignition Switch ON:

Both: Battery Voltage

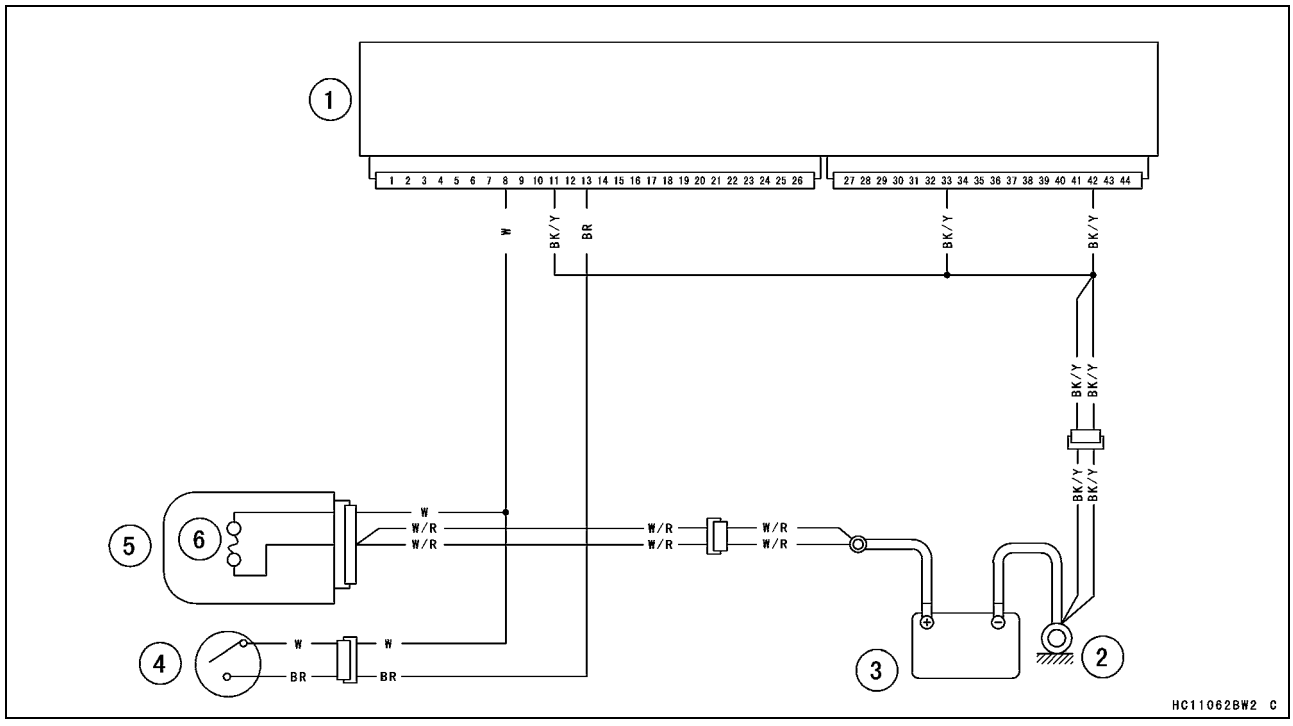
★If the meter does not read as specified, check the following.

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

Power Source Wiring (see wiring diagram in this section)

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

ECU Power Source Circuit



1. ECU (Electronic Control Unit)
2. Engine Ground Terminal
3. Battery 12 V 12 Ah
4. Ignition Switch
5. Fuse Box
6. Main Fuse 30 A

Fuel Line

Fuel Pressure Inspection

NOTE

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

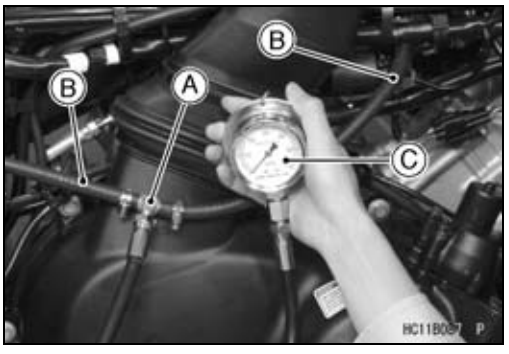
● Remove the fuel hose (see Fuel Hose Replacement in the Periodic Maintenance chapter).

⚠ WARNING

Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

● Install the fuel pressure gauge adapter [A] and fuel hoses (Special Tool and suitable length available on the market) [B] between the fuel pump outlet pipe and the delivery pipe.
● Connect the pressure gauge [C] to the fuel pressure gauge adapter.

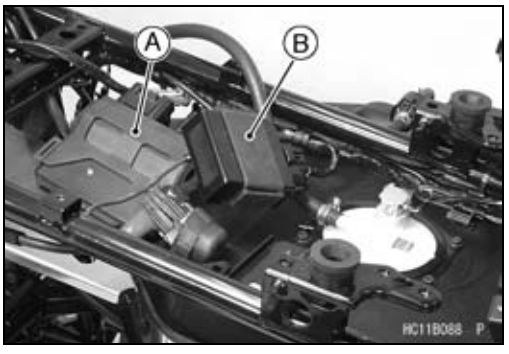
Special Tools - Oil Pressure Gauge, 5 kgf/cm²: 57001-125
Fuel Pressure Gauge Adapter: 57001-1593
Fuel Hose: 57001-1607



⚠ WARNING

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

● Temporarily, install the ECU [A] and actuator controller [B].
● Turn the ignition switch ON. The fuel pump will turn for 3 seconds, and then stop.



NOTE

○*Turn the ignition switch ON and inspect the fuel line leakage after installing the special tools.*

NOTICE

Do not drive the fuel pump without the fuel in the fuel tank. If the fuel pump is driven without the fuel, it may be damaged.

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

Fuel Pressure (Idling)
Standard: 294 kPa (3.0 kgf/cm², 43 psi)

Fuel Line

NOTE

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

★If the fuel pressure is much lower than specified, the fuel pressure regulator in the fuel pump have been clogged or stuck. Replace the fuel pump (see Fuel Pump section).

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

Fuel Line Leakage

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 throttle body assy, or the fuel pump and measure the fuel pressure again (see appropriate sections).

- Remove the fuel pressure gauge, hoses and adapter.
- Install the removed parts.

Fuel Flow Rate Inspection

NOTE

○*Be sure the battery is fully charged.*

⚠ WARNING

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

- Turn the ignition switch, and engine stop switch OFF.
- Wait until the engine cools down.
- Prepare a fuel hose (Special Tool: 57001-1607) and a measuring cylinder.

Special Tool - Fuel Hose: 57001-1607

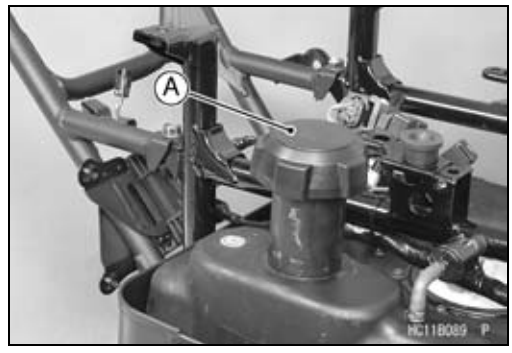
- Remove the fuel hose (see Fuel Hose Replacement in the Periodic Maintenance chapter).

⚠ WARNING

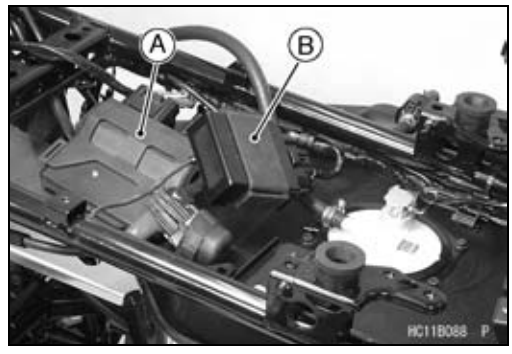
Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

Fuel Line

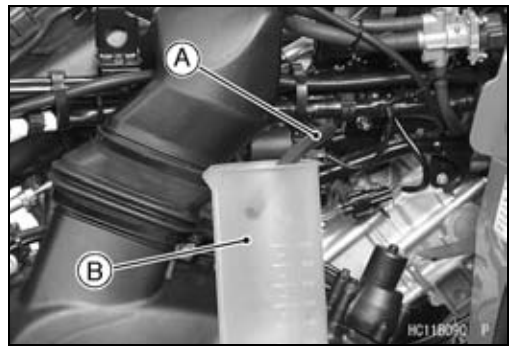
● Open the fuel tank cap [A] to lower the pressure in the tank.



● Temporarily, install the ECU [A] and actuator controller [B].



● Connect the prepared fuel hose [A] to the fuel pump outlet pipe.
● Secure the fuel hose with a clamp.
● Run the other side of the fuel hose into the measuring cylinder [B].



⚠ WARNING

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

● Close the fuel tank cap.
● 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 fuel hose is filled with fuel.

NOTICE

Do not drive the fuel pump without the fuel in the fuel tank.

● Measure the discharge for 3 seconds.
○Repeat this operation several times.

Amount of Fuel Flow
Standard: 50 mL (1.7 US oz.) or more for 3 seconds

★If the fuel flow is much less than the specified, check the battery condition (see Charging Condition Inspection in the Electrical System chapter).
★If the battery is good, replace the fuel pump (see Fuel Pump Removal/Installation).
● After inspection, connect the fuel hose (see Fuel Tank Installation).
● Start the engine and check for fuel leakage.

Fuel Pump

Fuel Pump Removal

NOTICE

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

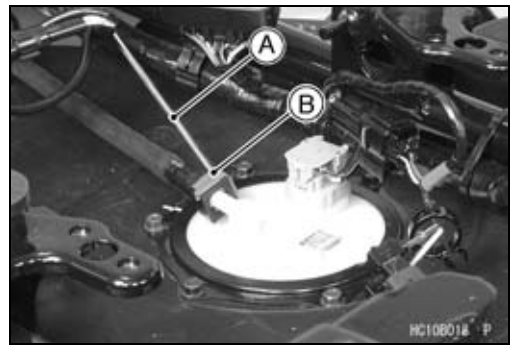
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Disconnect the battery (-) terminal. To avoid fuel spills, draw it from the tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

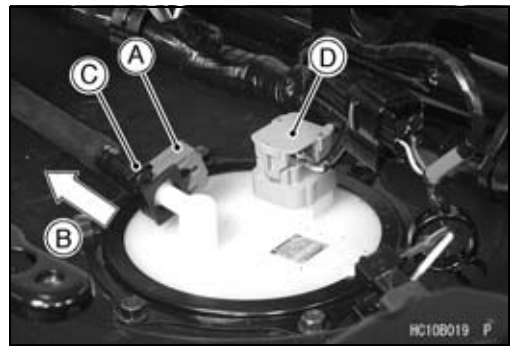
- Remove the electrical parts case (see Electrical Parts Case Removal in Frame chapter).

○Be careful of fuel spillage from the fuel tank since fuel still remains in the fuel tank and fuel pump. Plug the fuel pipe of the fuel tank.

- Be sure to place a piece cloth around the fuel hose joint.
- Insert a minus screwdriver [A] into the slit on the joint lock [B].



- Twist the screwdriver to disconnect the joint lock [A].
- Pull [B] the fuel hose joint [C] out of the fuel pump.



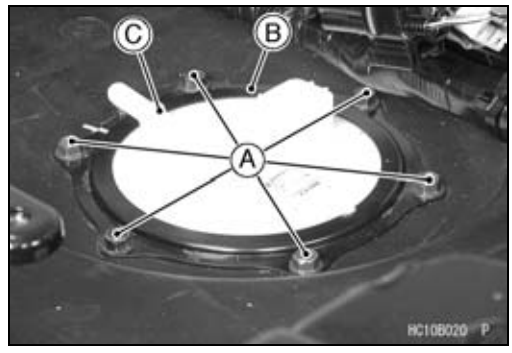
⚠ WARNING

Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe. Cover the hose connection with a clean shop towel to prevent fuel spillage.

- Disconnect:
  Fuel Pump Connector [D]

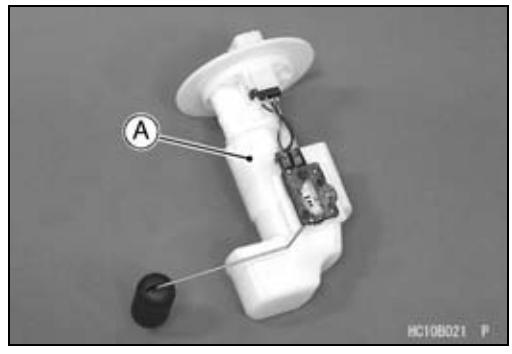
Fuel Pump

- Remove:
  Fuel Pump Bolts [A]
  Plate [B]
  Fuel Pump [C]
  O-ring



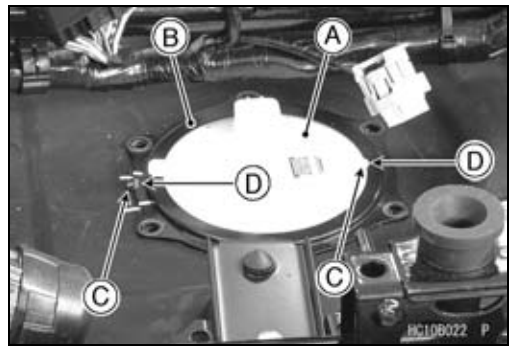
Fuel Pump Installation

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

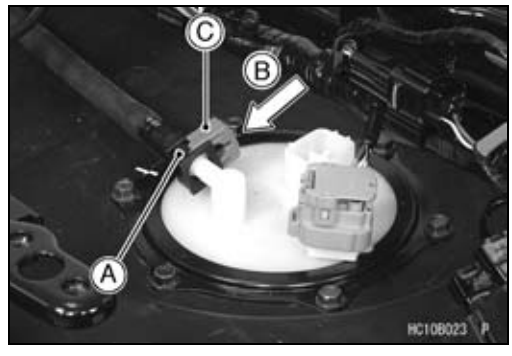


- Install:
  Fuel Pump [A]
  O-ring
- Install the plate [B] so that fit the projections [C] and hellows [D] of the fuel pump and plate.
- Tighten the fuel pump bolts to a snug fit, tighten them alternating diagonally.

  Torque - Fuel Pump Bolts: 4.0 N·m (0.41 kgf·m, 35 in·lb)
- Tighten the pump bolts again alternating diagonally to check the tightness.

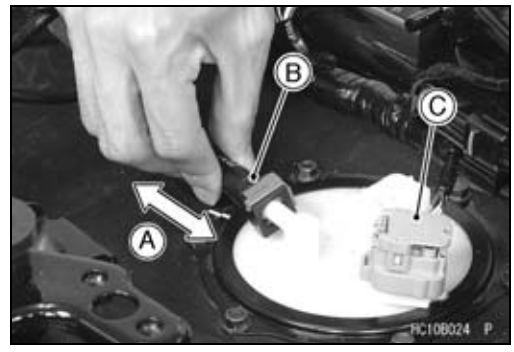


- Install the fuel hose.
- Insert the fuel hose joint [A] straight onto the fuel pump until the hose joint clicks.
- Push [B] the joint lock [C].



Fuel Pump

● Push and pull [A] the fuel hose joint [B] back and forth more than two times and make sure it is locked and doesn't come off.



⚠ WARNING

Leaking fuel can cause a fire or explosion resulting in serious burns. Make sure the fuel hose joint is installed correctly on the fuel pump.

★If it comes off, reinstall the hose joint.
● Connect:
Fuel Pump Connector [C]
● Run the fuel hose correctly (see Cable, Wire and Hose Routing section in the Appendix chapter).
● Install the removed parts (see appropriate chapters).
● Start the engine and check the fuel hose for leaks.

Fuel Pump Operation Inspection

NOTE

○*Be sure the battery is fully charged.*
○*Just listen to the pump sound in the fuel tank to confirm pump operation.*

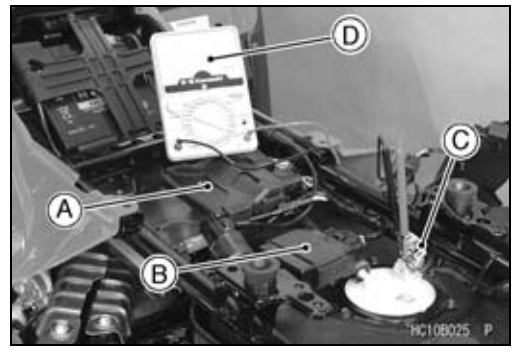
● Turn the ignition switch ON and make sure that the fuel pump operates (make light sounds) for 3 seconds, and then stops.
● Turn the ignition switch OFF.
★If the pump does not work as described above, inspect the operating voltage.

Fuel Pump Operating Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

● Turn the ignition switch OFF.
● Remove:
Electrical Parts Case (see Electrical Parts Case Removal in the Frame chapter)
● Temporary connect the ECU [A] and actuator controller [B].
● Open the fuel pump connector cap [C].



Fuel Pump

● Connect the hand tester [D] (× DC 25 V) to the fuel pump connector with needle adapter set.

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

Pump Operating Voltage at Pump Connections to Pump Connectors

Tester (+) → W/R Lead

Tester (–) → BK/Y Lead

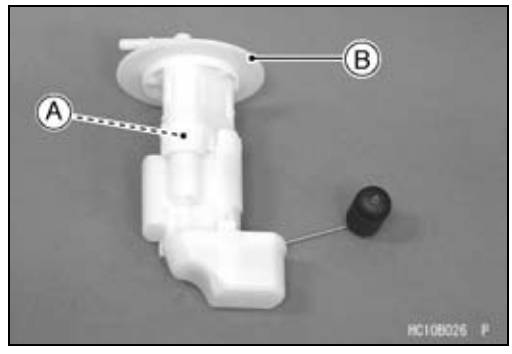
● Measure the operating voltage with the engine stopped, and with the connector joined.
● Turn the engine stop switch to run position.
● Turn the ignition switch ON.
○The tester needle should indicate battery voltage for 3 seconds, and then 0 V.

Operating Voltage at Pump Connector
Standard: Battery Voltage for 3 seconds, and then 0 V

★If the reading stays on battery voltage, and never shows 0 V. Check the ECU for its ground and power supply (see ECU Power Supply Inspection) and fuel pump relay.
★If the voltage is in specification, but the pump doesn't work, replace the pump (see Fuel Pump Removal/Installation).
★If there is still no battery voltage, check the pump relay (see Relay Inspection in the Electrical System chapter).

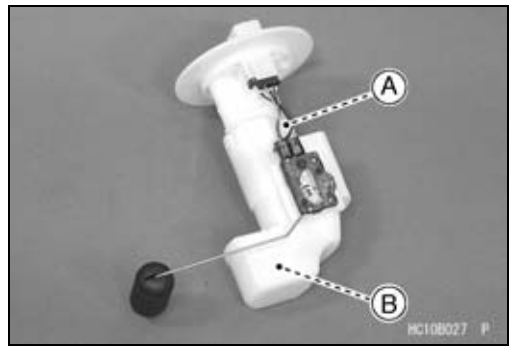
Pressure Regulator Removal

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



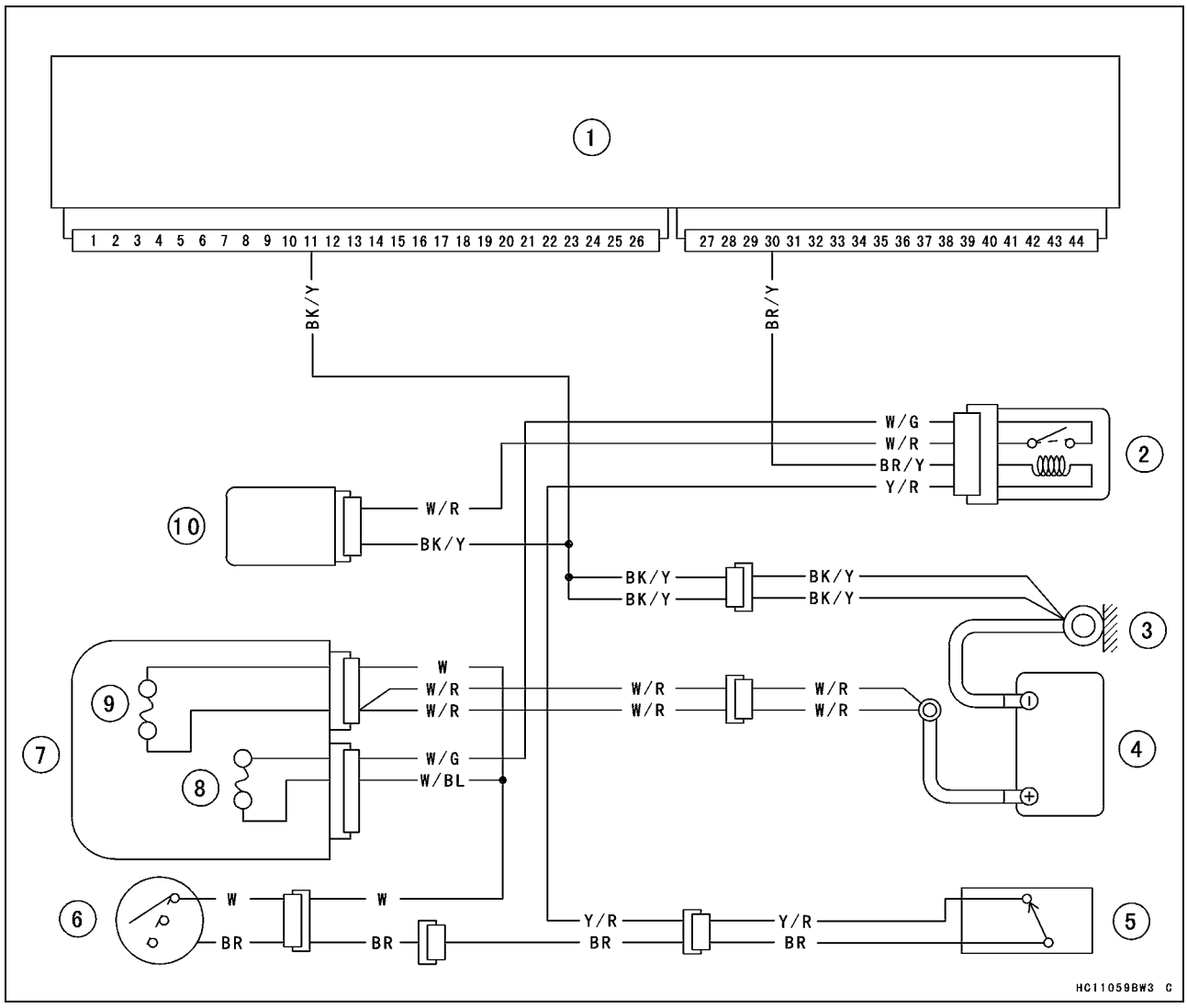
Pump Screen, Fuel Filter Cleaning

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



Fuel Pump

Fuel Pump Circuit



1. ECU (Electronic Control Unit)
2. Fuel Pump Relay
3. Engine Ground Terminal
4. Battery 12 V 12 Ah
5. Engine Stop Switch
6. Ignition Switch
7. Fuse Box
8. Fuel Pump Fuse 10 A
9. Main Fuse 30 A
10. Fuel Pump

Throttle Lever and Cable

Throttle Lever Free Play Inspection

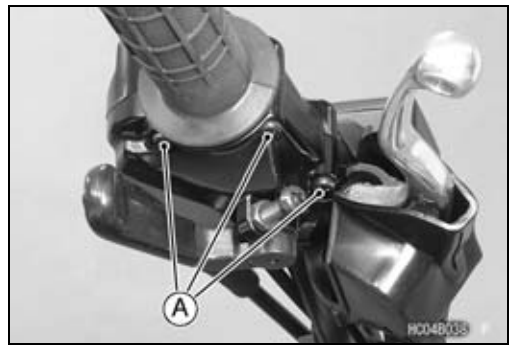
● Refer to the Throttle Lever Free Play Inspection in the Periodic Maintenance chapter.

Throttle Lever Free Play Adjustment

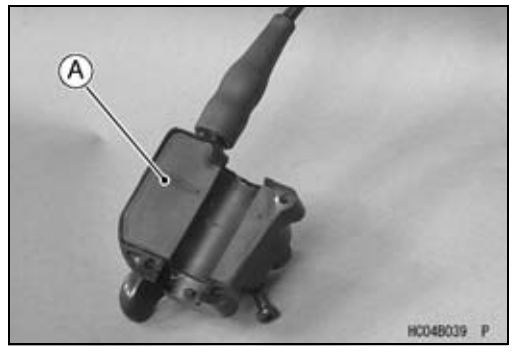
● Refer to the Throttle Lever Free Play Adjustment in the Periodic Maintenance chapter.

Throttle Case Removal/Disassembly

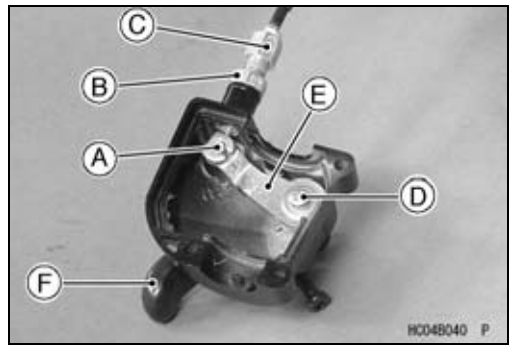
● Remove the throttle case screws [A] and pull the case open.
● Slide the cable adjuster dust cover out of place.



● Remove the rubber cover [A].

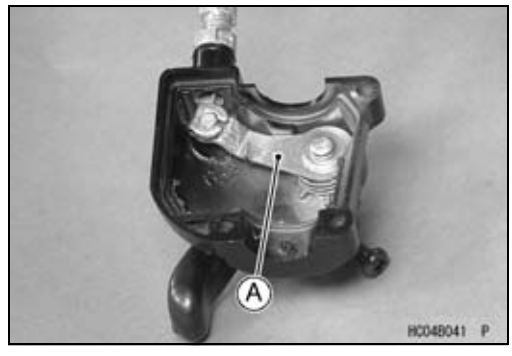


● Pull the cable tip [A] out of the throttle lever catch with the throttle lever opened.
● Loosen the locknut [B] and unscrew the adjuster [C].
● Disassemble the throttle case as follows:
○Remove the throttle lever screw [D], lockwasher, and flat washer, and lift the throttle lever [E] and return spring from the case.
○Pull the throttle control lever [F] out of the case.



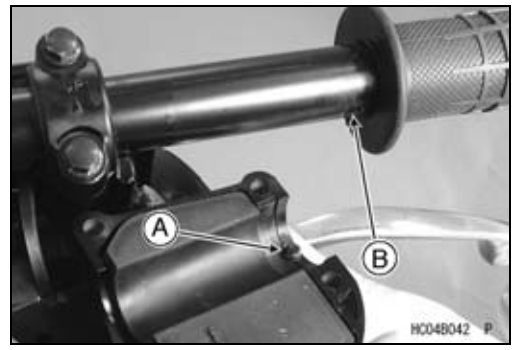
Throttle Case Assembly/Installation

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

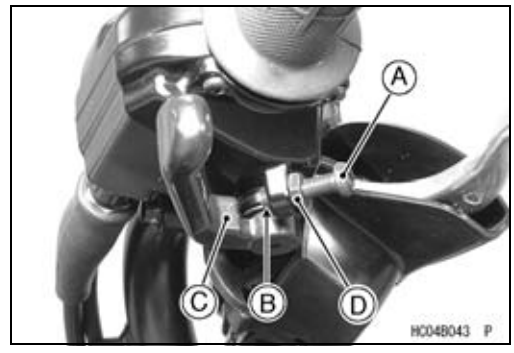


Throttle Lever and Cable

● Install the throttle case so that the projection [A] fit to the hole [B] of the handlebar.



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



NOTE

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

⚠ WARNING

Operation with an improperly assembled throttle case could result in an unsafe riding condition. Be sure the throttle case is assembled correctly.

● Check the throttle lever free play (see Throttle Lever Free Play Inspection in the Periodic Maintenance chapter).

Throttle Cable Installation

● Lubricate the throttle cable before installation.
● Route the cable correctly according to the Cable, Wire, and Hose Routing in the Appendix chapter.

⚠ WARNING

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

● Check the throttle cable (see Throttle Lever Free Play Inspection in the Periodic Maintenance chapter).

Throttle Case Inspection

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

Throttle Cable Lubrication and Inspection

● Whenever the throttle cable is removed or in accordance with the Periodic Maintenance Chart in the Periodic Maintenance chapter, lubricate the cable .
● Refer to the General Lubrication in the Periodic Maintenance chapter.

Throttle Body Assy

Idle Speed Inspection

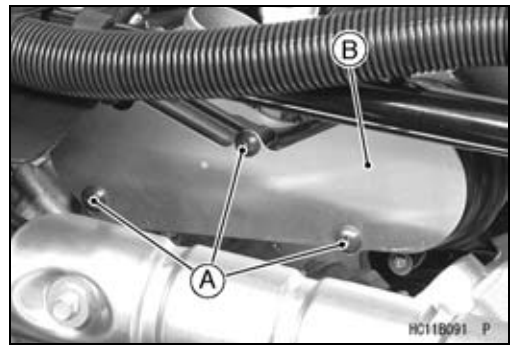
● Refer to the Idle Speed Inspection in the Periodic Maintenance chapter.

Throttle Body Assy Removal

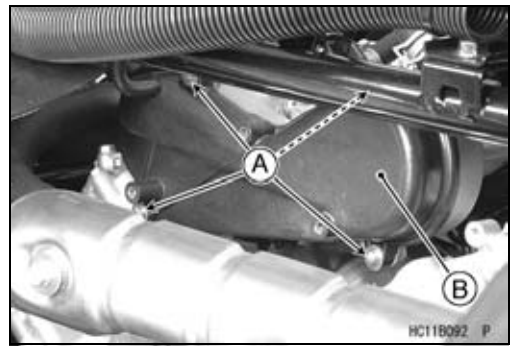
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Disconnect the battery (-) terminal. To avoid fuel spills, draw it from the tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

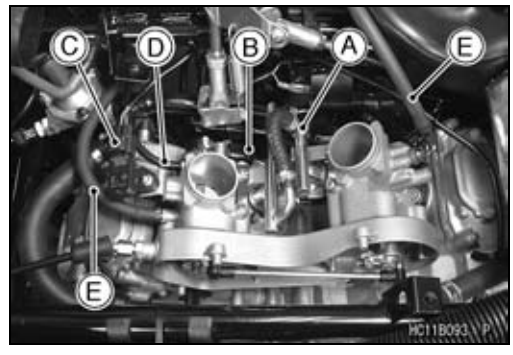
● Remove:
Air Cleaner (see Air Cleaner Housing Removal)
Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
Screws [A]
Heat Guard Plate [B]



● Remove:
Screws [A]
Throttle Link Case Cover [B]

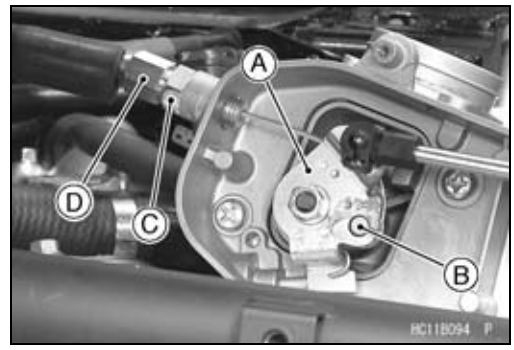


● Remove:
Delivery Pipe [A] (see Fuel Injection Removal)
Throttle Sensor Connector [B]
Intake Air Pressure Sensor Connector [C]
Vacuum Hose [D]
ISC Valve Hoses [E]



Throttle Body Assy

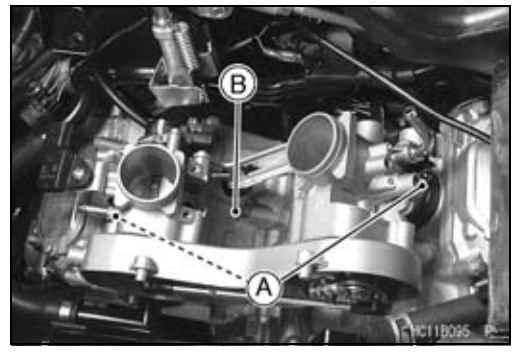
- Turn the throttle pully [A] clockwise to remove the throttle cable tip [B].
- Loosen the locknut [C] and adjusting nut [D] fully to remove the throttle cable from the throttle body assy.



- Loosen the clamp screws [A] fully.
- Remove the throttle body assembly [B].
- After removing the throttle body assy, stuff pieces of lint-free, clean cloths into the throttle body assy holders.

NOTICE

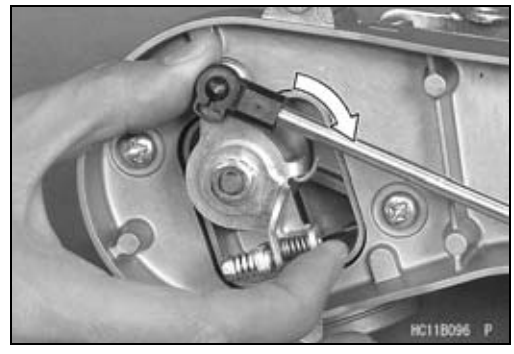
If dirt gets into the engine, excessive engine wear and possible engine damage will occur.



Throttle Body Assy Installation

- Turn the throttle pulley to check that the throttle valve move smoothly and return by spring force.

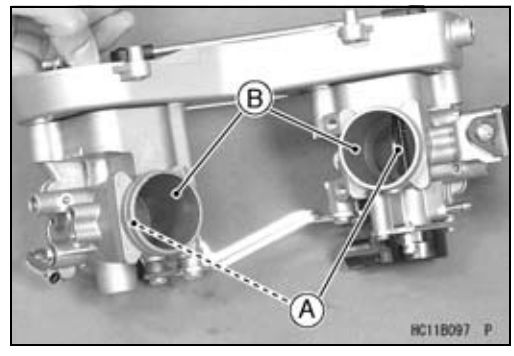
★If the throttle valve do not move smoothly, replace the throttle body.



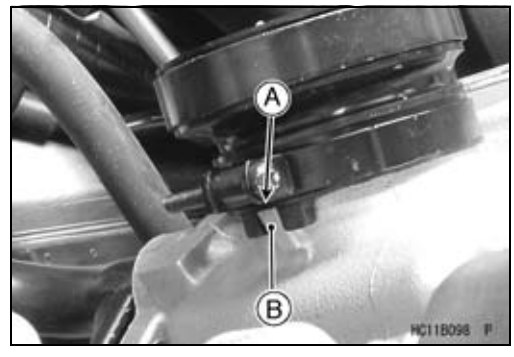
- Open the butterfly valves [A], and wipe any carbon off the throttle bores [B] around the valve, using a piece of lint-free cloth penetrated with a high-flash point solvent.
- Blow away dirt or dust from the throttle body by applying compressed air.

NOTICE

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

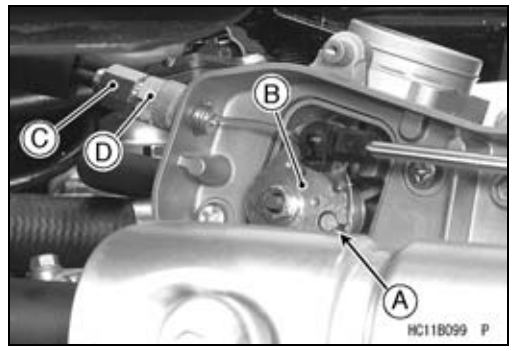


- Be sure to groove [A] of the throttle body holder fits on the projection [B] of the cylinder head.
- Install the throttle body assy.
- Tighten the throttle body holder clamp screw securely.
- Run the leads and hoses as shown in the Cable, Wire, and Hose Routing section of the Appendix chapter.

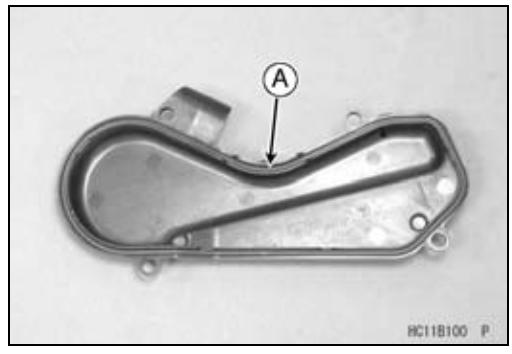


Throttle Body Assy

- Apply a thin coating of grease to the throttle cable lower end.
- Fit the throttle cable lower end [A] into the throttle pulley [B].
- Tighten the adjusting nut [C] and locknut [D].



- Be sure to install the seal [A] on the throttle link case cover.
- Install the removed parts.
- Check the throttle lever free play (see Throttle Lever Free Play Inspection in the Periodic Maintenance chapter).



⚠ WARNING

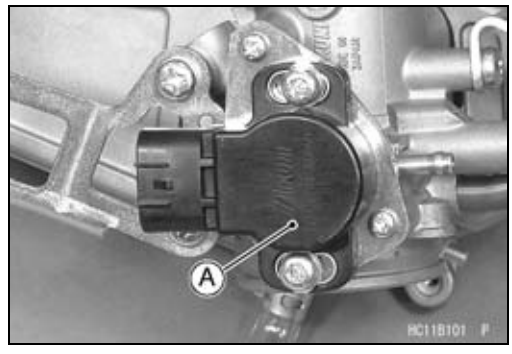
Operation with an incorrectly routed cable could result in an unsafe riding condition. Be sure the cable is routed correctly.

- Adjust:
  Throttle Lever Free Play (see Throttle Lever Free Play Inspection in the Periodic Maintenance chapter)
  Idle Speed (see Idle Speed Adjustment in the Periodic Maintenance chapter)

Throttle Body Assy Disassembly

NOTICE

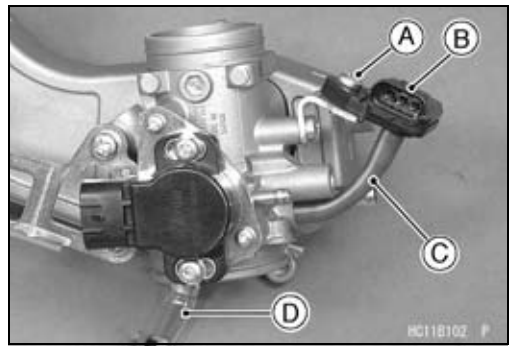
Do not remove, disassemble or adjust the throttle sensor [A] and throttle body assy, because they are adjusted or set at the manufacturer. Adjustment of these parts could result in poor performance, requiring replacement of the throttle body assy.



NOTICE

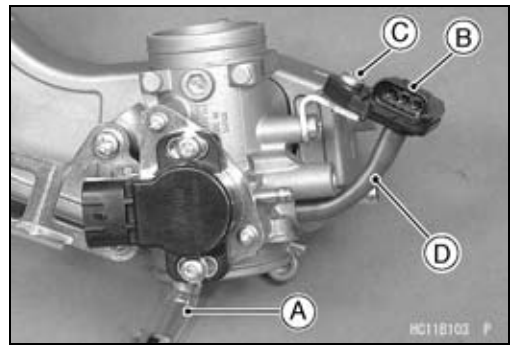
Never drop the throttle body assy , especially on a hard surface. Such a shock to the body assy can damage it.

- Remove:
  Throttle Body Assy (see Throttle Body Assy Removal)
  Screw [A]
  Intake Air Pressure Sensor [B]
  Vacuum Hose [C]
- Remove the drain tube [D], if necessary.



Throttle Body Assy

Throttle Body Assy Assembly

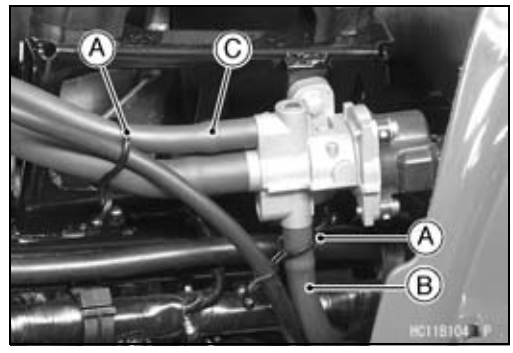


- Install the drain tube [A], if removed
- Install the intake air pressure sensor [B]
- Tighten:

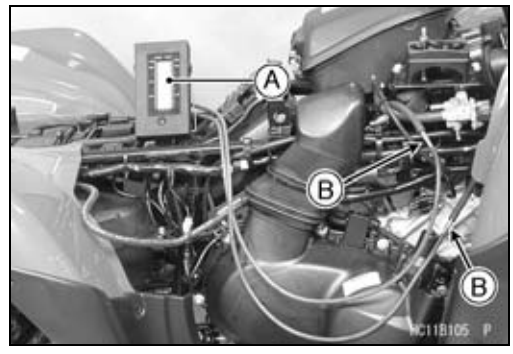
Torque - Intake Air Pressure Sensor Mounting Screw [C]: 5.0 N·m (0.51 kgf·m, 44 in·lb)

- Connect the vacuum hose [D].

Engine Vacuum Synchronization Inspection



- Remove:
  Side Covers (see Left and Right Side Cover Removal in the Frame chapter)
  Throttle Link Case Cover
- Check idle speed.
- Remove:
  Clamps [A]
  ISC Valve Tube (Front) [B]
  ISC Valve Tube (Rear) [C]



- Connect the vacuum gauge [A] as shown.

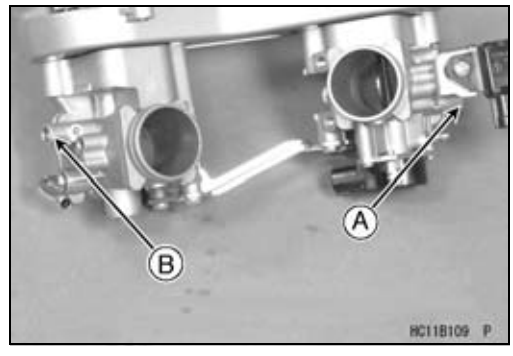
Special Tools - Vacuum Gauge: 57001-1369
Vacuum Gauge Adapter [B]: 57001-401

- Start the engine and read the intake vacuum when idling.

★If the vacuum is out of the specified range, adjust it.

Engine Vacuum Synchronization Vacuum
Standard: 29.6 ±1.3 kPa (222 ±9.8 mmHg) at Idle Speed

Engine Vacuum Synchronization Adjustment



- Turn in the bypass screws until it seats fully but not tightly.

Special Tool - Pilot Screw Adjuster, A: 57001-1239

NOTICE

Do not over tighten them. They could be damaged, requiring replacement.

- Turn out the bypass screw of the higher vacuum between #1 [A] and #2 [B] to the lower vacuum.

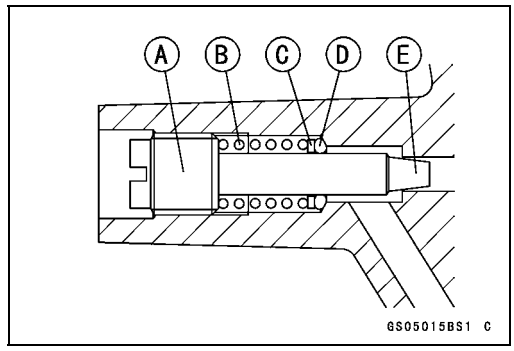
○In this photo, the throttle body has been removed for clarity.

- Open and close the throttle valves after each measurement and adjust the idle speed as necessary.
- Inspect the vacuums as before.

★If both vacuums are within the specification, finish the engine vacuum synchronization.

★If any vacuum can not be adjusted within the specification, remove the bypass screws #1, #2 and clean them.

Throttle Body Assy



● Remove the bypass screw [A], spring [B], washer [C] and O-ring [D].
○Check the bypass screw and its hole for carbon deposits.
★If any carbon accumulates, wipe the carbon off the bypass screw and the hole, using a cotton pad penetrated with a high-flash point solvent.
○Replace the O-ring with a new one.
○Check the tapered portion [E] of the bypass screw for wear or damage.
★If the bypass screw is worn or damaged, replace it.
● Turn in the bypass screw until it seats fully but not tightly.

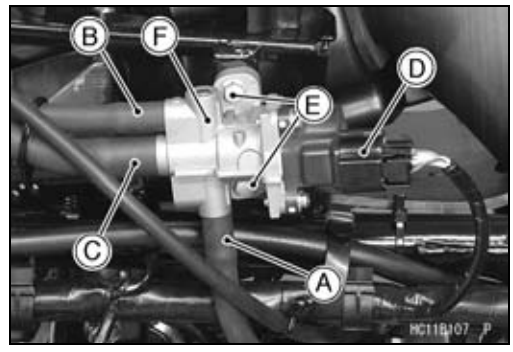
● Repeat the same procedure for other bypass screw.
● Repeat the synchronization.
★If the vacuums are correct, check the output voltage of the throttle sensor (see Throttle Sensor Output Voltage Inspection in the Fuel System (DFI) chapter).

Throttle Sensor Output Voltage
Connections to ECU
Meter (+) → Y/W lead (ECU terminal 15)
Meter (–) → BR/BK lead (ECU terminal 10)
Standard:
1.00 ~ 1.24 V DC (at idle throttle opening)

★If the output voltage is out of the range, check the throttle input voltage (see Throttle Sensor Input Voltage Inspection in the Fuel System (DFI) chapter).

ISC Valve

ISC Valve Removal



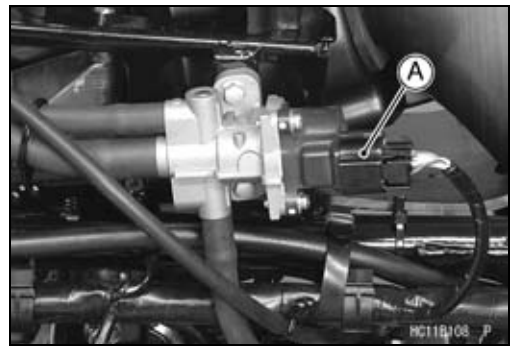
● Remove:
Front Fender (see Front Fender Removal in the Frame chapter)
ISC Valve Tube (Front) [A]
ISC Valve Tube (Rear) [B]
ISC Valve Tube (Primary) [C]
Connector [D]
Bolts [E]
ISC Valve [F]

ISC Valve Installation

● Install the ISC valve.
● Tighten:

Torque - ISC Valve Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

ISC Valve Inspection



● Remove:
Front Fender (see Front Fender Removal in the Frame chapter)
ISC Valve Connector [A]

● Connect the hand tester to the following pair of terminals.

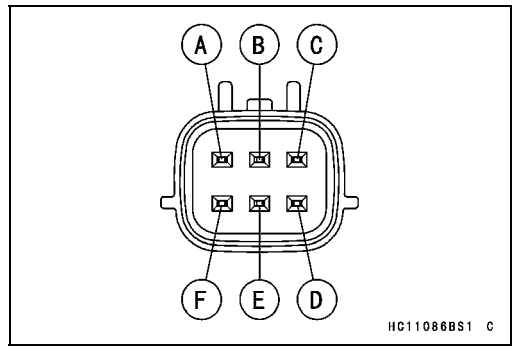
Special Tool - Hand Tester: 57001-1394

● Set the hand tester to the 10 Ω range.

Connections:

Terminal A-B,	**Terminal B-C**
Terminal D-E,	**Terminal E-F**

Standard Resistence:
28.8 ~ 31.2 Ω at 20°C (68°F)

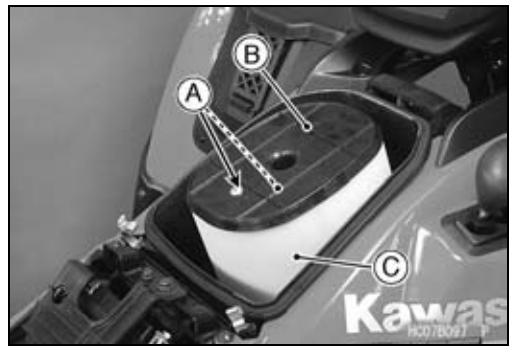


★If the tester does not read as specified, replace the ISC valve.

Air Cleaner

Air Cleaner Element Removal

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



- Remove:
  Element Holder Screws [A]
  Element Holder [B]
  Element [C]
- After removing the element, stuff pieces of lint-free, clean cloth into the air cleaner ducts to keep dirt out of the throttle body assy and engine.

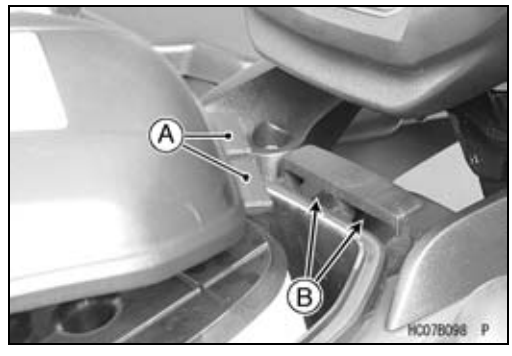
⚠ WARNING

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

NOTICE

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

Air Cleaner Element Installation



- Install:
  Element
  Element Holder
- Tighten:

Torque - Air Cleaner Element Holder Screw: 3.5 N·m (0.36 kgf·m, 31 in·lb)
Air Cleaner Element Holder Tapping Screw: 1.5 N·m (0.15 kgf·m, 13 in·lb)

- Fit the tangs [A] of the housing cap into the guides [B].

Air Cleaner Element Cleaning and Inspection

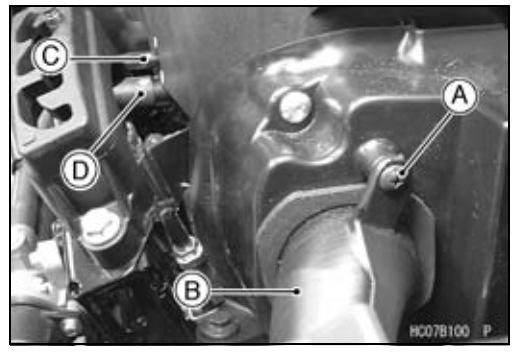
- Refer to the Air Cleaner Element Cleaning and Inspection in the Periodic Maintenance chapter.

Air Cleaner

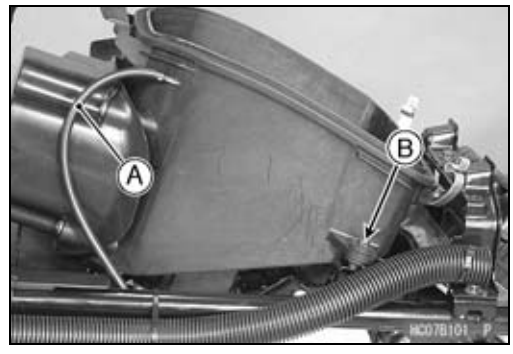
Air Cleaner Housing Removal

- Remove:
  Air Cleaner Element (see Air Cleaner Element Removal)
  Spark Arrester [A]
  Side Covers (see Left and Right Side Cover Removal in the Frame chapter)

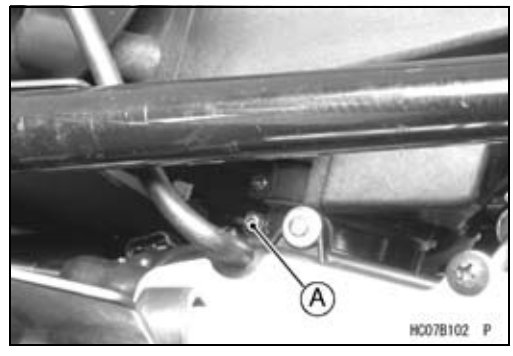
- Remove:
  Screw [A]
  Air Intake Duct [B]
  Tube [C]
  ISC Valve Intake Tube [D]



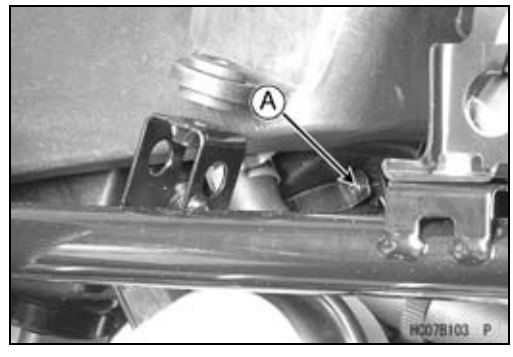
- Remove:
  Tube [A]
  Air Cleaner Housing Bolts [B] (both side)



- Loosen the clamp screw [A].

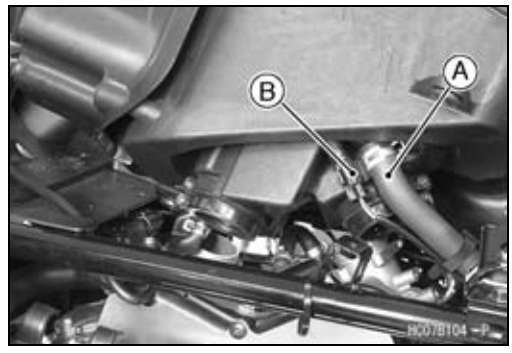


- Loosen the clamp screw [A].



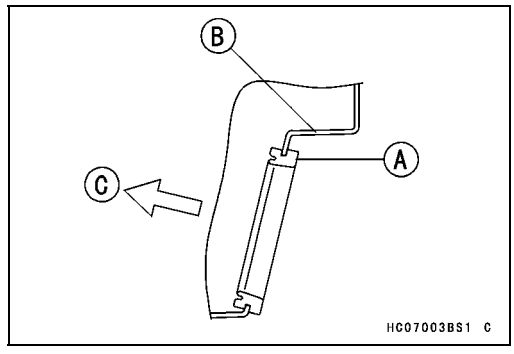
Air Cleaner

- While pulling up the air cleaner housing, remove the breathe hose [A] and intake air temperature sensor connector [B].
- Remove the air cleaner housing.

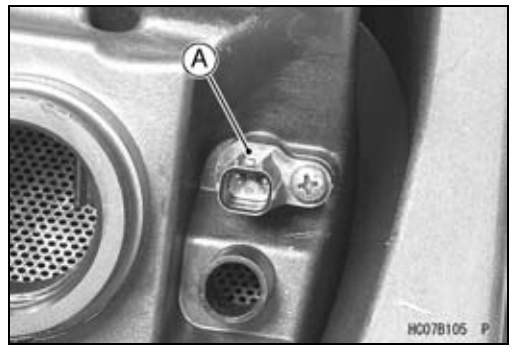


Air Cleaner Housing Installation

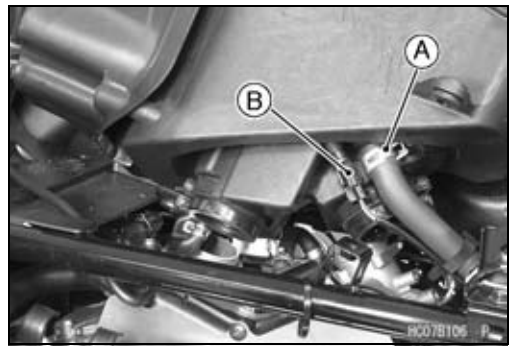
- Install:
  Dust Seal [A]
  Air Cleaner Housing Cover [B]
  [C] Inside



- Be sure to the intake air temperature sensor [A] is installed.



- Install:
  Clamp [A] and Breather Hose
  Intake Air Temperature Sensor Connector [B]
- Install the air cleaner housing and joint duct on the throttle body assy.
- Fit the joint duct on the fitting of the throttle body assy securely and tighten the clamp screws.
- Tighten the air cleaner housing bolts.
- Install the removed hoses.
- Install:
  Spark Arrester
  Element Holder
  Element (see Air Cleaner Element Installation)



Fuel Tank

Fuel Tank Removal

⚠ WARNING

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

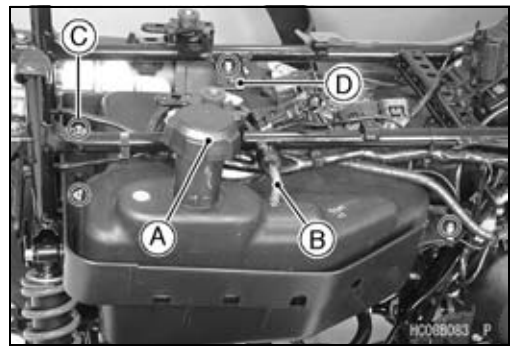
- Turn the ignition switch and engine stop switch OFF.
- Wait until the engine cools down.
- Disconnect the battery (–) cable terminal (see Battery Removal in the Electrical System chapter).

- Remove:
  Electrical Parts Case (see Electrical Parts Case Removal in the Frame chapter)

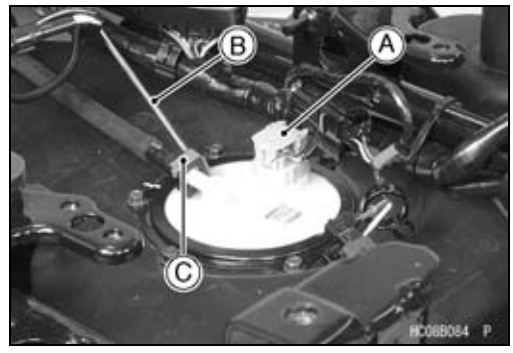
- Open the fuel tank cap [A] to lower the pressure in the tank.

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

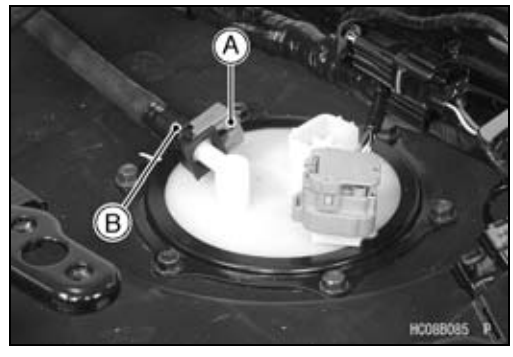
- Remove:
  Storage Case (Optional Part)
  Check Valve Hose [B]
  Bolts [C]
  Fuel Tank Bracket [D]



- Disconnect:
  Fuel Pump Lead Connector [A]
- Be sure to place a piece of cloth around the fuel hose joint.
- Insert a minus screwdriver [B] into the slit on the joint lock [C].



- Twist the driver to disconnect the joint lock [A].
- Pull the fuel hose joint [B] out of the outlet pipe.



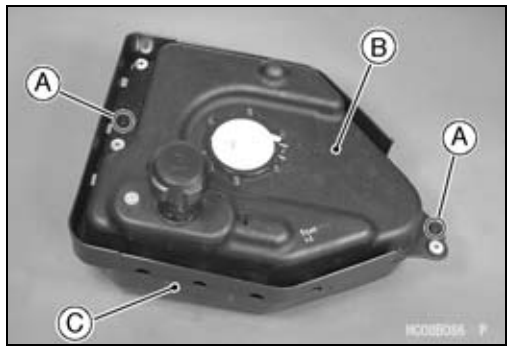
⚠ WARNING

Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

- Close the fuel tank cap.
- Remove the fuel tank together with the tank case from the vehicle right side.

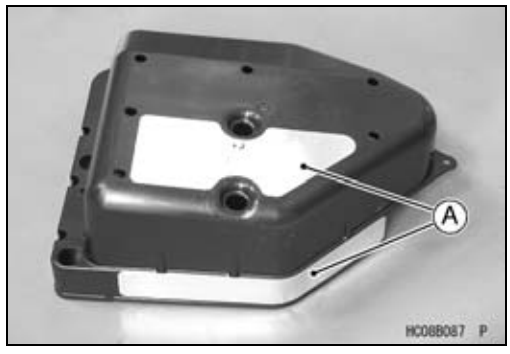
Fuel Tank

● Remove the quick rivets [A] to speparate the fuel tank [B] and tank case [C].

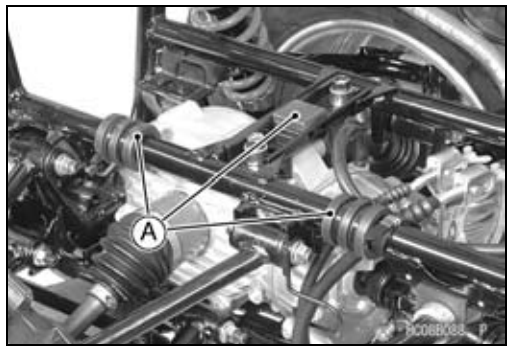


Fuel Tank Installation

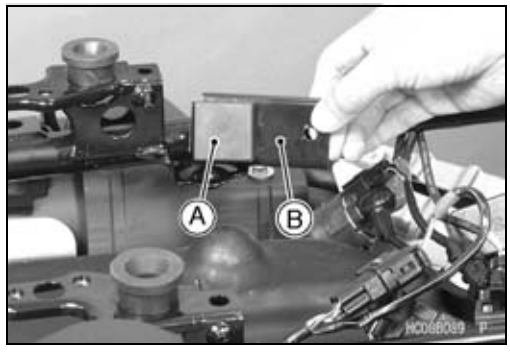
● Note the above WARNING (see Fuel Tank Removal)
● Check the insulators [A] on the tank case.
★If the insulators are damaged or deteriorated, replace them.



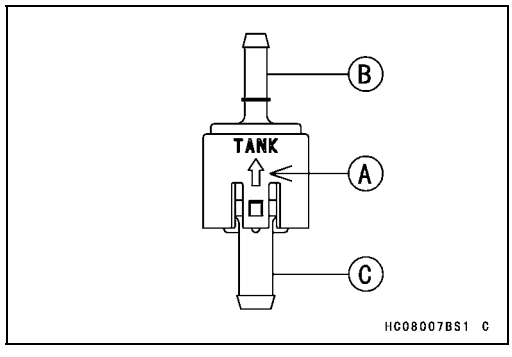
● Check the rubber dampers [A] on the frame as shown.
★If the dampers are damaged or deteriorated, replace them.



● Install the fuel tank with case, and tighten the bolts.
● Check the damper [A] on the damper bracket [B].
★If the damper is damaged or deteriorated, replace it.
● Tighten the damper bracket bolt.

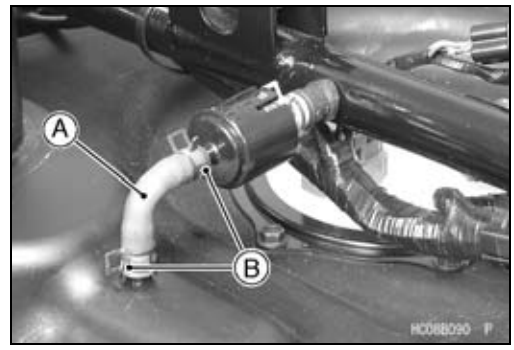


● Install the check valve so that the arrow [A] faces fuel tank.
[B] Black Color
[C] Blue Color

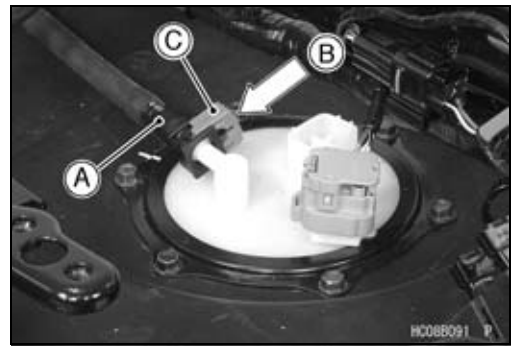


Fuel Tank

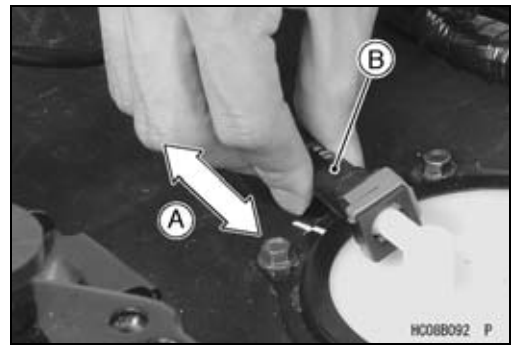
- Install:
  Hose [A]
  Clamps [B]



- Insert the fuel hose joint [A] straight onto the delivery pipe until the hose joint clicks.
- Push [B] the joint lock [C] .



- 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.



⚠ WARNING

Leaking fuel can cause a fire or explosion resulting in serious burns. Make sure the hose joint is installed correctly on the delivery pipe by sliding the joint.

★If it comes off, reinstall the hose joint.
- Connect the fuel pump connector and the battery (–) cable terminal.

Fuel Tank Cleaning

⚠ WARNING

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

- Remove:
  Fuel Tank (see Fuel Tank Removal)
  Fuel Pump (see Fuel Pump Removal)
- Remove the fuel pump intake hose and the fuel pump (see Fuel Pump Removal).
- Pour some high-flash point solvent into the fuel tank and shake the tank to remove dirt and fuel deposits.
- Draw the solvent out of the fuel tank.
- Dry the tank with compressed air.
- Install the fuel pump (see Fuel Pump Installation).
- Install the fuel tank (see Fuel Tank Installation).

Cooling System

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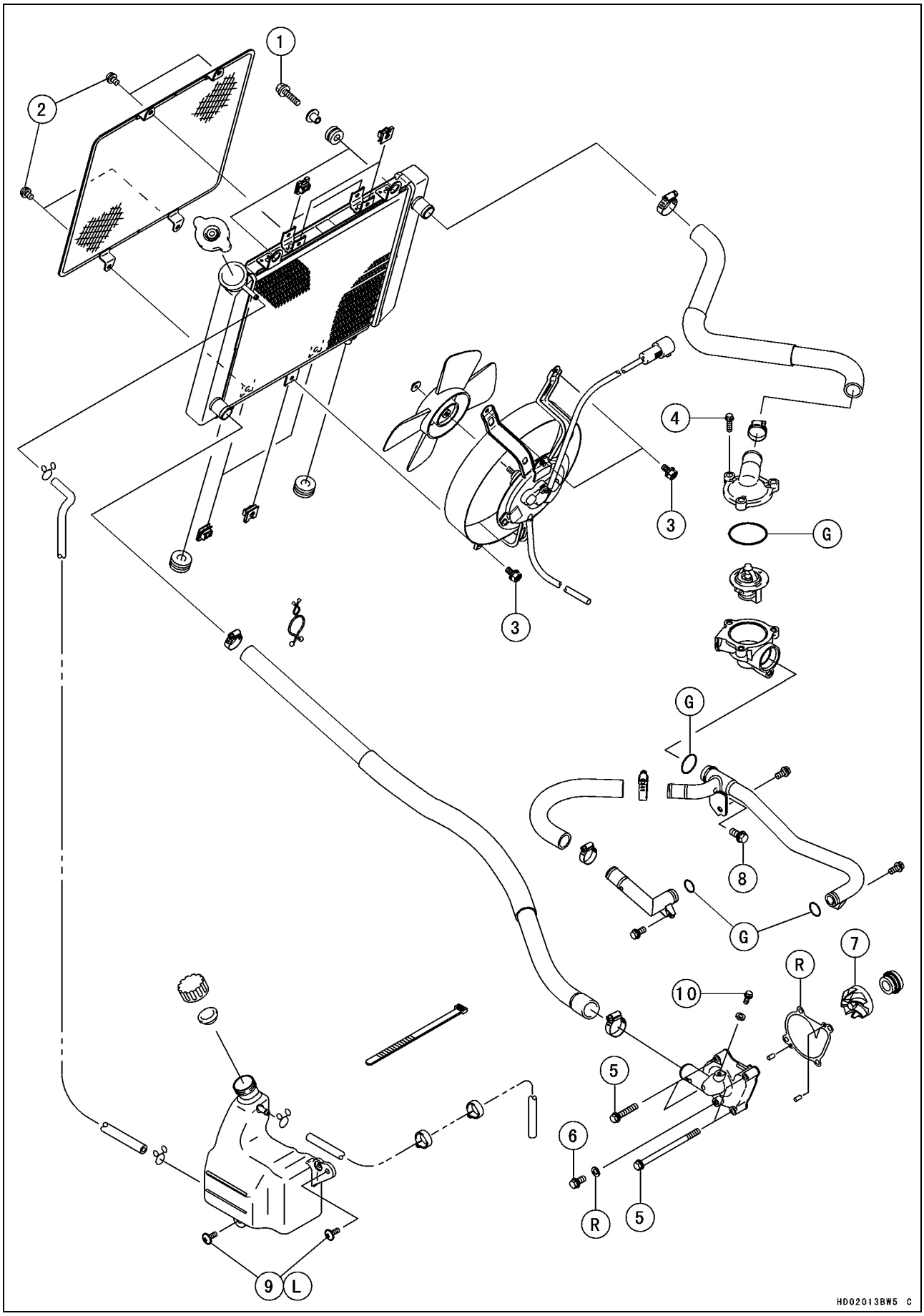
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Radiator Mounting Bolts	8.8	0.90	78 in·lb	
2	Radiator Screen Mounting Bolts	4.0	0.40	35 in·lb	
3	Radiator Fan Assembly Bolts	4.9	0.50	43 in·lb	
4	Thermostat Housing Cover Bolts	8.8	0.90	78 in·lb	
5	Water Pump Cover Bolts	8.8	0.90	78 in·lb	
6	Coolant Drain Bolt	7.0	0.71	62 in·lb	
7	Water Pump Impeller	7.8	0.80	69 in·lb	
8	Water Pipe Joint Bolt	8.8	0.90	78 in·lb	
9	Reserve Tank Mounting Screws	4.0	0.40	35 in·lb	L
10	Air Bleeder Bolt	7.0	0.71	62 in·lb	

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

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 (coupled with the oil pump) turns and the coolant circulates.

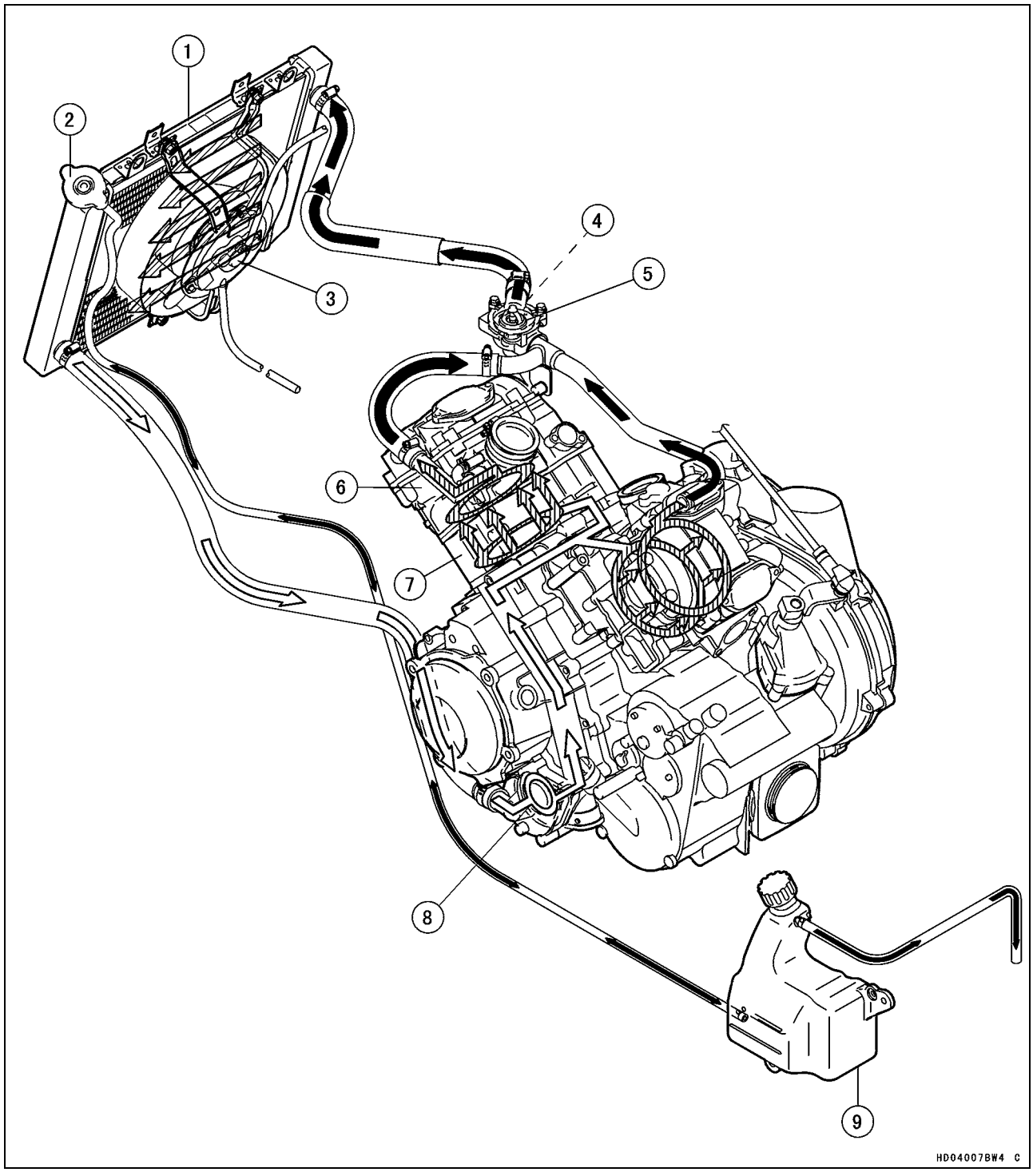
The thermostat is a wax pellet type which opens or closes with coolant temperature changes. The thermostat continuously changes its valve opening to keep the coolant temperature at the proper level. When coolant temperature is below 67°C (153°F), the thermostat closes so that the coolant flow is restricted through the air bleeder hole, causing the engine to warm up more quickly. When coolant temperature is more than 69.5 ~ 72.5°C (157 ~ 162°F), the thermostat opens and the coolant flows. When the coolant temperature goes up beyond 100°C (212°F), the radiator fan relay 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 90°C (194°F), the fan relay 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 contract, and the stored coolant flows back to the radiator from the reserve tank.

The radiator cap has two valves. One is a pressure valve which holds the pressure in the system when the engine is running. When the pressure exceeds 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm², 14 ~ 18 psi), the pressure valve opens and releases the pressure to the reserve tank. As soon as pressure escapes, the valve closes, and keeps the pressure at 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm², 14 ~ 18 psi). When the engine cools down, another small valve (vacuum valve) in the cap opens. As the coolant cools, the coolant contracts to form a vacuum in the system. The vacuum valve opens and allows the coolant from the reserve tank to enter the radiator.

Coolant Flow Chart



1. Radiator
2. Radiator Cap
3. Radiator Fan
4. Water Temperature Switch
5. Thermostat
6. Cylinder
7. Cylinder Head
8. Water Pump
9. Reserve Tank

Black Painted Arrow: Hot Coolant
White Painted Arrow: Cold Coolant

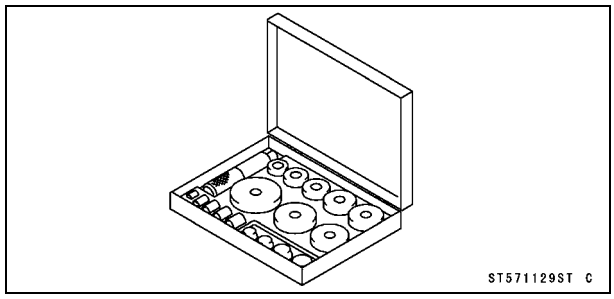
4-6 COOLING SYSTEM

Specifications

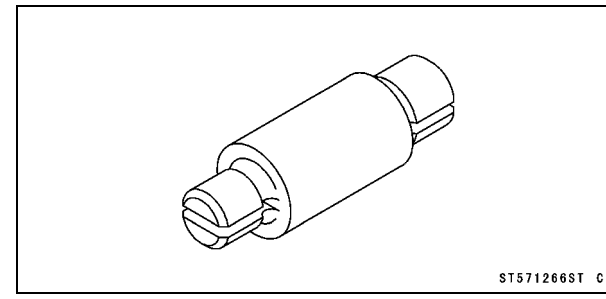
Item	Standard	Service Limit
Coolant Provided when Shipping		
Type	Permanent type of antifreeze (soft water and ethylene glycol plus corrosion and rust inhibitor chemicals for aluminum engines and radiators)	– – –
Color	Green	– – –
Mixed Ratio	Soft water 50%, coolant 50%	– – –
Freezing Point	−35°C (−31°F)	– – –
Total Amount	2.2 L (2.3 US qt) (reserve tank full level including radiator and engine)	– – –
Radiator Cap		
Relief Pressure	93 ~123 kPa (0.95 ~ 1.25 kgf/cm², 14 ~ 18 psi)	– – –
Thermostat		
Valve Opening Temperature	69.5 ~ 72.5°C (157 ~ 162°F)	– – –
Valve Full Opening Lift	8 mm (0.3 in.) or more @85°C (185°F)	– – –

Special Tools

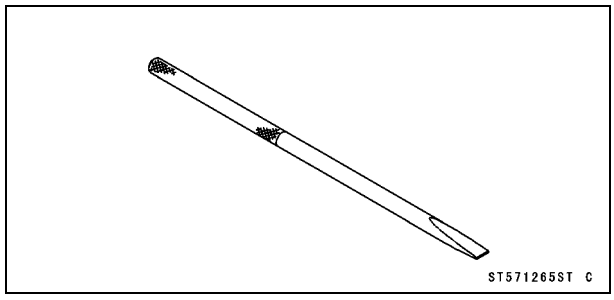
Bearing Driver Set:
57001-1129



Bearing Remover Head, ϕ10 × ϕ12:
57001-1266



Bearing Remover Shaft, ϕ9:
57001-1265



Coolant

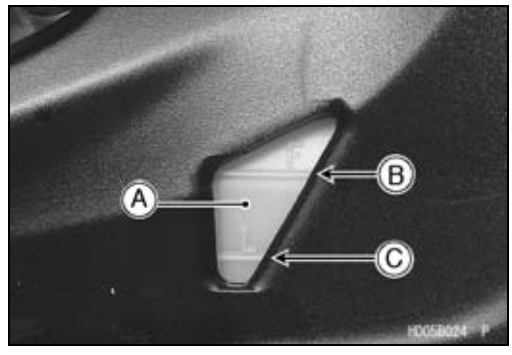
Coolant Deterioration Inspection

- Remove:
  Left Footboard (see Left Footboard Removal in the Frame chapter)
- Visually inspect the coolant in the reserve tank [A].

★If whitish cotton-like wafts are observed, aluminum parts in the cooling system are corroded. If the coolant is brown, iron or steel parts are rusting. In either case, flush the cooling system.

★If the coolant gives off an abnormal smell, check for cooling system leak. It may be caused by exhaust gas leaking into the cooling system.

Coolant Level Inspection

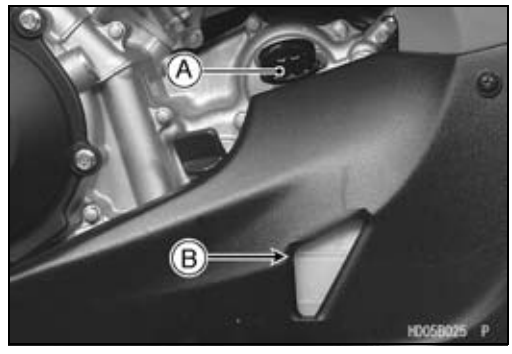


NOTE

○*Check the level when the engine is cold (room or ambient temperature).*

- Check the coolant level in the reserve tank with the vehicle held perpendicularly.
  Reserve Tank [A]
  F (full) Mark [B]
  L (low) Mark [C]

★If the coolant level is lower than the L mark, remove the reserve tank cap [A], then add coolant to the F mark [B].



NOTICE

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 attach 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 Draining

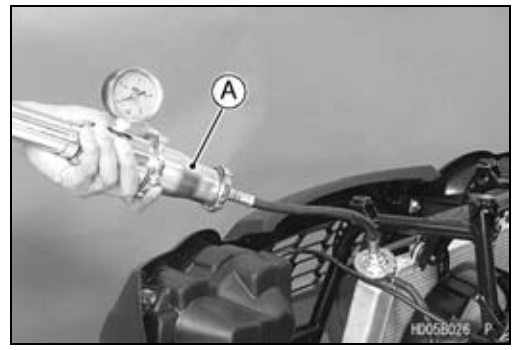
- Refer to the Coolant Change in the Periodic Maintenance chapter.

Coolant Filling

- Refer to the Coolant Change in the Periodic Maintenance chapter.

Coolant

Pressure Testing



- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
- Remove the radiator cap, and install a cooling system pressure tester [A] on the radiator filler neck.

NOTE

○*Wet the cap sealing surfaces with water or coolant to prevent pressure leakage.*

- Build up pressure in the system carefully until the pressure reaches 123 kPa (1.25 kgf/cm², 18 psi).

NOTICE

During pressure testing, do not exceed the pressure for which the system is designed. The maximum pressure is 123 kPa (1.25 kgf/cm², 18 psi).

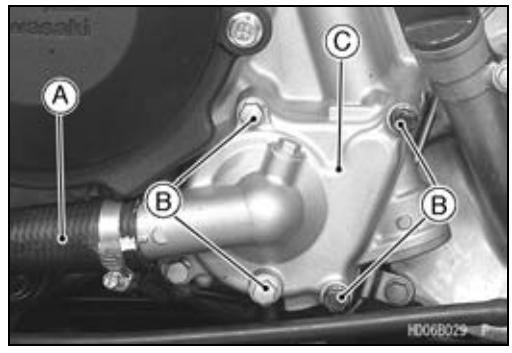
- Watch the gauge for at least 6 seconds.

★If the pressure holds steady, the system is alright.

★If the pressure drops soon, check for leaks.

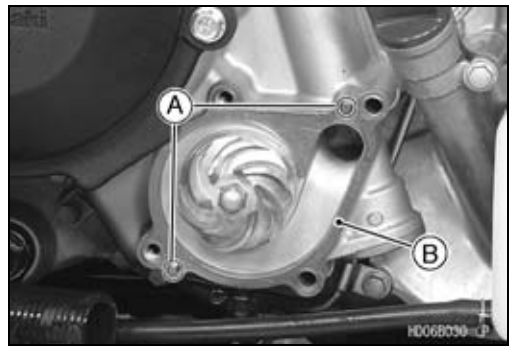
Water Pump

Water Pump Cover Removal



- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Remove:
  Radiator Hose [A]
  Water Pump Cover Bolts [B]
  Water Pump Cover [C]

Water Pump Cover Installation

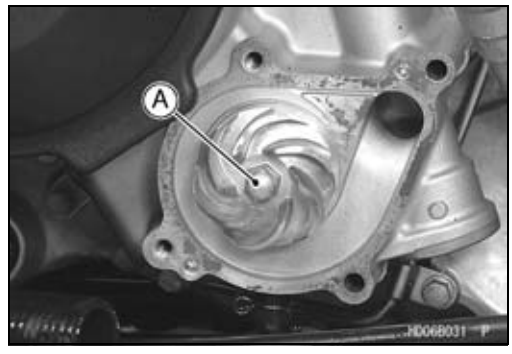


- Install:
  Knock Pins [A]
  New Gasket [B]
- Tighten:

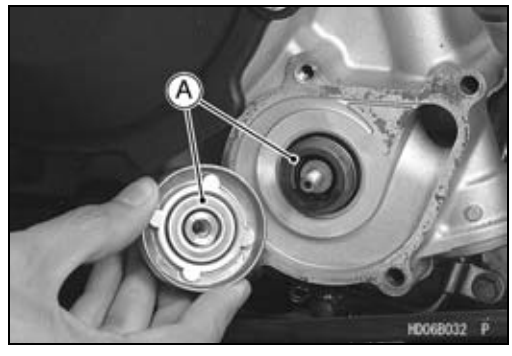
Torque - Water Pump Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Water Pump Impeller Removal

- Drain the coolant (see Coolant Change in the Periodic Maintenance chpater).
- Remove:
  Water Pump Cover (see Water Pump Cover Removal)
- Loosen the water pump impeller [A] counterclockwise.



Water Pump Impeller Installation

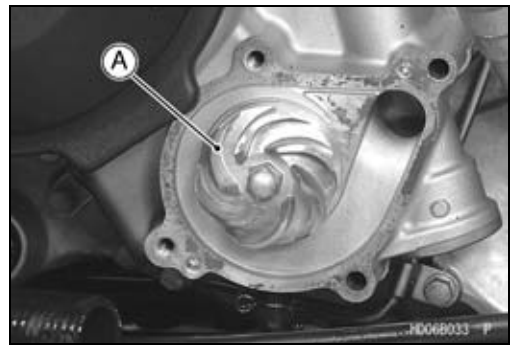


- Apply a small amount of coolant on the sliding surface [A] of the mechanical seal and the sealing seat.
- Install the impeller on the water pump shaft and tighten the impeller.

Torque - Water Pump Impeller: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Water Pump

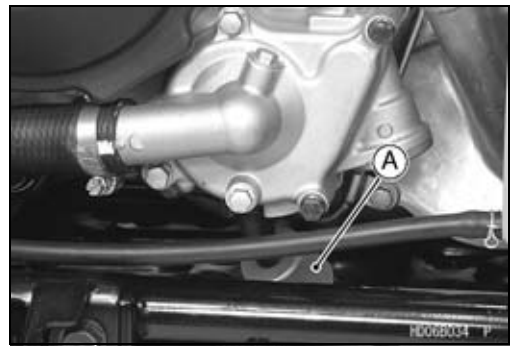
Water Pump Impeller Inspection



- Visually inspect the impeller [A].

★If the surface is corroded or the blades are damaged, replace the impeller.

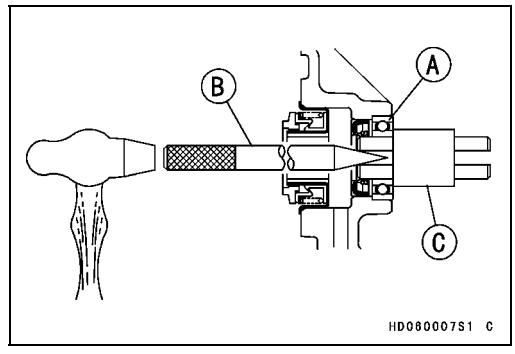
Water Pump Leakage Inspection



- Check the drainage catch tank [A] at the bottom of the water pump body for coolant leakage.

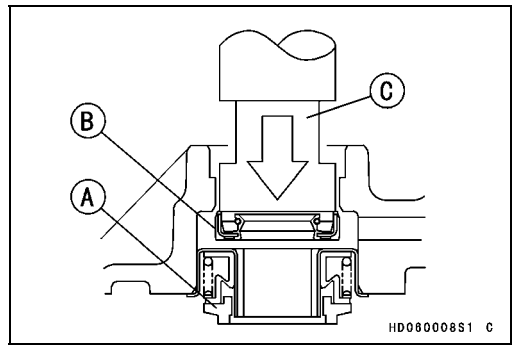
★If there is a coolant leak, the mechanical seal in the pump could be damaged. Replace the mechanical seal with a new one (see Mechanical Seal Replacement).

Mechanical Seal Replacement



- Remove:
  Water Pump Impeller (see Water Pump Impeller Removal)
  Alternator Cover (see Alternator Cover Removal in the Electrical System chapter)
- Take the bearing [A] out of the alternator cover, using the bearing remover.

Special Tools - Bearing Remover Shaft, ϕ9 [B]: 57001-1265
Bearing Remover Head, ϕ10 × ϕ12 [C]: 57001-1266



- Press out the mechanical seal [A] and oil seal [B] from the inside of the alternator cover with the bearing driver set [C].

Special Tool - Bearing Driver Set: 57001-1129

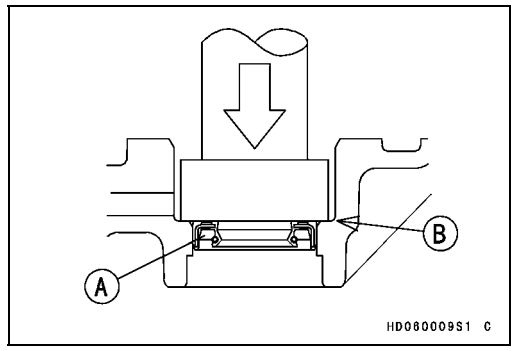
NOTICE

If either the mechanical seal, oil seal, or the ball bearing is removed, make sure to replace all of them simultaneously with a new one.
Be careful not to block the inspection hole with the oil seal. If the inspection hole is blocked, the coolant may pass through the oil seal and flow into the crankcase.

Water Pump

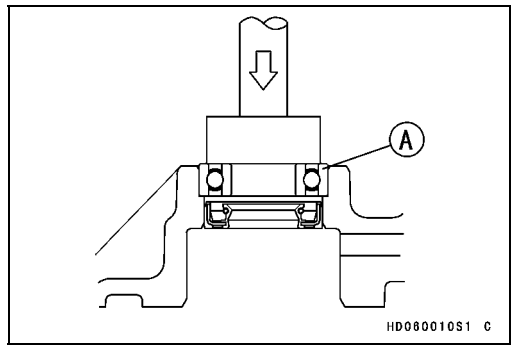
- Apply heat-resistance grease on the oil seal lip.
- From outside the alternator cover, press and insert the oil seal [A] so that its surface is flush with the step portion of the cover as shown [B].

Special Tool - Bearing Driver Set: 57001-1129



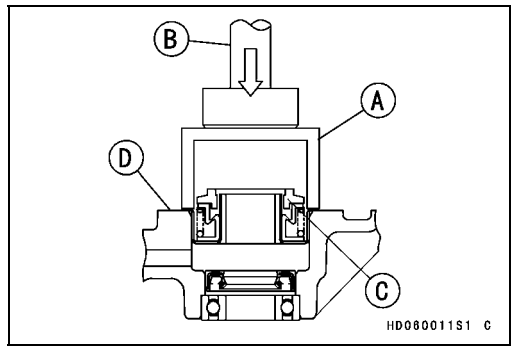
- From inside the alternator cover, press and insert the ball bearing [A] until it is bottomed.

Special Tool - Bearing Driver Set: 57001-1129



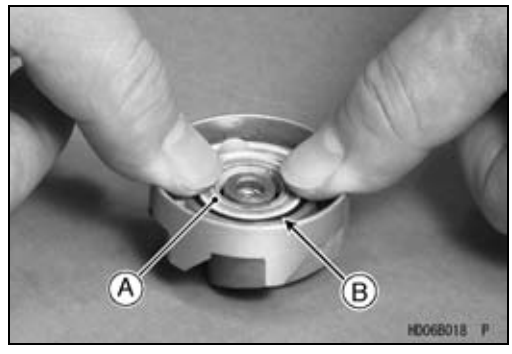
- Using a suitable socket [A] and the bearing driver [B], press and insert a new mechanical seal [C] until its flange stops at the step [D] of the hole.

Special Tool - Bearing Driver Set: 57001-1129



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

Torque - Water Pump Impeller: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Radiator

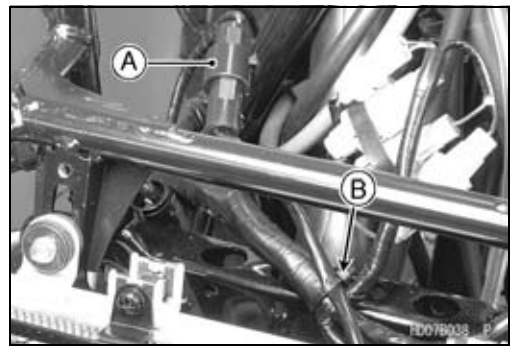
Radiator Removal

⚠ WARNING

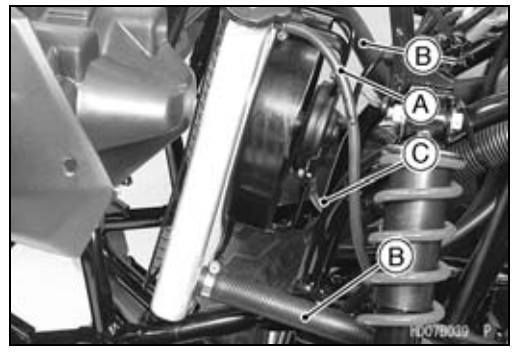
A spinning radiator fan can cause serious injury. The radiator fan is connected directly to the battery and may start even if the ignition switch is off. Do not touch the radiator fan until it has been disconnected from the battery.

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

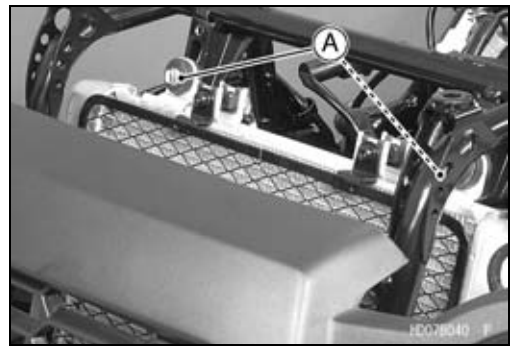
- Remove:
  Radiator Cover (see Radiator Cover Removal in the Frame chapter)
  Radiator Fan Motor Lead Connector [A]
- Cut the band [B].



- Remove:
  Reserve Tank Hose [A]
  Radiator Hoses [B]
  Fan Motor Breather Hose [C]



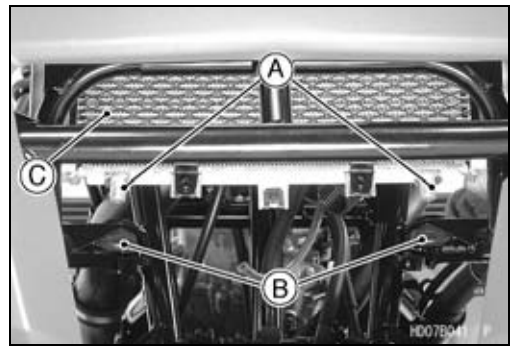
- Remove:
  Radiator Mounting Bolts [A]



- Pull the projections [A] out of from the dampers [B], and remove the radiator [C].

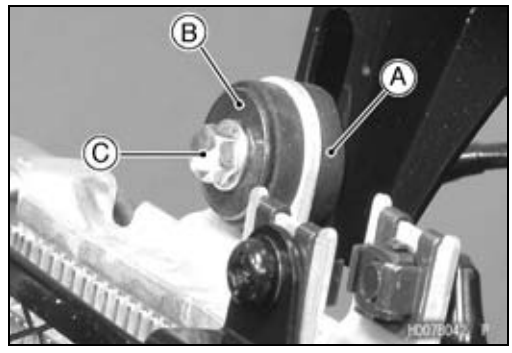
NOTICE

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



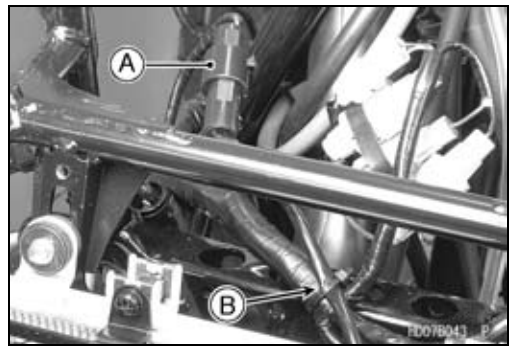
Radiator

Radiator Installation

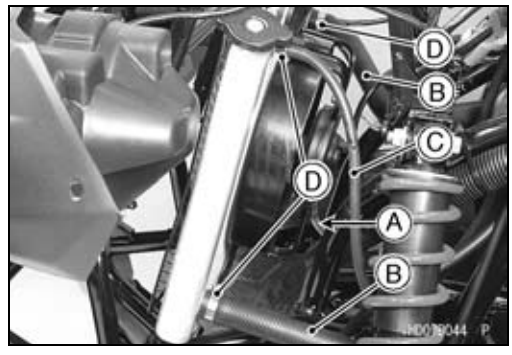


- Insert the projections of the radiator in the dampers.
- Install:
  Dampers [A]
  Collars [B]
- Tighten:

Torque - Radiator Mounting Bolts [C]: 8.8 N·m (0.90 kgf·m, 78 in·lb)



- Connect:
  Radiator Fan Motor Lead Connector [A]
- Fix the fan motor lead and main harness with a band [B].



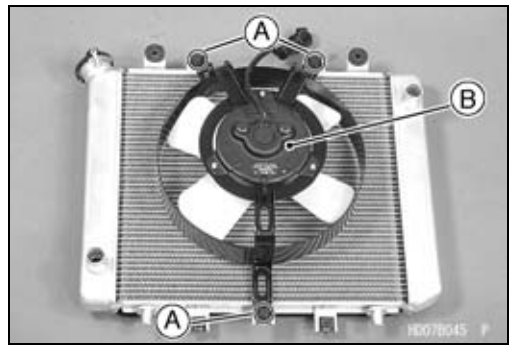
- Install the fan motor breather hose [A].

NOTE

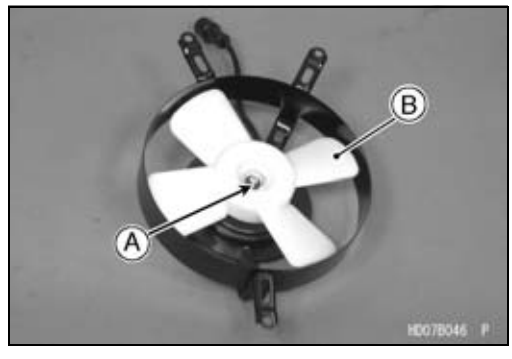
○*Do not apply lubricant at fitting hose region.*

- Install:
  Radiator Hoses [B]
  Reserve Tank Hose [C]
  Clamps [D]
- Run the hoses according to the Cable, Wire, and Hose Routing section in the Appendix chapter.

Radiator Fan Removal



- Remove:
  Radiator (see Radiator Removal)
  Radiator Fan Assembly Bolts [A]
  Fan Assembly [B]



- Remove:
  Radiator Fan Mounting Nut [A]
  Radiator Fan [B]

Radiator

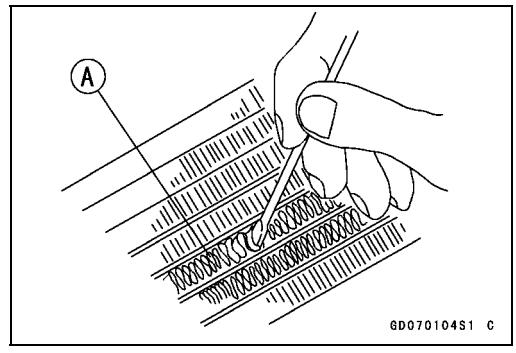
Radiator Fan Installation

● Install:
  Radiator Fan
  Radiator Fan Mounting Nut
● Install:
  Radiator Fan Assembly
● Tighten:

Torque - Radiator Fan Assembly Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)

Radiator Inspection

● Check the radiator core.
★If there are obstructions to air flow, remove the radiator and remove obstructions.
★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.

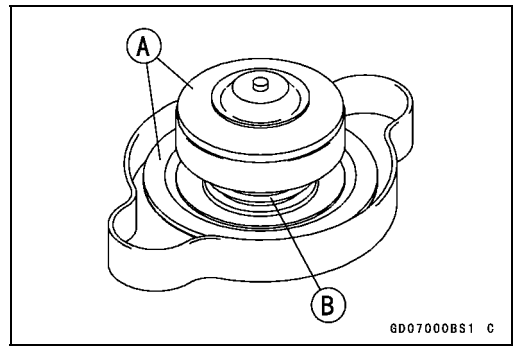


Radiator Cleaning

● Refer to the Radiator Cleaning in the Periodic Maintenance chapter.

Radiator Cap Inspection

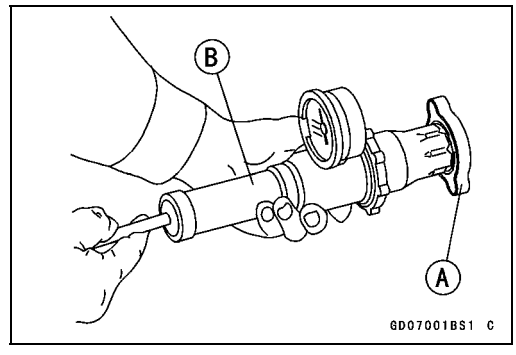
● Check the condition of the top and bottom valve seals of the radiator cap.
★If any one of them shows visible damage, replace the cap.
  Top and Bottom Valve Seals [A]
  Valve Spring [B]



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

NOTE

○*Wet the cap sealing surfaces with water or coolant to prevent pressure leakage.*



● Watching the pressure gauge, slowly pump the pressure tester to build up the pressure. The relief valve opens, indicated by the gauge hand flicks downward.
○The relief valve must open within the relief pressure range in the table below and the gauge hand must remain within the specified range at least 6 second.

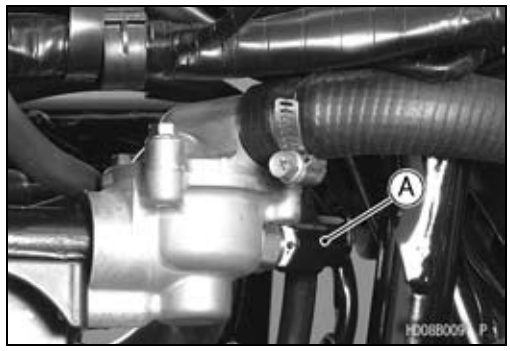
Radiator Cap Relief Pressure
Standard: 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm², 14 ~ 18 psi)

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

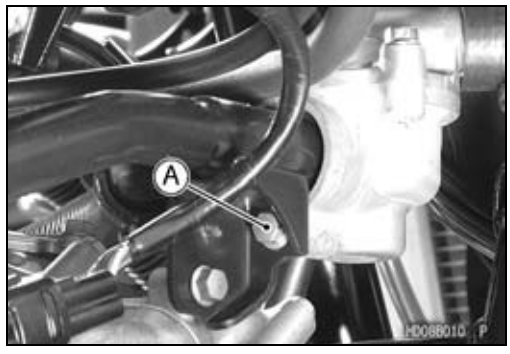
Thermostat

Thermostat Removal

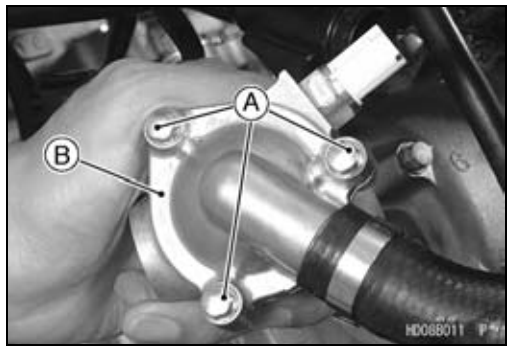
- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
  Water Temperature Sensor Connector [A]



- Remove:
  Water Pipe Bolt [A]



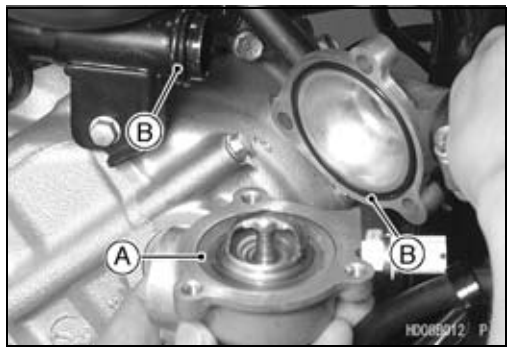
- Remove:
  Thermostat Housing Cover Bolts [A]
  Thermostat Housing Cover [B]
  Thermostat



Thermostat Installation

- Install:
  Thermostat [A]
- Be sure to install the O-rings [B] on the housing cover and water pipe.
- Tighten:

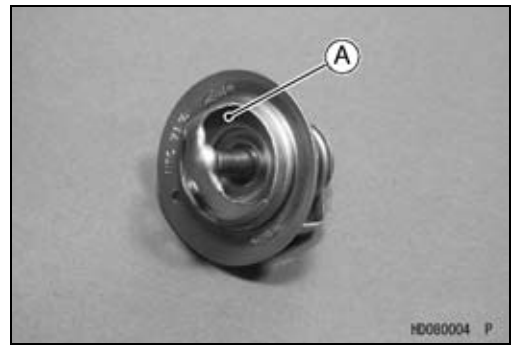
Torque - Thermostat Housing Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)
Water Pipe Joint Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)



- Add coolant (see Coolant Change in the Periodic Maintenance chapter).

Thermostat

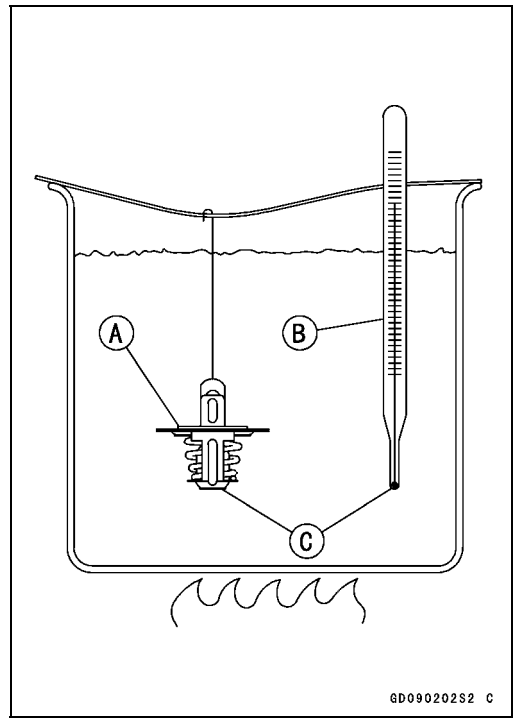
Thermostat Inspection



- Remove the thermostat, and inspect the thermostat valve [A] at room temperature.

★If the valve is open, replace the valve with a new one.

- To check valve opening temperature, suspend the thermostat [A] and an accurate thermometer [B] in a container of water with the heat-sensitive portions [C] in almost the same depth.



NOTE

○*The thermostat must be completely submerged and the thermostat and thermometer must not touch the container sides or bottom.*

- Gradually raise the temperature of the water while stirring the water gently for even temperature.

★If the measurement is out of the specified range, replace the thermostat.

Thermostat Valve Opening Temperature
69.5 ~ 72.5°C (157 ~ 162°F)

Water Temperature Sensor

Water Temperature Sensor Removal/Installation

NOTICE
The water temperature sensor should never be allowed to fall on a hard surface. Such a shock to water temperature sensor can damage it.

- Refer to the Water Temperature Sensor Removal/Installation in the Fuel System (DFI) chapter.

Water Temperature Sensor Inspection

- Refer to the Water Temperature Sensor Inspection in the Electrical System chapter.

Engine Top End

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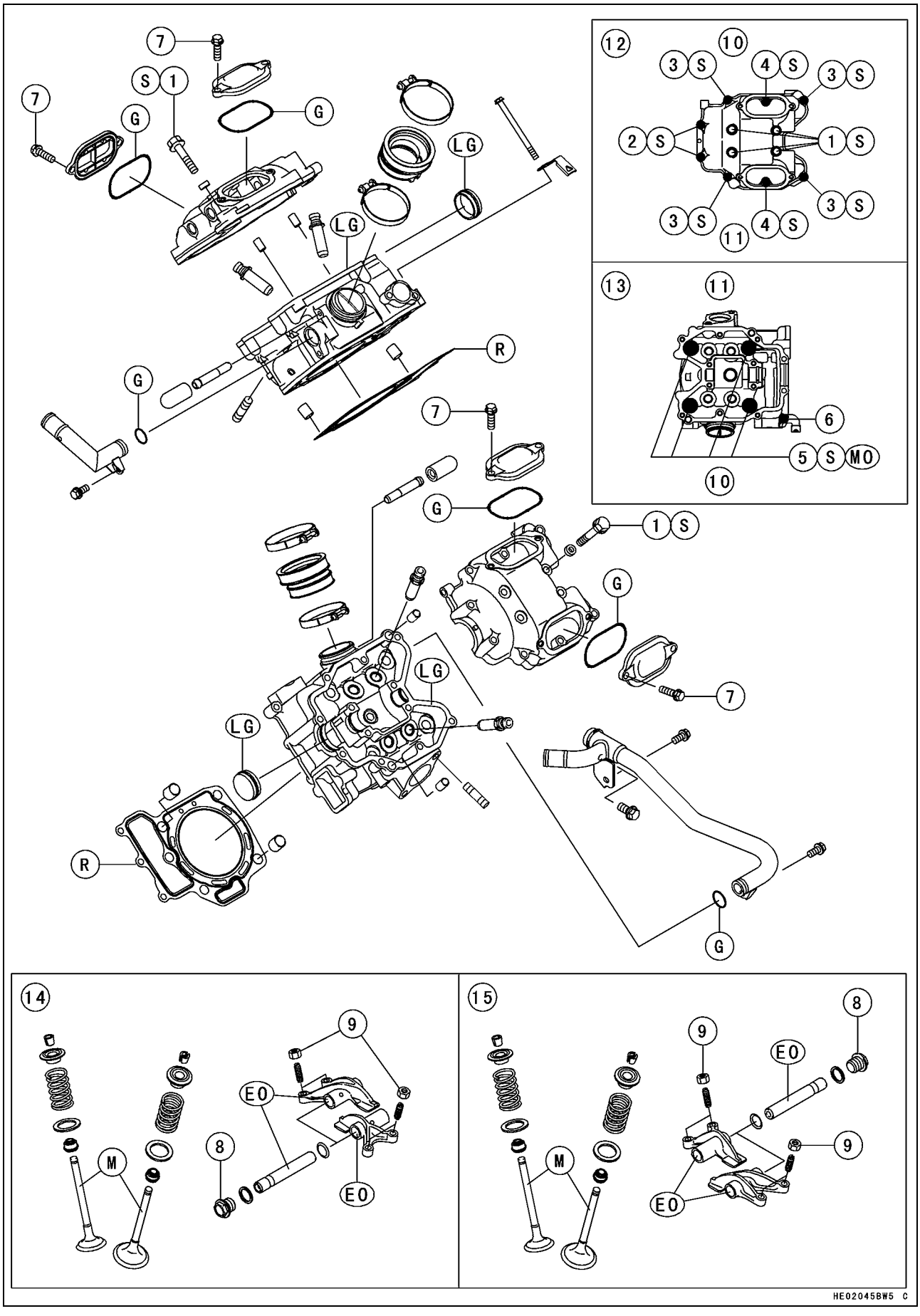
Exploded View



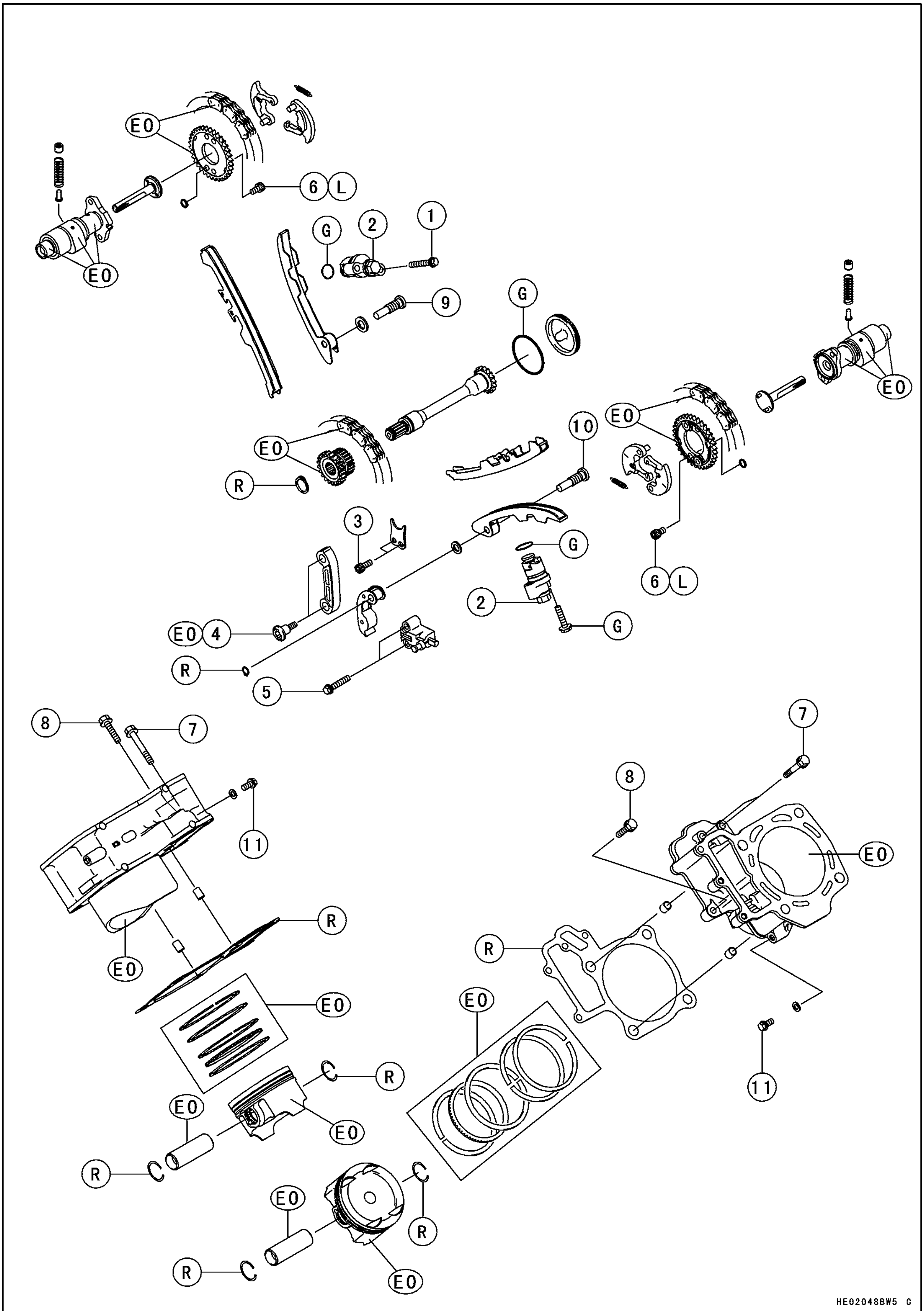
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rocker Case Bolts 55 mm (2.2 in.)	8.8	0.90	78 in·lb	S
2	Rocker Case Bolts 130 mm (5.1 in.)	9.8	1.0	87 in·lb	S
3	Rocker Case Bolts 30 mm (1.2 in.)	9.8	1.0	87 in·lb	S
4	Rocker Case Bolts 25 mm (1.0 in.)	9.8	1.0	87 in·lb	S
5	Cylinder Head Bolts (M10), First Torque	25	2.5	18	S, MO
5	Cylinder Head Bolts (M10), Final Torque	49	5.0	36	
6	Cylinder Head Bolts (M6)	9.8	1.0	87 in·lb	
7	Valve Adjusting Cap Bolts	8.8	0.90	78 in·lb	
8	Rocker Shaft Bolts	22	2.2	16	
9	Valve Adjusting Screw Locknuts	12	1.2	106 in·lb	

10. Intake
11. Exhaust
12. Rocker Case
13. Cylinder Head
14. Front
15. Rear

EO: Apply engine oil.
G: Apply grease.
LG: Apply liquid gasket (Liquid Gasket, TB1216: 92104-1063).
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil (mixture of the engine oil and molybdenum disulfide grease in a weight ratio: 10 : 1).
R: Replacement Parts
S: Follow the specific tightening sequence.

Exploded View

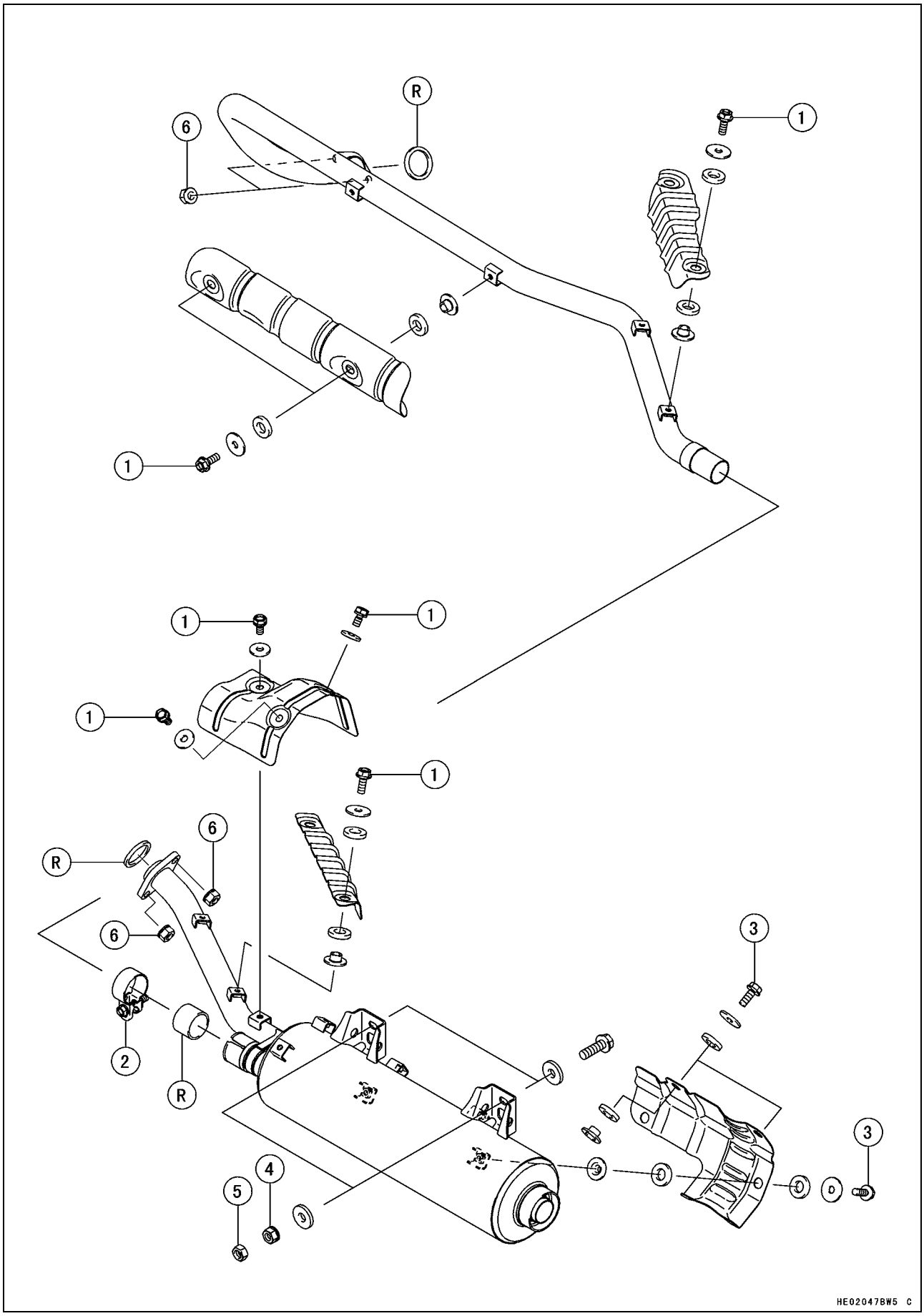


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Camshaft Chain Tensioner Mounting Bolts	8.8	0.90	78 in·lb	
2	Camshaft Chain Tensioner Cap Bolts	22	2.2	16	
3	Position Plate Bolts	8.8	0.90	78 in·lb	
4	Intermediate Shaft Chain Guide Bolts	8.8	0.90	78 in·lb	EO
5	Intermediate Shaft Chain Tensioner Bolts	8.8	0.90	78 in·lb	
6	Camshaft Sprocket Bolts	12	1.2	106 in·lb	L
7	Cylinder Bolts 40 mm (1.6 in.)	9.8	1.0	87 in·lb	
8	Cylinder Bolts 30 mm (1.2 in.)	9.8	1.0	87 in·lb	
9	Front Cylinder Camshaft Chain Guide Bolt	20	2.0	15	
10	Rear Cylinder Camshaft Chain Guide Bolt	20	2.0	15	
11	Coolant Drain Bolt (Cylinder)	7.0	0.71	62 in·lb	

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
R: Replacement Parts

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Pipe Cover Bolts	8.8	0.90	78 in·lb	
2	Muffler Clamp Bolt	8.8	0.90	78 in·lb	
3	Muffler Cover Bolts	8.8	0.90	78 in·lb	
4	Muffler Mounting Nuts	19.6	2.0	14	
5	Muffler Mounting Locknuts	31.4	3.2	23	
6	Exhaust Pipe Holder Nuts	17	1.7	12	

R: Replacement Parts

Specifications

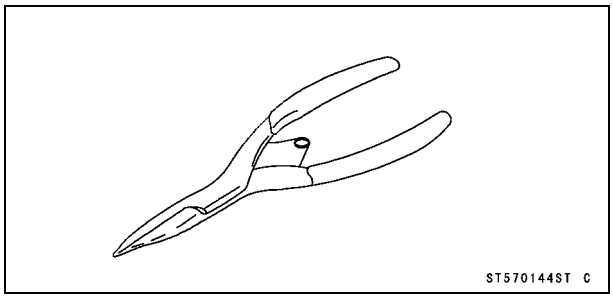
Item	Standard	Service Limit
Rocker Case		
Rocker Arm Inside Diameter	12.000 ~ 12.018 mm (0.4724 ~ 0.4731 in.)	12.05 mm (0.474 in.)
Rocker Shaft Diameter	11.983 ~ 11.994 mm (0.4718 ~ 0.4722 in.)	11.96 mm (0.471 in.)
Camshafts		
Cam Height:		
Exhaust	35.363 ~ 35.477 mm (1.3922 ~ 1.3967 in.)	35.26 mm (1.388 in.)
Intake	35.622 ~ 35.736 mm (1.4024 ~ 1.4069 in.)	35.52 mm (1.398 in.)
Camshaft Bearing Clearance:		
ϕ18	0.016 ~ 0.052 mm (0.0006 ~ 0.0020 in.)	0.14 mm (0.0055 in.)
ϕ22	0.020 ~ 0.062 mm (0.0008 ~ 0.0024 in.)	0.15 mm (0.0059 in.)
Camshaft Journal Diameter:		
ϕ18	17.966 ~ 17.984 mm (0.7073 ~ 0.7080 in.)	17.94 mm (0.706 in.)
ϕ22	21.959 ~ 21.980 mm (0.8645 ~ 0.8653 in.)	21.93 mm (0.863 in.)
Camshaft Bearing Inside Diameter:		
ϕ18	18.000 ~ 18.018 mm (0.7087 ~ 0.7094 in.)	18.08 mm (0.712 in.)
ϕ22	22.000 ~ 22.021 mm (0.8661 ~ 0.8670 in.)	22.08 mm (0.870 in.)
Camshaft runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.0039 in.)
KACR (Kawasaki Automatic Compression Release):		
KACR Operating Engine Speed	760 ±30 r/min (rpm)	– – –
Cylinder Head		
Cylinder Compression (Usable Range)		
Electric Starter	251 ~ 456 kPa (2.56 ~ 4.65 kgf/cm², 36 ~ 66 psi) @380 r/min (rpm)	– – –
Cylinder head warp	– – –	0.05 mm (0.002 in.)
Valve		
Valve Clearance:		
Exhaust	0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)	– – –
Intake	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	– – –
Valve Head Thickness:		
Exhaust	0.8 mm (0.031 in.)	0.4 mm (0.016 in.)
Intake	0.5 mm (0.020 in.)	0.3 mm (0.012 in.)
Valve Stem Bend	– – –	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	4.955 ~ 4.970 mm (0.1951 ~ 0.1957 in.)	4.94 mm (0.1945 in.)
Intake	4.975 ~ 4.990 mm (0.1959 ~ 0.1965 in.)	4.96 mm (0.1953 in.)
Valve Guide Inside Diameter:		
Exhaust	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.08 mm (0.20 in.)
Intake	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.08 mm (0.20 in.)

Specifications

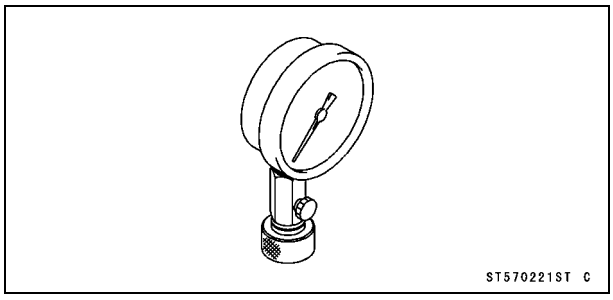
Item	Standard	Service Limit
Valve/Valve Guide Clearance (Wobble Method):		
Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.37 mm (0.0146 in.)
Intake	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.31 mm (0.0122 in.)
Valve Seat Cutting Angle	45°, 32°, 60°	– – –
Valve Seating Surface:		
Outside Diameter:		
Exhaust	25.2 ~ 25.4 mm (0.992 ~ 1.000 in.)	– – –
Intake	29.4 ~ 29.6 mm (1.157 ~ 1.165 in.)	– – –
Width:		
Exhaust	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	– – –
Intake	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	– – –
Valve Spring Free Length:		
Exhaust	41.3 mm (1.626 in.)	39.5 mm (1.555 in.)
Intake	41.3 mm (1.626 in.)	39.5 mm (1.555 in.)
Cylinder, Piston		
Cylinder Inside Diameter	84.994 ~ 85.006 mm (3.3462 ~ 3.3467 in.)	85.10 mm (3.350 in.)
Piston Diameter	84.964 ~ 84.979 mm (3.3450 ~ 3.3456 in.)	84.81 mm (3.3390 in.)
Piston/Cylinder Clearance	0.015 ~ 0.042 mm (0.0006 ~ 0.0017 in.)	– – –
Piston Ring/Groove Clearance:		
Top	0.04 ~ 0.08 mm (0.0016 ~ 0.0032 in.)	0.18 mm (0.0071 in.)
Second	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Piston Ring Groove Width:		
Top	1.03 ~ 1.05 mm (0.0405 ~ 0.0413 in.)	1.13 mm (0.0445 in.)
Second	1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.)	1.12 mm (0.0441 in.)
Piston Ring Thickness:		
Top	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.90 mm (0.035 in.)
Second	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.90 mm (0.035 in.)
Piston Ring End Gap:		
Part Number 13008-0008		
Top	0.20 ~ 0.30 mm (0.0079 ~ 0.0118 in.)	0.60 mm (0.0236 in.)
Second	0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)	0.75 mm (0.0295 in.)
Oil	0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)	1.00 mm (0.0394 in.)
Part Number 13008-0040		
Top	0.15 ~ 0.25 mm (0.0059 ~ 0.0098 in.)	0.55 mm (0.0217 in.)
Second	0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)	0.75 mm (0.0295 in.)
Oil	0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)	1.00 mm (0.0394 in.)

Special Tools and Sealant

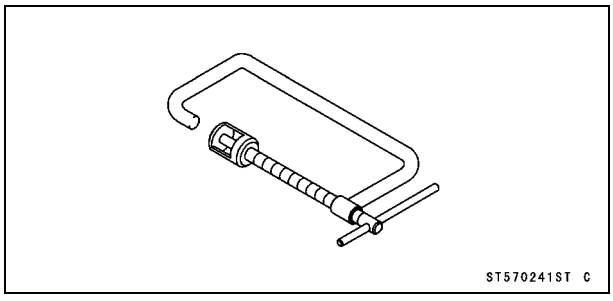
Outside Circlip Pliers:
57001-144



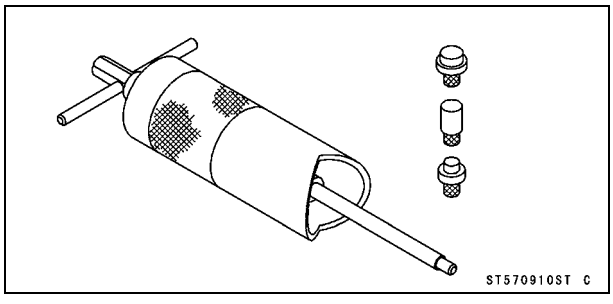
Compression Gauge, 20 kgf/cm²:
57001-221



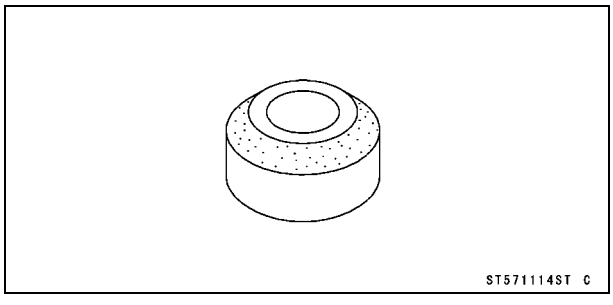
Valve Spring Compressor Assembly:
57001-241



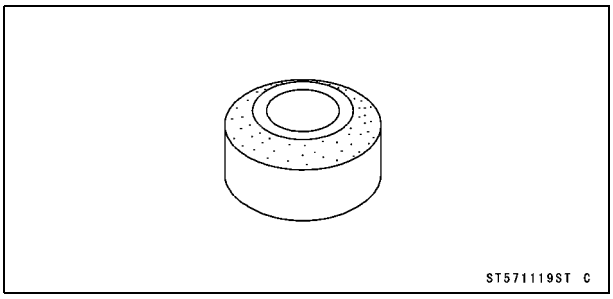
Piston Pin Puller Assembly:
57001-910



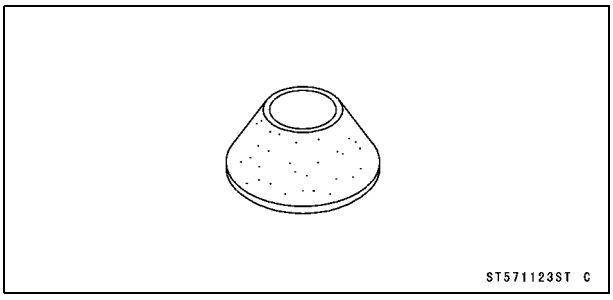
Valve Seat Cutter, 45° - ϕ27.5:
57001-1114



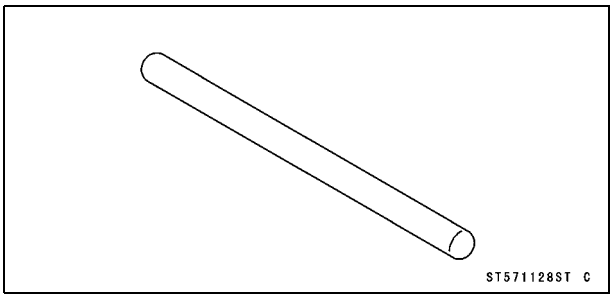
Valve Seat Cutter, 32° - ϕ28:
57001-1119



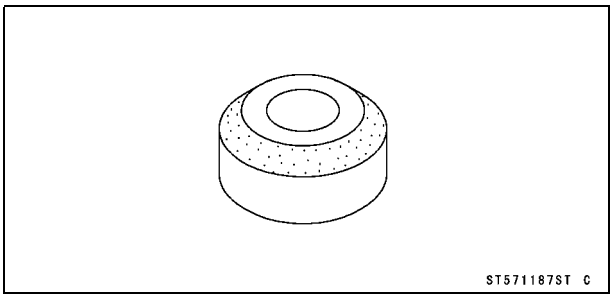
Valve Seat Cutter, 60° - ϕ30:
57001-1123



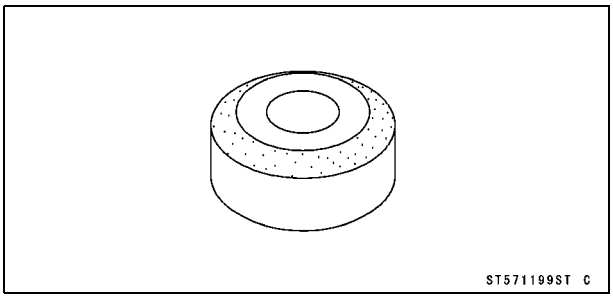
Valve Seat Cutter Holder Bar:
57001-1128



Valve Seat Cutter, 45° - ϕ30:
57001-1187

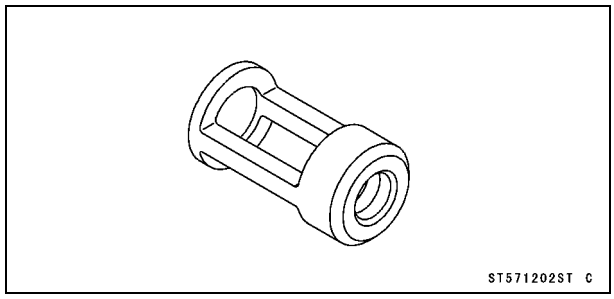


Valve Seat Cutter, 32° - ϕ33:
57001-1199

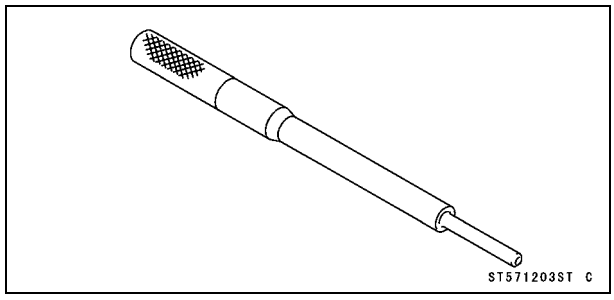


Special Tools and Sealant

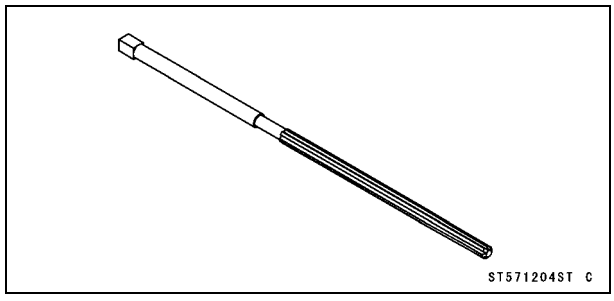
Valve Spring Compressor Adapter, ϕ22:
57001-1202



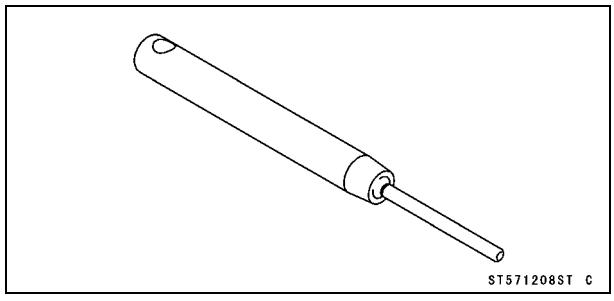
Valve Guide Arbor, ϕ5:
57001-1203



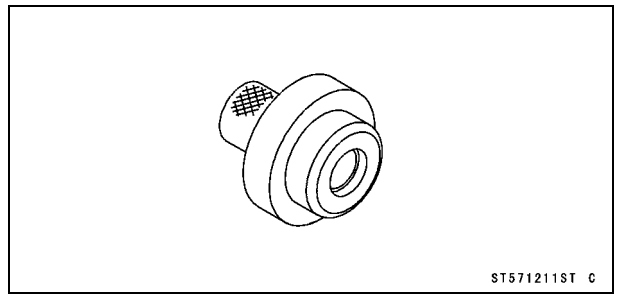
Valve Guide Reamer, ϕ5:
57001-1204



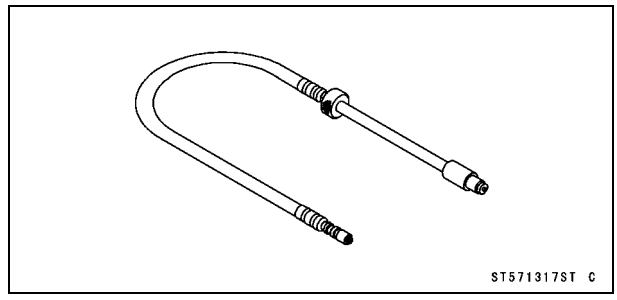
Valve Seat Cutter Holder, ϕ5:
57001-1208



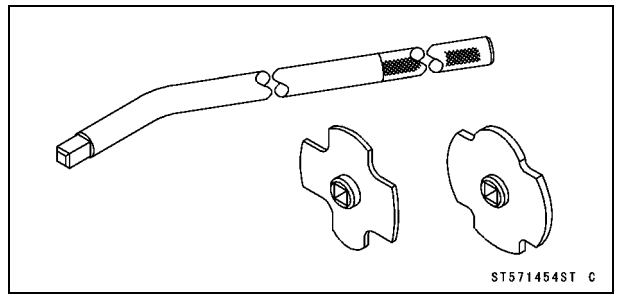
Piston Pin Puller Adapter, ϕ14:
57001-1211



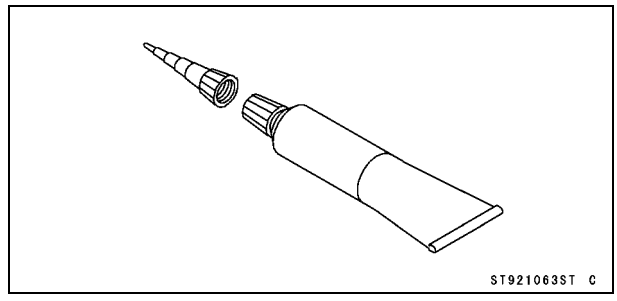
Compression Gauge Adapter, M10 × 1.0:
57001-1317



Filler Cap Driver:
57001-1454



Liquid Gasket, TB1216:
92104-1063



Camshaft Chain Tensioner

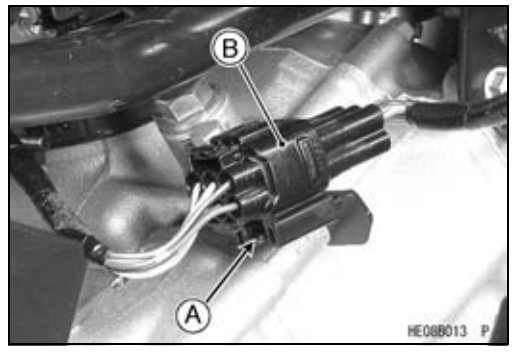
Camshaft Chain Tensioner Removal

NOTICE

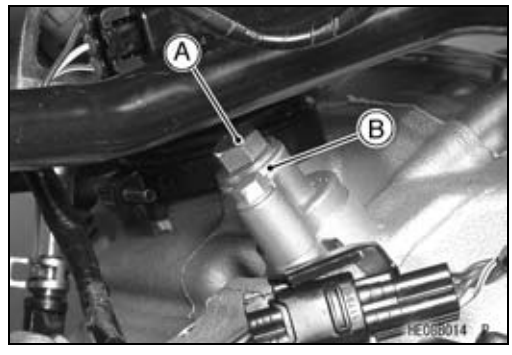
This is a non-return type cam chain tensioner. The push rod does not return to its original position once it moves out to take up cam chain slack. Observe all the rules listed below:
When removing the tensioner, do not take out the mounting bolts only partway. Retightening the mounting bolts from this 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.

Front Cylinder

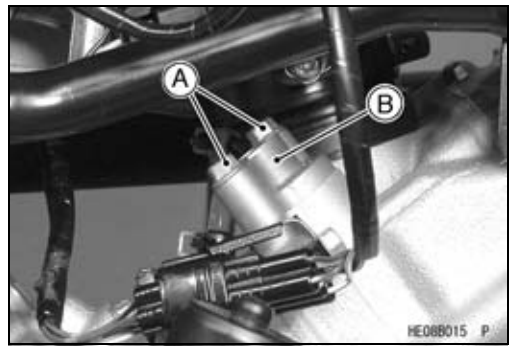
- For front cylinder, push down the stopper [A] to clear the connector [B].



- Remove:
  Cap Bolt [A]
  Washer [B]
  Pin and Spring

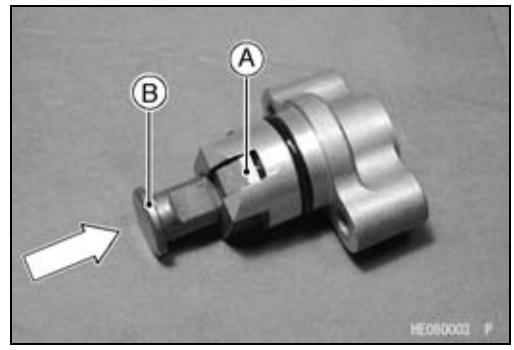


- Remove:
  Tensioner Mounting Bolts [A]
  Camshaft Chain Tensioner [B]

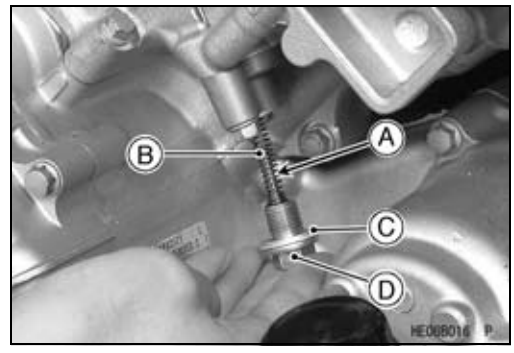


Camshaft Chain Tensioner

Camshaft Chain Tensioner Installation



- Push the stopper [A] to release the ratchet and push the push rod [B] into the tensioner body.



- Tighten:

Torque - Camshaft Chain Tensioner Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Install:
  Pin [A] and Spring [B]
  Washer [C] and Chain Tensioner Cap Bolt [D]
- Tighten:

Torque - Camshaft Chain Tensioner Cap Bolt: 22 N·m (2.2 kgf·m, 16 ft·lb)

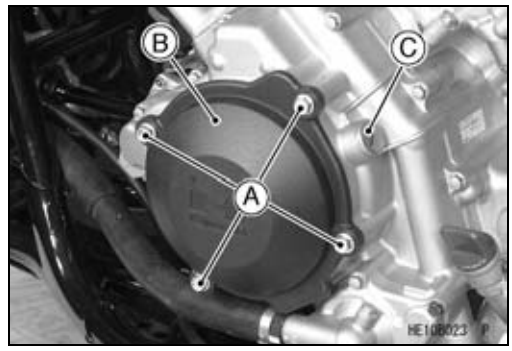
Rocker Case

Rocker Case Removal

Front Rocker Case

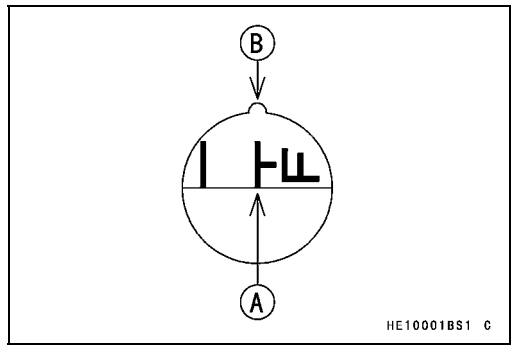
- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
  Alternator Outer Cover Bolts [A]
  Alternator Outer Cover [B]
  Timing Inspection Plug [C]

Special Tool - Filler Cap Driver: 57001-1454



- Remove:
  Valve Adjusting Caps

- Using a wrench on the alternator bolt, turn the crankshaft counterclockwise until “T-F” mark [A] is aligned with the notch [B] in the inspection window, and the cam lobes are pointing away from the rocker arms: the end of the compression stroke.

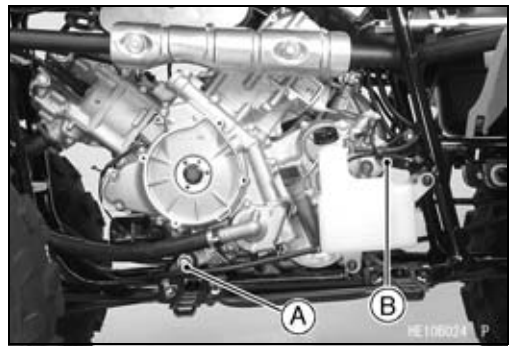


NOTICE

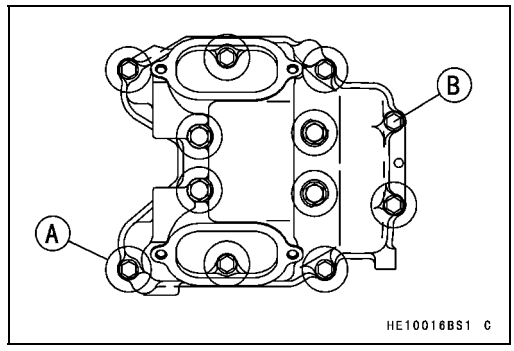
Be sure to position the crankshaft at TDC of the end of the compression stroke when removing or installing the rocker case. The rocker arms could bend the valves.

- Drain the coolant (see Coolant Change section in the Periodic maintenance chapter).

- Remove:
  Thermostat and Left Water Pipe (see Thermostat Removal in the Cooling System chapter)
  Front and Rear Propeller Shafts (see Front and Rear Propeller Shaft Removal in the Final Drive chapter)
  Air Cleaner Housing Mounting Bolts
  Front Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Rear Muffler (see Muffler and Exhaust Pipe Removal)
  Converter Rubber Ducts (Intake and Outlet)
  Front Engine Mounting Bolt [A] and Nut
- Loosen:
  Rear Engine Mounting Bolt [B]

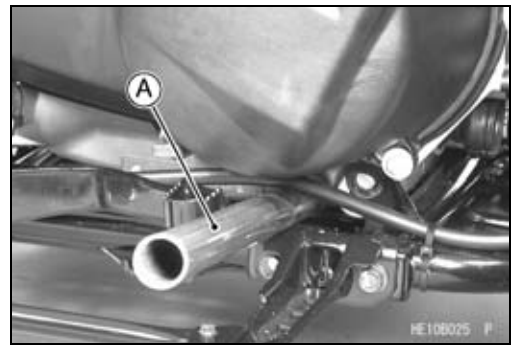


- Remove:
  Rocker Case Bolts [A]
- Loosen:
  Rocker Case Bolt [B]

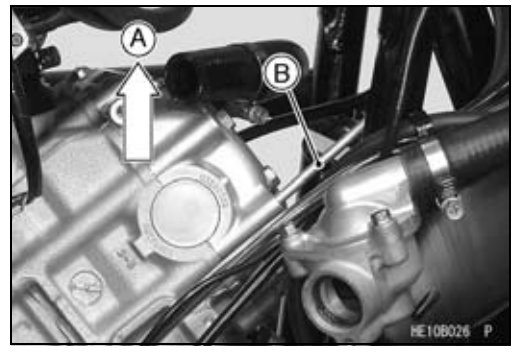


Rocker Case

- Insert a suitable bar [A] under the front of the engine.

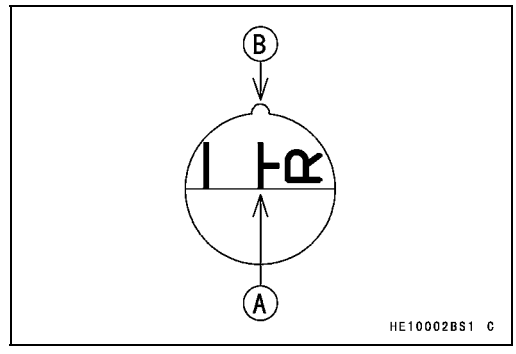


- Lift [A] the front of the engine to remove the bolt [B] of the front right side on the rocker case.
- Lift the rocker case to clear of the dowel pins in the cylinder head and slide the rocker case out of the frame.



Rear Rocker Case

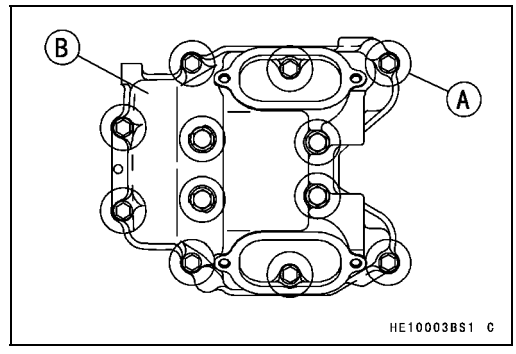
- Remove:
  Front Rocker Case
  Battery Case
- Using a wrench on the alternator bolt, turn the crankshaft **counterclockwise** (270°) until "T-R" mark [A] is aligned with the notch [B] in the inspection window, and the cam lobes are pointing away from the rocker arms: the end of the compression stroke.



NOTICE

Be sure to position the crankshaft at TDC of the end of the compression stroke when removing or installing the rocker case. The rocker arms could bend the valves.

- Remove:
  Rear Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Rocker Case Bolts [A]
  Rear Rocker Case [B]
- Lift the rocker case to clear of the dowel pins in the cylinder head and slide the rocker case out of the frame.



Rocker Case Installation

- Check that the crankshaft is positioned at TDC and at the end of the compression stroke.

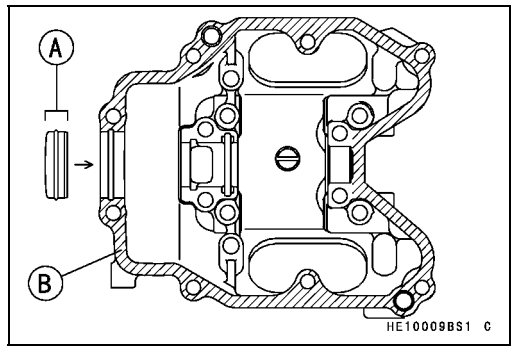
NOTICE

Be sure to position the crankshaft is at TDC of the end of the compression stroke. The rocker arms could bend the valves.

Rocker Case

● Apply silicone sealant to the outer surface of the cap [A] and the cylinder head upper surface [B] as shown.

Sealant - Liquid Gasket, TB1216: 92104-1063

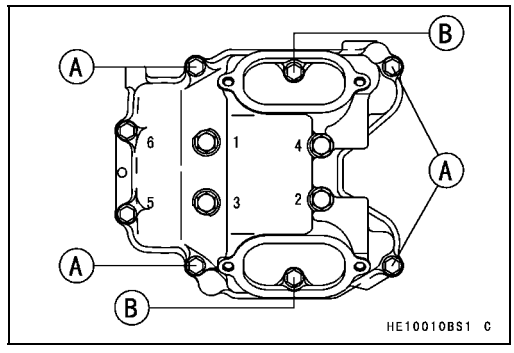


● Tighten the rocker case bolts following the tightening sequence shown.

Torque - Rocker Case Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)
[1, 2, 3, 4] L = 55 mm (2.2 in.) with washers
Rocker Case Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)
[5, 6] L = 130 mm (5.1 in.)
[A] L = 30 mm (1.2 in.)
[B] L = 25 mm (1.0 in.)

○Lift the front of the engine to install the bolt of the front right side on the front rocker case.

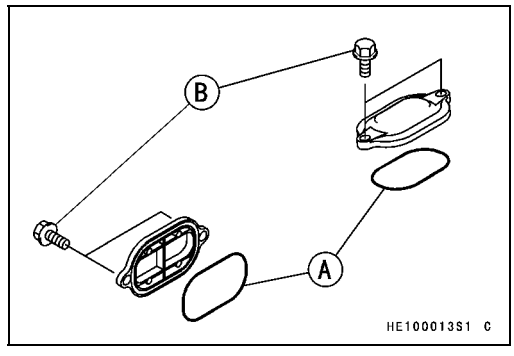
● Check the valve clearance and adjust it if necessary.



● Apply grease to the O-ring [A].

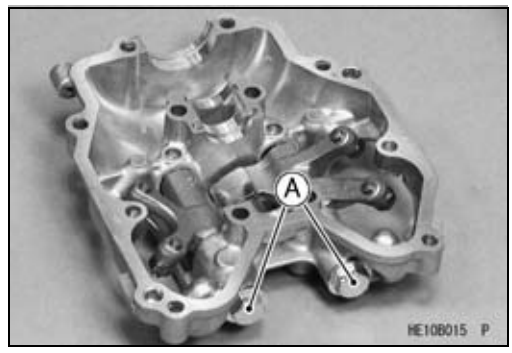
● Tighten:

Torque - Valve Adjusting Cap Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

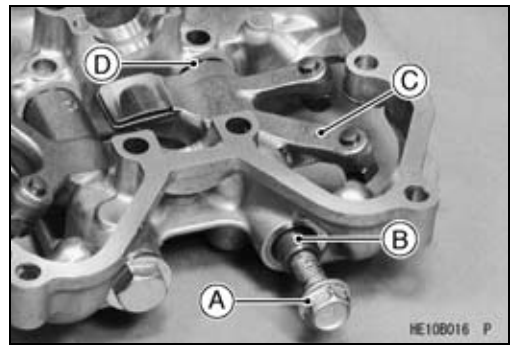


Rocker Arm Removal

● Remove:
Rocker Case (see Rocker Case Removal)
Rocker Shaft Bolts [A]



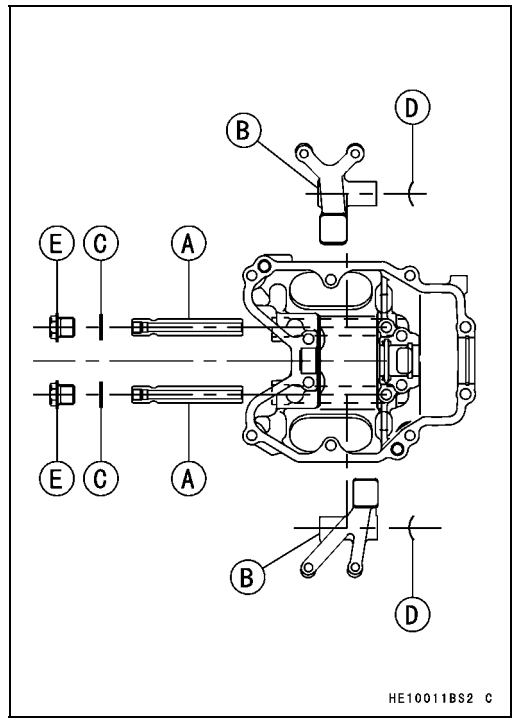
Rocker Case



- Using a M8 bolt [A], remove the rocker shaft [B].
- Remove:
  Rocker Arm [C]
  Washers [D]

○Mark and record the rocker arm location so it can be installed in the original position.
○The rocker arms come off with the rocker shafts.

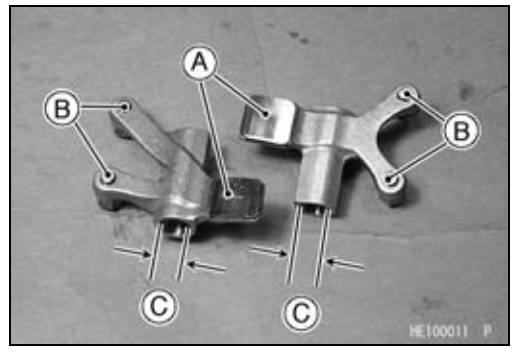
Rocker Arm Installation



- Apply engine oil:
  Rocker Shafts [A]
  Hole in Rocker Arms [B]
- Replace the copper washers [C] with new ones.
- Install:
  Wave Washers [D] (as shown)
  Rocker Arms (as shown)
  Rocker Shafts and Copper Washers
- Tighten:

Torque - Rocker Shaft Bolts [E]: 22 N·m (2.2 kgf·m, 16 ft·lb)

Rocker Arm Inspection



- Inspect the area [A] on the rocker arm where the cam rubs.

★If the rocker arm is scored, discolored or otherwise damaged, replace it. Also inspect the camshaft lobes.

- Inspect the end of the valve clearance adjusting screws [B] where it contacts the valve stem.

★If the end of the adjusting screw is mushroomed or damaged in any way, or if the screw will not turn smoothly, replace it. Also inspect the end of the valve stem.

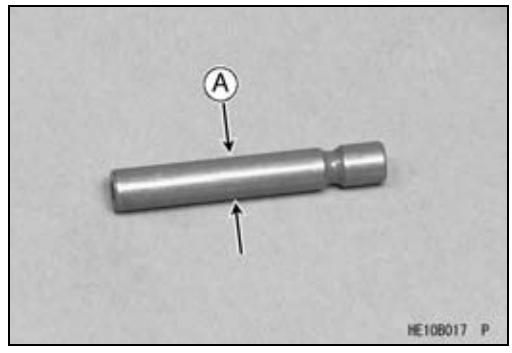
- Measure the inside diameter [C] of the rocker arm with a dial bore gauge.

★If the rocker arm inside diameter is larger than the service limit, replace it. Also check the rocker shaft diameter (see Rocker Shaft Diameter Measurement).

Rocker Arm Inside Diameter
Standard: 12.000 ~ 12.018 mm (0.4724 ~ 0.4731 in.)
Service Limit: 12.05 mm (0.474 in.)

Rocker Case

Rocker Shaft Diameter Measurement



- Measure the diameter [A] of the rocker shaft where the rocker arm pivots on it with a micrometer.

★If the rocker shaft diameter is smaller than the service limit, replace it. Also check the rocker arm inside diameter (see Rocker Arm Inspection).

Rocker Shaft Diameter

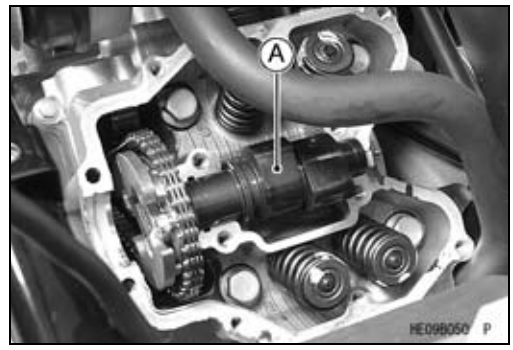
Standard: 11.983 ~ 11.994 mm (0.4718 ~ 0.4722 in.)

Service Limit: 11.96 mm (0.471 in.)

Camshaft

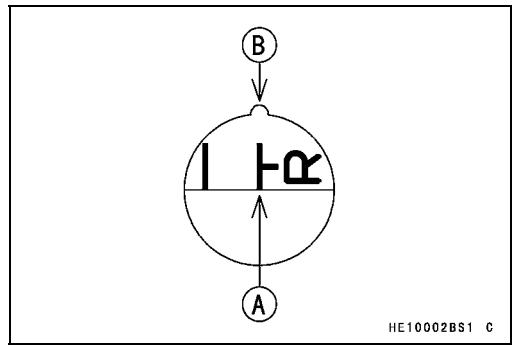
Camshaft Removal

- Remove:
  Camshaft Chain Tensioners (see Camshaft Chain Tensioner Removal)
  Rocker Cases (see Rocker Case Removal)
  Camshafts [A]
- Support the chain using a suitable tool.

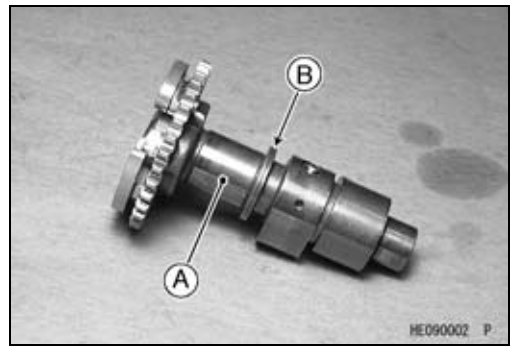


Camshaft Installation

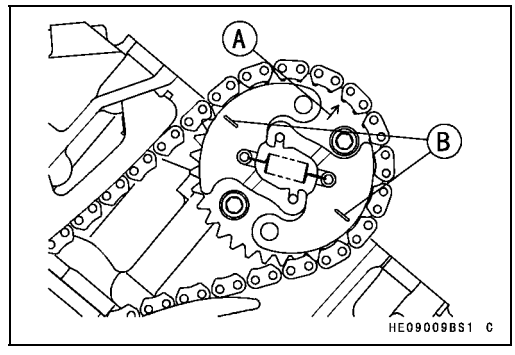
- Using a wrench on the alternator bolt, turn the crankshaft **clockwise** until "T-R" mark [A] is aligned with the notch [B] in the inspection window.



- The rear camshaft [A] has a groove [B].
- First, install the rear camshaft.

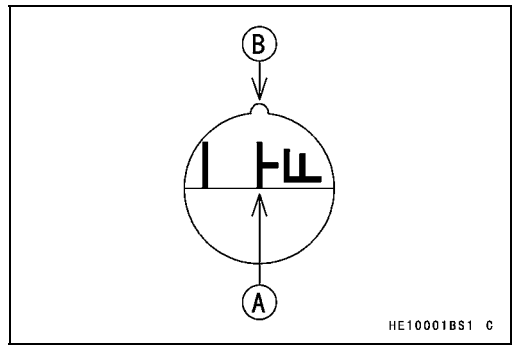


- Face the arrow [A] of the rear camshaft sprocket upward (left side view).
- Engage the rear camshaft chain with the rear camshaft sprocket.
- Align the marks [B] on the weights with the rear cylinder head upper surface.



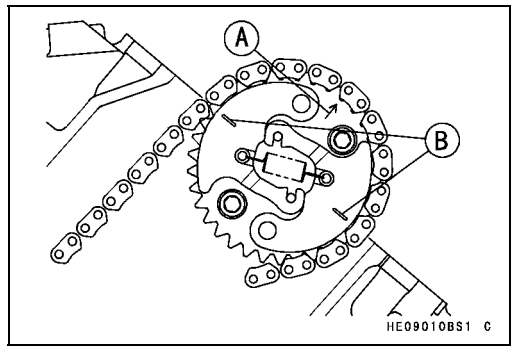
- Using a wrench on the alternator bolt, turn the crankshaft **clockwise** 270°.

○Align the "T-F" mark [A] with the notch [B] in the inspection window.



Camshaft

- Face the arrow [A] of the front camshaft sprocket upward (right side view).
- Engage the front camshaft chain with the front camshaft sprocket.
- Align the marks [B] on the weights with the front cylinder head upper surface.

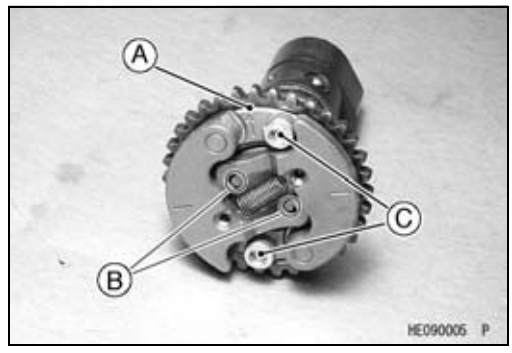


- Install:
  Rocker Cases (see Rocker Case Installation)
  Camshaft Chain Tensioners (see Camshaft Chain Tensioner Installation)
- Check the valve clearance (see Valve Clearance Inspection).

Camshaft Assembly

- Install the KACR unit [A] (sprocket) on the camshaft so that the unit fits onto the camshaft pins [B].
- Apply a non-permanent locking agent to the camshaft sprocket bolts [C].
- Tighten:

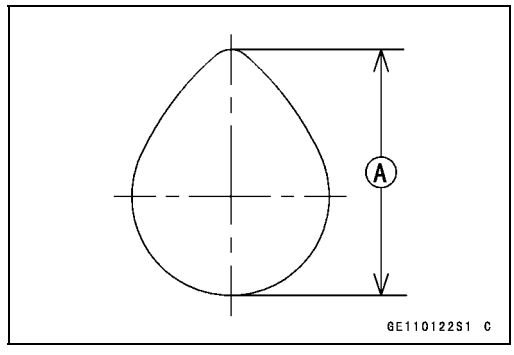
Torque - Camshaft Sprocket Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)



Cam Wear Inspection

- Remove the camshaft.
- Measure the height [A] of the cam with a micrometer.

★If the cams are worn past the service limit, replace the camshaft.



Cam Height

Standard:

Exhaust	**35.363 ~ 35.477 mm (1.3922 ~ 1.3967 in.)**
Intake	**35.622 ~ 35.736 mm (1.4024 ~ 1.4069 in.)**

Service Limit:

Exhaust	**35.26 mm (1.388 in.)**
Intake	**35.52 mm (1.398 in.)**

Camshaft

Camshaft Bearing Wear Inspection

○The journal wear is measured using plastigage (press gauge), which is inserted into the clearance to be measured. The plastigage indicates the clearance by the amount it is compressed and widened when the parts are assembled.

● Cut strips of plastigage to journal width. Place a strip on each journal parallel to the camshaft with the camshaft installed in the correct position so that the plastigage will be compressed between the journal and rocker case.

● Install the rocker case, tightening the bolts in the correct sequence to the specified torque (see Rocker Case Installation).

NOTE

○*Do not turn the camshaft when the plastigage is between the journal and rocker case.*

● Remove the rocker case and measure the plastigage width [A] to determine the clearance between the journal and the rocker case. Measure the widest portion of the plastigage.

Camshaft Bearing Clearance (φ18)
Standard: 0.016 ~ 0.052 mm (0.0006 ~ 0.0020 in.)
Service Limit: 0.14 mm (0.0055 in.)

Camshaft Bearing Clearance (φ22)
Standard: 0.020 ~ 0.062 mm (0.0008 ~ 0.0024 in.)
Service Limit: 0.15 mm (0.0059 in.)

★If any clearance exceeds the service limit, measure the diameter of the camshaft journal.

Camshaft Journal Diameter (φ18)
Standard: 17.966 ~ 17.984 mm (0.7073 ~ 0.7080 in.)
Service Limit: 17.94 mm (0.706 in.)

Camshaft Journal Diameter (φ22)
Standard: 21.959 ~ 21.980 mm (0.8645 ~ 0.8653 in.)
Service Limit: 21.93 mm (0.863 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 the rocker case.

NOTICE

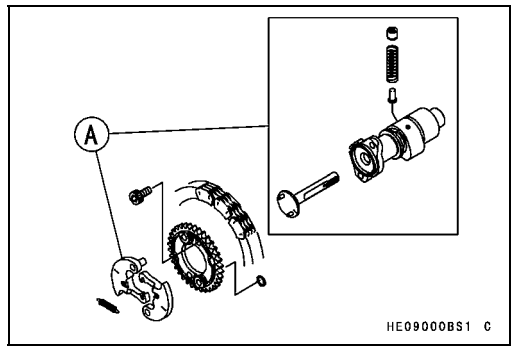
The cylinder head and rocker case are machined as a set, and must be replaced as a set.

Camshaft

KACR Inspection

The Kawasaki Automatic Compression Release (KACR) momentarily opens the exhaust valves on the compression stroke at very low speeds. This allows some of the compression pressure to escape, making it easy to turn over the engine during starting.

Due to the simplicity of the mechanism, no periodic maintenance is needed. There are only two symptoms of problems with the KACR mechanism [A]: compression is not released during starting, and compression is released during running.



(1) If compression is not released during starting, the weights are not returning to their rest position.

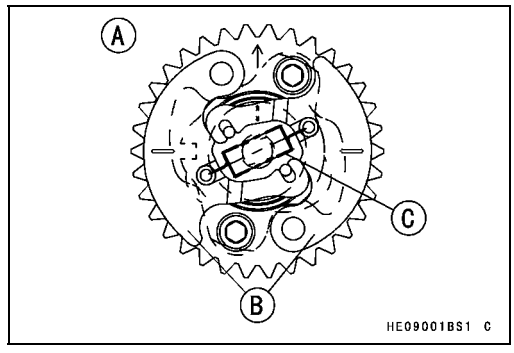
- Remove the camshaft (see Camshaft Removal).
- Remove the KACR unit.
- Visually inspect the spring.

★If damaged, deformed, or missing, replace the spring.

- Remove the spring and move the weights back and forth.

★If the weights do not move smoothly, replace the KACR unit. Also inspect the exhaust rocker arm for any damage, and replace the rocker arm if necessary.

[A] Rest Position (compression is released)
[B] Weights
[C] Spring

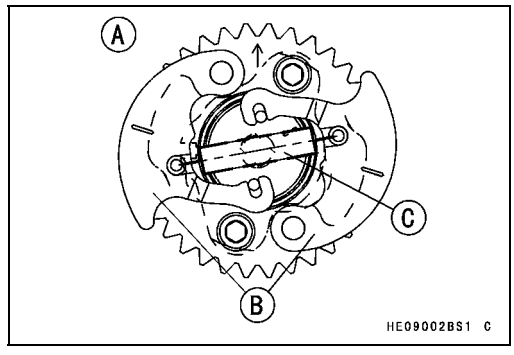


(2) If compression is released while the engine is running, the weights are not swinging out.

- Remove the spring and move the weights 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.

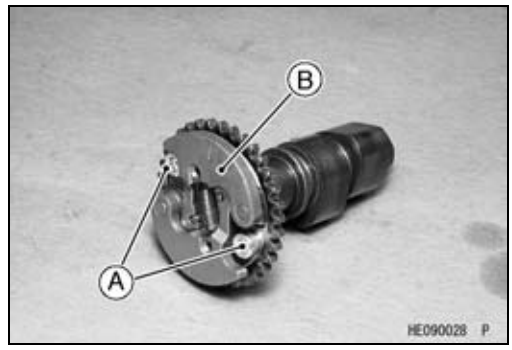
[A] Running Position (compression is not released)
[B] Weights
[C] Spring



KACR Removal

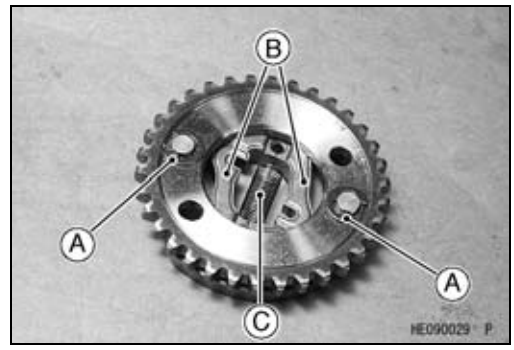
- Remove:

Camshaft (see Camshaft Removal)
Camshaft Sprocket Bolts [A]
KACR Unit [B]



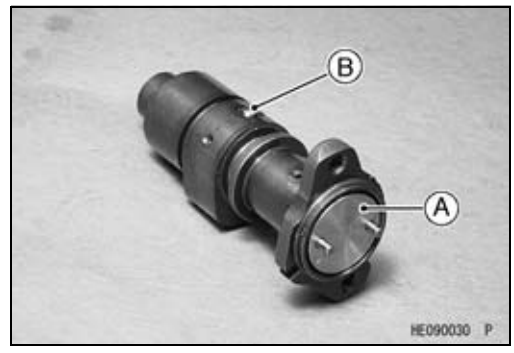
Camshaft

● Remove:
Circlips [A]
Weights [B]
Spring [C]



NOTE

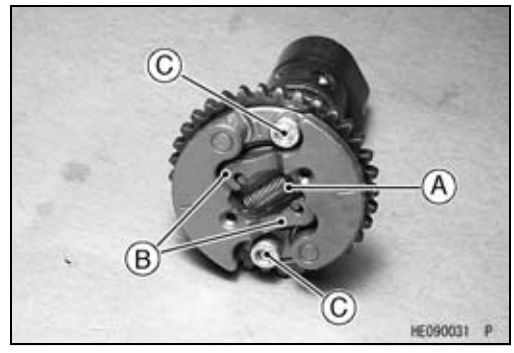
○*Do not remove the shaft [A] and pin [B].*
○*If the parts are removed, they cannot be reinstalled.*



KACR Installation

● Install:
Weights
Circlips
Spring [A]
○Hook the spring from the outside with the open side of the hook inwards.
● Install:
KACR Unit
● Hook the arms [B] on the pins.
● Apply a non-permanent locking agent to the camshaft sprocket bolts [C] and tighten them.

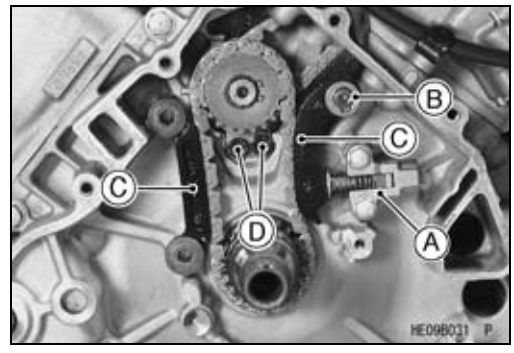
Torque - Camshaft Sprocket Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)



Camshaft Chain Removal

● Remove (left side view):
Rear and Front Camshafts (see Camshaft Removal)
Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
Oil Pump (see Oil Pump Removal in the Engine Lubrication System chapter)
Intermediate Shaft Chain Tensioner [A]
Circlip [B] and Washer

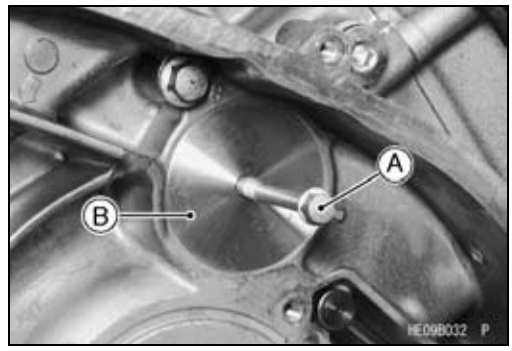
Special Tool - Outside Circlip Pliers: 57001-144



● Remove:
Intermediate Shaft Chain Guides [C]
Position Plate Bolts [D] and Position Plate

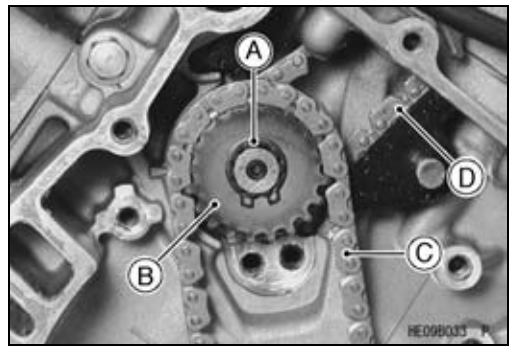
Camshaft

- Remove (right side view):
  Torque Converter Cover (see Torque Converter Cover Removal in the Converter System chapter)
- Using a M6 bolt [A], pull out the cover [B].



- Remove (left side view):
  Circlip [A]

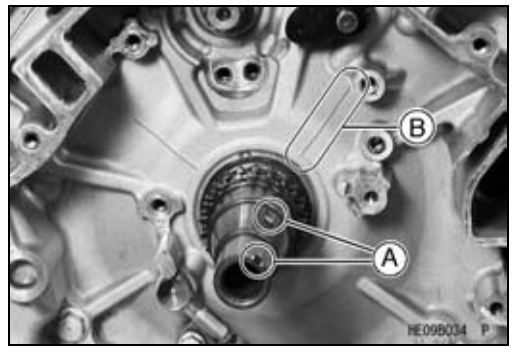
  Special Tool - Outside Circlip Pliers: 57001-144
- Remove:
  Intermediate Shaft Sprocket [B]
  Intermediate Shaft Drive Chain [C]
  Rear Camshaft Chain [D]
  Front Camshaft Chain (right side)



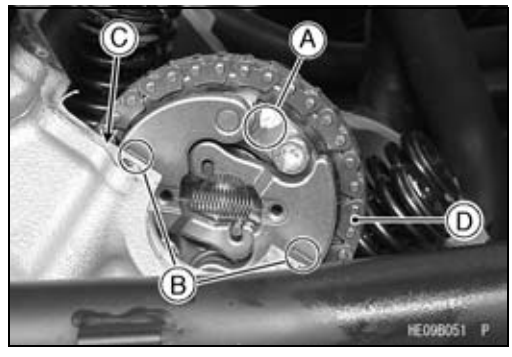
Camshaft Chain Installation

Rear Camshaft Chain

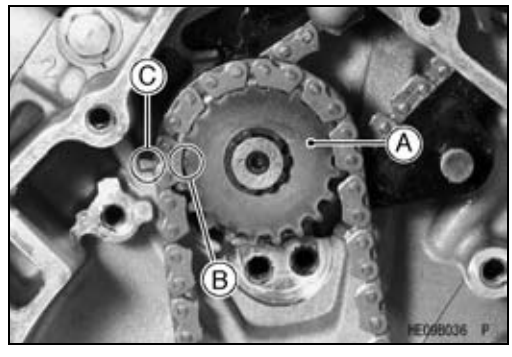
- Align the key grooves [A] on the crankshaft with the embossed line [B] on the crankcase (left side view).



- Face the arrow [A] of the rear camshaft sprocket upward.
- Align the marks [B] on the weights with the rear cylinder head upper surface [C].
- Place the rear camshaft chain [D] onto the rear camshaft sprocket.



- Engage the camshaft and intermediate shaft chains on the intermediate shaft sprocket [A] and insert the intermediate shaft (left side view).
- Align the punch marks [B] on the sprocket with the embossed mark [C] on the crankcase.



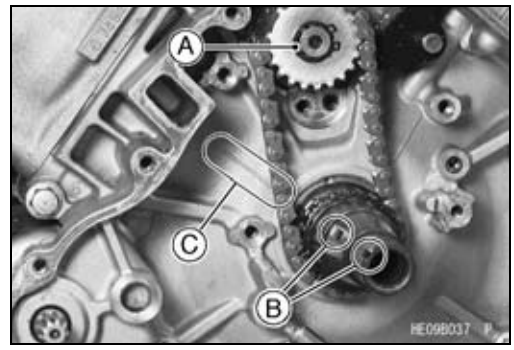
Camshaft

Front Camshaft Chain

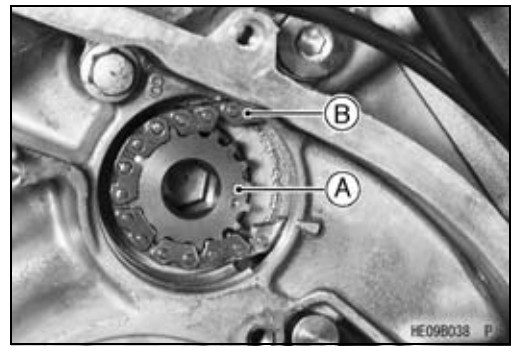
- Install the circlip [A].

  Special Tool - Outside Circlip Pliers: 57001-144

- Rotate the crankshaft **clockwise** 270°.
- Align the key grooves [B] on the crankshaft with the embossed line [C] on the crankcase.

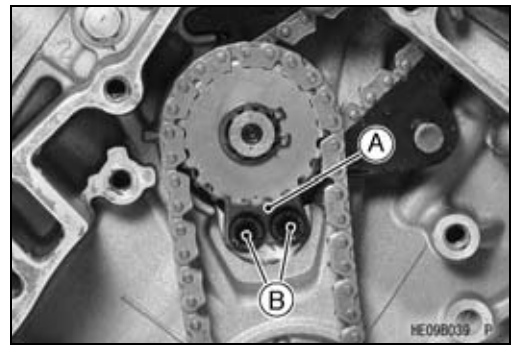


- Move the intermediate shaft [A] to the left side of the engine.
- Engage the front camshaft chain [B] with the sprocket on the intermediate shaft.



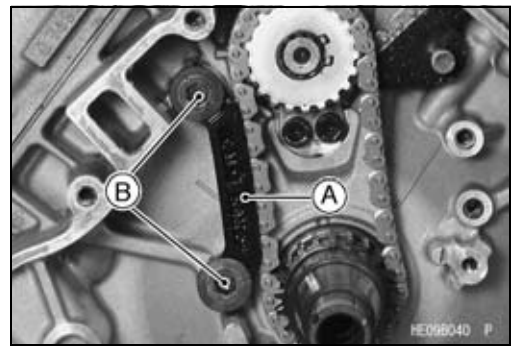
- Install (left side view):
  Position Plate [A]
- Tighten:

  Torque - Position Plate Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)



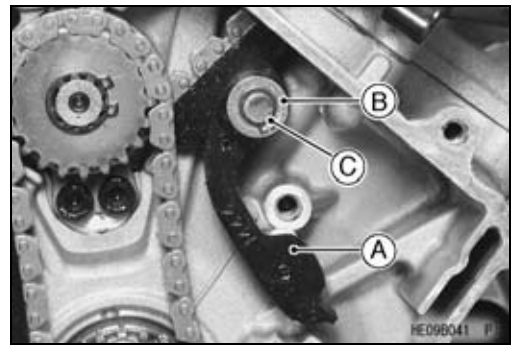
- Install:
  Intermediate Shaft Chain Guide [A] (front)
- Tighten:

  Torque - Intermediate Shaft Chain Guide Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)



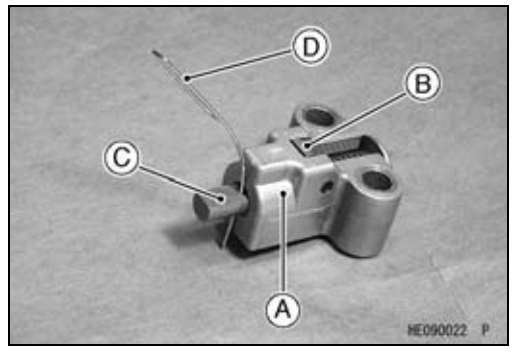
- Install:
  Intermediate Shaft Chain Guide [A] (Rear)
  Washer [B]
  Circlip [C]

  Special Tool - Outside Circlip Pliers: 57001-144



Camshaft

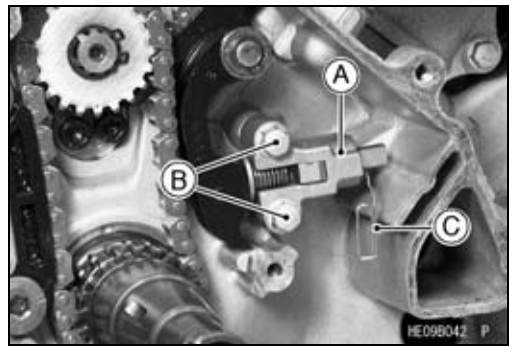
- Install the intermediate shaft chain tensioner [A] as follows:
- Release the stopper [B] and push the push rod [C] into the tensioner body.
- Insert a wire [D] into the rod hole to hold the rod in place.



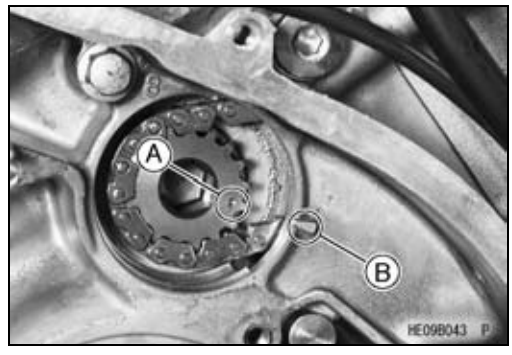
- Install:
  Intermediate Shaft Chain Tensioner [A]
- Tighten:

Torque - Intermediate Shaft Chain Tensioner Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

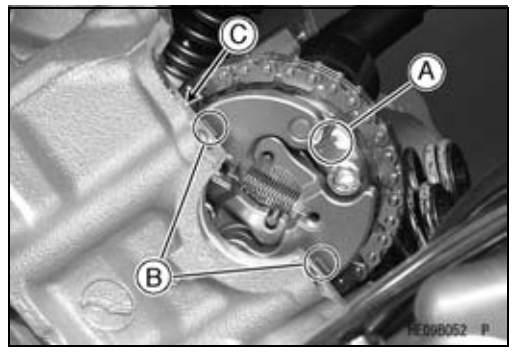
- Remove the wire [C] to free the push rod.



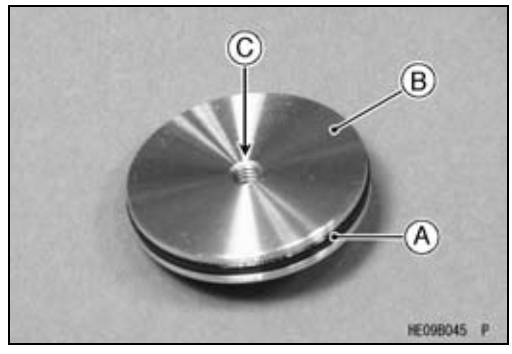
- Confirm that the punch mark [A] on the intermediate shaft sprocket (Right Side) is aligned with the embossed mark [B] on the crankcase.



- Face the arrow mark [A] upward.
- Align the marks [B] on the weights with the front cylinder head upper surface [C].
- Place the front camshaft chain on the front camshaft sprocket.



- Apply grease to the O-ring [A] and install the cover [B] into the right side of the crankcase so that the tapped hole [C] faces outward.



Camshaft

- Install:
  Rocker Cases (see Rocker Case Installation)
  Camshaft Chain Tensioners (see Camshaft Chain Tensioner Installation)
- Check the valve clearances (see Valve Clearance Inspection).

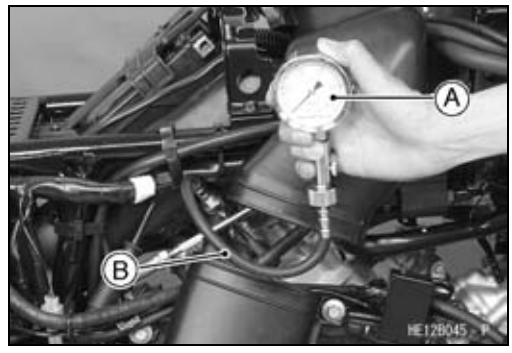
Camshaft Chain Guide Wear Inspection

- Visually inspect the rubber on the guides.

★If the rubber is damaged, cut, or is missing pieces, replace the guide.

Cylinder Head

Cylinder Compression Measurement



NOTE

○*Use the battery which is fully charged.*

- Warm up the engine thoroughly, and stop the engine.
- Remove the spark plug (see Spark Plug Removal in the Electrical System chapter).
- Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.

Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221
Compression Gauge Adapter, M10 × 1.0: 57001-1317

- Hold the throttle wide open and crank the engine with the electric starter or the recoil starter several times.

When the gauge stops rising, stop cranking and read the gauge.

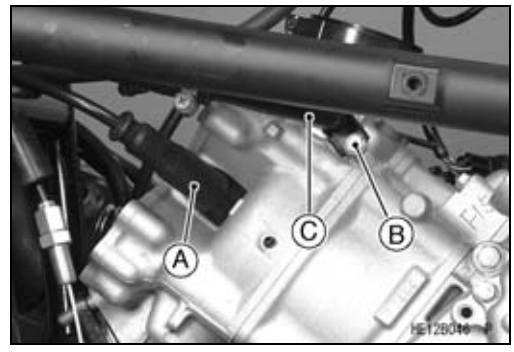
Cylinder Compression (Usable Range)
Electric Starter: 251 ~ 456 kPa (2.56 ~ 4.65 kgf/cm², 36 ~ 66 psi) @380 r/min (rpm)

The following table should be consulted if the obtainable compression reading is not within the usable range.

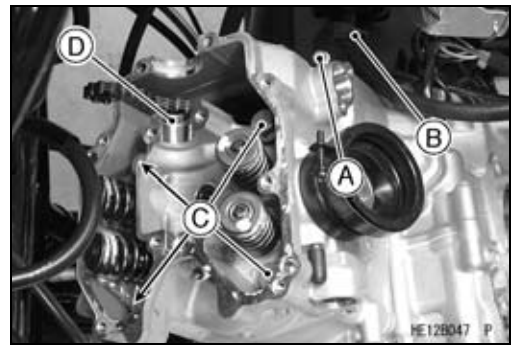
Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon accumulation on piston, cylinder head, and in combustion chamber possibly due to damaged valve stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	Incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
	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 seating	Repair if necessary.
	Incorrect valve clearance.	Adjust the valve clearance.
	Incorrect piston/cylinder clearance	Replace the piston and/or cylinder
	Piston seizure.	Inspect the cylinder and 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

Cylinder Head Removal



- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Remove:
  Throttle Body (see Throttle Body Removal in the Fuel System (DFI) chapter)
  Exhaust Pipe (see Muffler and Exhaust Pipe Removal)
  Thermostat (see Thermostat Removal in the Cooling System chapter)
  Camshaft (see Camshaft Removal)
  Spark Plug Cap [A]
  Water Pipe Bolt [B]
  Left Water Pipe [C]

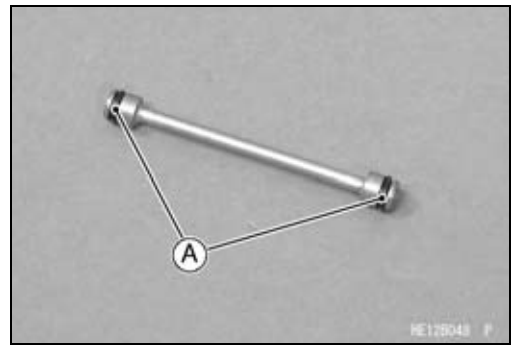


- Remove:
  Cylinder Head Bolt (M6) [A]
  Bracket [B] (Front only)
  Cylinder Head Bolts (M10) [C] and Washers
  Cylinder Head [D] and Gasket

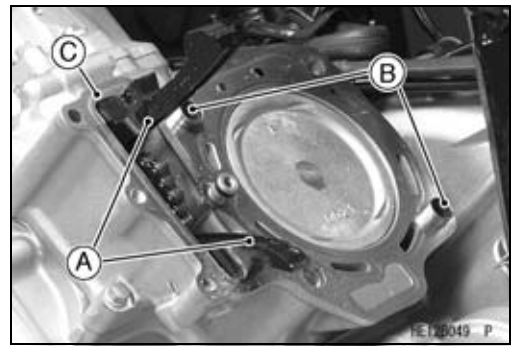
○For front cylinder head removal, lift up the front of the engine with a suitable bar to remove the two cylinder head bolts.

○For rear cylinder head removal, push the engine right ward to remove the right side cylinder head bolts.

Cylinder Head Installation



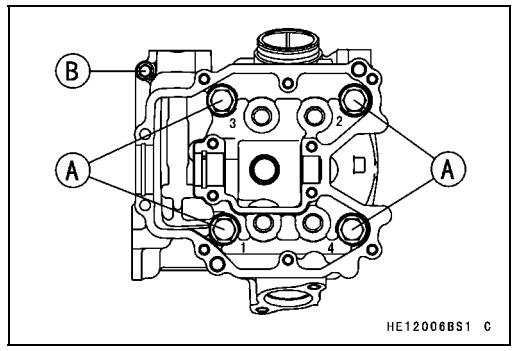
- Apply oil to the O-rings [A] on the oil pipe, and insert the pipe.



- Install:
  Camshaft Chain Guides [A]
  Dowel Pins [B]
  New Cylinder Head Gasket [C]
- Tighten:

Torque - Front Cylinder Camshaft Chain Guide Bolt: 20 N·m (2.0 kgf·m, 15 ft·lb)

Cylinder Head



- Apply molybdenum disulfide oil to the threads and seating surface of the cylinder head bolts and both sides of the washers.
- Tighten the cylinder head bolts [A] following the tightening sequence as shown.

First Torque - Cylinder Head Bolts (M10): 25 N·m (2.5 kgf·m, 18 ft·lb)

Final Torque - Cylinder Head Bolts (M10): 49 N·m (5.0 kgf·m, 36 ft·lb)

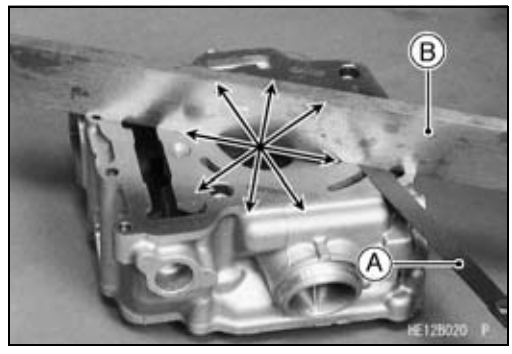
- Tighten the cylinder head bolts (M6) [B].

Torque - Cylinder Head Bolts (M6): 9.8 N·m (1.0 kgf·m, 87 in·lb)

Cylinder Head Cleaning

- Remove the cylinder head (see Cylinder Head Removal).
- Scrape the carbon out of the combustion chamber and exhaust port with a suitable tool.
- Wash the head with a high-flash point solvent.
- Blow out any particles which may obstruct the oil passage in the cylinder head using compressed air.

Cylinder Head Warp Inspection



- Clean the cylinder head (see Cylinder Head Cleaning).
- Lay a straightedge across the lower surface of the cylinder head.
- Use a thickness gauge [A] to measure the space between the straightedge [B] and the head at several locations.

Cylinder Head Warp
Service Limit: 0.05 mm (0.002 in.)

★If the cylinder head is warped more than the service limit, replace it.

★If the cylinder head is warped less than the service limit, repair the head by lapping the lower surface with emery paper secured to a surface plate (first No. 200, then No. 400).

Valves

Valve Clearance Inspection

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

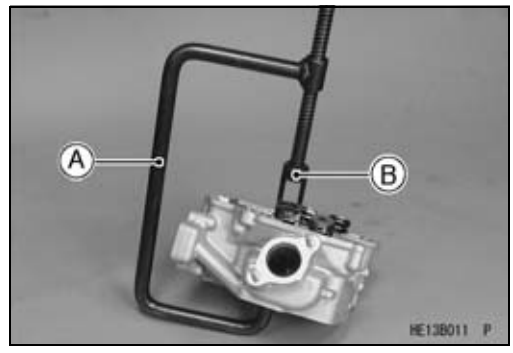
Valve Clearance Adjustment

● Refer to the Valve Clearance Adjustment in the Periodic Maintenance chapter.

Valve Removal

● Remove the cylinder head (see Cylinder Head Removal).
○Mark and record the valve location so it can be installed in the original position.
● Using the valve spring compressor assembly, remove the valve.

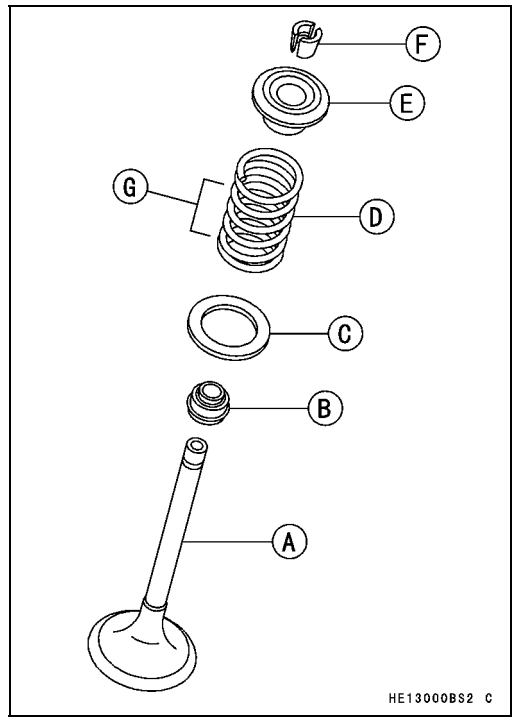
Special Tools - Valve Spring Compressor Assembly: 57001 -241 [A]
Valve Spring Compressor Adapter, ϕ22: 57001-1202 [B]



Valve Installation

● Replace the valve stem oil seal.
★If a new valve is to be used, check the valve-to-guide clearance (see Valve-to-Guide Clearance Measurement).
★If there is too little clearance, ream the valve guide (see Valve Guide Installation).
★If there is too much clearance, install a new valve guide (see Valve Guide Removal and Valve Guide Installation).
● Check the valve seat (see Valve Seat Inspection).
● Apply a thin coat of molybdenum disulfide grease to the valve stem.
● Install each spring so that the closed coil end faces downwards.
○The green paint on the spring faces upwards.

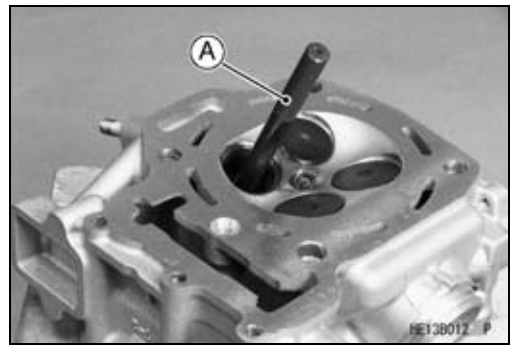
Valve Stem [A]
Oil Seal [B]
Spring Seat [C]
Spring [D]
Retainer [E]
Split Keepers [F]
Closed Coil End [G]



Valve Guide Removal

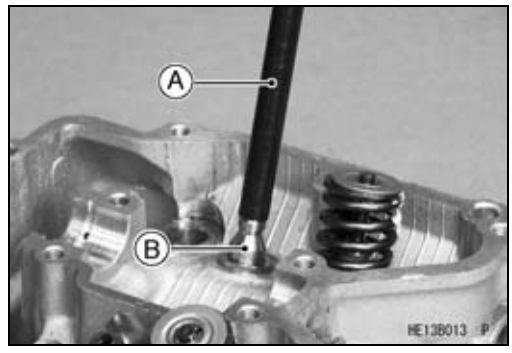
● Remove:
Valve (see Valve Removal)
Valve Stem Oil Seal
● Hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

Special Tool - Valve Guide Arbor, ϕ5: 57001-1203



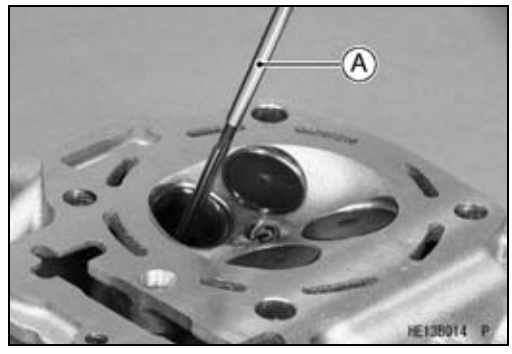
Valves

Valve Guide Installation



- Lightly oil the valve guide outer surface.
- Using the valve guide arbor [A], drive the valve guide [B] until its flange touches the cylinder head.

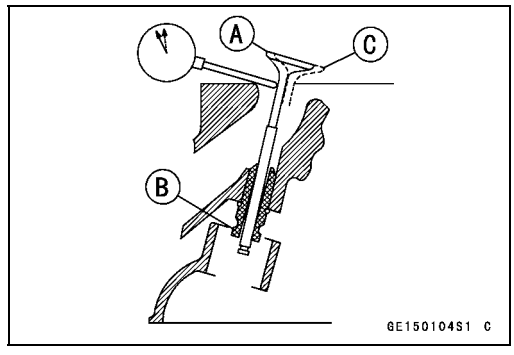
Special Tool - Valve Guide Arbor, ϕ5: 57001-1203



- Ream the valve guide with the valve guide reamer [A] , it may be necessary to ream the guide even if the old guide is reused.

Special Tool - Valve Guide Reamer, ϕ5: 57001-1204

Valve-to-Guide Clearance Measurement



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

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

★If the reading exceeds the service limit, replace the guide.

NOTE

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

Valve/Valve Guide Clearance (Wobble Method)

Standard:

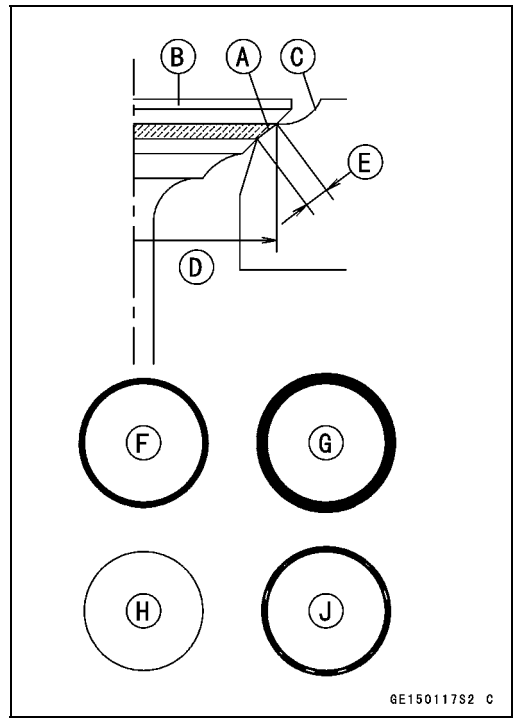
Exhaust	**0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)**
Intake	**0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)**

Service Limit:

Exhaust	**0.37 mm (0.0146 in.)**
Intake	**0.31 mm (0.0122 in.)**

Valves

Valve Seat Inspection



- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].

○Coat the valve seat with machinist's dye.
○Push the valve into the guide.
○Rotate the valve against the seat with a lapping tool.
○Pull the valve out, and check the seating pattern on the valve head. It must be the correct width and even all the way around.

- Measure the outside diameter [D] of the seating pattern on the valve seat.

★If the outside diameter of the valve seating pattern is too large or too small, repair the seat (see Valve Seat Repair).

Valve Seating Surface Outside Diameter

Exhaust:	**25.2 ~ 25.4 mm (0.992 ~ 1.000 in.)**
Intake:	**29.4 ~ 29.6 mm (1.157 ~ 1.165 in.)**

NOTE

○*The valve stem and guide must be in good condition, or this check will not be valid.*

★If the valve seating pattern is not correct, repair the seat (see Valve Seat Repair).

- Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with vernier calipers.

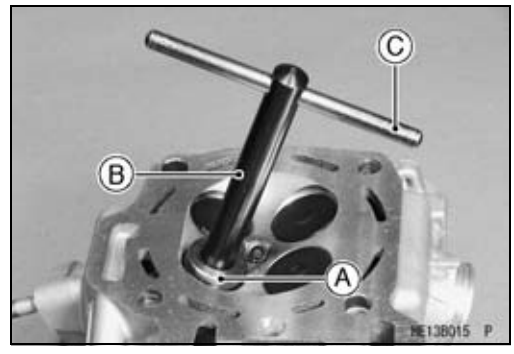
★If the width is too wide, too narrow or uneven, repair the seat (see Valve Seat Repair).

[F] Good
[G] Too Wide
[H] Too Narrow
[J] Uneven

Valve Seating Surface Width

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

Valve Seat Repair (Valve Lapping)



- Using the valve seat cutters [A], repair the valve seat.

Special Tools - Valve Seat Cutters:
Exhaust Valves:
Valve Seat Cutter, 45° - ϕ27.5: 57001-1114
Valve Seat Cutter, 32° - ϕ28: 57001-1119
Valve Seat Cutter, 60° - ϕ30: 57001-1123
Intake Valves:
Valve Seat Cutter, 45° - ϕ30: 57001-1187
Valve Seat Cutter, 32° - ϕ33: 57001-1199
Valve Seat Cutter, 60° - ϕ30: 57001-1123
Holder and Bar:
Valve Seat Cutter Holder, ϕ5: 57001-1208 [B]
Valve Seat Cutter Holder Bar: 57001-1128 [C]

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

Valves

Seat Cutter Operation Care

1. This valve seat cutter is developed to grind the valve seat for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

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

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

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

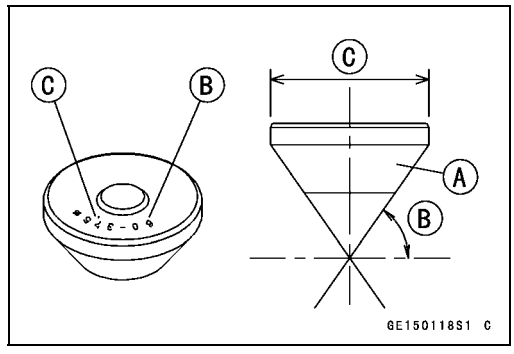
5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter

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

60° ..... Cutter angle [B]

37.5ϕ ..... Outer diameter of cutter [C]



Operating Procedures

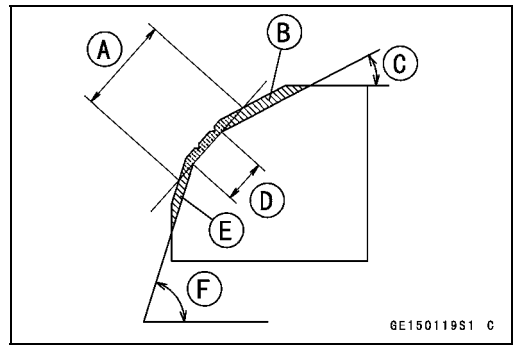
- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

NOTICE

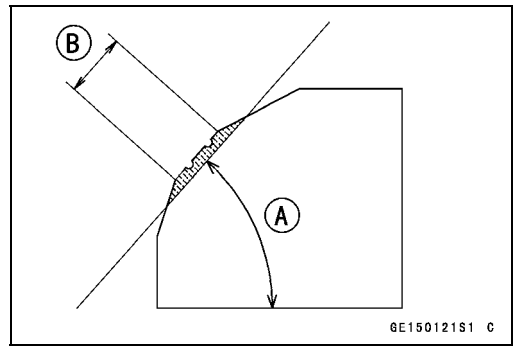
Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.

Valves

Widened Width [A] of engagement by machining with 45° cutter
Ground Volume [B] by 32° cutter
32° [C]
Correct Width [D]
Ground Volume [E] by 60° cutter
60° [F]



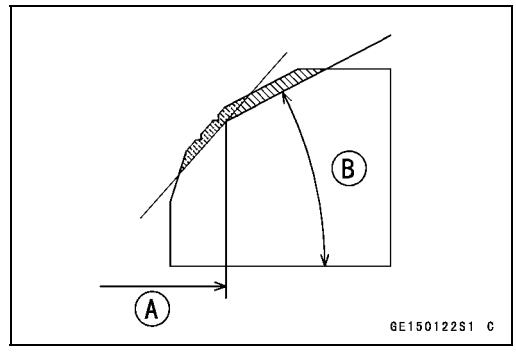
● Measure the outside diameter of the seating surface with vernier calipers.
★If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.
Original Seating Surface [B]



NOTE

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

★If the outside diameter (O.D.) [A] of the seating surface is too large, make the 32° grind described below.
★If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.
● Grind the seat at a 32° angle [B] until the seat O.D. is within the specified range.
○To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.
Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



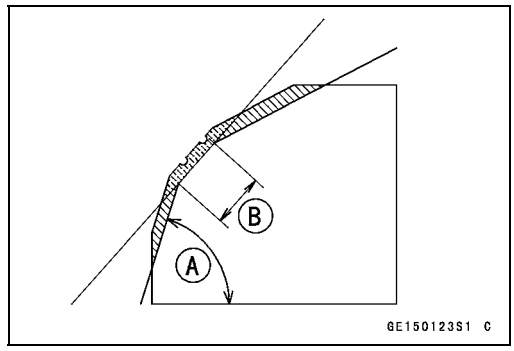
NOTICE

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

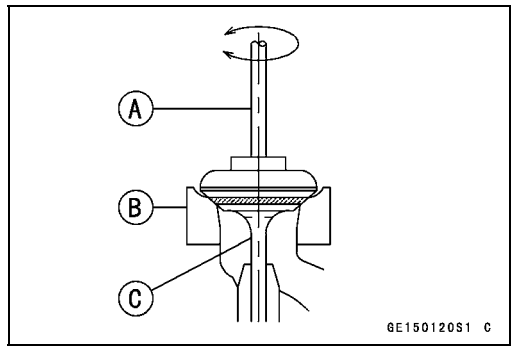
After making the 32° grind, return to the seat O.D. measurement step above.
● To measure the seat width, use vernier calipers to measure the width of the 45° angle portion of the seat at several places around the seat.
★If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.

Valves

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



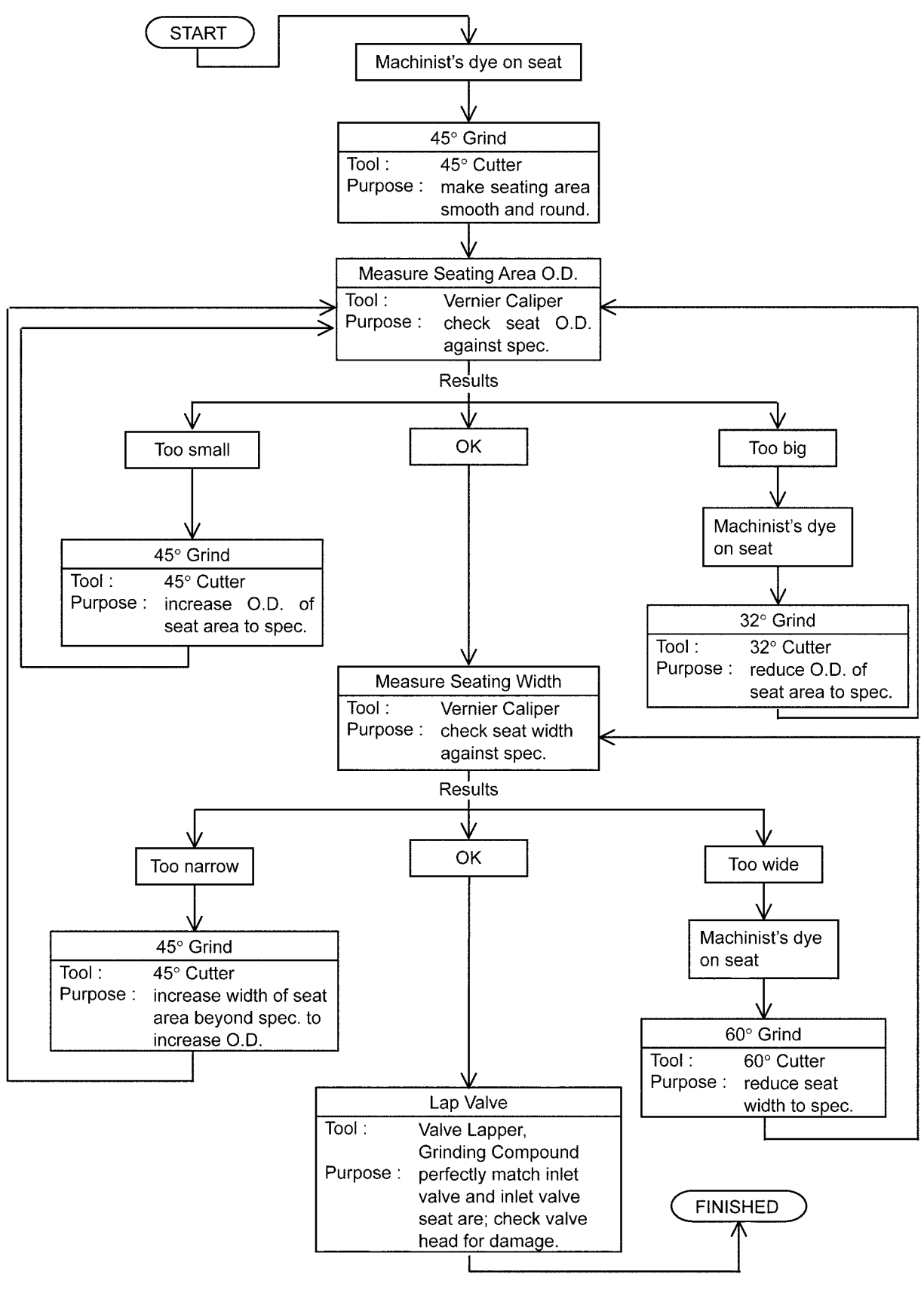
● Lap the valve to the seat, once the seat width and O.D. are within the ranges specified above.
○Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
○Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
○Repeat the process with a fine grinding compound.
[A] Lapper
[B] Valve Seat
[C] Valve



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

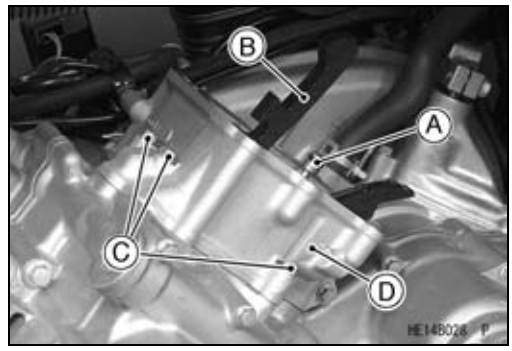
Valves

Valve Seat Repair



Cylinder and Piston

Cylinder Removal



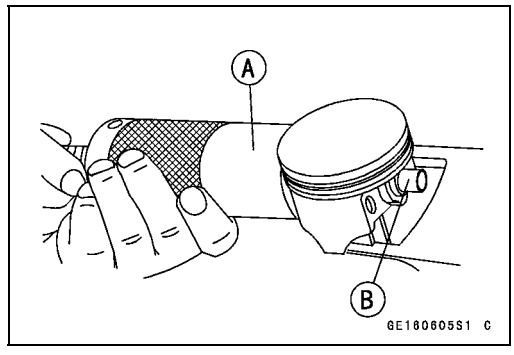
- Remove:
  Cylinder Head (see Cylinder Head Removal)
  Oil Pipe [A]
  Chain Guide [B]
  Cylinder Bolts [C]
  Cylinder [D]
  Cylinder Base Gasket

Piston Removal

- Remove the cylinder block (see Cylinder Removal).
- Place a piece of clean cloth under the piston and remove the piston pin snap rings [A] from the outside of each piston.

NOTICE

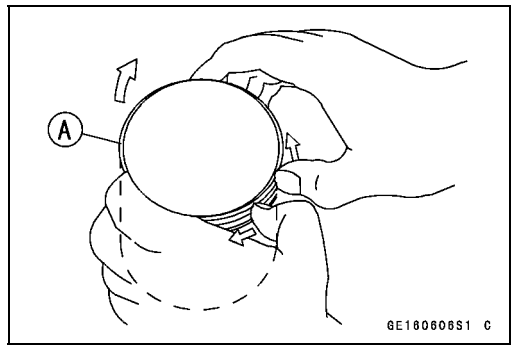
Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.



- Using the piston pin puller assembly (special tool), remove the piston pins.

  Special Tools - Piston Pin Puller Assembly [A]: 57001-910
  Piston Pin Puller Adapter, ϕ14 [B]: 57001 -1211

- Remove the piston.



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

Cylinder, Piston Installation

NOTE

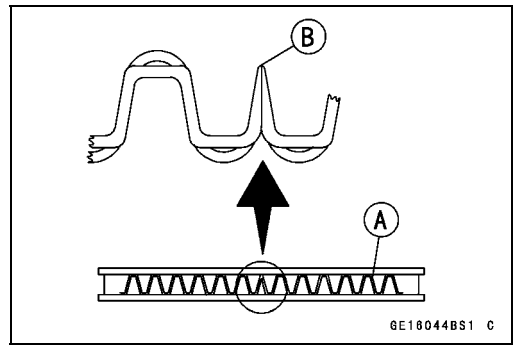
○*If a new piston or cylinder is used, check piston to cylinder clearance (see Piston/Cylinder Clearance), and use new piston rings.*

Cylinder and Piston

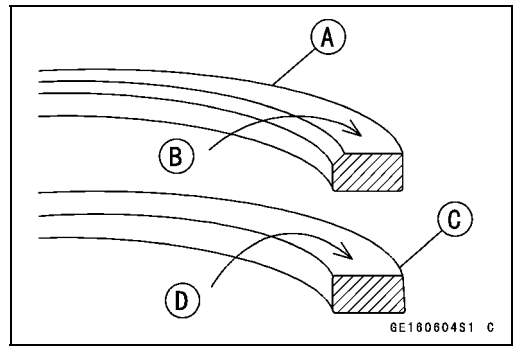
NOTE

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

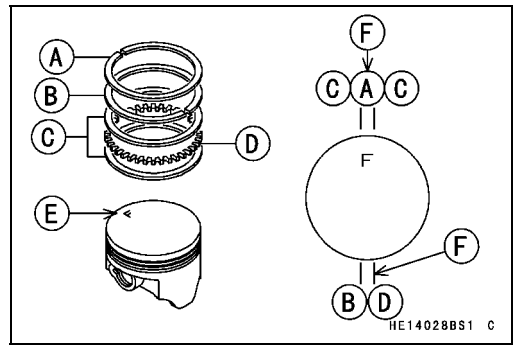
● Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
● Install the oil ring steel rails, one above the expander and one below it.
○Spread the rail with your thumbs, but only enough to fit the rail over the piston.
○Release the rail into the bottom piston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



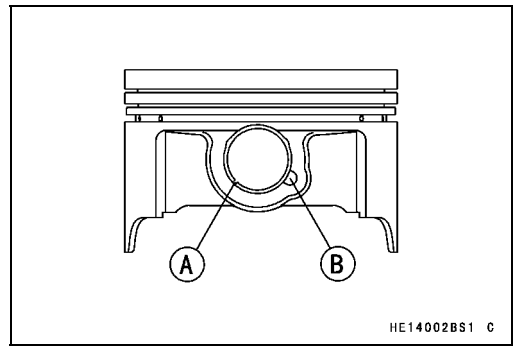
● Do not mix up the top ring and second ring.
● Install the top ring [A] so that the "**R**" mark [B] faces up.
● Install the second ring [C] so that the "**RN**" mark [D] faces up.



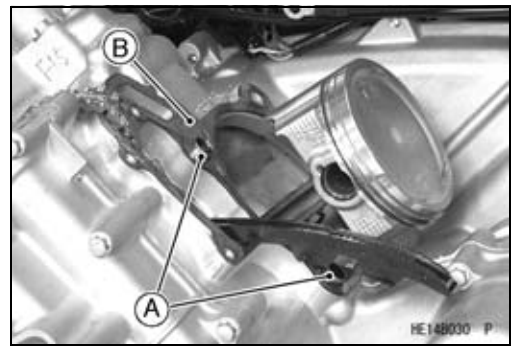
● The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails do not align.
Top Ring [A]
Second Ring [B]
Oil Ring Steel Rails [C]
Oil Ring Expander [D]
F mark [E] must be faced toward Front Side for front and rear pistons
Opening Positions [F]



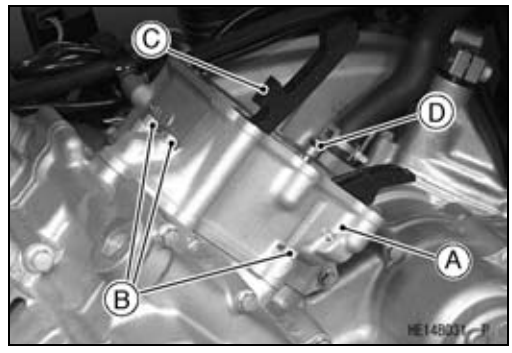
● Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.
○When installing the piston pin snap ring, compress it only enough to install it and no more.
● Apply engine oil to the cylinder bore and, piston skirt.



● Install:
Dowel Pins [A]
New Cylinder Base Gasket [B]



Cylinder and Piston

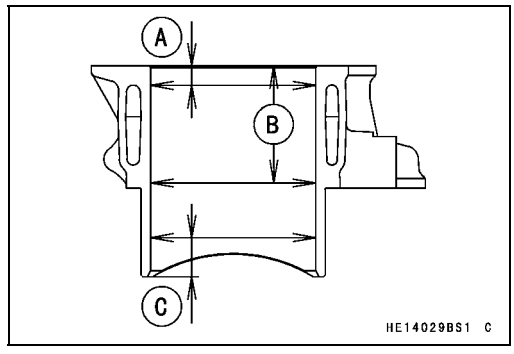


- Install:
  Cylinder [A]
- Tighten:

Torque - Cylinder Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install:
  Chain Guide [C]
- Apply oil to the O-ring on the oil pipe [D], and insert the pipe.

Cylinder Wear Inspection



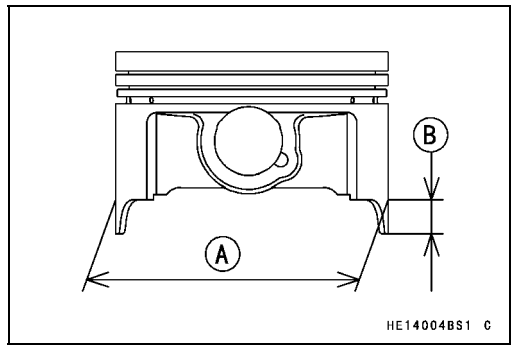
- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the three locations (total of six measurements) shown in the figure.

★If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.
  10 mm (0.4 in.) [A]
  60 mm (2.4 in.) [B]
  20 mm (0.8 in.) [C]

Cylinder Inside Diameter

Standard:	**84.994 ~ 85.006 mm (3.3462 ~ 3.3467 in.), and less than 0.01 mm (0.0004 in.) difference between any two measurements.**
Service Limit:	**85.10 mm (3.350 in.), or more than 0.05 mm (0.0020 in.) difference between any two measurements.**

Piston Wear Inspection



- Measure the outside diameter [A] of each piston 18 mm (0.71 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★If the measurement is under service limit, replace the piston.

Piston Diameter

Standard:	**84.964 ~ 84.979 mm (3.3450 ~ 3.3456 in.)**
Service Limit:	**84.81 mm (3.3390 in.)**

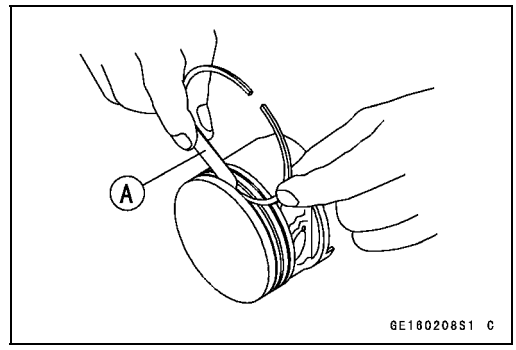
Piston/Cylinder Clearance Inspection

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

Piston/Cylinder Clearance
Standard: 0.015 ~ 0.042 mm (0.0006 ~ 0.0017 in.)

Cylinder and Piston

Piston Ring, Piston Ring Groove Wear Inspection



- Check for uneven groove wear by inspecting the ring seating.

★The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.

- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

Piston Ring/Groove Clearance
Standard:

Top	**0.04 ~ 0.08 mm (0.0016 ~ 0.0032 in.)**
Second	**0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)**

Service Limit:

Top	**0.18 mm (0.0071 in.)**
Second	**0.17 mm (0.0067 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 Inspection

- Measure the piston ring groove width.

○Use a vernier caliper at several points around the piston.

Piston Ring Groove Width
Standard:

Top	**1.03 ~ 1.05 mm (0.0405 ~ 0.0413 in.)**
Second	**1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.)**

Service Limit:

Top	**1.13 mm (0.0445 in.)**
Second	**1.12 mm (0.0441 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 Inspection

- Measure the piston ring thickness.

○Use a micrometer to measure at several points around the ring.

Piston Ring Thickness
Standard:

Top	**0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)**
Second	**0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)**

Service Limit:

Top	**0.90 mm (0.035 in.)**
Second	**0.90 mm (0.035 in.)**

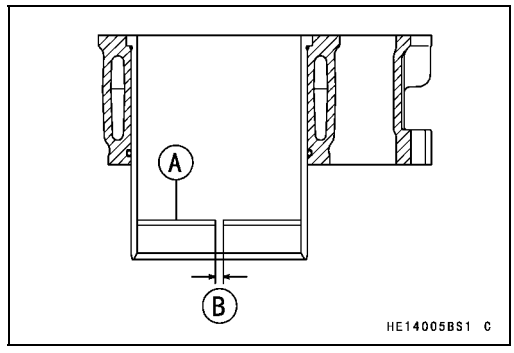
★If any of the measurements is less than the service limit on either of the rings, replace all the rings.

NOTE

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

Cylinder and Piston

Piston Ring End Gap Inspection



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

Piston Ring End Gap
Part Number 13008-0008
Standard:

Top	**0.20 ~ 0.30 mm (0.0079 ~ 0.0118 in.)**
Second	**0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)**
Oil	**0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)**

Service Limit:

Top	**0.60 mm (0.0236 in.)**
Second	**0.75 mm (0.0295 in.)**
Oil	**1.00 mm (0.0394 in.)**

Part Number 13008-0040
Standard:

Top	**0.15 ~ 0.25 mm (0.0059 ~ 0.0098 in.)**
Second	**0.30 ~ 0.45 mm (0.0118 ~ 0.0177 in.)**
Oil	**0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)**

Service Limit:

Top	**0.55 mm (0.0217 in.)**
Second	**0.75 mm (0.0295 in.)**
Oil	**1.00 mm (0.0394 in.)**

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

Exhaust System

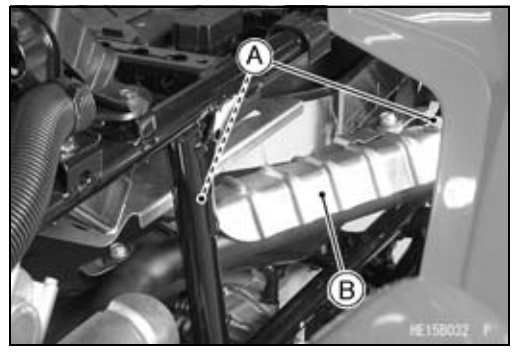
This vehicle is equipped with a spark arrester approved for off-road use by the United States Forest Service. It must be properly maintained to ensure its efficiency. In accordance with the Periodic Maintenance Chart, clean the spark arrester.

Spark Arrester Cleaning

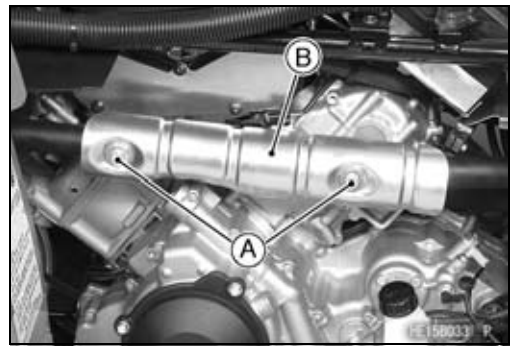
- Refer to the Spark Arrester Cleaning in the Periodic Maintenance chapter.

Muffler and Exhaust Pipe Removal

- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
  Bolts [A]
  Middle Front Exhaust Pipe Cover [B]

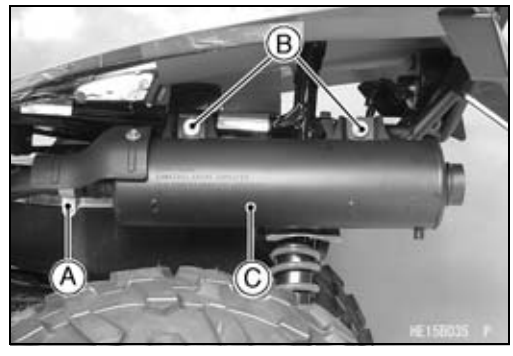


- Remove:
  Bolts [A]
  Front Exhaust Pipe Cover [B]



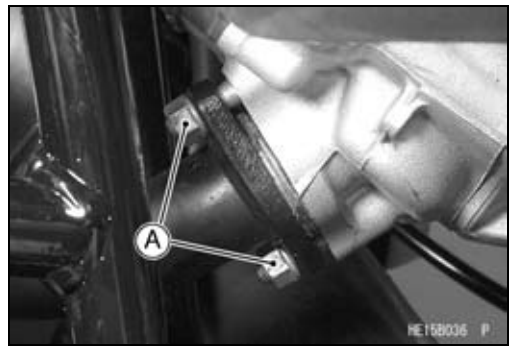
- Remove:
  Rear Exhaust Pipe Nuts [A]

- Remove:
  Muffler Clamp Bolt [A]
  Muffler Mounting Nuts [B], Washers and Bolts
  Muffler Body [C]



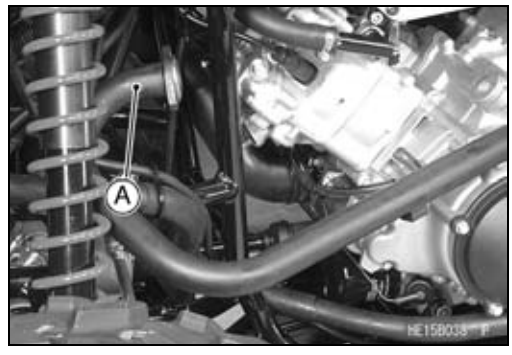
Exhaust System

- Remove:
  Front Exhaust Pipe Nuts [A]

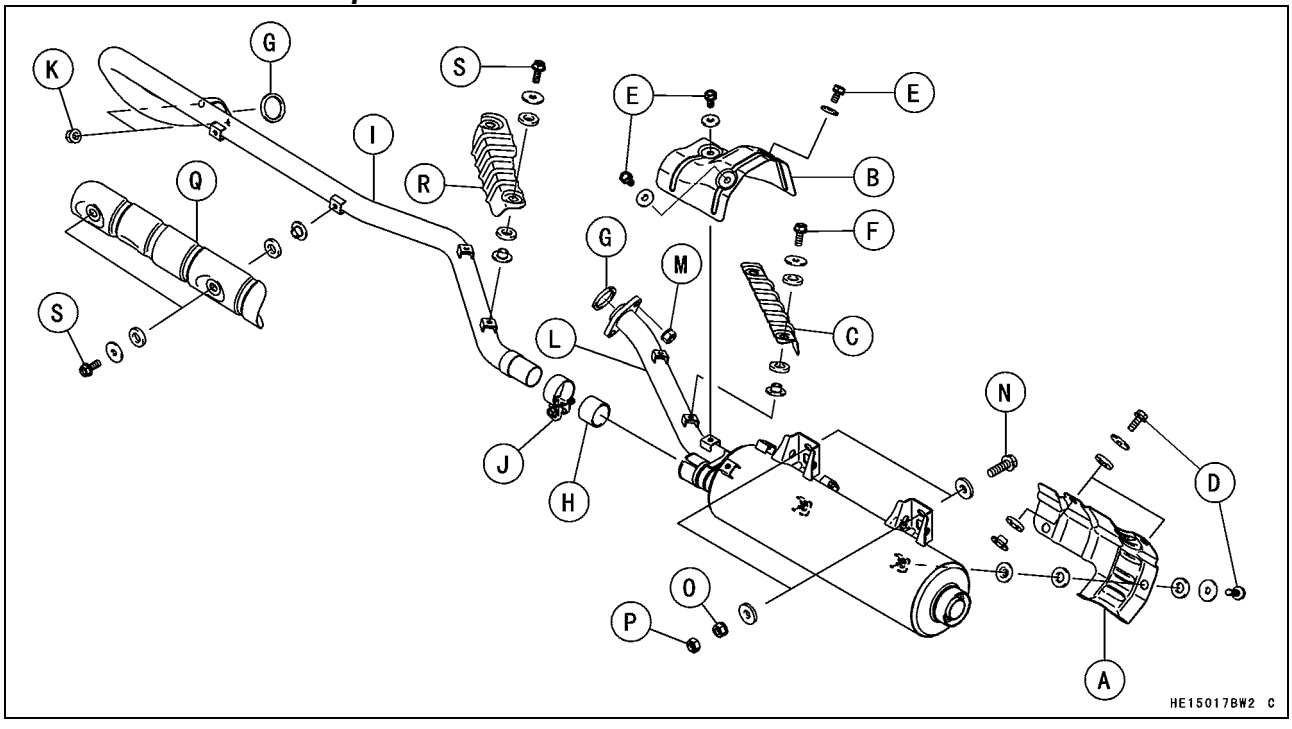


- Move the front exhaust pipe rear end [A] under the fuel tank.

- Move the front exhaust pipe front end [A] as shown.
- Turn the front exhaust pipe front end to install the front exhaust pipe.



Muffler and Exhaust Pipe Installation



Exhaust System

● If the muffler cover [A], rear and middle exhaust pipe covers [B] [C] are removed, tighten them.

Torque - Muffler Cover Bolts [D]: 8.8 N·m (0.90 kgf·m, 78 in·lb)
Rear Exhaust Pipe Cover Bolts [E]: 8.8 N·m (0.90 kgf·m, 78 in·lb)
Middle Exhaust Pipe Cover Bolts [F]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

● Replace the exhaust pipe gaskets [G] and clamp gasket [H] with new ones.
● Install (But do not tighten the following nuts and bolts.):
Front Exhaust Pipe [I], Clamp [J] and Nuts [K]
Rear Exhaust Pipe [L] and Nuts [M]
Muffler Mounting Bolts [N] and Washers
● Tighten:

Torque - Exhaust Pipe Holder Nuts: 17 N·m (1.7 kgf·m, 13 ft·lb)

● Tighten the muffler mounting nuts [O] (flange nut) and then the locknuts [P].
○Hold the nut while tightening the locknuts.

Torque - Muffler Mounting Nuts: 19.6 N·m (2.0 kgf·m, 14 ft·lb)
Muffler Mounting Locknuts: 31.4 N·m (3.2 kgf·m, 23 in·lb)
Muffler Clamp Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

● Install:
Front Exhaust Pipe Front Cover [Q]
Front Exhaust Pipe Rear Cover [R]

Torque - Front Exhaust Pipe Cover Bolts [S]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Exhaust System Inspection

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

Converter System

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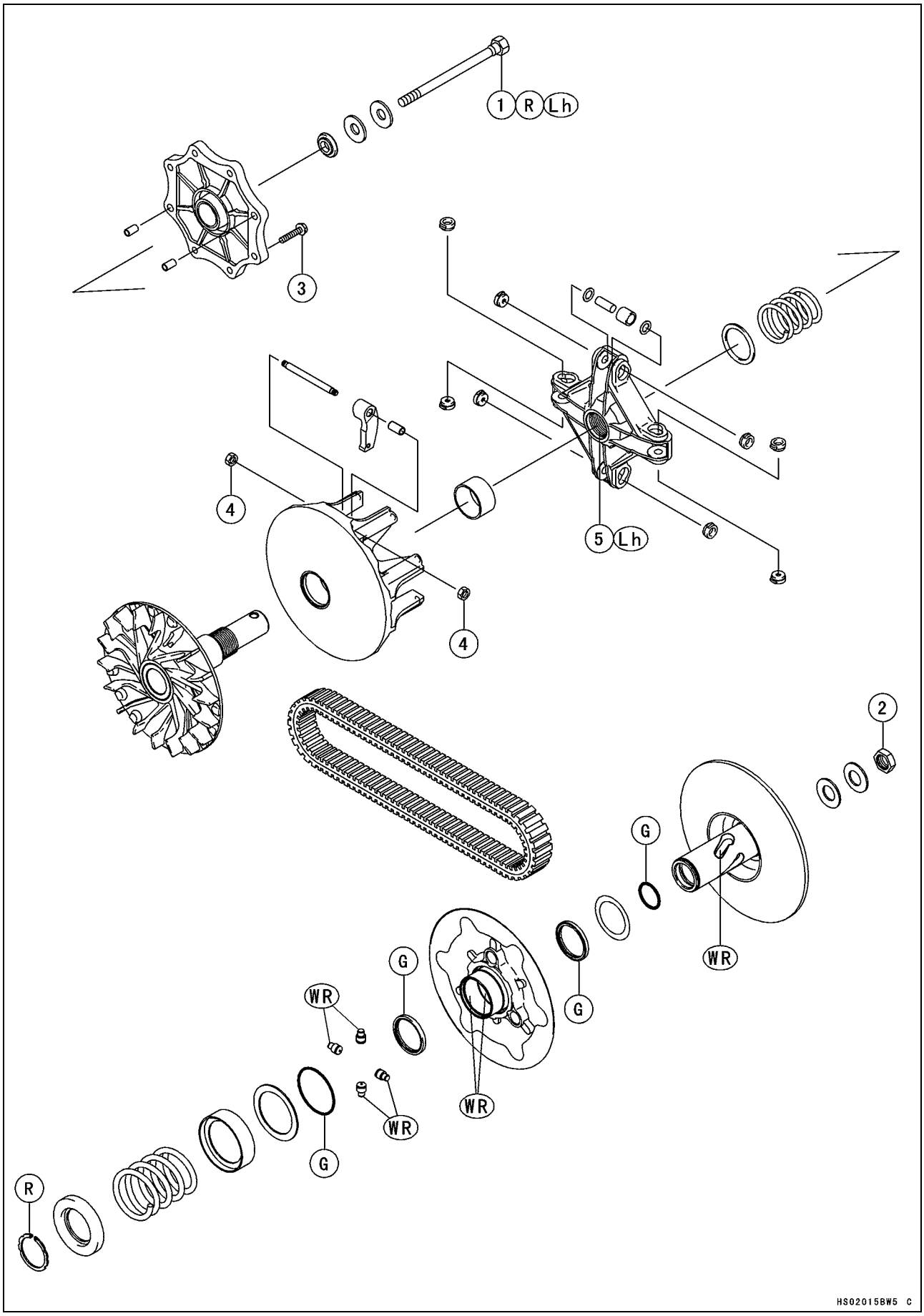
Exploded View

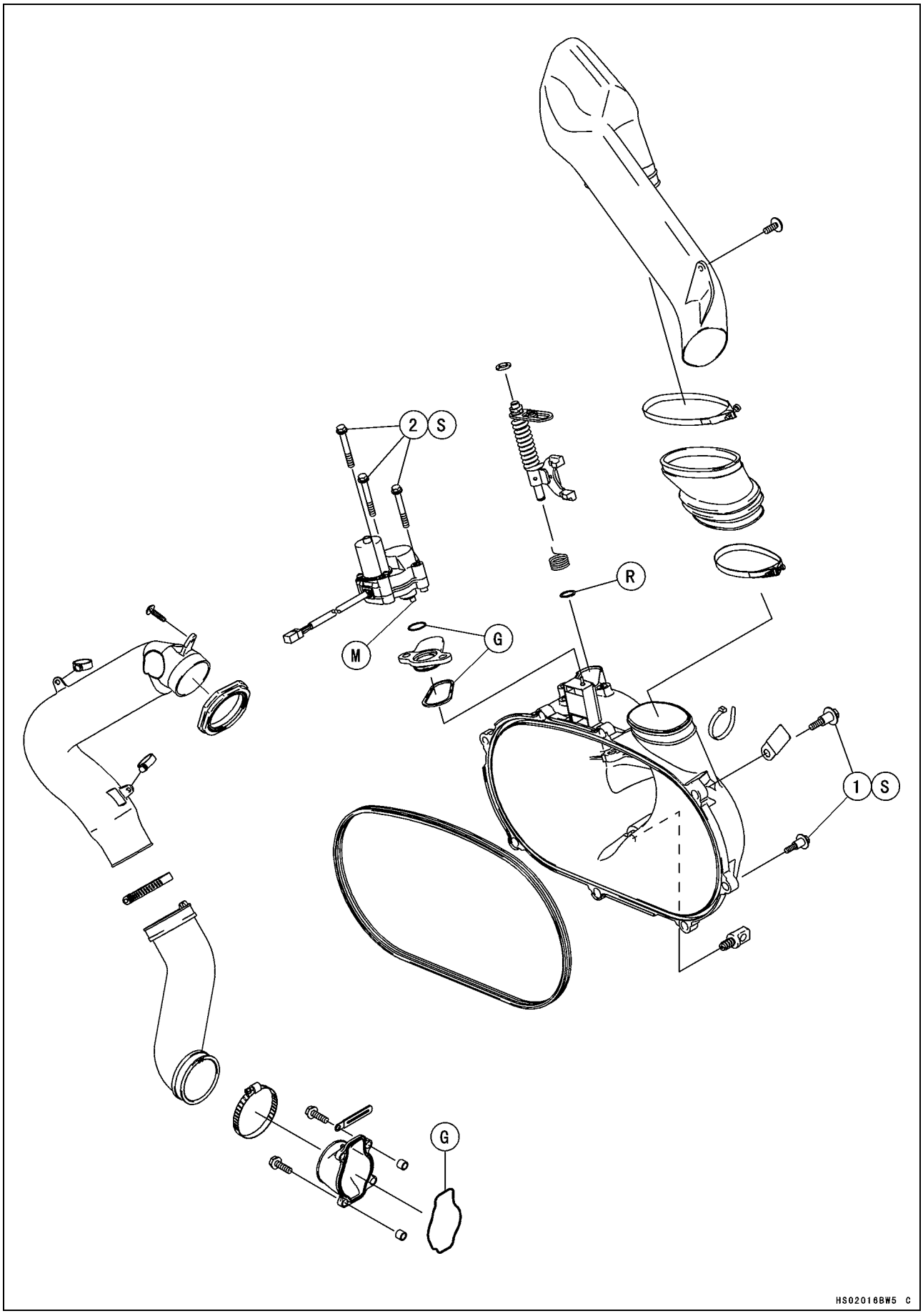


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Drive Pulley Bolt	93	9.5	68	R, Lh
2	Driven Pulley Nut	93	9.5	68	
3	Drive Pulley Cover Bolts	13	1.3	115 in·lb	
4	Ramp Weight Nuts	6.9	0.70	61 in·lb	
5	Spider	275	28	203	Lh

G: Apply grease.
Lh: Left-hand Threads
R: Replacement Parts
WR: Apply grease (WR500-No.2 KYODO YUSHI, POWER LITE WR #2 KYODO YUSHI, or SERAN -HV TOTAL FINA).

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Torque Converter Cover Bolts	8.8	0.90	78 in·lb	S
2	Engine Brake Actuator Mounting Bolts	8.8	0.90	78 in·lb	S

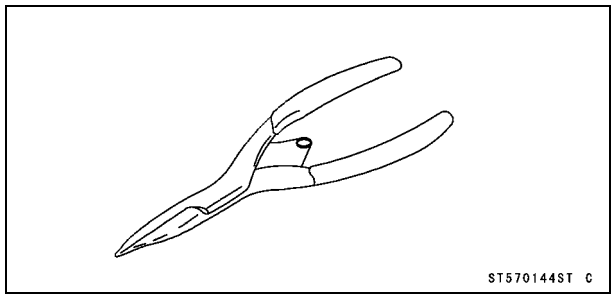
G: Apply grease.
M: Apply molybdenum disulfide grease.
R: Replacement Part
S: Follow the specific tightening sequence.

Specifications

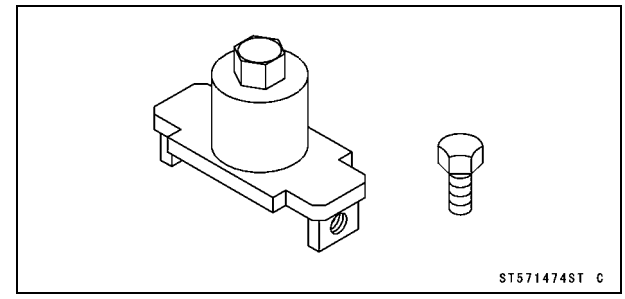
Item	Standard	Service Limit
Torque Converter		
Actuator Lever Guide Shoe	– – –	6 mm (0.24 in.)
Drive Belt		
Belt Width	29.7 ~ 30.3 mm (1.17 ~ 1.19 in.)	28.0 mm (1.10 in.)
Belt Deflection	22 ~ 27 mm (0.87 ~ 1.06 in.)	– – –
Drive Pulley		
Shoe Side Clearance	Up to 0.20 mm (0.008 in.) (in the text)	– – –
Cover Bushing Inside Diameter	27.985 ~ 28.085 mm (1.1018 ~ 1.1057 in.)	28.12 mm (1.107 in.)
Sheave Bushing Inside Diameter	37.985 ~ 38.085 mm (1.4955 ~ 1.4994 in.)	38.12 mm (1.501 in.)
Spring Free Length	59.5 mm (2.34 in.)	– – –
Driven Pulley		
Sheave Bushing Inside Diameter	40.000 ~ 40.039 mm (1.5748 ~ 1.5763 in.)	40.07 mm (1.578 in.)
Spring Free Length	75.1 mm (2.96 in.)	– – –

Special Tools

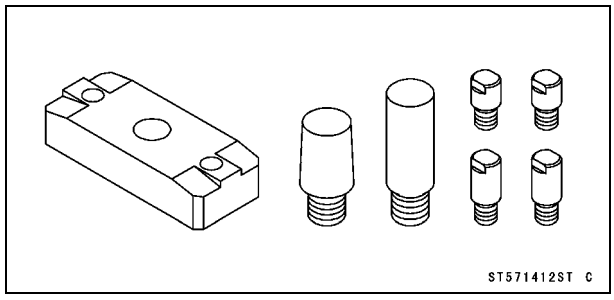
Outside Circlip Pliers:
57001-144



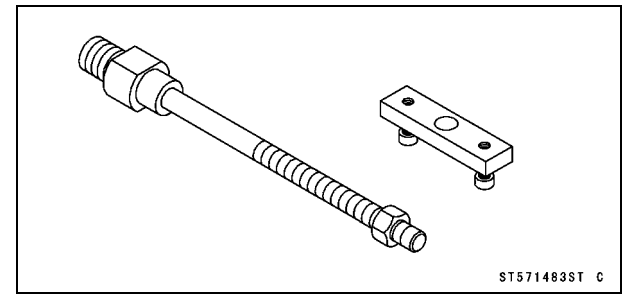
Drive Pulley Wrench:
57001-1474



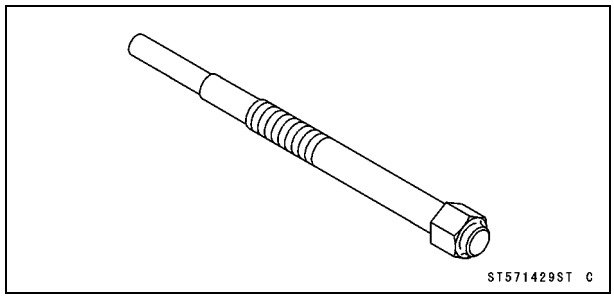
Drive & Driven Pulley Holder:
57001-1412



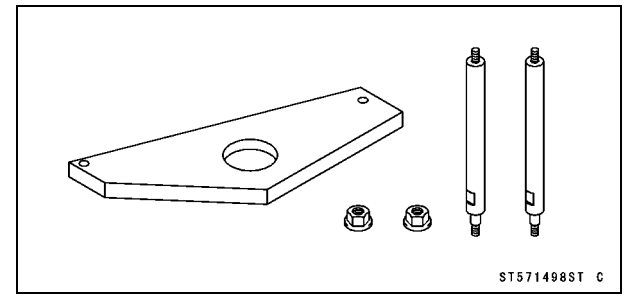
Spring Holder Set:
57001-1483



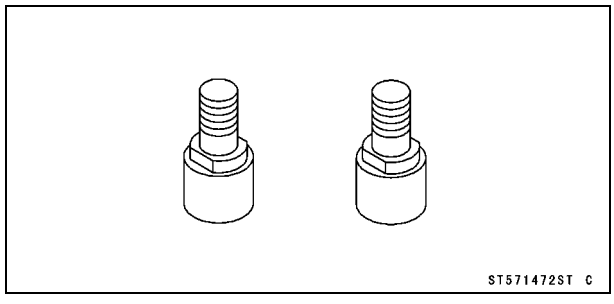
Drive Pulley Puller Bolt:
57001-1429



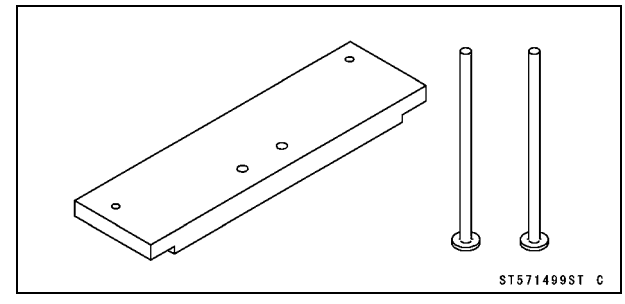
Drive Pulley Measurement Tool:
57001-1498



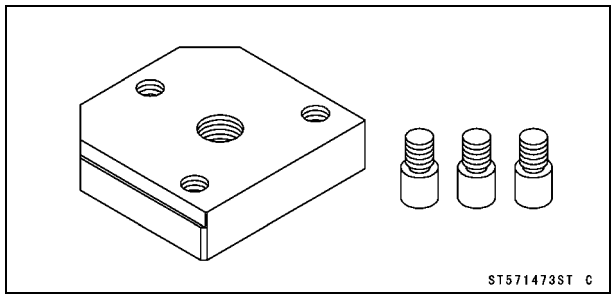
Pulley Holder Attachment:
57001-1472



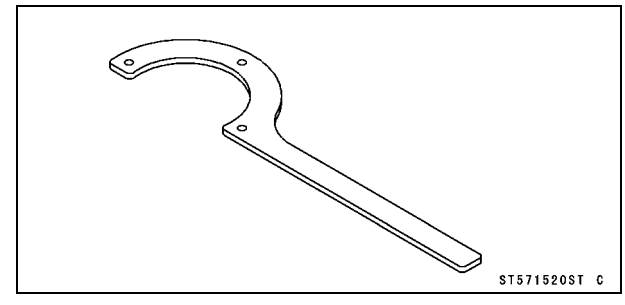
Actuator Lever Measurement Tool:
57001-1499



Drive & Driven Pulley Holder:
57001-1473

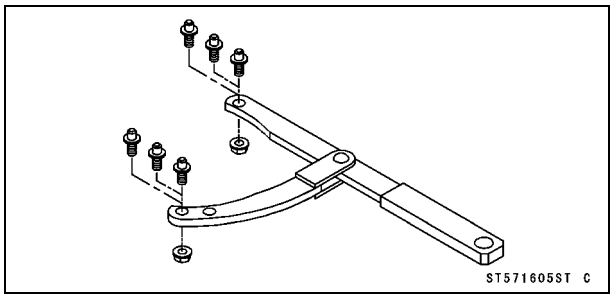


Drive Pulley Holder:
57001-1520



Special Tools

Flywheel & Pulley Holder:
57001-1605



Torque Converter Cover

⚠ WARNING

Excessive imbalance or operating rpm could cause torque converter pulley failure resulting in severe injury or death. The pulleys of the belt drive torque converter are precision balanced components designed to operate within certain rpm limits. Disassembly/assembly and servicing procedures of the pulley assemblies must be followed closely. Modifications to the engine or pulleys that increase rpm may cause failure.

NOTICE

Do not turn the ignition switch OFF position from ON position, while the torque converter cover is removed.
If it is done, the learning control of Kawasaki Engine Brake Control system works and the engine brake actuator works an error operation.

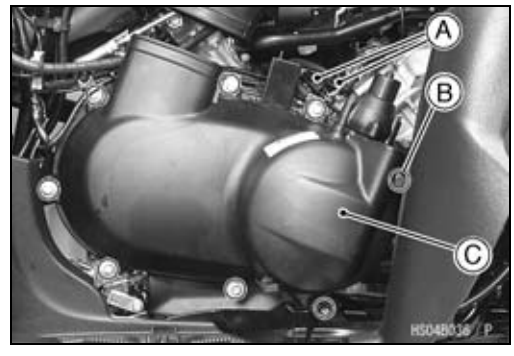
NOTE

○*If the drive belt failure detection system is activated by abnormal belt, the drive belt failure detection switch is damaged. Make sure to replace the torque converter cover (see Torque Converter Cover Removal/Installation).*

Torque Converter Cover Removal

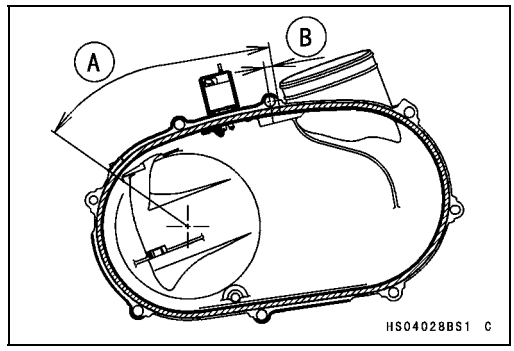
- Confirm that the ignition switch is in OFF position.
- Remove:
  Right Side Cover (see Right Side Cover Removal in the Frame chapter)
  Clamp Screws [A] and Clamps
  Rubber Air Duct [B]

- Remove:
  Actuator Lead Connector and Drive Belt Failure Detection Switch Lead Connector [A]
  Torque Converter Cover Bolts [B]
  Torque Converter Cover [C]



Torque Converter Cover

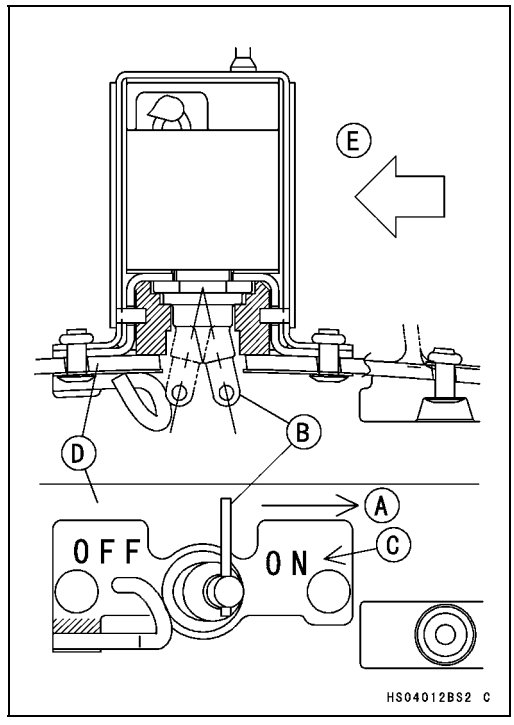
Torque Converter Cover Installation



- Check the actuator lever assembly installation length (see Torque Converter Cover Assembly).
- Fit the trim seal into the converter cover.

○Set the trim seal juncture in the area [A] when insert the trim seal in the cover.
[B] 10 mm (0.39 in.)

- Check:
  Drive Belt Failure Detection Switch (see Switch Inspection section in Electric System chapter)
- Set [A] the switch lever [B] to the ON mark side [C].
  [D] Converter Cover
  [E] Front



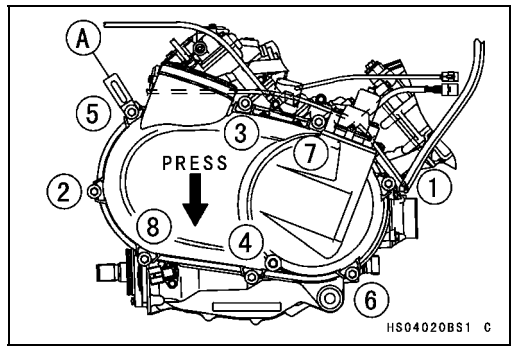
NOTE

○*The failure detection system is activated when the switch is in the ON position. This is the normal running mode. Engine rpm is limited when the switch is in the OFF position.*

- Tighten (loosely):
  #3 Bolt
  #1 and #2 Bolts
- Press the cover downward and tighten the cover bolts following the tightening sequence as shown.

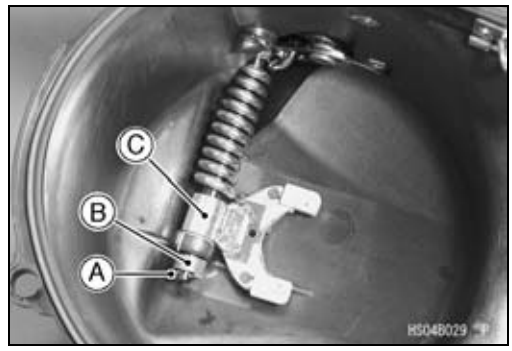
Torque - Torque Converter Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

[A] Clamp



Torque Converter Cover Disassembly

- Remove:
  Torque Converter Cover (see Torque Converter Cover Removal)
  Engine Brake Actuator (see Engine Brake Actuator Removal in the Electrical System chapter)
  Circlip [A]
  Spring [B]
  Actuator Lever Assembly [C]



Torque Converter Cover

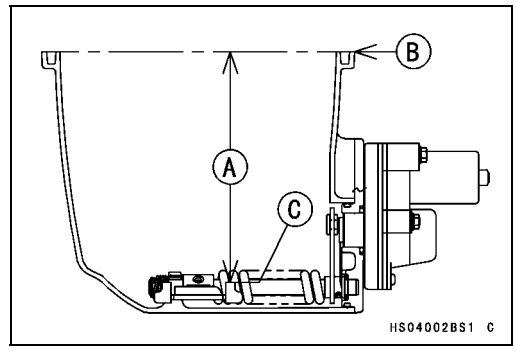
Actuator Lever (Engine Brake Control Lever) Assembly Inspection

● Refer to the Actuator Lever (Engine Brake Control Lever) Assembly Inspection in the Periodic Maintenance chapter.

Torque Converter Cover Assembly

● Install:
New Circlip
Spring
Actuator Lever Assembly
Engine Brake Actuator (see Engine Brake Actuator Installation in the Electrical System chapter)

Torque - Engine Brake Actuator Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

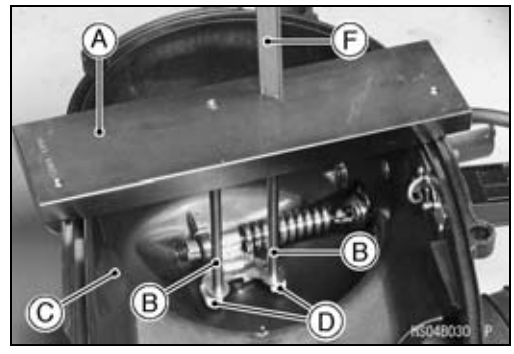


● Measure the installation length [A] of the actuator lever assembly between the cover end [B] and resin tips [C] on the actuator lever assembly as follows:

Actuator Lever Assembly Installation Length
Standard: 149.33 ~ 150.47 mm (5.879 ~ 5.924 in.)

○Remove the trim seal.
○Install the actuator lever measurement tool (plate [A] and rods [B]) on the torque converter cover [C] and tighten the two cover bolts.

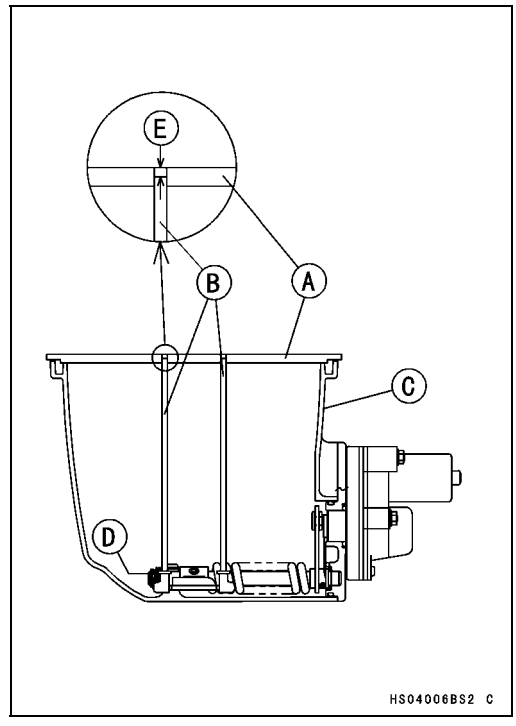
Special Tool - Actuator Lever Measurement Tool: 57001 -1499



○Set the rod ends on the resin tips [D].
○Measure the recess length [E] between the plate and rods with Vernier calipers [F] or depth gauge.

Measurement Length [E]
Standard: 1.33 ~ 2.47 mm (0.052 ~ 0.097 in.)

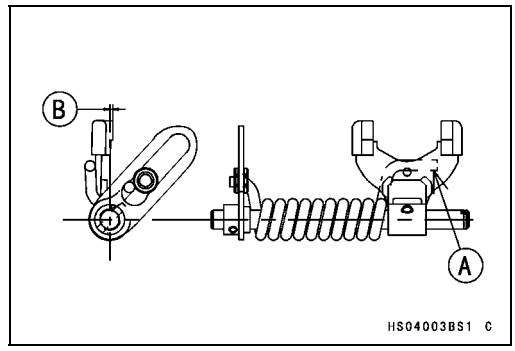
★If the measurement is less than 1.33 mm (0.052 in.), use the actuator lever assembly (13236-0046) of yellow paint.
★If the measurement is more than 2.47 mm (0.097 in.), use the actuator lever assembly (13236-0047) of green paint.
★If the length is not within the specified length after the actuator lever assembly is replaced, replace the torque converter cover, and install the actuator lever assembly (13236-0048).



Torque Converter Cover

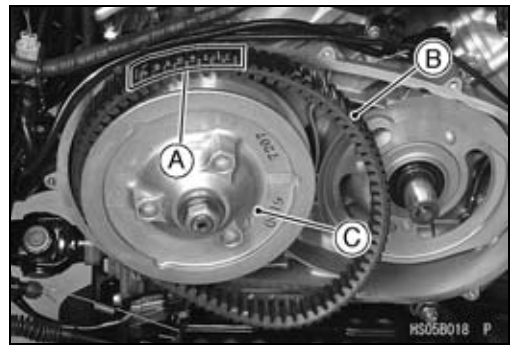
Actuator Lever Assemblies

Part Number	Paint Color [A]	Length [B]
13236-0046	Yellow	0.4 ±0.1 mm (0.016 ±0.004 in.)
13236-0048	None	1.0 ±0.1 mm (0.039 ±0.004 in.)
13236-0047	Green	1.6 ±0.1 mm (0.063 ±0.004 in.)



Drive Belt

Drive Belt Removal



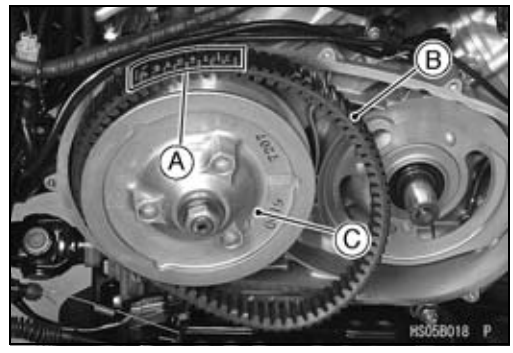
- Remove the drive pulley (see Drive Pulley Removal).

NOTE

○*Before removing, observe the direction the belt's printed information [A] (such as manufacturer's name) is facing so that it may be reinstalled on the pulleys to rotate in the same direction as originally installed.*

- Lift the drive belt [B] off the driven pulley [C].

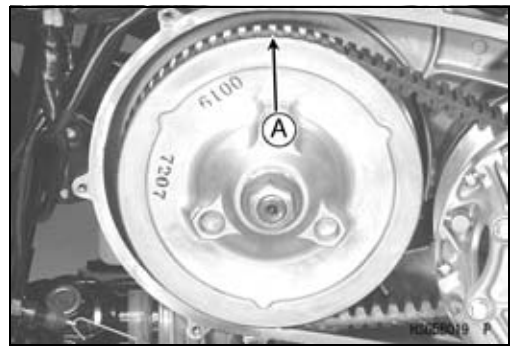
Drive Belt Installation



NOTE

○*Be sure the printed information faces the same direction so the belt rotates in the same direction as originally installed. When installing a new belt, install it so the printed information [A] can be read from beside the vehicle.*

- Installation is basically the reverse of removal.
- Loop the belt [B] over the driven pulley [C].
- Install the drive pulley (see Drive Pulley Installation).



- Put the transmission in neutral, and rotate the driven pulley to allow the belt to return to the top [A] of the sheaves, before measuring belt deflection.

Drive Belt Deflection Inspection

- Refer to the Drive Belt Deflection Inspection in the Periodic Maintenance chapter.

Drive Belt Deflection Adjustment

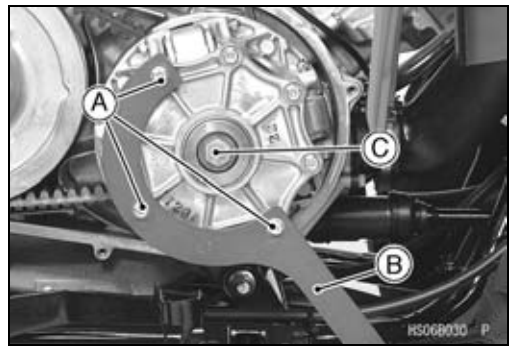
- Refer to the Drive Belt Deflection Adjustment in the Periodic Maintenance chapter.

Drive Belt Inspection

- Refer to the Drive Belt Inspection in the Periodic Maintenance chapter.

Drive Pulley

Drive Pulley Removal



- Remove:
  Torque Converter Cover (see Torque Converter Cover Removal)
  Right Footboard (see Right Footboard Removal in the Frame chapter)
- Remove the three cover bolts [A] and install the drive pulley holder [B].

Special Tool - Drive Pulley Holder: 57001-1520

- Tighten the three cover bolts:

Torque - Drive Pulley Cover Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)

- Loosen the drive pulley bolt [C] (left-hand threads), holding the drive pulley with the drive pulley holder.

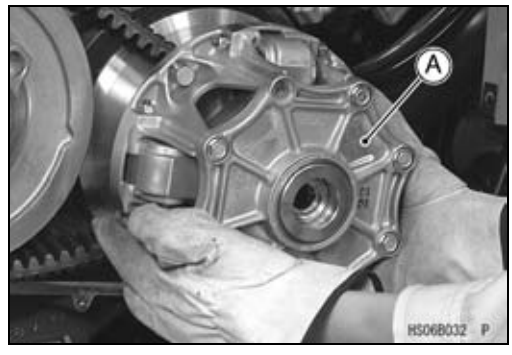
NOTE

○*The drive pulley bolt has left-hand threads. Turn the wrench clockwise for loosening.*

- Remove the drive pulley bolt, two washers, and the stepped washer, but do not remove the drive pulley holder yet.

- Screw the drive pulley puller bolt [A] **clockwise**, while holding the drive pulley with the drive pulley holder [B].

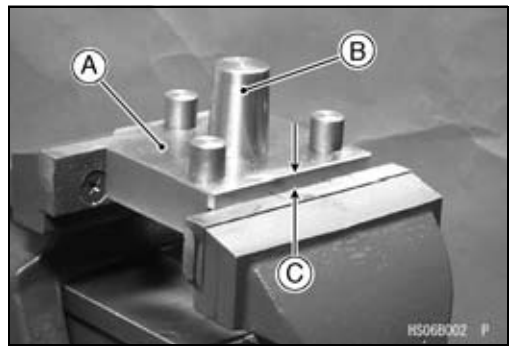
Special Tools - Drive Pulley Puller Bolt: 57001-1429
Drive Pulley Holder: 57001-1520



- Remove the puller bolt and pulley holder.

○Remove the drive pulley [A] from the crankshaft as shown.

Drive Pulley Disassembly

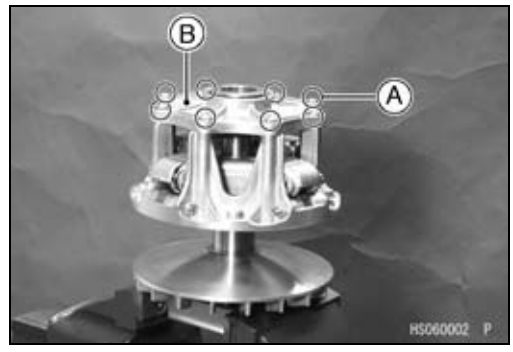


- Hold the drive & driven pulley holder (57001-1473) [A] and the tapered guide of the holder (57001-1412) [B] in a vise so that the upper surface on the holder is 7 mm (0.28 in.) [C] above the vise.

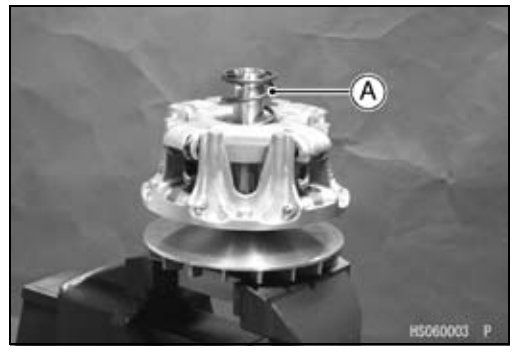
Special Tools - Drive & Driven Pulley Holder: 57001-1473
Drive & Driven Pulley Holder: 57001-1412

Drive Pulley

- Set the pulley onto the pulley holder.
- Remove:
  Drive Pulley Cover Bolts [A]
  Drive Pulley Cover [B]



- Remove:
  Spring [A]
  Spacer



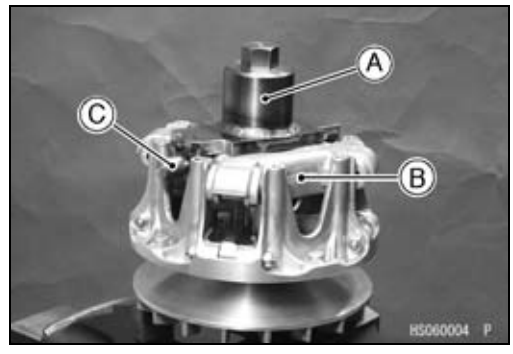
- Put the drive pulley wrench [A] on the spider [B] and tighten the bolt [C].

  Special Tool - Drive Pulley Wrench: 57001-1474

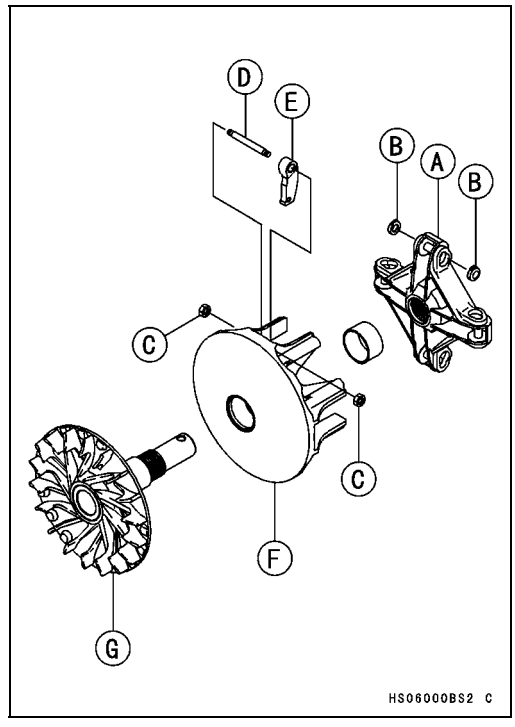
- Turn the wrench clockwise and remove the spider with the movable sheave.

NOTE

○*The spider has left-hand threads. Turn the wrench clockwise for loosening.*



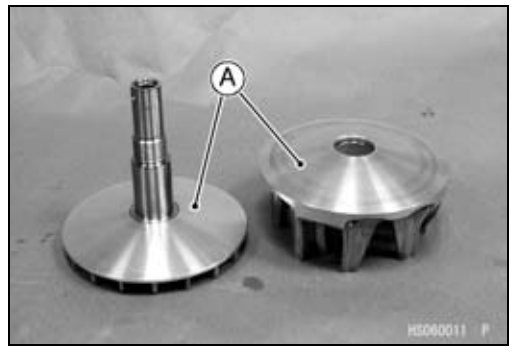
- Remove:
  Spider [A]
  Shoes [B]
  Nuts [C]
  Ramp Weight Pin [D]
  Ramp Weight [E]
  Movable Sheave [F]
  Fixed Sheave [G]



Drive Pulley

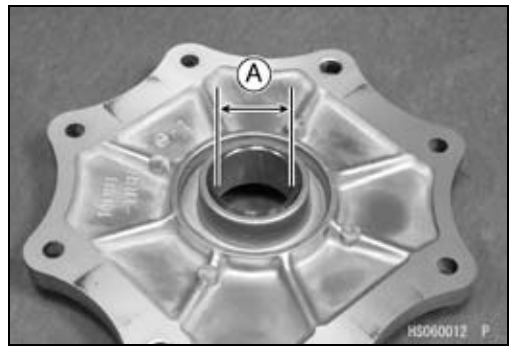
Drive Pulley Inspection

★If the sheave surfaces [A] appear damaged, replace the sheaves.



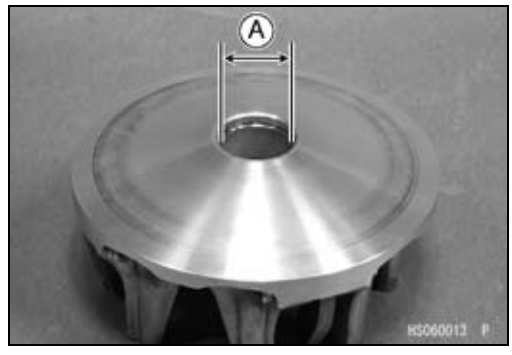
★If the cover bushing is damaged or worn, replace the drive pulley cover.

Cover Bushing Inside Diameter [A]
Standard: 27.985 ~ 28.085 mm (1.1018 ~ 1.1057 in.)
Service Limit: 28.12 mm (1.107 in.)

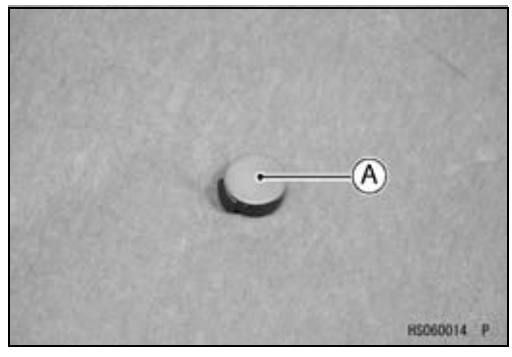


★If the sheave bushing is damaged or worn, replace it.

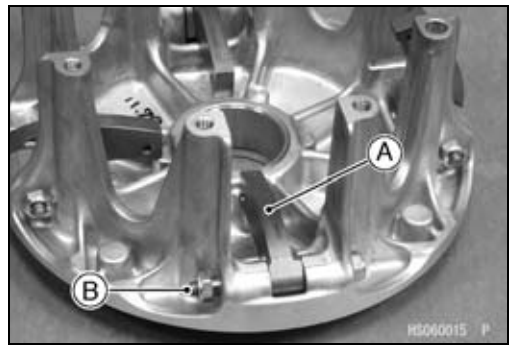
Sheave Bushing Inside Diameter [A]
Standard: 37.985 ~ 38.085 mm (1.4955 ~ 1.4994 in.)
Service Limit: 38.12 mm (1.501 in.)



★If the spider shoes [A] are damaged, replace them.
● Check the spider shoe side clearance (see Spider Shoe Side Clearance Inspection).

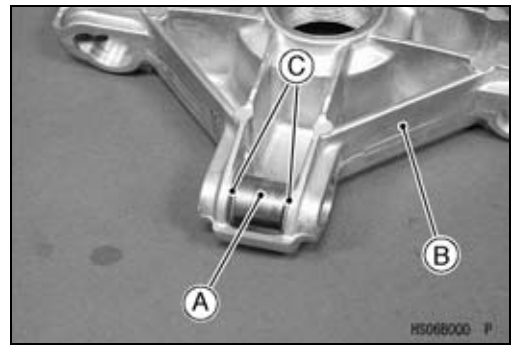


★If the ramp weights [A] in the movable sheave are damaged or worn, replace them.
★If the pins [B] are damaged or worn, replace them.



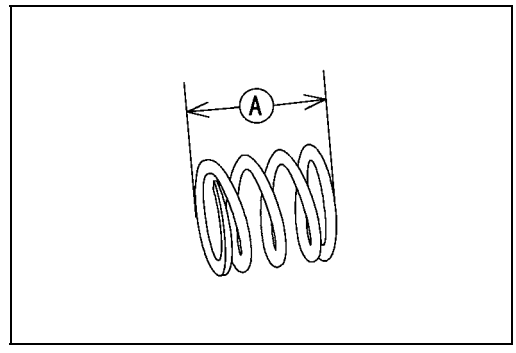
Drive Pulley

★If the rollers [A] are damaged or worn, replace the spider [B].
★If the washers [C] are damaged or worn, replace the spider.



★If the spring is worn or damaged, replace the spring.

Spring Free Length [A]
Standard: 59.5 mm (2.34 in.)



Spider Shoe Side Clearance Inspection/Adjustment

● Remove:
Drive Pulley (see Drive Pulley Removal)
Drive Pulley Cover and Spring (see Drive Pulley Disassembly)
● Temporarily install the following parts on the movable sheave.
Dowel Pins (2)
Drive Pulley Cover
Two Bolts (at dowel pins)
○Do not install the spring.

Drive Pulley

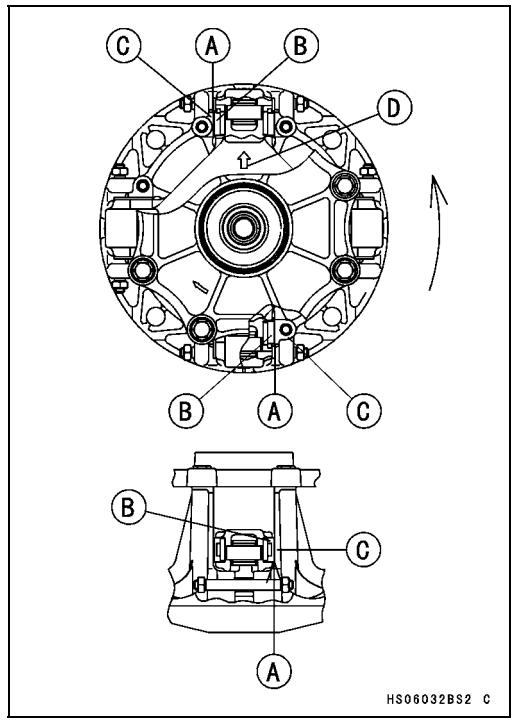
- Turn the movable sheave counterclockwise.
- Measure the resulting clearance [A] between the shoe [B] and the post [C] on the movable sheave at two positions as shown.
  [D] Arrow Mark

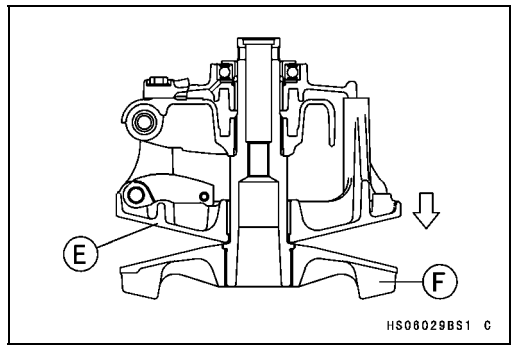
Shoe Side Clearance

Standard: up to 0.20 mm (0.008 in.), and there must be kept a clearance which the movable sheave [E] moves smoothly until it touches the fixed sheave [F] with its own weight.

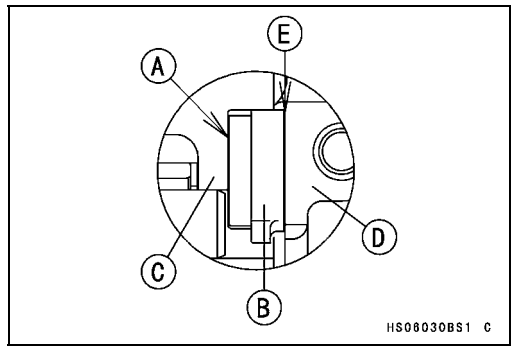
★If the clearance is not the specified range, adjust it using the following shoes.

	Part Number	Thickness
Standard Shoe	49048-1090	7.5 mm (0.295 in.)
Adjustment Shoes	49048-1087	7.2 mm (0.283 in.)
	49048-1088	7.3 mm (0.287 in.)
	49048-1089	7.4 mm (0.291 in.)
	49048-1091	7.6 mm (0.299 in.)
	49048-1092	7.7 mm (0.303 in.)
	49048-1093	7.8 mm (0.307 in.)
	49048-1094	7.9 mm (0.311 in.)
	49048-1095	8.0 mm (0.315 in.)





★If the clearance is not the specified range after the above shoes are replaced, use the spacer [A] (92026-0038) of the option part.
[B] Shoe
[C] Spider
[D] Post
[E] Clearance

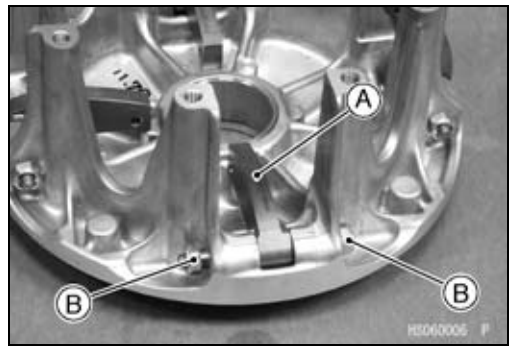


Drive Pulley Assembly

- Install the ramp weight [A] as shown.
- Tighten:

Torque - Ramp Weight Nuts [B]: 6.9 N·m (0.70 kgf·m, 61 in·lb)

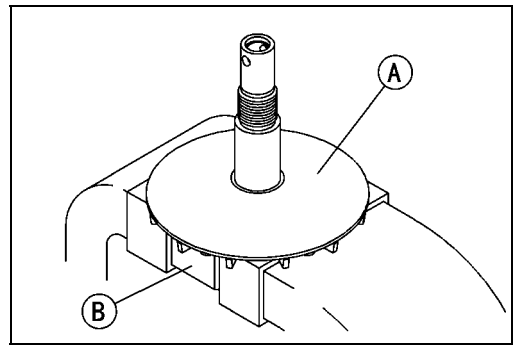
- Check that the ramp weights swing smoothly.



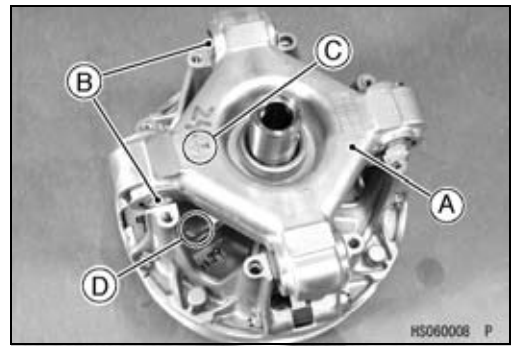
Drive Pulley

● Hold the fixed sheave [A] with the drive pulley holder [B] in a vise.

Special Tool - Drive & Driven Pulley Holder: 57001-1473



● Clean the threads of the fixed sheave and spider.
● Install:
Movable Sheave
Spider [A] and Shoes [B]
○Align the arrow [C] on the spider with the arrow [D] on the movable sheave.
○Insert the shoes so that the rubber side (black, small diameter) faces inward.



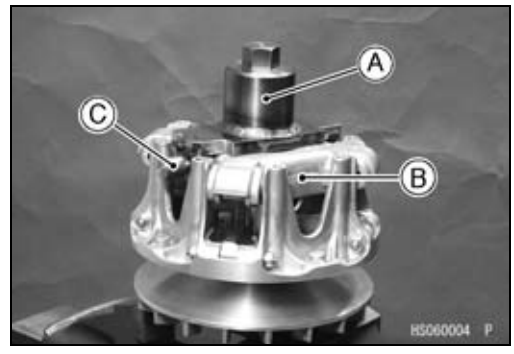
● Put the drive pulley wrench [A] on the spider [B] and tighten the bolt [C].

Special Tool - Drive Pulley Wrench: 57001-1474

● Turn the wrench counterclockwise for tightening.

Torque - Spider (left-hand threads): 275 N·m (28 kgf·m, 203 ft·lb)

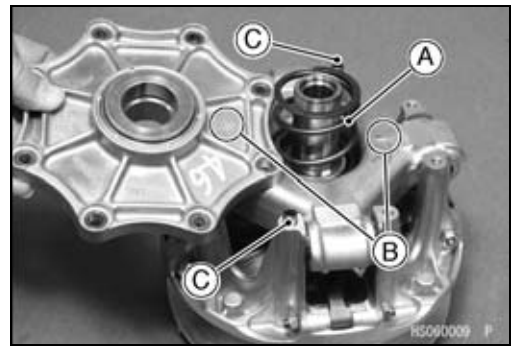
● Remove the drive pulley wrench.



● Install the spacer.
● Put the spring [A] in the groove of the spider.
● Align the arrows [B] on the drive pulley cover and spider.
● Install:
Dowel Pins [C]
Drive Pulley Cover
● Tighten:

Torque - Drive Pulley Cover Bolts: 13 N·m (1.3 kgf·m, 115 in·lb)

● Clean the surface of the sheaves with an oil-less cleaning fluid.

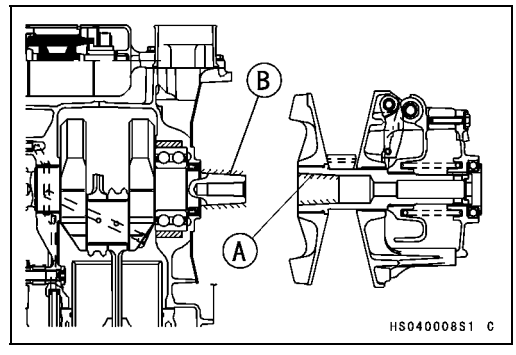


Drive Pulley Installation

● Clean the following portions with an oil-less cleaning fluid such as trichloroethylene or acetone.
Fixed Sheave Tapered Portion [A]
Crankshaft Tapered Portion [B]

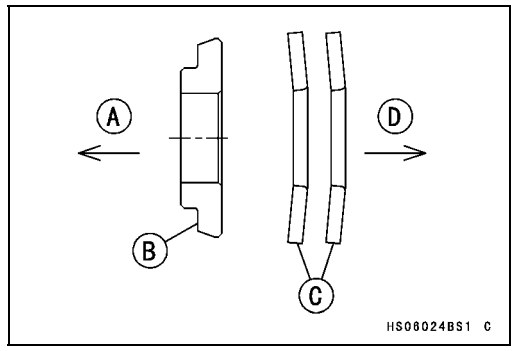
⚠ WARNING

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



Drive Pulley

- Install the drive pulley, stepped waster and two washers on the drive pulley bolt as shown.
  Crankcase Side [A]
  Stepped Washer [B]
  Two Washers [C]
  Bolt Head Side [D]

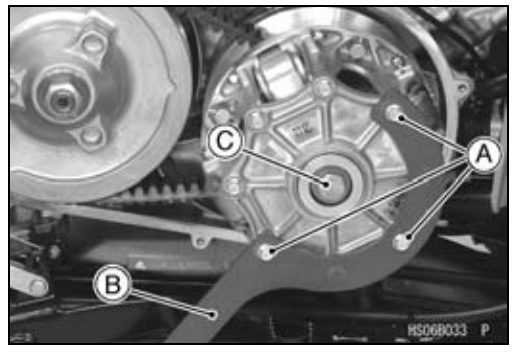


- Remove the three cover bolts [A] and install the drive pulley holder [B].

  Special Tool - Drive Pulley Holder: 57001-1620

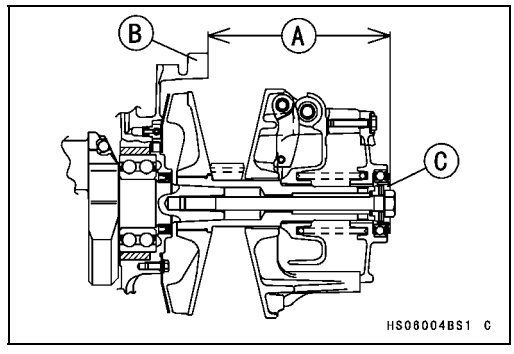
- Tighten:

  Torque - Drive Pulley Cover Bolts: 13 N·m (1.3 kgf·m, 115 in·lb)
  Drive Pulley Bolt [C] (new, left-hand threads): 93 N·m (9.5 kgf·m, 68 ft·lb)



- Remove the drive pulley holder and install three drive pulley cover bolts to the specified torque.
- Adjust the installation length [A] of the drive pulley between the surface of the crankcase [B] and the collar [C] on the drive pulley as followings.

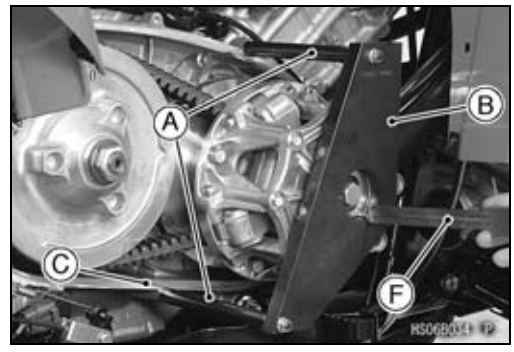
  Drive Pulley Installation Length [A]
  Standard: 149.85 ~ 150.95 mm (5.900 ~ 5.943 in.)



Drive Pulley

○Install the drive pulley measurement tool (legs [A] and plate [B]) on the crankcase [C].

Special Tool - Drive Pulley Measurement Tool: 57001-1498

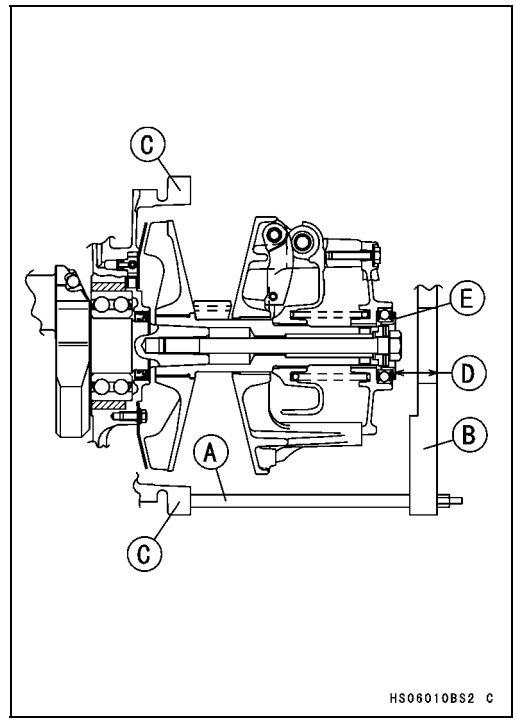


○Measure the length [D] between the plate and collar [E] with vernier calipers [F] or a depth gauge.

Measurement Length [D]
Standard: 14.55 ~ 15.65 mm (0.573 ~ 0.616 in.)

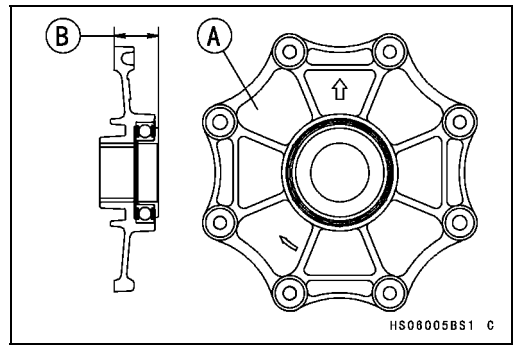
★If the measurement is not within the specified range, adjust it according to following table.

Status Quo		Replacement Part	
Measurement Length	Paint Color of Cover	Replace Part (Part Number)	Paint Color of Cover
less than 14.55 mm (0.573 in.)	Blue	Pulley Cover (14041-1161)	No Paint
	No Paint	Pulley Cover (14041-1159)	Red
	Red	Drive Pulley Assembly (49093-0022)	
more than 15.65 mm (0.616 in.)	Blue	Drive Pulley Assembly (49093-0022)	
	No Paint	Pulley Cover (14041-1160)	Blue
	Red	Pulley Cover (14041-1161)	No Paint



Drive Pulley Covers

Part Number	Paint Color [A]	Length [B]
14041-1159	Red	24.0 mm (0.945 in.)
14041-1160	Blue	25.4 mm (1.000 in.)
14041-1161	No Paint	24.7 mm (0.972 in.)

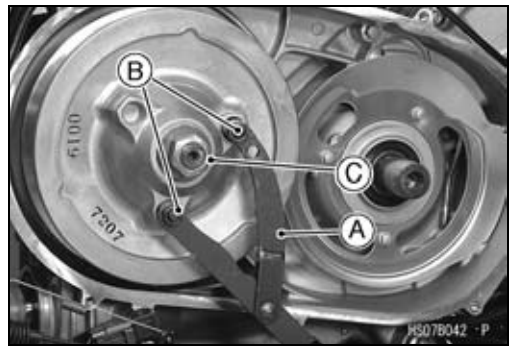


● Measure the length again, after the drive pulley cover is replaces.

★If the length is not within the specified length, replace the drive pulley assembly.

Driven Pulley

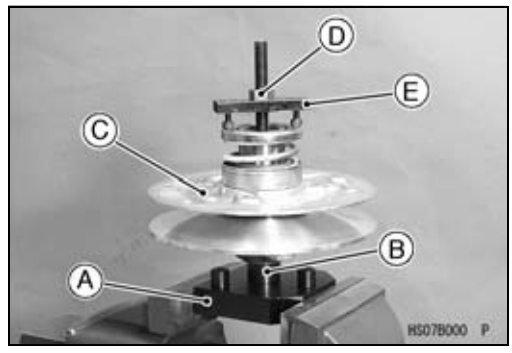
Driven Pulley Removal



- Remove:
  Torque Converter Cover (see Torque Converter Cover Removal)
  Drive Pulley (see Drive Pulley Removal)
  Drive Belt (see Drive Belt Removal)
- Using the flywheel & pulley holder [A] and attachments [B], remove the driven pulley nut [C] and washers. (Nut has R/H threads.)

  Special Tools - Flywheel & Pulley Holder: 57001-1605
  Pulley Holder Attachment: 57001-1472
- Remove:
  Driven Pulley

Driven Pulley Disassembly

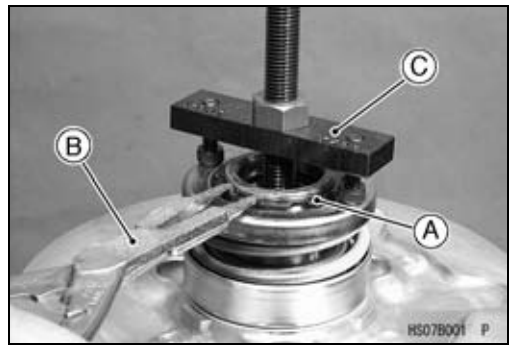


- Hold the drive & driven pulley holder [A] in a vise.

  Special Tool - Drive & Driven Pulley Holder: 57001-1473
- Screw the guide bar [B] into the holder.

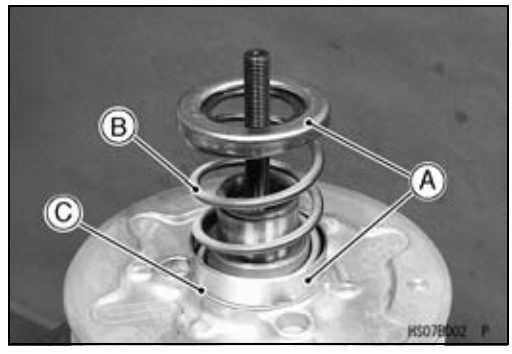
  Special Tool - Spring Holder Set: 57001-1483
- Put the driven pulley [C] on the guide bar.
- Tighten the nut [D], and compress the spring with the spring holder [E].

  Special Tool - Spring Holder Set: 57001-1483



- Remove the circlip [A] with circlip pliers [B].

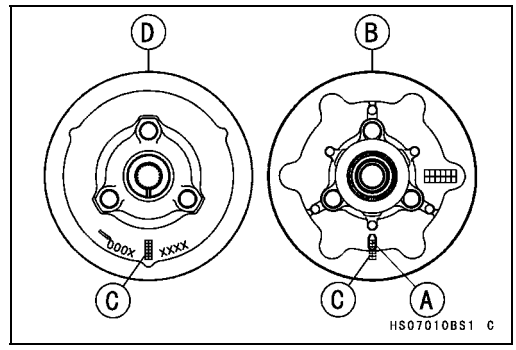
  Special Tool - Circlip Pliers: 57001-144
- Remove the nut and spring holder [C].



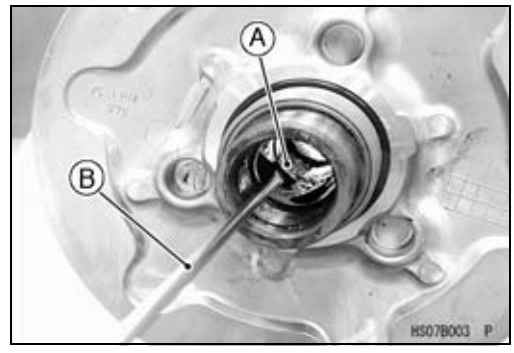
- Remove:
  Spring Seats [A]
  Spring [B]
  Thrust Plate [C]

Driven Pulley

- Confirm the paint mark “0” [A] on the movable sheave [B] in alignment with the point [C] on the fixed sheave [D] for phase fit of the sheaves.



- Wipe off the molybdenum disulfide grease.
- Remove the four pins [A] with a thin standard tip screwdriver [B].
- Remove the movable sheave from the fixed sheave.

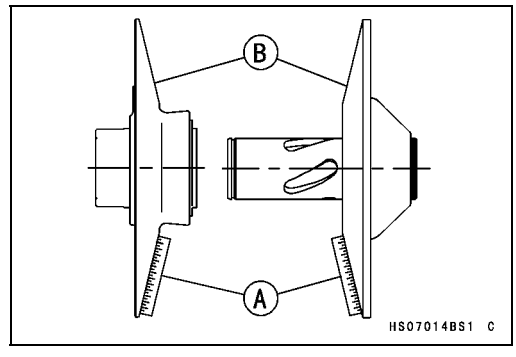


- Remove:
  Spacer(s) [A] (for Drive Belt Deflection Adjustment)

Driven Pulley Inspection

★If the sheave surfaces [A] appear damaged, replace the sheaves.

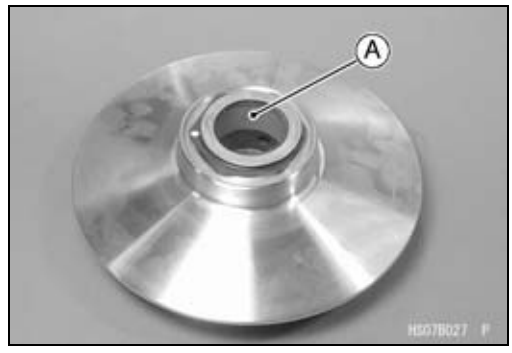
- Replace the sheave with uneven wear on the belt contacting surfaces.
  [A] Straight Edge
  [B] Sheave Surface



Driven Pulley

★If the sheave bushings [A] are damaged or worn, replace the movable sheave.

Sheave Bushing Inside Diameter
Standard: 40.000 ~ 40.039 mm (1.5748 ~ 1.5763 in.)
Service Limit: 40.07 mm (1.578 in.)

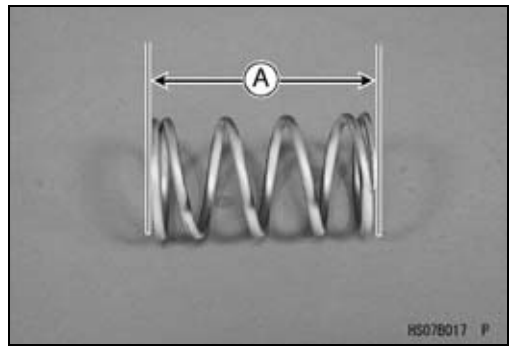


● Inspect seals for damage.
★If seals are damaged, replace the movable sheave.

★If the splines [A] are damaged or worn, replace the fixed sheave.

★If the spring is damaged or worn, replace the spring.

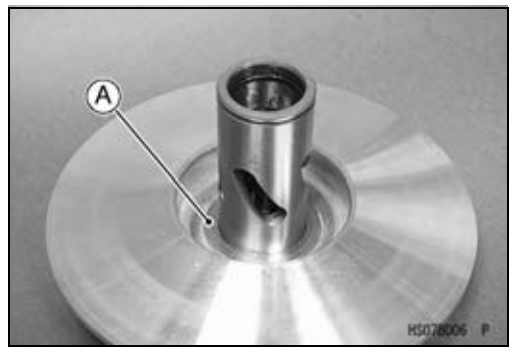
Spring Free Length [A]
Standard: 75.1 mm (2.96 in.)



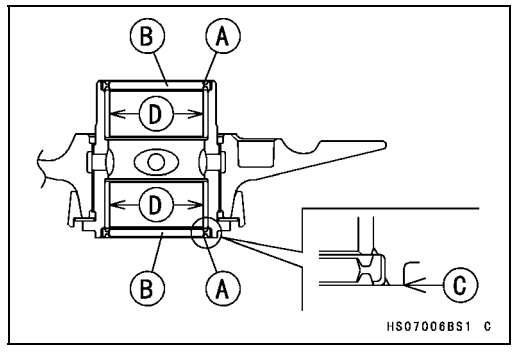
★If the spring coils are distorted, replace the spring.

Driven Pulley Assembly

● Clean off any grease or dirt on the movable and fixed sheaves, and dry them with a clean cloth.
● Install:
Spacers [A] (see Converter Drive Belt Deflection Adjustment in the Periodic Maintenance chapter)

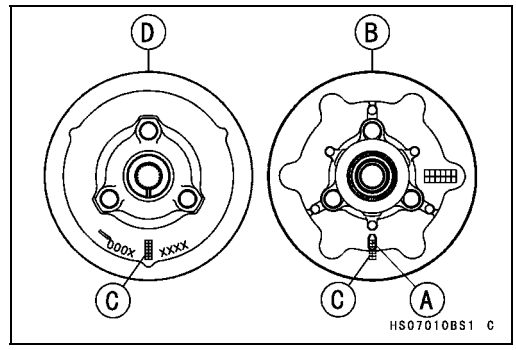


● Apply grease to the oil seal lips [A].
● Press the oil seals [B] in the movable sheave assembly so that the oil seal surface is flush [C] with the sleeve end.
● Apply [D] grease (WR500-No.2 (KYODO YUSHI), POWER LITE WR #2 (KYODO YUSHI), or SERAN-HV (TOTAL FINA)) to the inner surfaces of the busings.

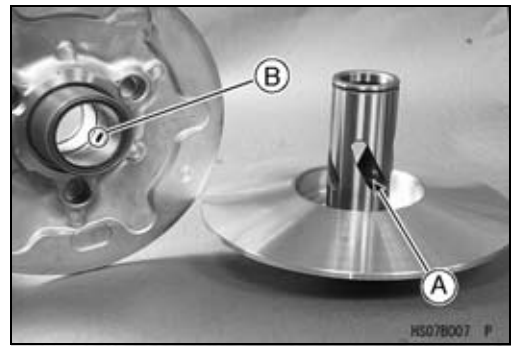


Driven Pulley

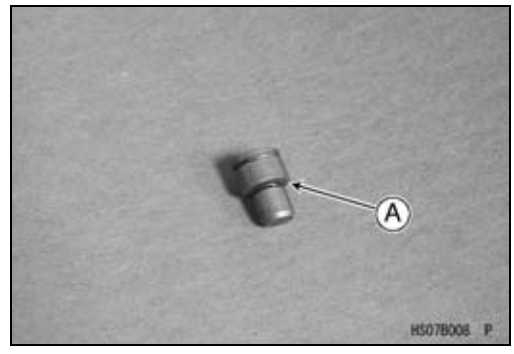
● Align the paint mark “0” [A] on the movable sheave [B] with the point [C] on the fixed sheave [D] for phase fit of the sheaves.



○In that case the opening [A] and hole [B] will be matched easily.



● Apply grease (WR500-No.2 (KYODO YUSHI), POWER LITE WR #2 (KYODO YUSHI), or SERAN-HV (TOTAL FINA)) to the seating surface [A] of the pins, and insert them into the holes in the movable sheave.

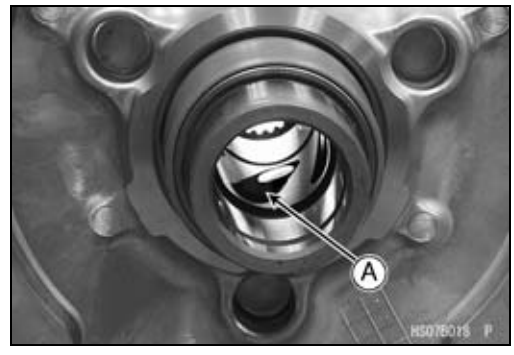


● Draw the movable sheave onto the fixed sheave, and apply grease of 1 g (0.035 oz) to all openings [A].

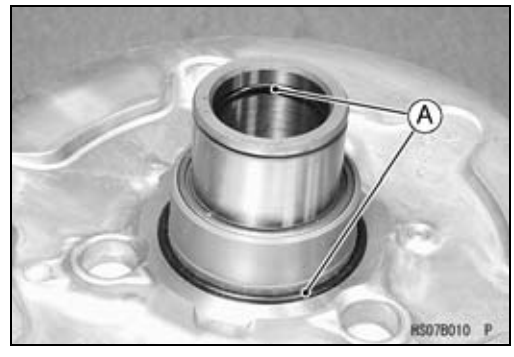
Grease - WR500-No.2 (KYODO YUSHI) or POWER LITE WR #2 (KYODO YUSHI) or SERAN-HV (TOTAL FINA)

NOTE

○*Do not heap up the grease out of the openings.*



● Check that the O-rings [A] are in good condition.
★If any of the O-rings are damaged, replace them.
● Apply grease to the O-rings.



Driven Pulley

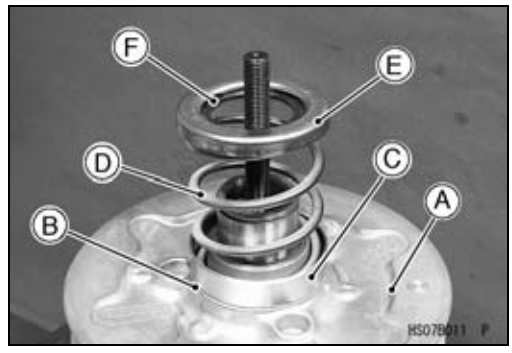
● Hold the drive & driven pulley holder in a vise.

Special Tool - Drive & Driven Pulley Holder: 57001-1473

● Screw the guide bar into the holder.

Special Tool - Spring Holder Set: 57001-1483

● Put the driven pulley [A] onto the guide bar.
● Put the thrust plate [B] so that the alloy side (gray) faces the movable sheave.
● Install:
Spring Seat [C]: 18.5 mm (0.728 in.)
Spring [D]
Spring Seat [E]: 9.3 mm (0.366 in.)
Circlip [F]



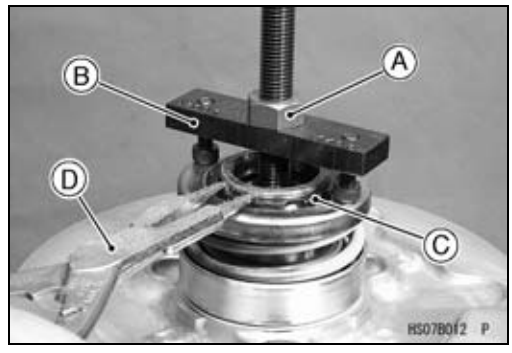
● Tighten the nut [A], and compress the spring with the spring holder [B].

Special Tool - Spring Holder Set: 57001-1483

● Install a new circlip [C] with circlip pliers [D].

Special Tool - Circlip Pliers: 57001-144

● Remove the driven pulley from the spring holder set.
● Clean the surface of the sheaves with an oil-less cleaning fluid.

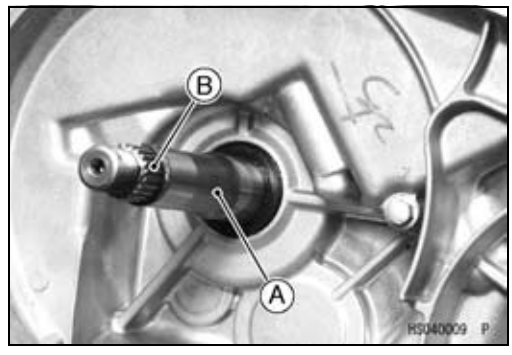


Driven Pulley Installation

● Clean the transmission driven shaft [A].
● Install:
Driven Pulley

NOTE

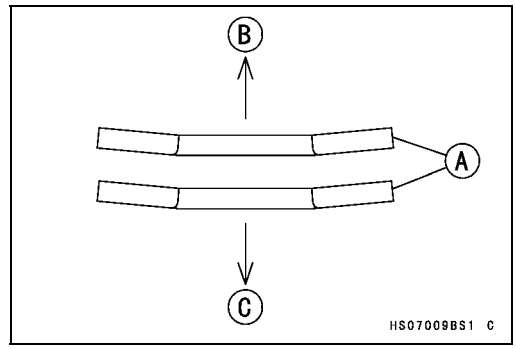
○*When engaging the spline on the driven pulley with the spline [B] on the shaft, do not damage the pulley's spline. If any damage occurs, remove it with a file.*



● Clean the threads of the driven shaft and driven pulley ends to open the air vent passage. Wipe off any extra grease.
○Wipe off any protruding grease [A].

Driven Pulley

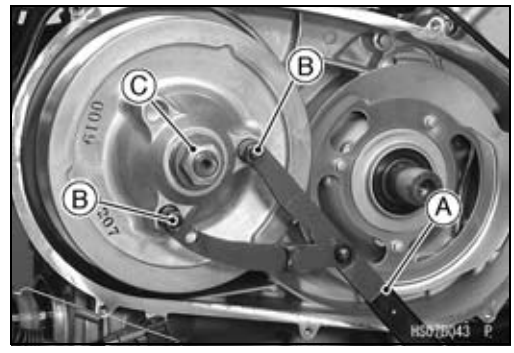
● Install two washers [A] on the shaft as shown.
Crankcase Side [B]
Bolt Head Side [C]



● Using the flywheel & pulley holder [A] and attachments [B], tighten the driven pulley nut [C].

Special Tools - Flywheel & Pulley Holder: 57001-1605
Pulley Holder Attachment: 57001-1472

Torque - Driven Pulley Nut: 93 N·m (9.5 kgf·m, 68 ft·lb)



High Altitude Setting Information

Specifications

Altitude m (ft)	Drive Pulley		
	Ramp Weights	Spring Spacer	(qty)
0 ~ 2 000 (0 ~ 6 500)	P/No. 39152-0019 (STD, X1)	P/No. 92026-1603 t = 1 mm (0.04 in.)	(1)
2 000 ~ 3 200 (6 500 ~ 10 400)	P/No. 39152-0028 (X1H)	P/No. 92026-1603 t = 1 mm (0.04 in.)	(2)

X1, X1H: Identification Marks

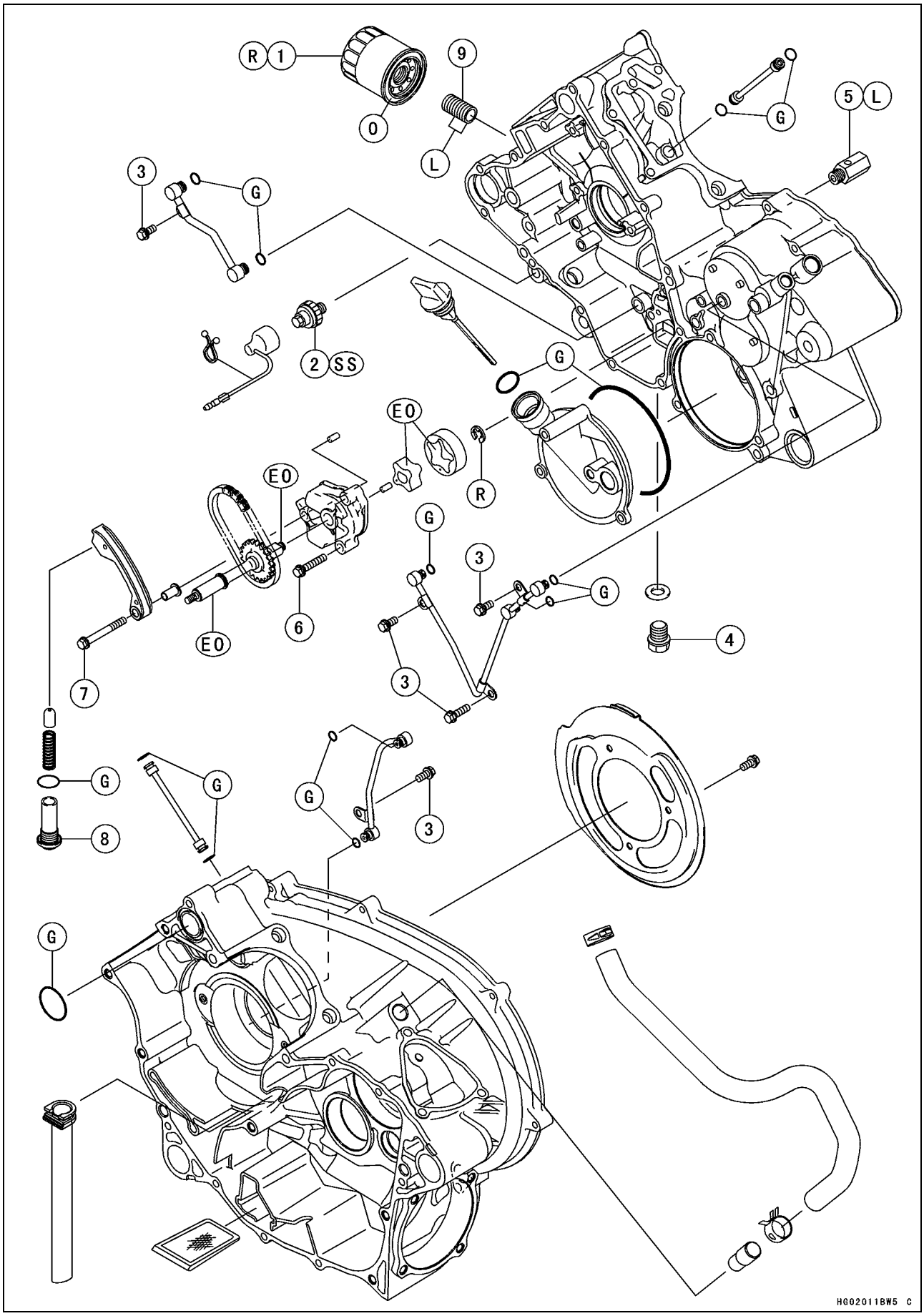
qty: quantity

● Refer to the Drive Pulley section for the parts replacement.

Engine Lubrication System

Table of Contents

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Filter	17.5	1.8	13	R
2	Oil Pressure Switch	15	1.5	11	SS
3	Oil Pipe Bolts	8.8	0.90	78 in·lb	
4	Engine Oil Drain Bolt	20	2.0	15	
5	Oil Pressure Relief Valve	15	1.5	11	L
6	Oil Pump Cover Bolts	8.8	0.90	78 in·lb	
7	Oil Pump Chain Guide Bolts	8.8	0.90	78 in·lb	
8	Oil Pump Drive Chain Tensioner Bolt	25	2.5	18	
9	Oil Filter Mounting Bolt	25	2.5	18	L (15 mm)

G: Apply grease.
L: Apply a non-permanent locking agent.
O: Apply engine oil.
R: Replacement Parts
SS: Apply silicone sealant (Liquid Gasket, TB1211: 56019-120).

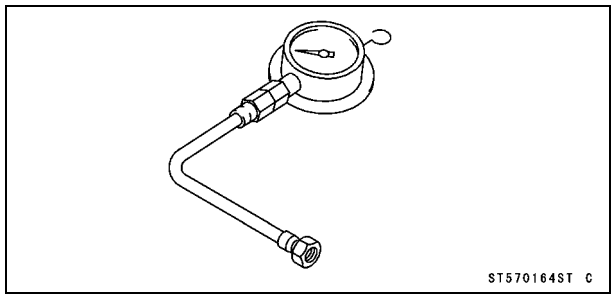
7-4 ENGINE LUBRICATION SYSTEM

Specifications

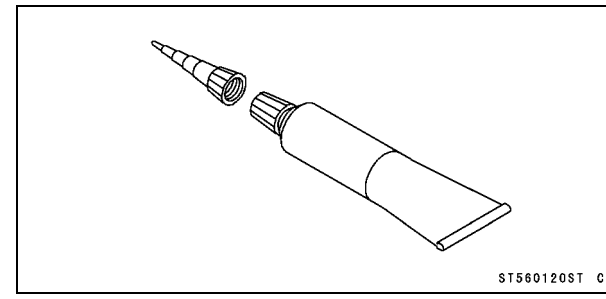
Item	Standard
Engine Oil	
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2
Viscosity	SAE 10W-40
Capacity	2.1 L (2.2 US qt) (when filter is not removed)
	2.2 L (2.3 US qt) (when filter is removed)
	2.6 L (2.7 US qt) (when engine is completely dry)
Oil Level (after warm-up or driving)	Between upper and lower level lines
Oil Pressure Measurement	
Oil Pressure @4 000 r/min (rpm), Oil Temperature 120°C (248°F)	430 kPa (4.4 kgf/cm², 62.6 psi)

Special Tools and Sealant

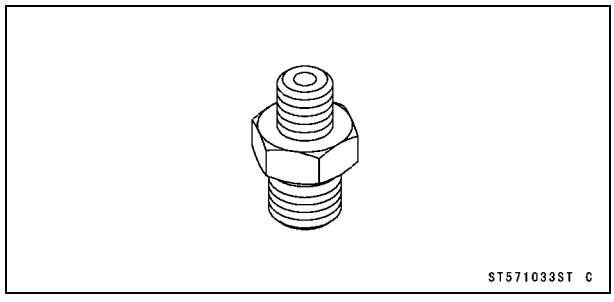
Oil Pressure Gauge, 10 kgf/cm²:
57001-164



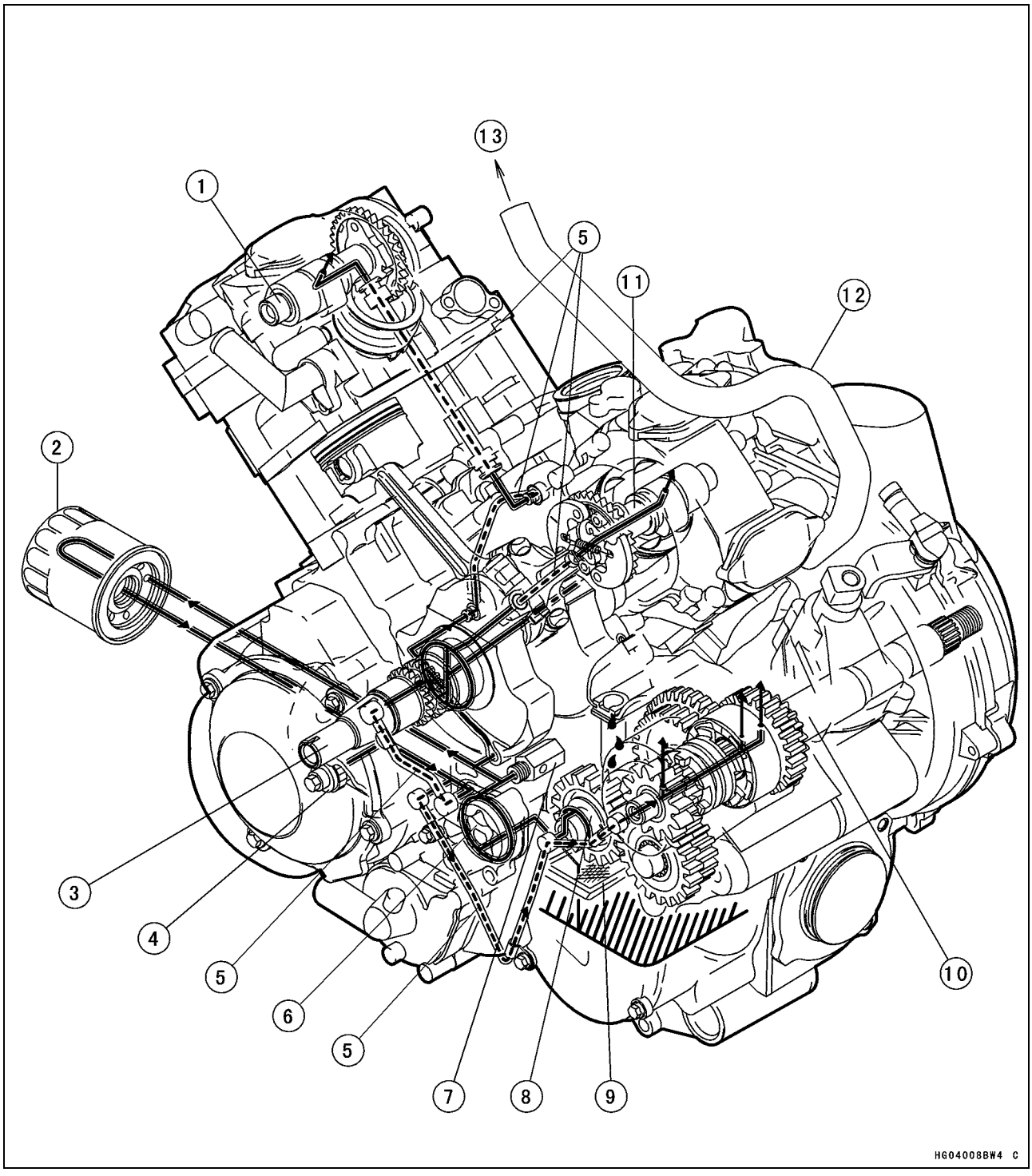
Liquid Gasket, TB1211:
56019-120



Oil Pressure Gauge Adapter, PT 1/8:
57001-1033



Engine Oil Flow Chart



1. Front Camshaft
2. Oil Filter
3. Crankshaft
4. Oil Pressure Switch
5. Oil Pipes
6. Oil Pump
7. Relief Valve
8. Transmission Idle Shaft
9. Oil Screen
10. Transmission Driven Shaft
11. Rear Camshaft
12. Breather Hose
13. To Air Cleaner

Engine Oil and Oil Filter

⚠ WARNING

Vehicle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine seizure, accident, and injury. Check the oil level before each use and change the oil and filter according to the periodic maintenance chart.

Oil Level Inspection

- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- If the oil has just been changed, start the engine, and run it for several minutes to fill the oil filter.

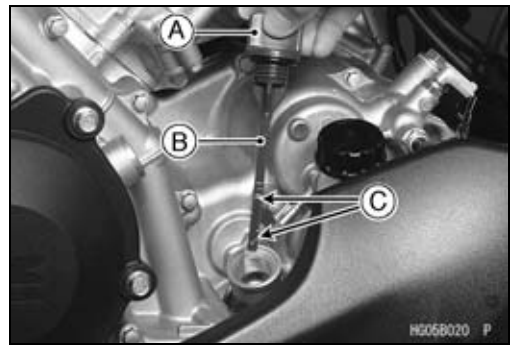
NOTICE

Allow the engine to idle for several minutes so that oil may reach all parts of the engine. Racing a "dry" engine may cause severe damage.

- Stop the engine and wait several minutes for all the oil to drain back to the sump.
- Unscrew the oil filler cap [A], wipe its dipstick [B] dry, and tighten it into the filler opening.
- Unscrew the oil filler cap and check the oil level. The oil level should be between the upper (H) and lower (L) level lines [C].

★If the level is too high, suck the excess oil out the filler hole with a syringe or other suitable device.

★If the level is too low, add oil through the filler hole. Use the same type and make of oil that is already in the engine.



Engine Oil Change

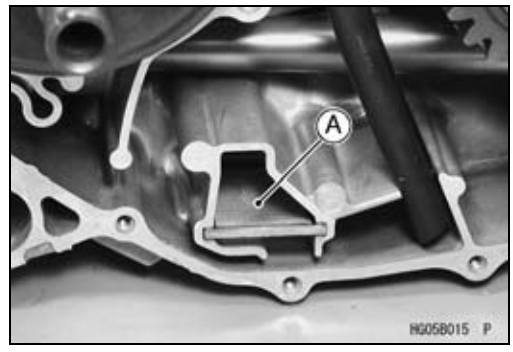
- Refer to the Engine Oil Change in the Periodic Maintenance chapter.

Oil Filter Change

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

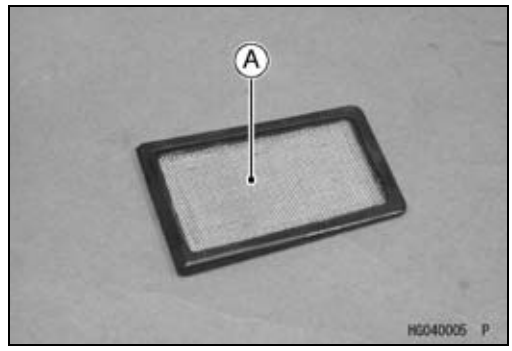
Oil Screen Removal

- Split the crankcase (see Crankcase Disassembly in the Crankshaft/Transmission chapter).
- Pull the oil screen [A] out of the crankcase.



Engine Oil and Oil Filter

Oil Screen Cleaning



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

⚠ WARNING

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the screen in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the screen.

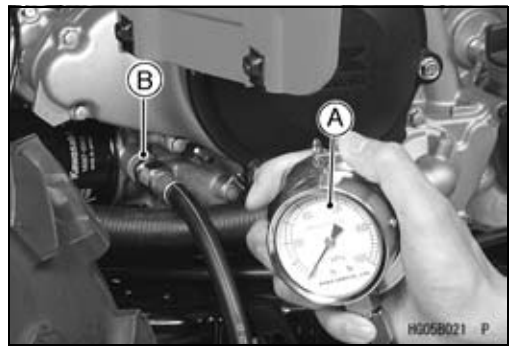
NOTE

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

- Check the screen carefully for any damage, holes, broken wires, or gasket pulling off.

★If the screen is damaged, replace it.

Oil Pressure Measurement



NOTE

○*Measure the oil pressure after the engine is warmed up.*

- Remove the oil pressure switch.
- Attach the oil pressure gauge [A] and adapter [B].

Special Tools - Oil Pressure Gauge, 10 kgf/cm²: 57001-164
Oil Pressure Gauge Adapter, PT 1/8: 57001 -1033

Oil Pressure
Standard: 430 kPa (4.4 kgf/cm², 62.6 psi) @4 000 r/min (rpm), 120°C (248°F) of oil temp.

★If the oil pressure is much lower than the standard, inspect the relief valve, oil pump, and/or crankshaft bearing insert wear.

★If the oil pressure is much higher than the standard, inspect the oil filter, oil screen, and other areas of the lubrication system for clogging.

- Stop the engine.
- Remove the oil pressure gauge and adapter.

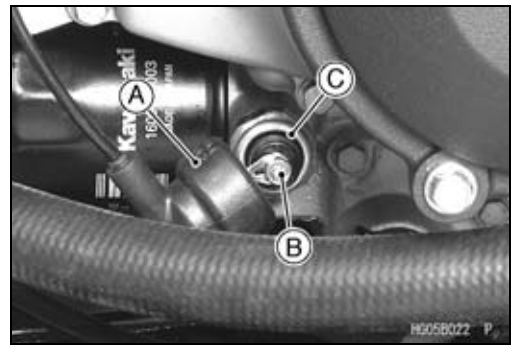
⚠ WARNING

Hot oil can cause severe burns. Beware of hot engine oil that will drain through the oil passage when the gauge adapter is removed.

- Install the oil pressure switch (see Oil Pressure Switch Installation).

Oil Pressure Switch

Oil Pressure Switch Removal



- Drain:
  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
- Remove:
  Switch Cover [A]
  Switch Lead Terminal [B]
  Oil Pressure Switch [C]

Oil Pressure Switch Installation

- Apply silicone sealant to the threads of the oil pressure switch, and tighten it.

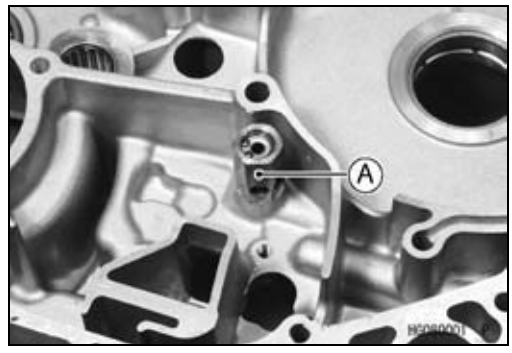
  Sealant - Liquid Gasket, TB1211: 56019-120

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

- Tighten the terminal bolt securely.
- Apply grease to the terminal, and install the switch cover.

Oil Pressure Relief Valve

Oil Pressure Relief Valve Removal



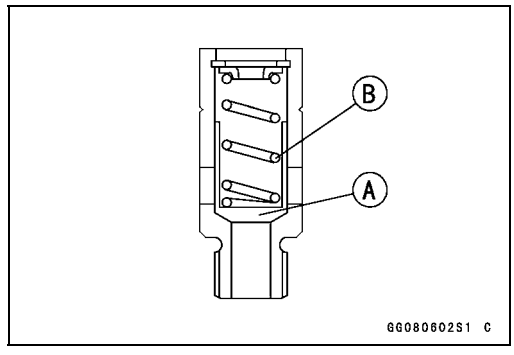
- Split the crankcase (see Crankcase Disassembly in the Crankshaft/Transmission chapter).
- Remove the oil pressure relief valve [A].

Oil Pressure Relief Valve Installation

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

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

Oil Pressure Relief Valve Inspection



- Remove the relief valve.
- Using a wooden stick, push the inner valve to make sure that the valve [A] moves smoothly and that it returns to its original position by the force of the spring [B].

NOTE

○*The relief valve cannot be disassembled and it must be inspected in the assembled state.*

★If the valve movement is not smooth, wash the relief valve with high-flash point solvent, and use compressed air to remove any foreign particles from it.

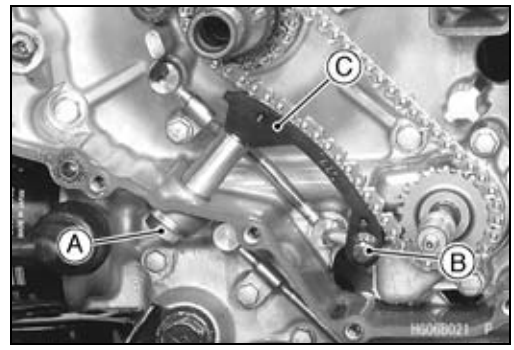
⚠ WARNING

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the oil pressure relief valve in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the oil pressure relief valve.

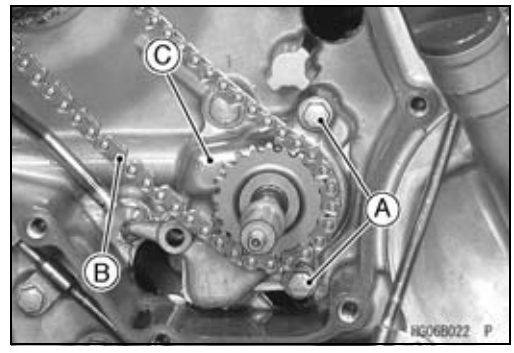
★If the valve does not move smoothly even after washing it, replace the relief valve. The oil pressure relief valve is precision made with no allowance for replacement of individual parts.

Oil Pump

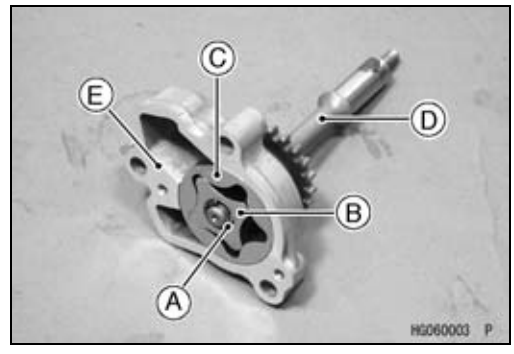
Oil Pump Removal



- Remove:
  Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
  Oil Pump Drive Chain Tensioner Bolt [A]
  Starter Motor Clutch Gear
  Chain Guide Bolt [B] and Collar
  Chain Guide [C]



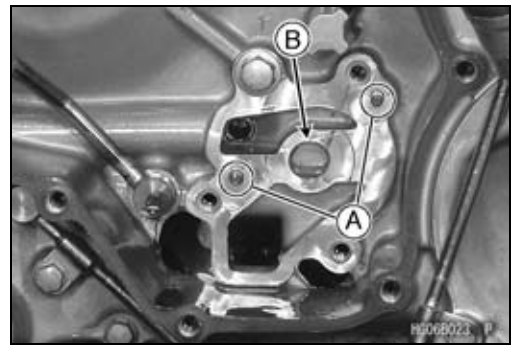
- Remove:
  Oil Pump Bolts [A]
  Oil Pump Drive Chain [B] together with Oil Pump Assembly [C]



- Remove:
  Circlip [A]
  Inner Rotor [B]
  Outer Rotor [C]
  Oil Pump Drive Shaft [D]
  Oil Pump Cover [E]

Oil Pump Installation

- Apply engine oil:
  Oil Pump Drive Shaft
  Inner and Outer Rotors
- Install:
  Oil Pump Drive Shaft
  Oil Pump Cover
  Inner Rotor
  Outer Rotor
  New Circlip

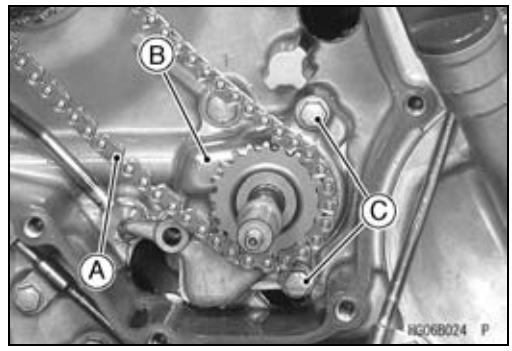


- Check to see that the dowel pins [A] are in place.
- Apply engine oil to the oil pump hole [B].

Oil Pump

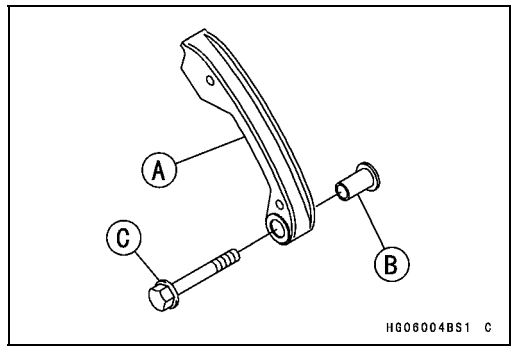
- Install the oil pump drive chain [A] with the oil pump assembly [B].
- Tighten:

Torque - Oil Pump Cover Bolts [C]: 8.8 N·m (0.90 kgf·m, 78 in·lb)



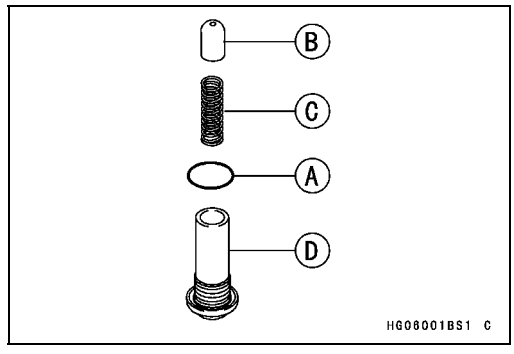
- Install:
  Chain Guide [A] and Collar [B]
- Tighten:

Torque - Oil Pump Drive Chain Guide Bolt [C]: 8.8 N·m (0.90 kgf·m, 78 in·lb)



- Apply grease to the O-ring [A].
- Install:
  Pin [B]
  Spring [C]
  O-ring
  Oil Pump Drive Chain Tensioner Bolt [D]
- Tighten:

Torque - Oil Pump Drive Chain Tensioner Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)

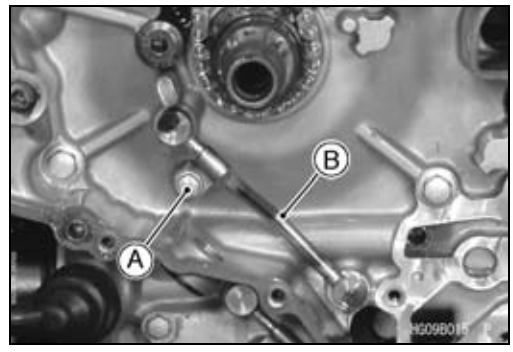


Oil Pipe

Oil Pipe Removal

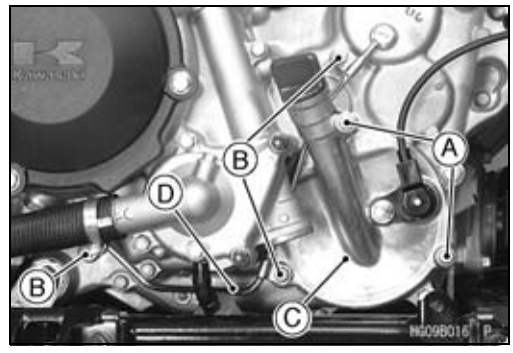
Engine Left Side Oil Pipe (Engine Inside)

- Remove:
  Oil Pump (see Oil Pump Removal)
  Oil Pipe Bolt [A]
  Oil Pipe [B]



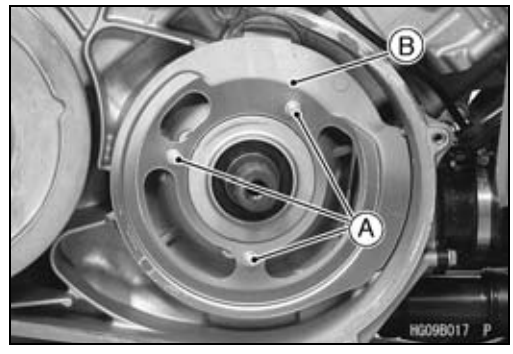
Engine Left Side Oil Pipe (Engine Outside)

- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove:
  Output Drive Bevel Gear Cover Bolts [A]
  Oil Pipe Bolts [B]
- Remove the bevel gear cover [C] to remove the oil pipe [D].

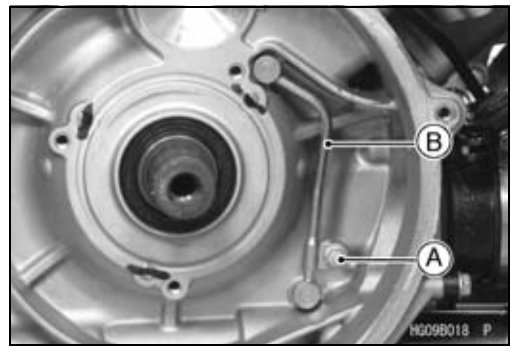


Engine Right Side Oil Pipe

- Remove:
  Drive Pulley (see Drive Pulley Removal in the Converter System chapter)
  Drive Pulley Inner Plate Bolts [A]
  Drive Pulley Inner Plate [B]

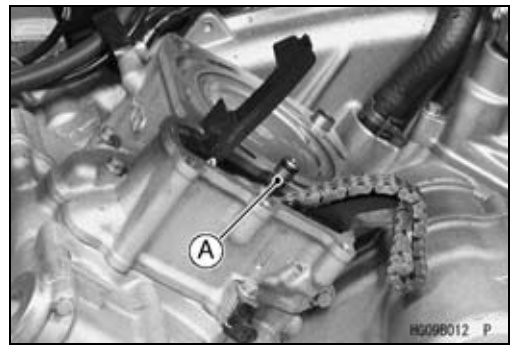


- Remove:
  Oil Pipe Bolt [A]
  Oil Pipe [B]



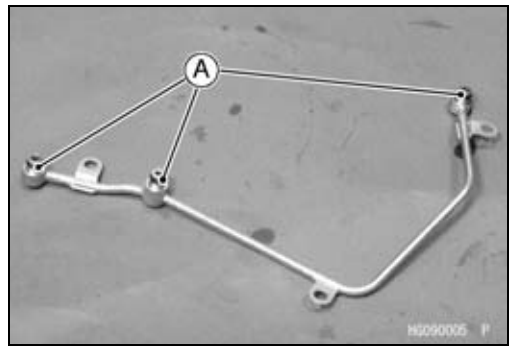
Engine Inside Oil Pipe

- Remove:
  Cylinder Head (see Cylinder Head Removal in the Engine Top End chapter)
  Oil Pipe [A]



Oil Pipe

Oil Pipe Installation



- Replace the O-ring [A] with new ones.
- Apply engine oil to the O-rings before installation.
- Tighten:

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

Engine Removal/Installation

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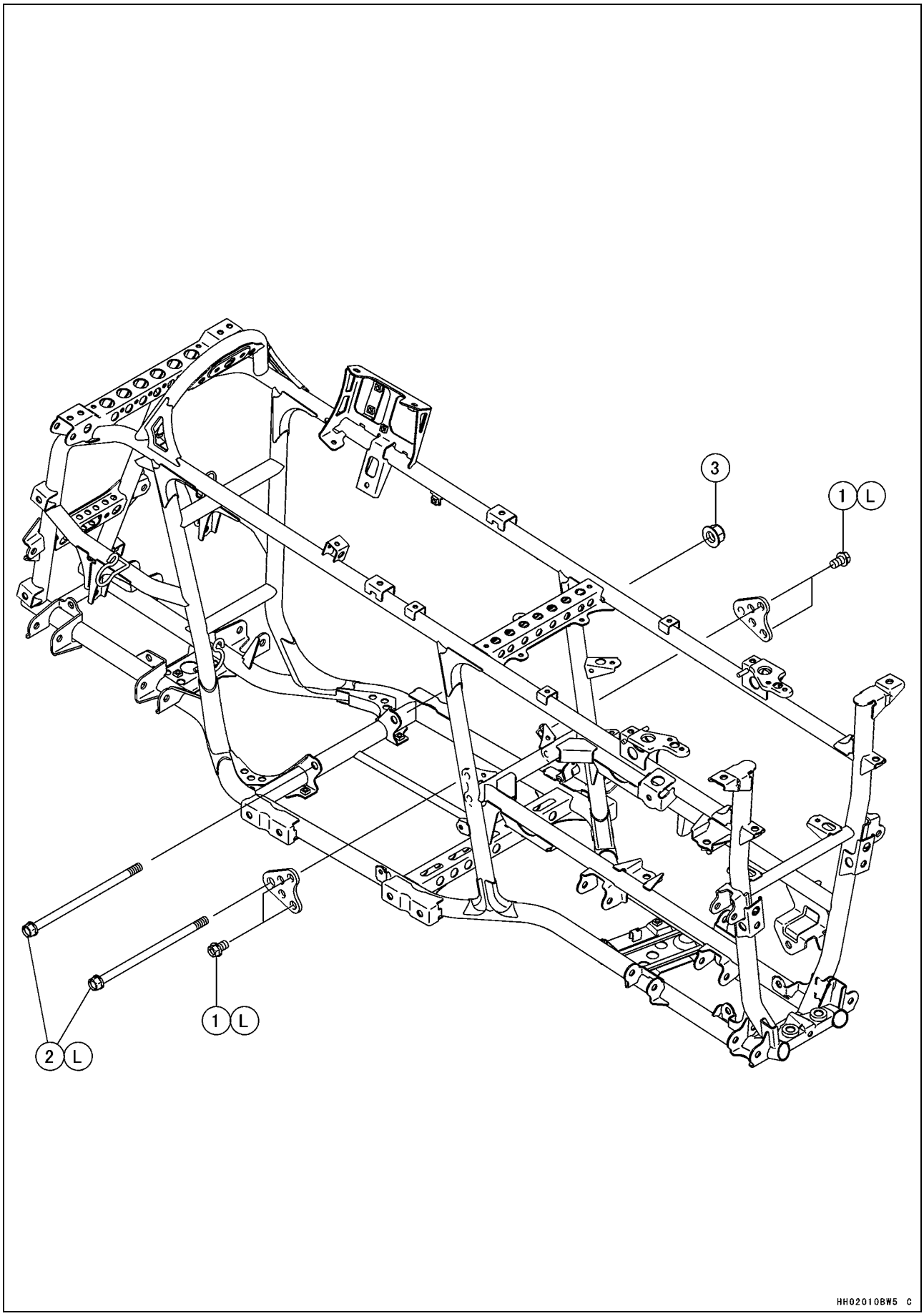
Exploded View



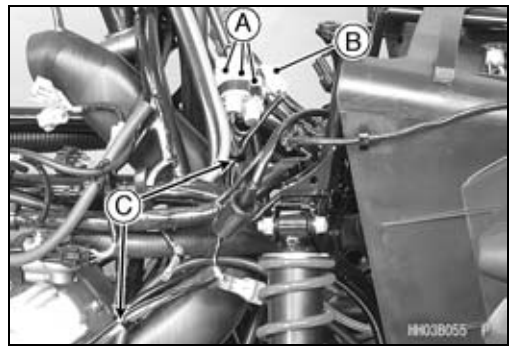
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Mounting Bracket Bolts	72	7.3	53	L
2	Engine Mounting Bolts	72	7.3	53	L
3	Engine Mounting Nut	100	10	74	

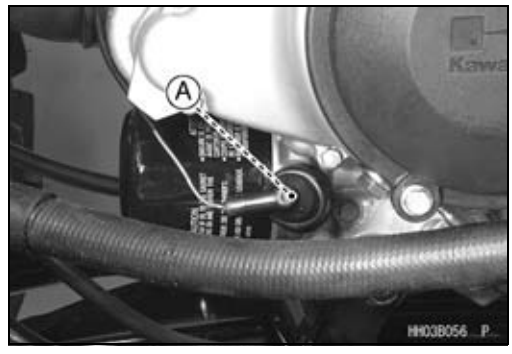
L: Apply a non-permanent locking agent.

Engine Removal/Installation

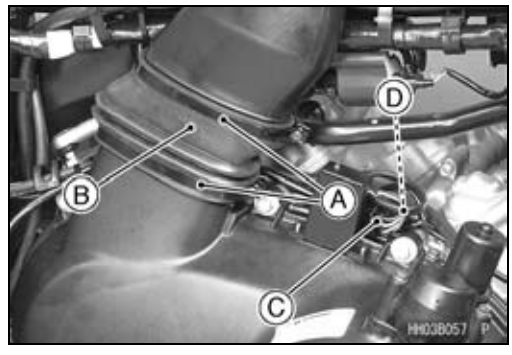
Engine Removal



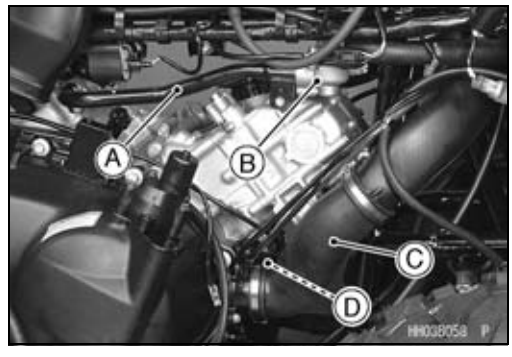
● Remove:
Engine Oil (drain) (see Engine Oil Change in the Periodic Maintenance chapter)
Coolant (drain) (see Coolant Change in the Periodic Maintenance chapter)
Muffler and Exhaust Pipe (see Muffler and Exhaust Pipe Removal in the Engine Top End chapter)
Throttle Body (see Throttle Body in the Fuel System (DFI) chapter)
Speed Sensor (see Speed Sensor Removal in the Electrical System chapter)
Front Propeller Shaft (see Front Propeller Shaft Removal in the Final Drive chapter)
Alternator Lead Connectors [A]
Crankshaft Sensor Lead Connector [B]
Clamps [C]



● Remove:
Oil Pressure Switch Terminal [A]



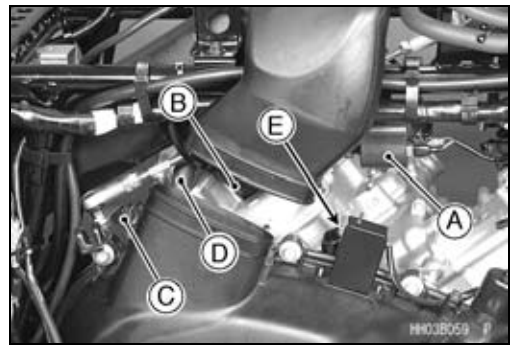
● Remove:
Rubber Duct Clamps [A]
Rubber Duct [B]
Engine Brake Actuator Lead Connector [C]
Drive Belt Failure Detection Switch Lead Connector [D]



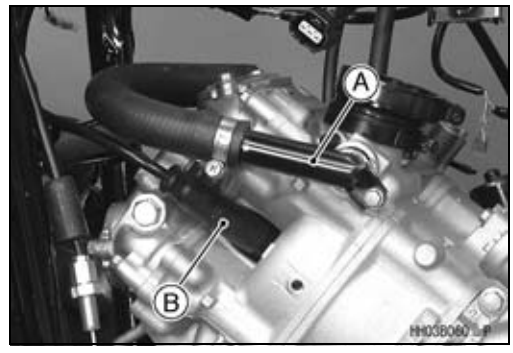
● Remove:
Water Pipe [A]
Thermostat Housing [B]
Air Rubber Duct [C]
Starter Motor Cable Nut [D] (see Front Propeller Shaft Removal in the Final Drive chapter)

Engine Removal/Installation

● Remove:
Ignition Coil [A] (rear)
Spark Plug Cap [B]
Shift Shaft Lever [C]
Breather Hose [D]
Engine Ground Terminal [E]

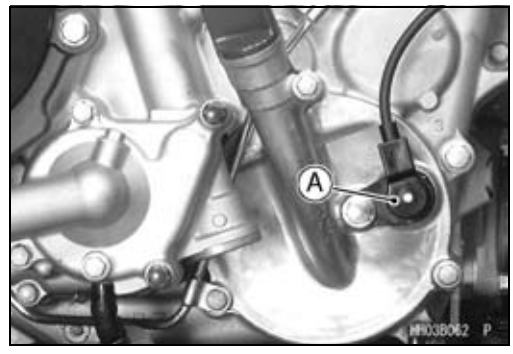


● Remove:
Water Pipe [A]
Spark Plug Cap [B]

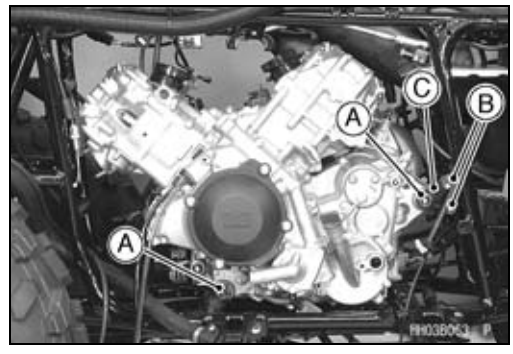


● Remove:
Coolant Reserve Tank [A]
Neutral Switch Lead Connector [B]
Reverse Switch Lead Connector [C]
Water Hose [D]

● Remove:
Forward/Reverse Detecting Sensor [A]



● Remove:
Engine Mounting Bolts [A]
Engine Mounting Bracket Bolts [B] (both side)
Engine Mounting Bracket [C]



Engine Removal/Installation

● Remove the engine [A] as shown.

Engine Installation

● Apply a non-permanent locking agent to the engine mounting bolts and engine mounting bracket bolts.
● Install:
Engine
Engine Bracket and Bolts
Engine Mounting Bolts (temporary)
● Tighten:

Torque - Engine Mounting Bracket Bolts: 72 N·m (7.3 kgf·m, 53 ft·lb)
Engine Mounting Bolts: 72 N·m (7.3 kgf·m, 53 ft·lb)
Engine Mounting Nut: 100 N·m (10 kgf·m, 74 ft·lb)

Crankshaft/Transmission

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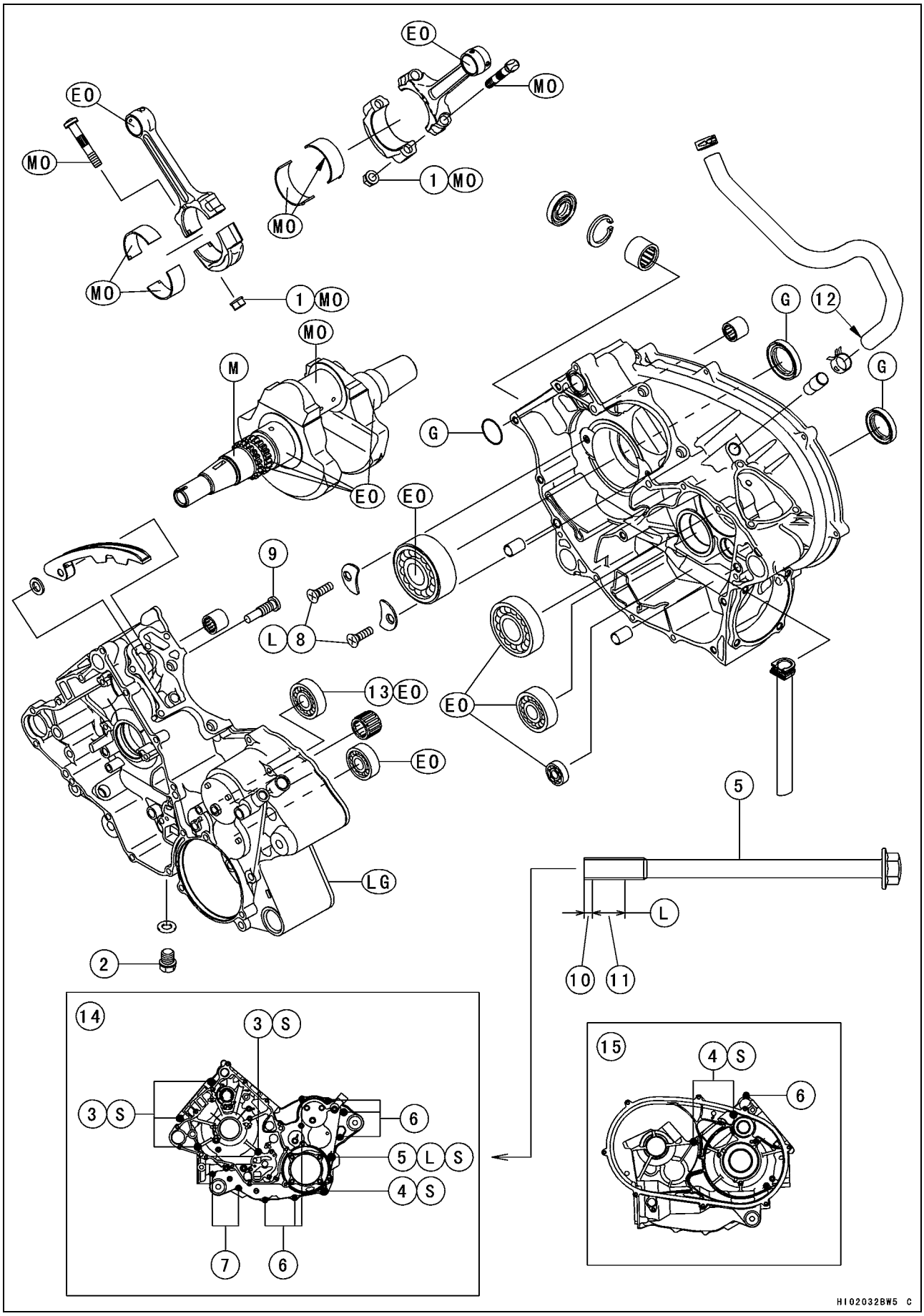
Exploded View



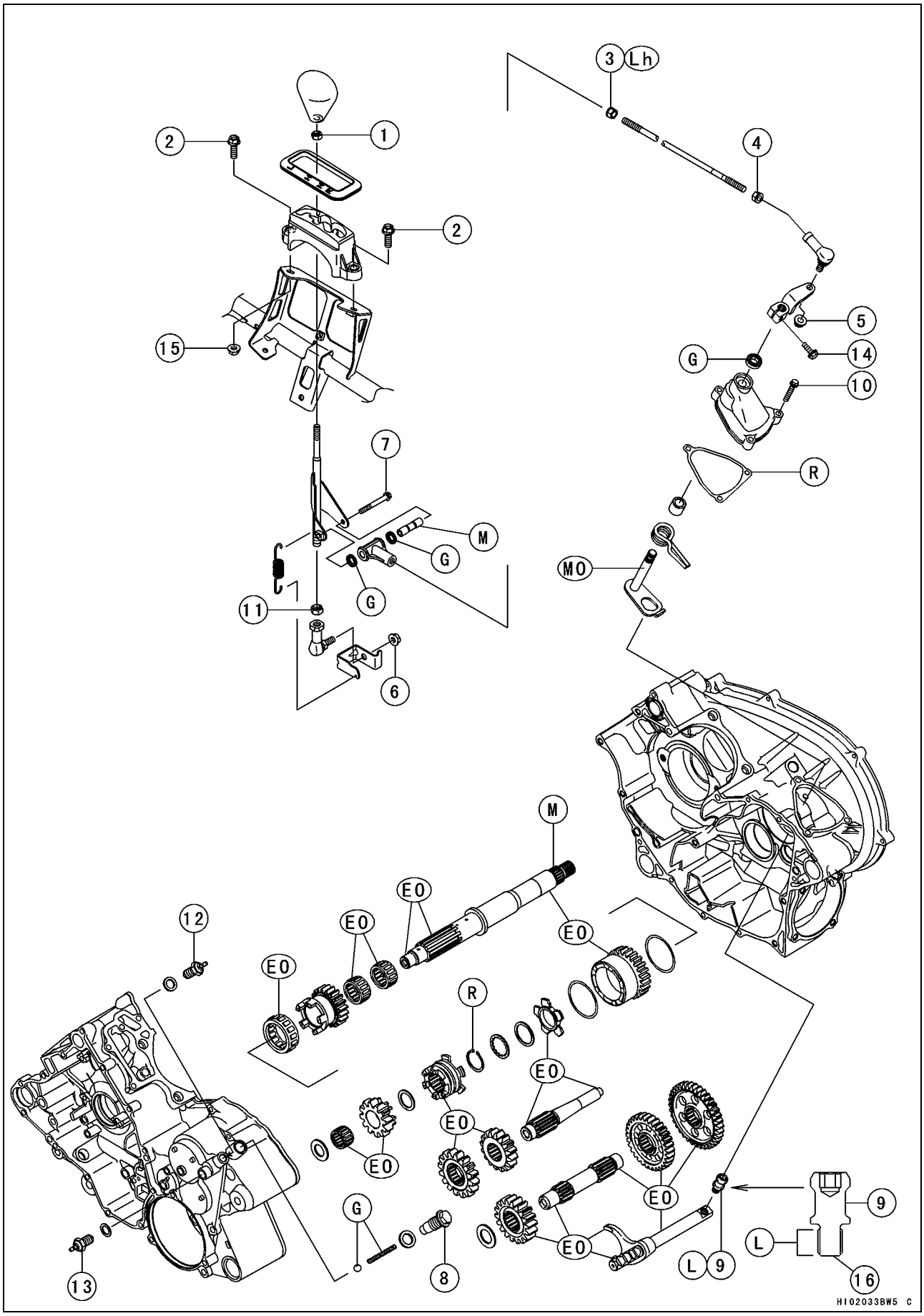
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Connecting Rod Big End Cap Nuts	34.3	3.5	25	MO
2	Engine Oil Drain Bolt	20	2.0	15	
3	Crankcase Bolts (M8) 75 mm (2.95 in.)	20	2.0	15	S
4	Crankcase Bolts (M8) 110 mm (4.33 in.)	20	2.0	15	S
5	Crankcase Bolt (M8) 110 mm (4.33 in.)	20	2.0	15	S, L
6	Crankcase Bolts (M6) 40 mm (1.57 in.)	9.8	1.0	87 in·lb	
7	Crankcase Bolts (M6) 65 mm (2.56 in.)	9.8	1.0	87 in·lb	
8	Bearing Position Plate Screws	4.9	0.50	43 in·lb	L
9	Rear Cylinder Camshaft Chain Guide Bolt	20	2.0	15	

10. Do not apply a non-permanent locking agent to this area (2 ~ 3 mm, 0.08 ~ 0.12 in.)
11. About 12 mm (0.47 in.)
12. White Mark: Face the mark backwards and align it with the crankcase mark.
13. Face the seal of the bearing to the left side (outward).
14. Left Crankcase
15. Right Crankcase

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket (Liquid Gasket, TB1216: 92104-1063).
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil (mixture of the engine oil and molybdenum disulfide grease in a weight ratio: 10 : 1).
S: Follow the specific tightening sequence.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Grip Holder Nut	9.8	1.0	87 in·lb	
2	Shift Lever Guide Mounting Bolts	19.6	2.0	14	
3	Tie-rod End Front Locknut	9.8	1.0	87 in·lb	Lh
4	Tie-rod End Rear Locknut	9.8	1.0	87 in·lb	
5	Tie-rod End Nut	19.6	2.0	14	
6	Shift Lever Assembly Nut	19.6	2.0	14	
7	Tie-rod End Bolt	9.8	1.0	87 in·lb	
8	Shift Shaft Positioning Bolt	25	2.5	18	
9	Shift Shaft Spring Bolt	25	2.5	18	L
10	Shift Shaft Cover Bolts	8.8	0.90	78 in·lb	
11	Tie-rod End Locknut	19.6	2.0	14	
12	Neutral Position Switch	15	1.5	11	
13	Reverse Position Switch	15	1.5	11	
14	Shift Lever Clamp Bolt	13.5	1.4	119 in·lb	
15	Shift Lever Guide Mounting Nut	19.6	2.0	14	

16. Do not apply a non-permanent locking agent to this end.
EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
Lh: Left-hand Threads
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil (mixture of the engine oil and molybdenum disulfide grease in a weight ratio: 10 : 1).
R: Replacement Part

Specifications

Item	Standard	Service Limit
Crankshaft, Connecting Rods		
Connecting Rod Bend	– – –	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	– – –	TIR 0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.16 ~ 0.46 mm (0.0063 ~ 0.0181 in.)	0.7 mm (0.028 in.)
Connecting Rod Big End Bearing Insert/Crankpin Clearance	0.028 ~ 0.052 mm (0.0011 ~ 0.0020 in.)	0.09 mm (0.0035 in.)
Crankpin Diameter:	39.984 ~ 40.000 mm (1.5742 ~ 1.5748 in.)	39.97 mm (1.5736 in.)
Marking:		
None	39.984 ~ 39.992 mm (1.5742 ~ 1.57448 in.)	– – –
○	39.993 ~ 40.000 mm (1.57452 ~ 1.5748 in.)	– – –
Connecting Rod Big End Inside Diameter:	43.000 ~ 43.016 mm (1.6929 ~ 1.6935 in.)	– – –
Marking:		
None	43.000 ~ 43.008 mm (1.6929 ~ 1.6932 in.)	– – –
○	43.009 ~ 43.016 mm (1.6933 ~ 1.6935 in.)	– – –
Connecting Rod Big End Bearing Insert Thickness:		
Brown	1.482 ~ 1.486 mm (0.05835 ~ 0.05850 in.)	– – –
Yellow	1.486 ~ 1.490 mm (0.05850 ~ 0.05866 in.)	– – –
Green	1.490 ~ 1.494 mm (0.05866 ~ 0.05882 in.)	– – –

Connecting Rod Big End Bearing Insert Selection:

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92028-1963
None	None	Yellow	92028-1962
○	○		
○	None	Green	92028-1961

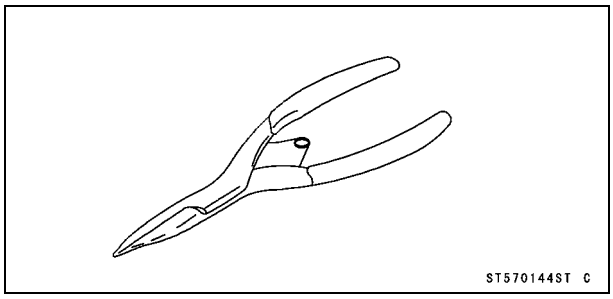
Crankshaft Runout	TIR 0.04 mm (0.0016 in.) or less	TIR 0.10 mm (0.0039 in.)
Crankshaft Main Journal Diameter	41.984 ~ 42.000 mm (1.6529 ~ 1.6535 in.)	41.96 mm (1.652 in.)
Crankshaft Main Bearing Bore Diameter	42.025 ~ 42.041 mm (1.6545 ~ 1.6552 in.)	42.08 mm (1.657 in.)

Specifications

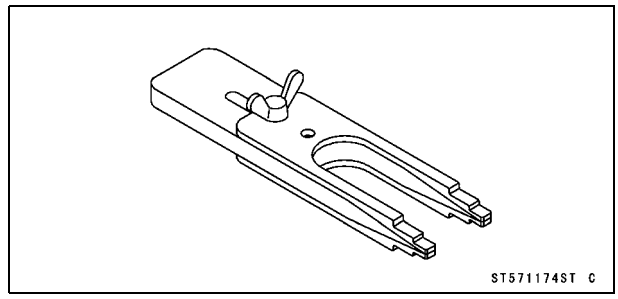
Item	Standard	Service Limit
Transmission		
Shift Fork Ear Thickness	5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)	5.8 mm (0.23 in.)
Shift Groove Width	6.05 ~ 6.15 mm (0.238 ~ 0.242 in.)	6.25 mm (0.246 in.)

Special Tools and Sealant

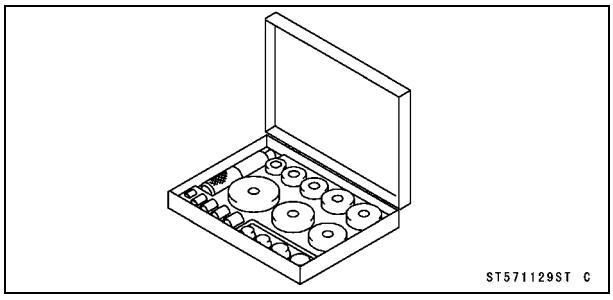
Outside Circlip Pliers:
57001-144



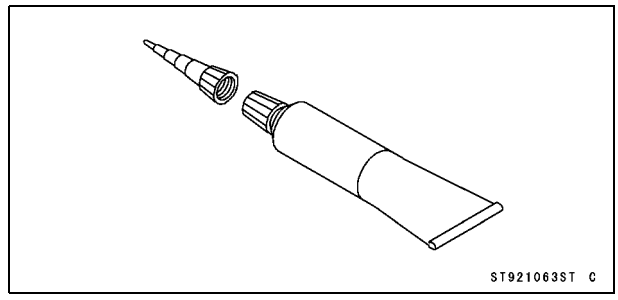
Crankshaft Jig:
57001-1174



Bearing Driver Set:
57001-1129

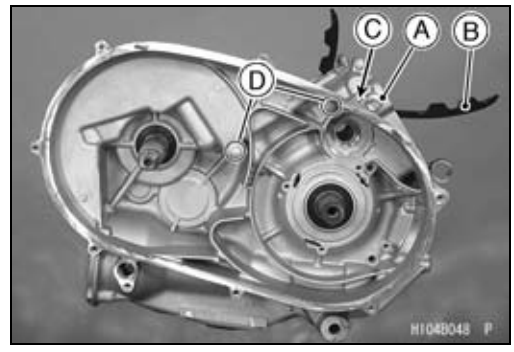


Liquid Gasket, TB1216:
92104-1063

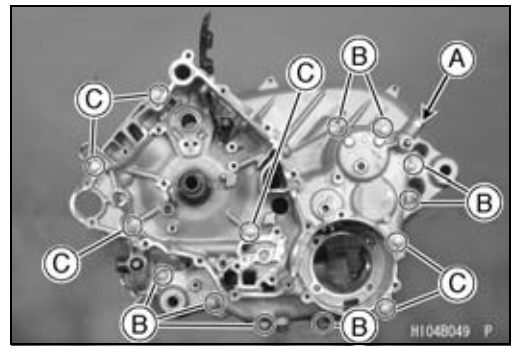


Crankcase

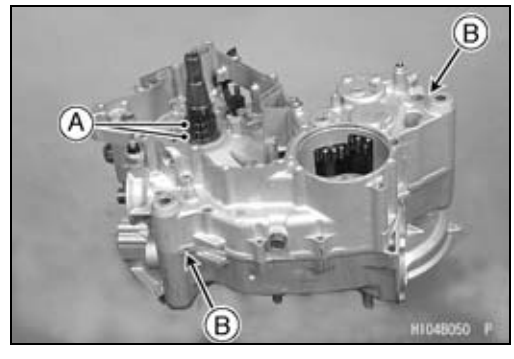
Crankcase Disassembly



● Remove:
Engine (see Engine Removal in the Engine Removal/Installation chapter)
Starter Motor (see Starter Motor Removal in the Electrical System chapter)
Oil Filter
Cylinder Blocks and Pistons (see Cylinder and Piston Removal in the Engine Top End chapter)
Intermediate Shaft and Chains (see Camshaft Chain Removal in the Engine Top End chapter)
Drive Pulley (see Drive Pulley Removal in the Converter system chapter)
Driven Pulley (see Driven Pulley Removal in the Converter system chapter)
Engine Right Side Oil Pipe (see Oil Pipe Removal in the Engine Lubrication System chapter)
Output Drive Bevel Gear (see Output Drive Bevel Gear removal in the Final Drive chapter)
Output Driven Bevel Gear (see Output Driven Bevel Gear removal in the Final Drive chapter)
Shift Shaft Cover (see Transmission Removal)
Shift Shaft (see Transmission Removal)
Shift Shaft Spring Bolt (see Transmission Removal)
Bolt [A]
Chain Guide [B]
Right Crankcase Bolt (M6) [C]
Right Crankcase Bolts (M8) [D]

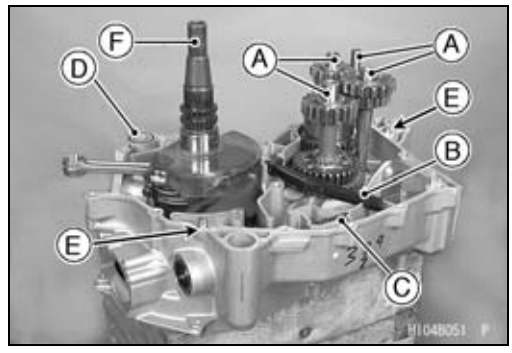


● Remove:
Shift Shaft Positioning Bolt [A], Washer, Spring, and Steel Ball
Left Crankcase Bolts (M6) [B]
Left Crankcase Bolts (M8) [C]



● Wrap the teeth on the sprockets [A] by taping for protecting the bushing in the crankcase.
● Using the pry points [B], split the crankcase halves.
● Lift off the left crankcase half.

Crankcase



- Remove the following parts from the right crankcase half.
  Transmission Shafts and Shift Rod [A] (see Transmission Removal)
  Oil Tube [B]
  Oil Screen [C]
  O-ring [D]
  Dowel Pins [E]
  Crankshaft [F] (see Crankshaft Removal)
  Oil Pressure Relief Valve (see Oil Pressure Relief Valve Removal in the Engine Lubrication System chapter)

Crankcase Assembly

NOTICE

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.

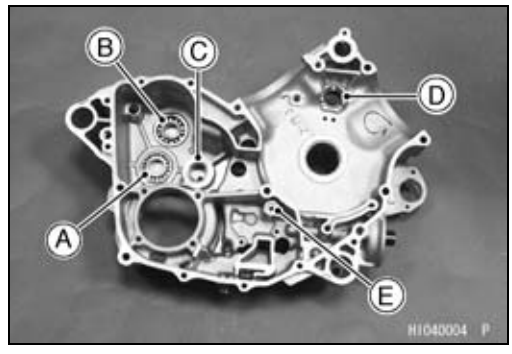
NOTE

○*Be certain that all parts are cleaned thoroughly before assembly.*

○*Blow through all oil passages with compressed air to clear any blockage in the crankcase halves and crankshaft.*

⚠ WARNING

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



- Press and insert the new ball bearings until they are bottomed.

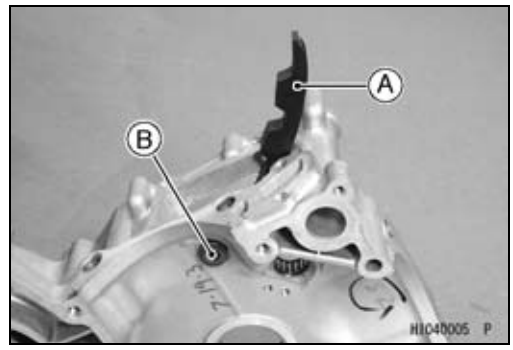
  Special Tool - Bearing Driver Set: 57001-1129

  [A] Ball Bearing
  [B] Ball Bearing (sealed side towards crankcase)
- Press and insert the new needle bearings so that the bearing surfaces are flush with the end of the hole.
  [C] Needle Bearing
  [D] Needle Bearing (Insert it from outside.)
- Apply engine oil to the bearings.
- Install:
  Oil Pressure Relief Valve [E] (see Oil Pressure Relief Valve Installation in the Engine Lubrication System chapter)

Crankcase

- Install:
  Rear Cylinder Camshaft Chain Guide [A]
- Tighten:

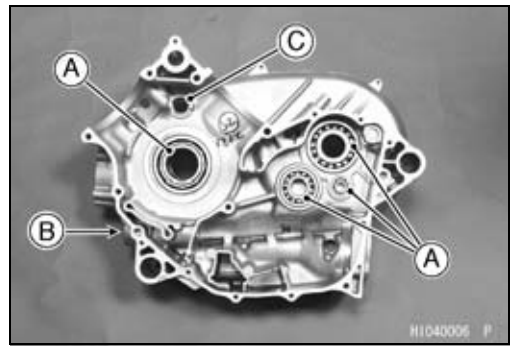
Torque - Rear Cylinder Camshaft Chain Guide Bolt [B]: 20 N·m (2.0 kgf·m, 15 ft·lb)



- Press and insert the new ball bearings [A] until they are bottomed.

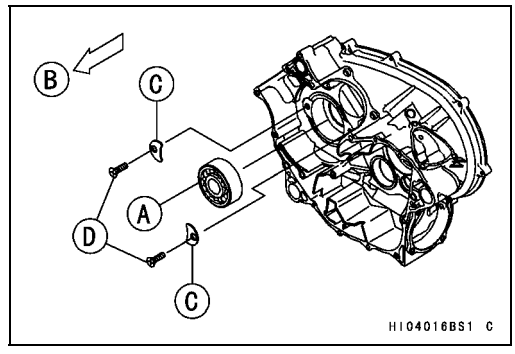
Special Tool - Bearing Driver Set: 57001-1129

- Press and insert the new needle bearings so that the bearing surfaces are flush with the end of the hole.
  [B] Needle Bearing
  [C] Needle Bearing (Insert it from outside.)
- Apply engine oil to the bearings.

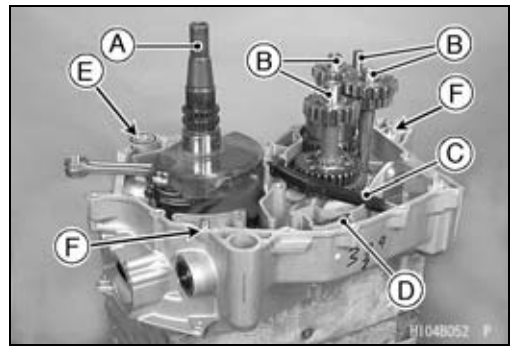


- Install the ball bearing [A] so that the stepped side faces outside [B].
- Install:
  Bearing Position Plates [C]
- Apply a non-permanent locking agent to the bearing position plate screws [D].
- Tighten:

Torque - Bearing Position Plate Screws: 4.9 N·m (0.50 kgf·m, 43 in·lb)

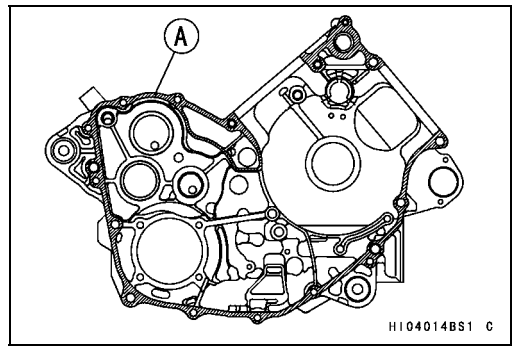


- Be sure the following parts are in place in the right crankcase half.
  Crankshaft [A]
  Transmission Shafts and Shift Rod [B] (see Transmission Installation)
  Oil Tube [C]
  Oil Screen [D]
  O-ring (Apply Grease) [E]
  Dowel Pins [F]



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

Sealant - Liquid Gasket, TB1216: 92104-1063



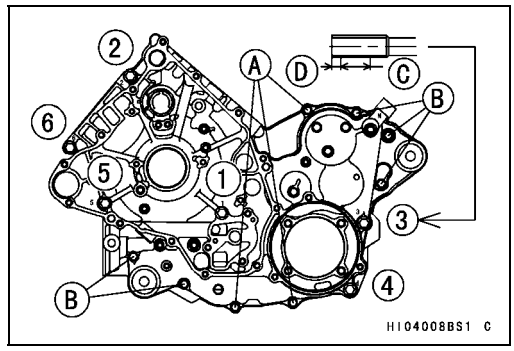
Crankcase

● Apply a non-permanent locking agent to the area [C] (12 mm, 0.47 in.) except for the tip [D] (2 ~ 3 mm, 0.08 ~ 0.12 in.).
Left Crankcase Bolt (M8) [3]

● Tighten the right and left crankcase bolts (M8) following the tightening sequence [1 ~ 8].

Torque - Crankcase Bolts (M8): 20 N·m (2.0 kgf·m, 15 ft·lb)

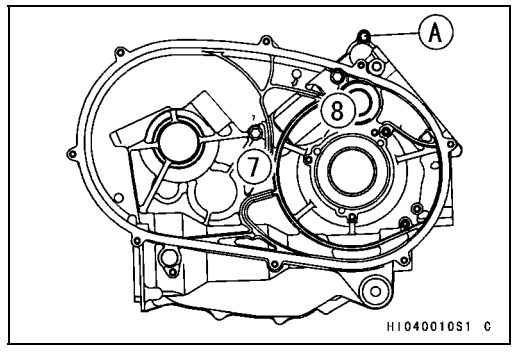
[1, 2, 5, 6] L = 75 mm (2.95 in.)
[3, 4, 7, 8] L = 110 mm (4.33 in.)



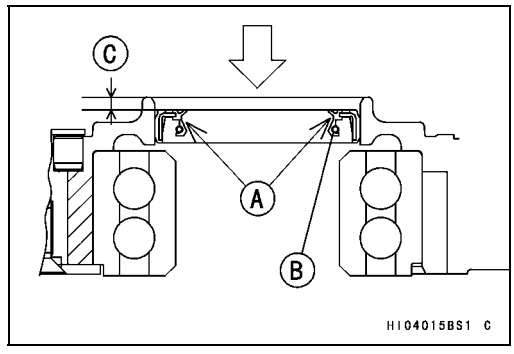
● Tighten:

Torque - Crankcase Bolts (M6): 9.8 N·m (1.0 kgf·m, 87 in·lb)

[A] L = 40 mm (1.57 in.)
[B] L = 65 mm (2.56 in.)



● Grease the lip [A] of the oil seal [B] and press the seal 3 mm (0.12 in.) [C] inwards from the end of the boss.

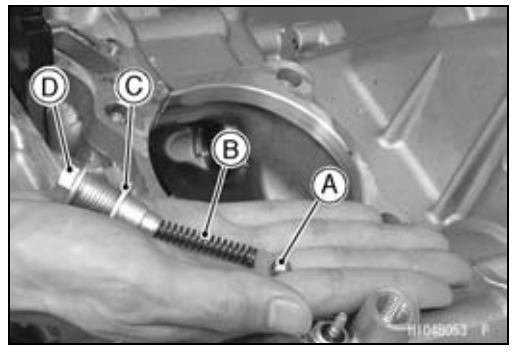


● Apply grease to the steel ball [A] and spring [B].

● Install:
Steel Ball
Spring
Washer [C]
Shift Shaft Positioning Bolt [D]

● Tighten:

Torque - Shift Shaft Positioning Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)



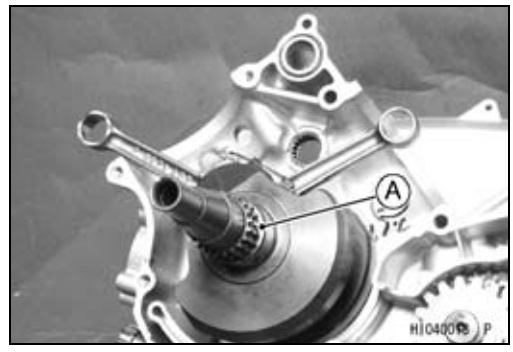
● Check:
Crankshaft and driven shaft turn freely.

★If any of the shafts do not turn freely, split the crankcase to locate the problem.

Crankshaft/Connection Rod

Crankshaft Removal

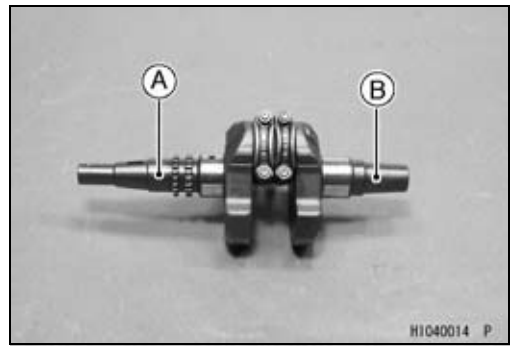
- Split the crankcase (see Crankcase Disassembly).
- Remove the crankshaft [A] from the crankcase using a press.



Crankshaft Installation

- The left shaft [A] of the crankshaft is longer than the right shaft [B].
- Apply engine oil to the both main journals.
- Insert the right crankshaft tapered end (the shorter end) into the right crankcase using a press and two crankshaft jigs.

Special Tools - Crankshaft Jig: 57001-1174 × 2



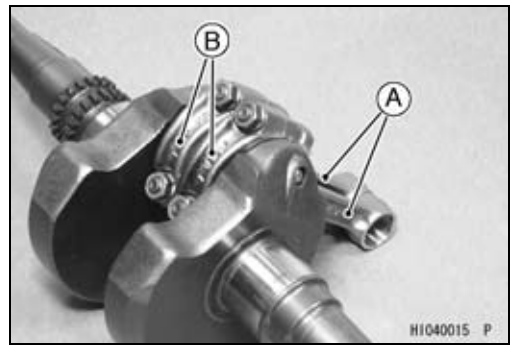
Connecting Rod Removal

- Remove the crankshaft (see Crankshaft Removal).
- Remove the connecting rods [A] from the crankshaft.

NOTE

○*Mark and record the locations of the connecting rods and their big end caps [B] so that they can be installed in their original positions.*

○Remove the connecting rod big end nuts, and take off the rod and cap with the bearing inserts.

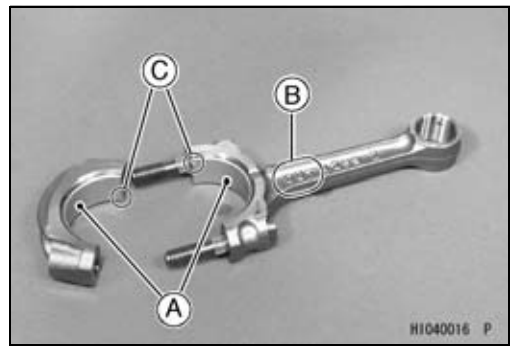


Connecting Rod Installation

NOTICE

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 the engine to be sure the correct bearing inserts are installed.

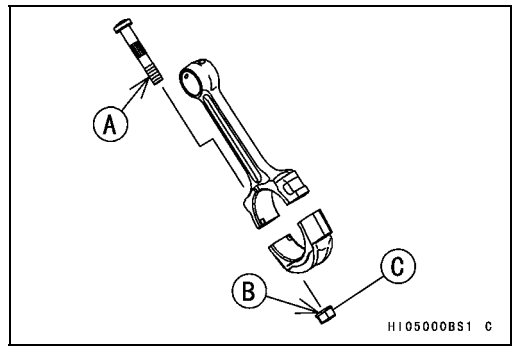
- Apply molybdenum disulfide oil:
  Inner Surface [A] of Bearing Inserts
- Face the “OUT” marks [B] of both connecting rods towards the outsides of the crankshaft.
- Fit the connecting rod cap so that the grooves [C] of the cap and connecting rod are on the same side.



Crankshaft/Connection Rod

- Apply molybdenum disulfide oil:
  Threads [A] of Connecting Rod Big End Cap Bolts
  Seating Surface [B] of Connecting Rod Big End Cap Nuts [C]
- Tighten:

Torque - Connecting Rod Big End Cap Nuts: 34.3 N·m (3.5 kgf·m, 25 ft·lb)



Crankshaft/Connecting Rod Cleaning

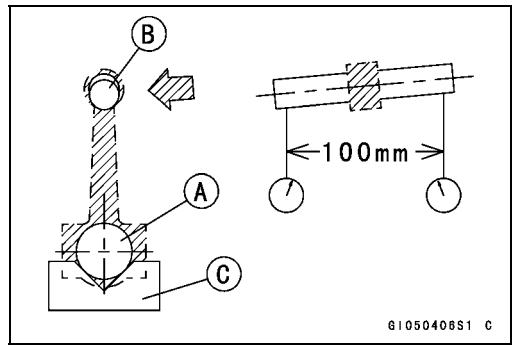
- After removing the connecting rods from the crankshaft, clean them with a high flash-point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

Connecting Rod Bend Inspection

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end cap.
- Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
- Select an arbor of the same diameter as the piston pin and at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
- On a surface plate, set the big-end arbor on 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 (3.94 in.) length to determine the amount of connecting rod bend.

★If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Bend
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)

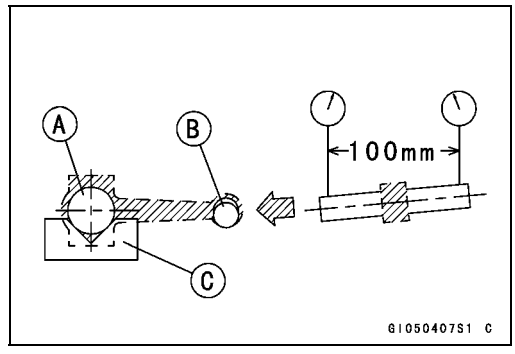


Connecting Rod Twist Inspection

- With the big-end arbor [A] still on 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 (3.94 in.) length of the arbor to determine the amount of connecting rod twist.

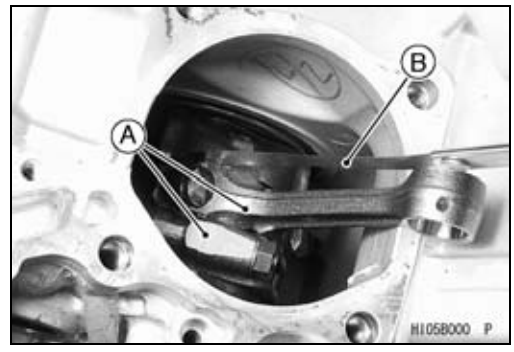
★If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)



Crankshaft/Connection Rod

Connecting Rod Big End Side Clearance Inspection



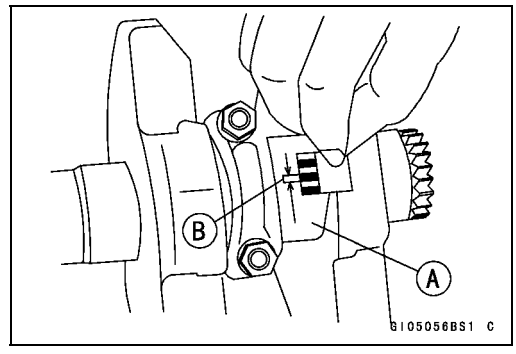
● Measure the side clearance of the connecting rod big end [A].

○Insert a thickness gauge [B] between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance
Standard: 0.16 ~ 0.46 mm (0.0063 ~ 0.0181 in.)
Service Limit: 0.7 mm (0.028 in.)

★If the clearance exceeds the service limit, replace the connecting rod with new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

Connecting Rod Big End Bearing/Crankpin Wear Inspection



● Measure the bearing insert/crankpin [A] clearance with plastigage [B].

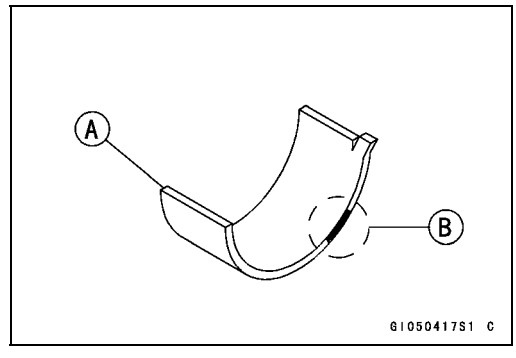
○Tighten the big end cap nuts to the specified torque.

Torque - Connecting Rod Big End Cap Nuts: 34.3 N·m (3.5 kgf·m, 25 ft·lb)

NOTE

○*Do not move the connecting rod and crankshaft during clearance measurement.*

Connecting Rod Big End Bearing, Insert/Crankpin Clearance
Standard: 0.028 ~ 0.052 mm (0.0011 ~ 0.0020 in.)
Service Limit: 0.09 mm (0.0035 in.)



★If the clearance is within the standard, no bearing insert replacement is required.

★If the clearance is between 0.052 mm (0.0020 in.) and the service limit 0.09 mm (0.0035 in.), replace the bearing inserts [A] with inserts painted green [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.

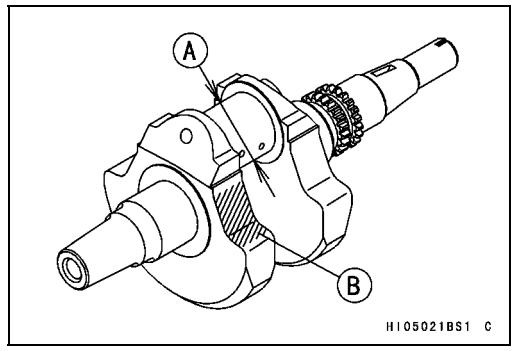
★If the clearance exceeds the service limit, measure the diameter of the crankpin.

Crankpin Diameter
Standard: 39.984 ~ 40.000 mm (1.5742 ~ 1.5748 in.)
Service Limit: 39.97 mm (1.5736 in.)

★If the crankpin has worn past the service limit, replace the crankshaft with a new one.

Crankshaft/Connection Rod

★If the measured crankpin diameter [A] is not less than the service limit, but does not coincide with the original diameter marking on the crankshaft, make a new mark on it.



Crankpin Diameter Marks

None: 39.984 ~ 39.992 mm (1.5742 ~ 1.57448 in.)

○: 39.993 ~ 40.000 mm (1.57452 ~ 1.5748 in.)

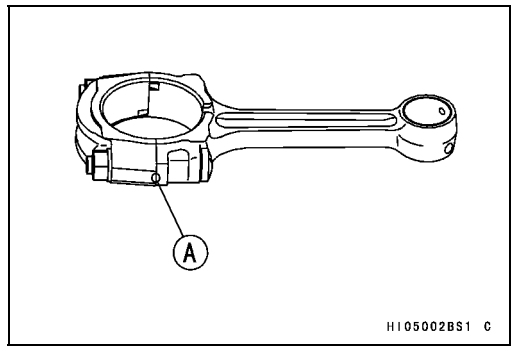
Crankpin Diameter Mark [B]: "○" mark or no mark

- Measure the connection rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- Tighten the big end nuts to the specified torque.

Torque - Connecting Rod Big End Cap Nuts: 34.3 N·m (3.5 kgf·m, 25 ft·lb)

NOTE

○*The mark already on the big end should almost coincide with the measurement because of little wear.*



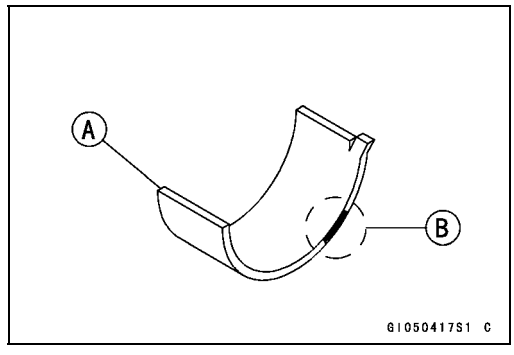
Connecting Rod Big End Inside Diameter Marks

None: 43.000 ~ 43.008 mm (1.6929 ~ 1.6932 in.)

○: 43.009 ~ 43.016 mm (1.6933 ~ 1.6935 in.)

Diameter Mark [A]: "○" or no mark

- Select the proper bearing insert [A] in accordance with the combination of the connecting rod and crankshaft coding. Size Color [B]



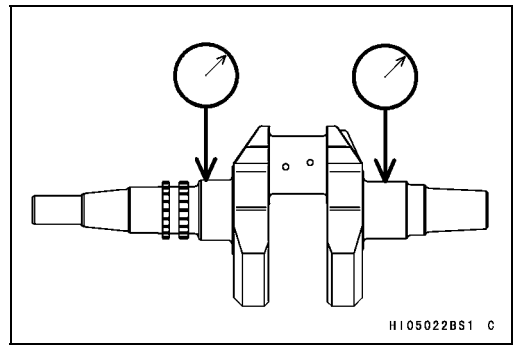
Big End Bearing Insert Selection

Con-rod Big End Bore Diameter Mark	Crankpin Diameter Mark	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92028-1963
None	None	Yellow	92028-1962
○	○		
○	None	Green	92028-1961

- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

Crankshaft/Connection Rod

Crankshaft Runout Inspection



● Measure the crankshaft runout.

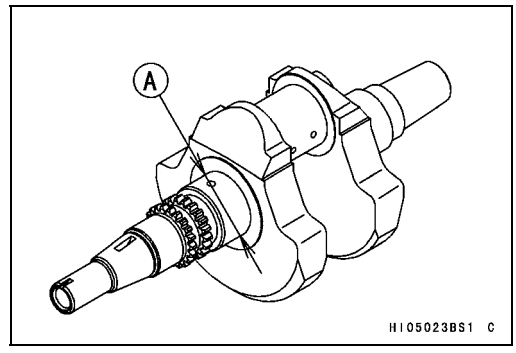
★If the measurement exceeds the service limit, replace the crankshaft.

Crankshaft Runout

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

Service Limit: TIR 0.10 mm (0.0039 in.)

Crankshaft Main Bearing/Journal Wear Inspection



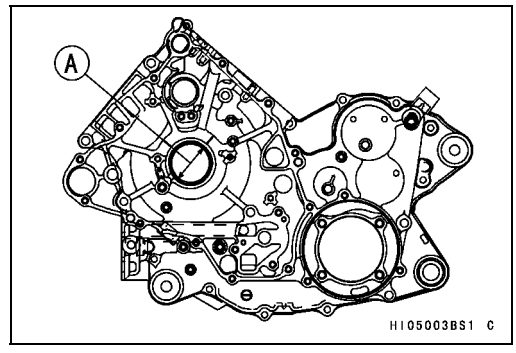
● Measure the diameter [A] of the crankshaft main journal.

Crankshaft Main Journal Diameter

Standard: 41.984 ~ 42.000 mm (1.6529 ~ 1.6535 in.)

Service Limit: 41.96 mm (1.652 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: 42.025 ~ 42.041 mm (1.6545 ~ 1.6552 in.)

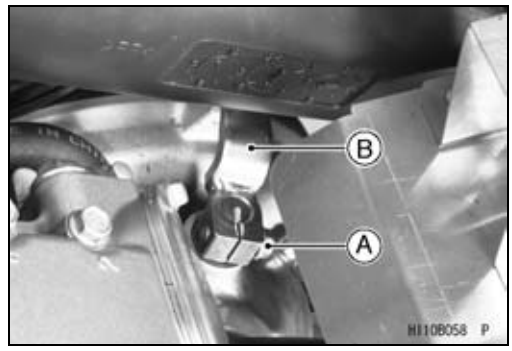
Service Limit: 42.08 mm (1.6567 in.)

★If there is any signs of seizure, damage, or excessive wear, replace the crankcase halves as a set.

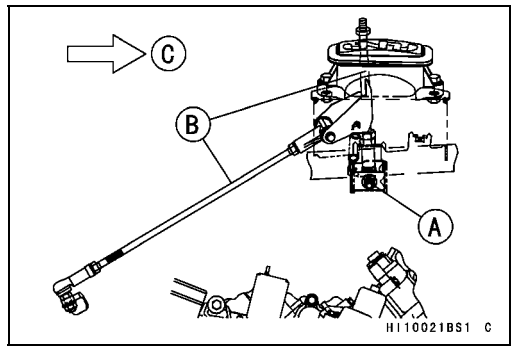
Transmission

Shift Lever Removal

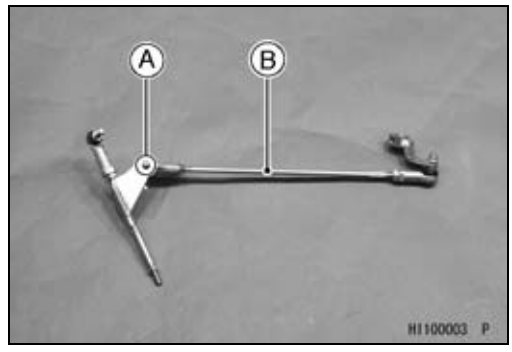
- Set the shift lever in the neutral position.
- Remove:
  Right Side Cover (see Right Side Cover Removal in the Frame chapter)
  Shift Shaft Lever Bolt [A]
- Remove the shift shaft lever [B] from the shift shaft.



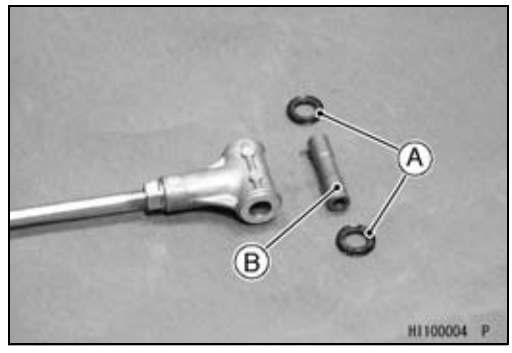
- Remove:
  Nut [A]
  Shift Lever Assembly [B]
  Front [C]



- Remove:
  Tie-rod End Bolt [A]
  Tie-rod [B]

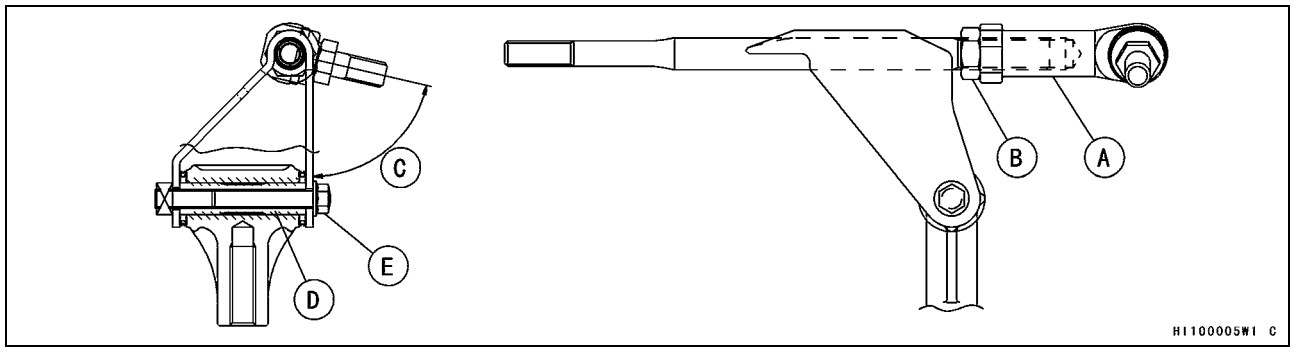


- Remove:
  Oil Seals [A]
  Collar [B]



Transmission

Shift Lever Installation

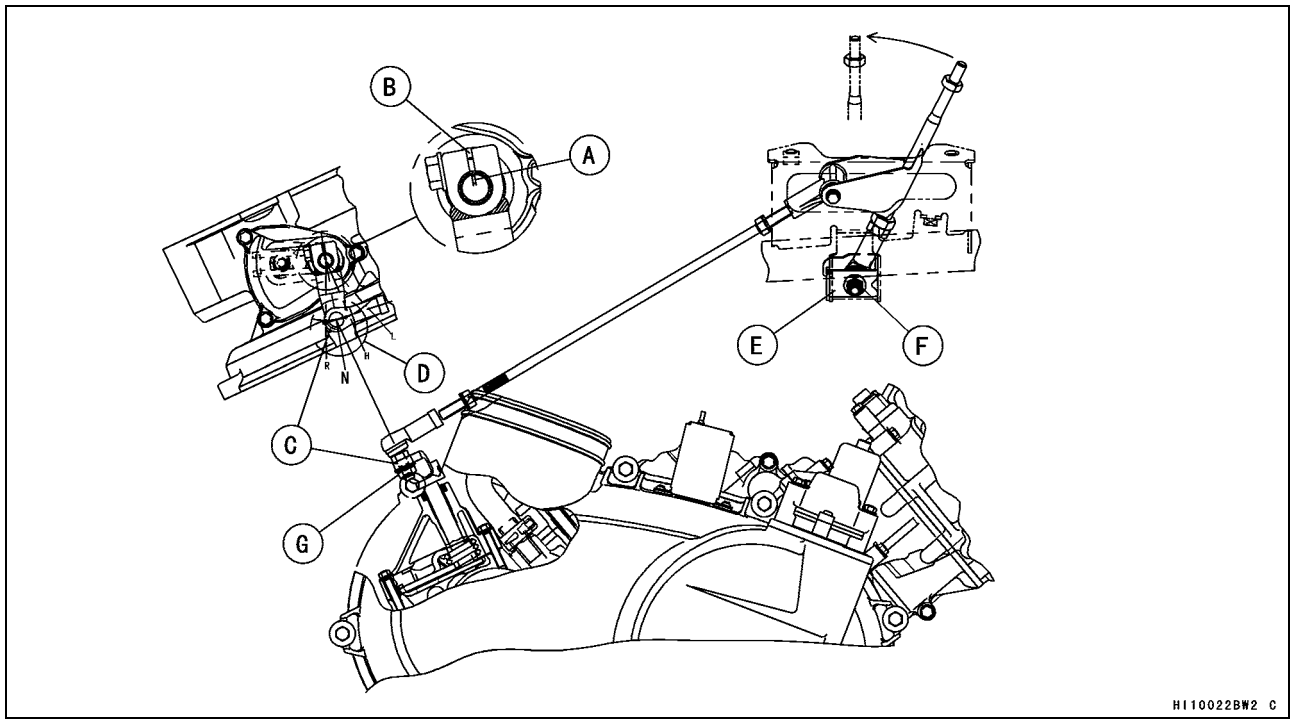


- Twist the tie-rod end [A] and tie-rod end locknut [B] to bottom of the screw and then turn back to dimension with 77° ±10° [C] as shown.
- Tighten the locknut against the tie-rod end:

Torque - Tie-rod End Locknut: 19.6 N·m (2.0 kgf·m, 14 ft·lb)

- Apply molybdenum disulfide grease:
  Outside of Tie-rod End Collar [D]
- Apply grease to the oil seals, and install them.
- Tighten:

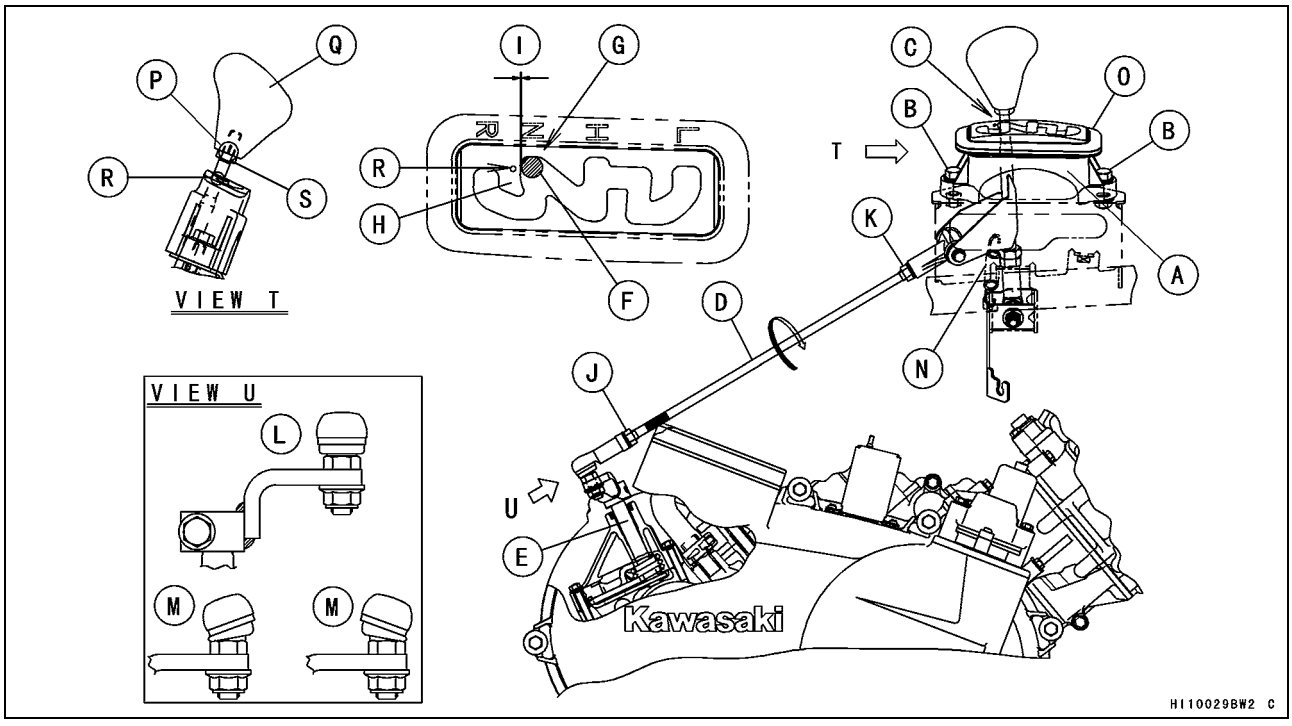
Torque - Tie-rod End Bolt [E]: 9.8 N·m (1.0 kgf·m, 87 in·lb)



- Align the mark [A] on the shaft end with the slit [B] of the shift shaft lever.
- Position the shift shaft lever end [C] on the boss-center [D] of the crankcase.
- Install:
  Bracket [E]
  Shift Lever Assembly Nut [F]
- Tighten:

Torque - Shift Lever Assembly Nut: 20 N·m (2.0 kgf·m, 14 ft·lb)
Tie-rod End Nut [G]: 19.6 N·m (2.0 kgf·m, 14 ft·lb)

Transmission



● Install:
Guide [A]

● Tighten:

Torque - Shift Lever Guide Mounting Bolts [B]: 19.6 N·m (2.0 kgf·m, 14 ft·lb)

● Set the lever assembly in the neutral position [C] while turning the tie-rod [D].

NOTE

○*Do not turn the shift shaft [E] when setting the lever assembly on neutral position.*

○Turn the tie-rod counterclockwise until the rod [F] of the shift lever assembly contacts with the neutral position [G] of the guide [H]. At that time, the clearance [I] between the rod and guide is 0 mm.

○Move the rod [F] to right side and check it returns to left side automatically.

● Tighten:

Torque - Tie-rod End Rear Locknut [J]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

● Holding the rear tie-rod end, and tighten the front locknut [K].

Torque - Tie-rod End Front Locknut: 9.8 N·m (1.0 kgf·m, 87 in·lb)

NOTE

○*The front locknut has left-hand threads.*

Transmission

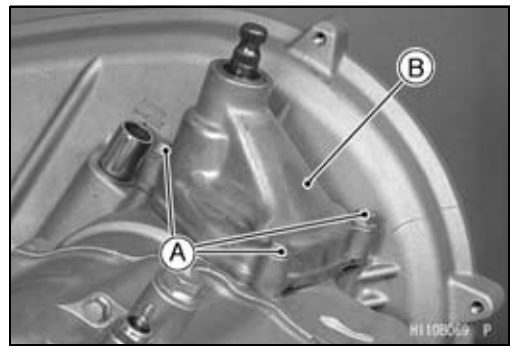
○Do not lean the tie-rod rear end after tightening the front locknut.
Right [L]
Wrong [M]

- Check that the shift lever moves from right to left automatically.
- Install:
  Spring [N]
  Trim Seal [O]
- Align the mark [P] of the grip [Q] with the projection [R] on the guide.
- Tighten:

Torque - Grip Holder Nut [S]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Transmission Removal

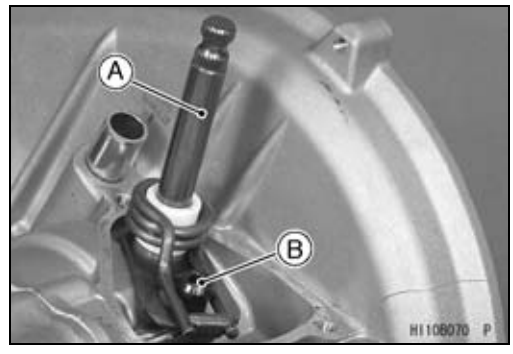
- Remove:
  Shift Shaft Cover Bolts [A]
  Shift Shaft Cover [B]



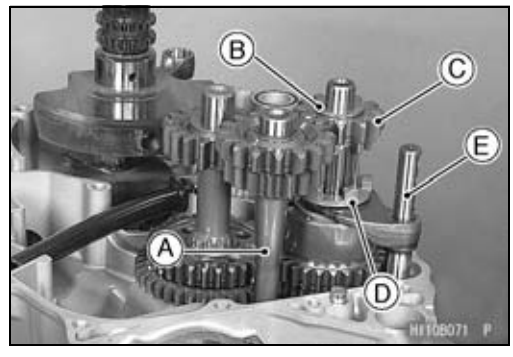
- While opening the shift shaft spring end, remove the shift shaft [A].

Special Tool - Outside Circlip Pliers: 57001-144

- Remove:
  Shift Shaft Spring Bolt [B]



- Split the crankcase (see Crankcase Disassembly).
- Remove:
  Reverse Idle Shaft [A]
  Spacer [B]
  Reverse Drive Gear [C], Needle Bearing, and Spacer
  Shifter [D]
  Shift Rod [E]

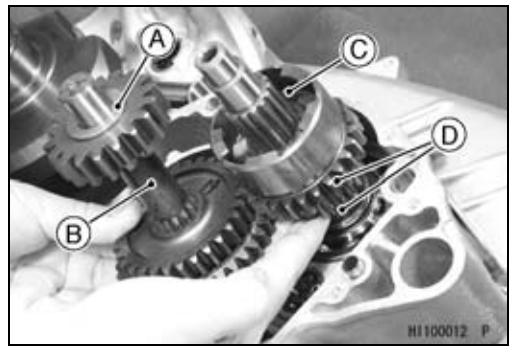


Transmission

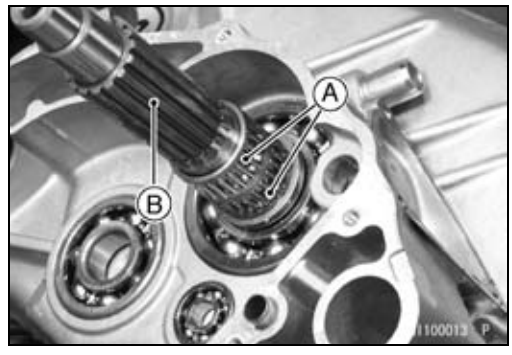
● Remove:
Circlip [A]

Special Tool - Outside Circlip Pliers: 57001-144

● Remove:
Spacer [A]
Idle Gear Assembly [B]
Washers and Spacer [C]
Low and High Gears [D]



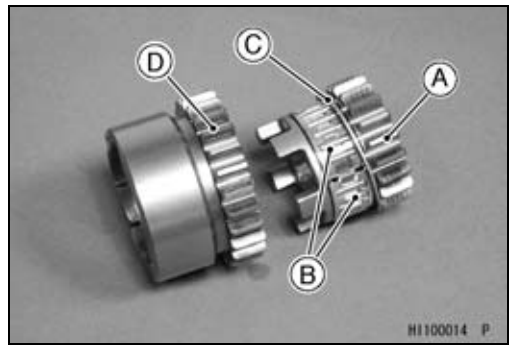
● Remove:
Needle Bearings [A]
● Remove the driven shaft [B] from the crankcase using a press.



Transmission Installation

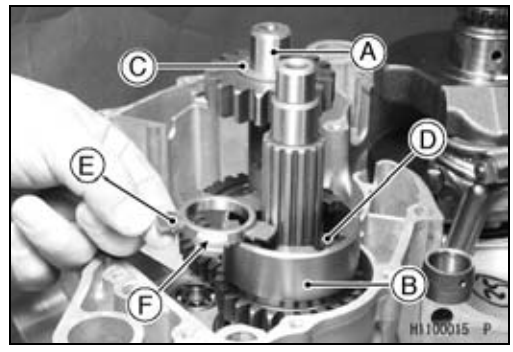
● Insert the driven shaft in the crankcase until it is bottomed using a press.
● Apply engine oil to the needle bearings and install them.

● Install the following parts on the low gear [A].
Needle Bearings [B]
Spacer [C] (P/No. 92026-1599, 48.2 × 54.3 × 1.0)
High Gear [D]



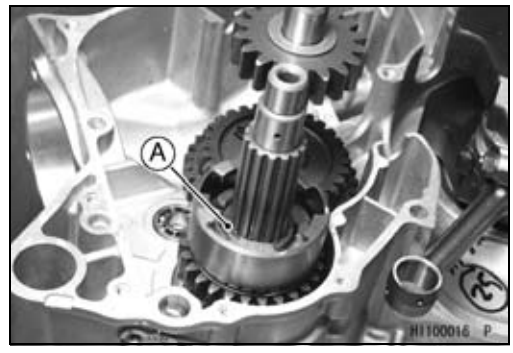
Transmission

- Install:
  Idle Shaft [A] with Gear Assembly [B]
  Spacer [C]
  Spacer [D] (P/No. 92026-1599, 48.2 × 54.3 × 1.0)
- Apply engine oil to the inner surface of the spacer [E].
- Install the spacer [E] so that the stepped side [F] faces outward.

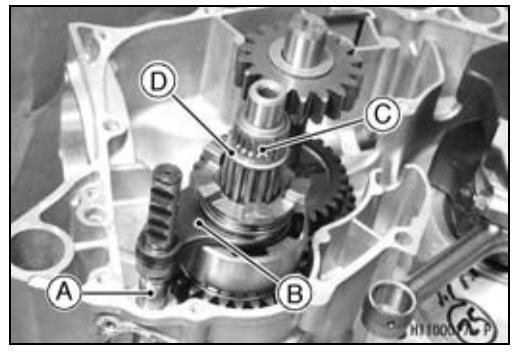


- Install:
  Spacer
  Toothed Washer [A]
  Circlip

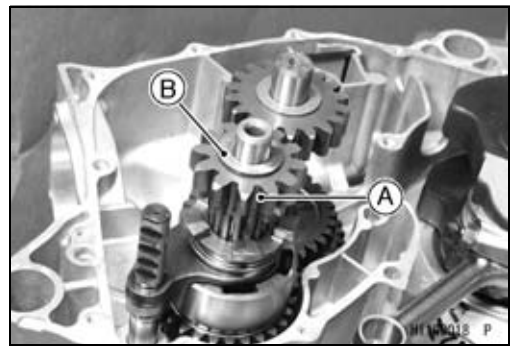
Special Tool - Outside Circlip Pliers: 57001-144



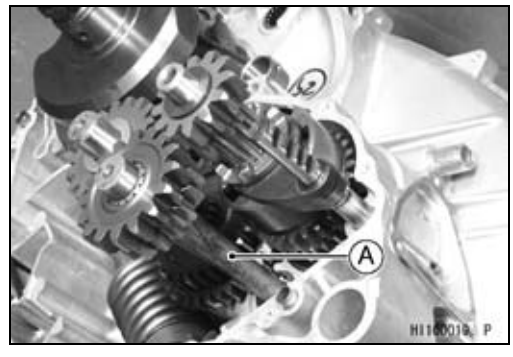
- Apply engine oil:
  Shift Rod [A] and Shift Fork Ear [B]
  Needle Bearing [C]
- Install:
  Shift Rod with Shift Fork
  Spacer [D]
  Needle Bearing



- Install:
  Reverse Drive Gear [A]
  Spacer [B]



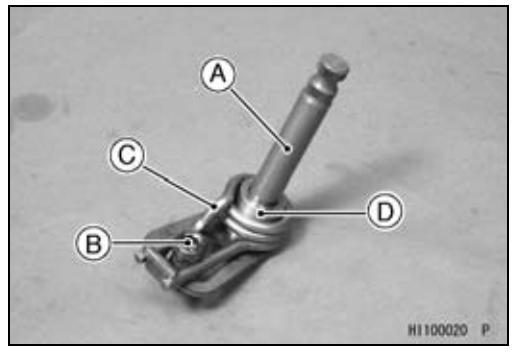
- Install:
  Reverse Idle Shaft [A]



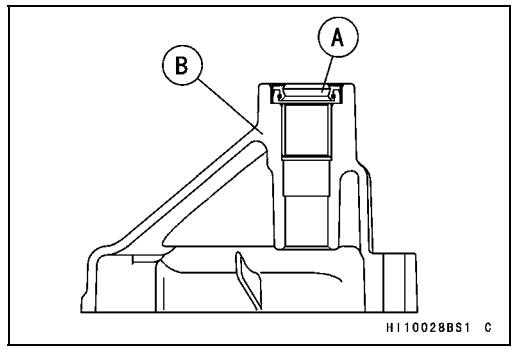
Transmission

● Apply molybdenum disulfide oil to the shift shaft [A].
● Install:
Shift Shaft Spring Bolt [B]
Spring [C]
Guide [D]
● Apply a non-permanent locking agent:
Shift Shaft Spring Bolt
● Tighten:

Torque - Shift Shaft Spring Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)



● When an oil seal [A] is installed in the shift shaft cover [B], press and insert the oil seal so that its surface is flush with the end of the hole.

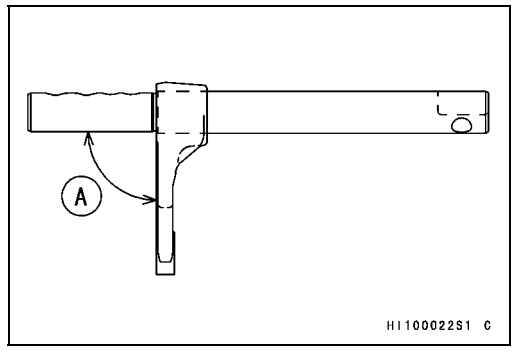


● Install:
Shift Shaft Cover
● Tighten:

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

Shift Fork Bending Inspection

● Visually inspect the shift fork.
★If the fork is bent, replace the shift rod with a new one. A bent fork could cause difficulty in shifting, or allow the transmission to jump out of gear when under power.
[A] 90°



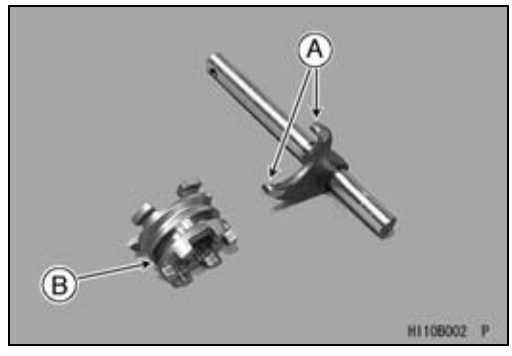
Shift Fork/Gear and Shifter Groove Wear Inspection

● Measure the thickness of the shift fork ears [A], and measure the width [B] of the shifter groove.
★If the thickness of a shift fork ear is less than the service limit, the shift rod must be replaced.

Shift Fork Ear Thickness
Standard: 5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)
Service Limit: 5.8 mm (0.23 in.)

★If the groove is worn over the service limit, the shifter must be replaced.

Shifter Groove Width
Standard: 6.05 ~ 6.15 mm (0.238 ~ 0.242 in.)
Service Limit: 6.25 mm (0.246 in.)

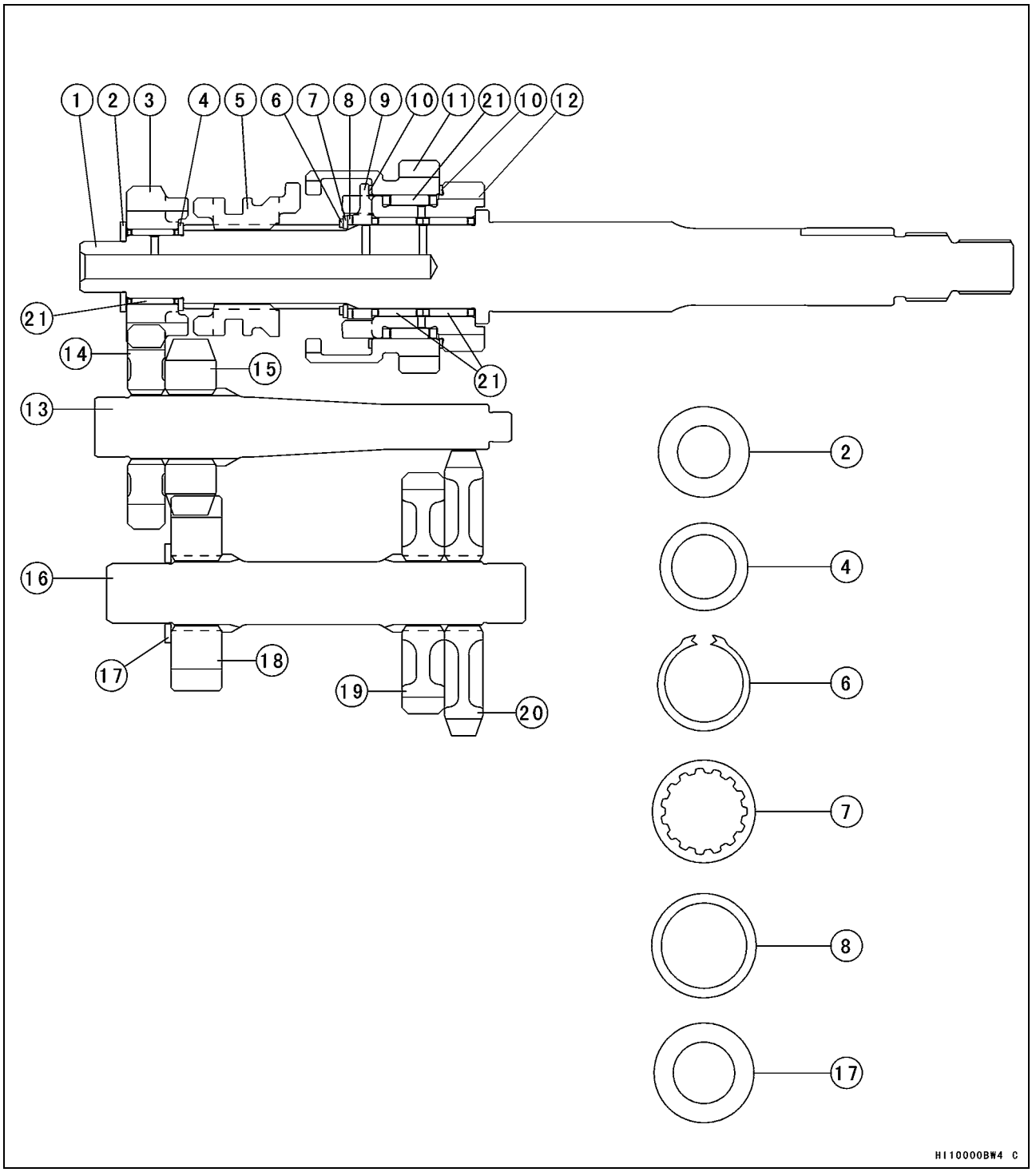


Transmission

Transmission and Shift Mechanism Inspection

● Visually inspect:
Gears
Dogs of Gear and Shifter
★If they are damaged or worn excessively, replace them.

Transmission



1. Driven Shaft
2. Spacer (17.3 × 30 × 2.0)
3. Reverse Gear (12T)
4. Spacer (21.2 × 29 × 1.6)
5. Shifter
6. Circlip
7. Toothed Washer (t = 1.5)
8. Spacer (28.2 × 34.5 × 1.6)
9. Spacer (Hi and Low)
10. Spacer (48.2 × 54.3 × 1.0)
11. Drive Hi Gear (26T)
12. Drive Low Gear (20T)
13. Reverse Idle Shaft
14. Reverse Driven Gear (16T)
15. Reverse Driven Output Gear (16T)
16. Idle Shaft
17. Spacer (20.3 × 33 × 2.0)
18. Drive Output Gear (18T)
19. Driven Hi Gear (30T)
20. Driven Low Gear (36T)
21. Needle Bearing

Ball Bearing, Needle Bearing, and Oil Seal

Ball and Needle Bearing Replacement

NOTICE

Do not remove the ball or needle bearings unless it is necessary. Removal may damage them.

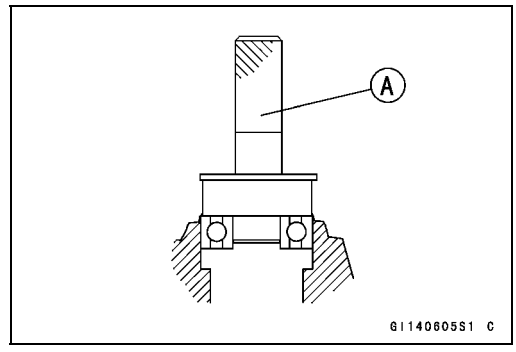
● Using a press or puller, remove the ball bearing and/or three needle bearings.

NOTE

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

NOTICE

Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.



● Using a press and the bearing driver set [A], install the new ball bearing until it stops at the bottom of its housing.

○Three new needle bearings must be pressed into the crankcase so that the end is flush with the end of the hole.

Special Tool - Bearing Driver Set: 57001-1129

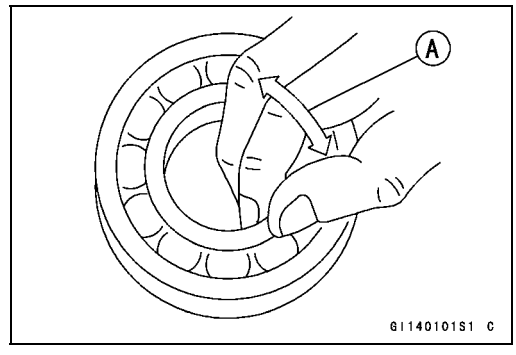
Ball and Needle Bearing Wear Inspection

NOTICE

Do not remove the bearings for inspection. Removal may damage them.

● Check the ball bearings.

○Since the ball bearings are made to extremely close tolerances, the wear must be judged by feel rather than measurement. Clean each bearing in a high-flash point solvent, dry it (do not spin the bearing while it is dry), and oil it with engine oil.



○Spin [A] the bearing by hand to check its condition.

★If the bearing is noisy, does not spin smoothly, or has any rough spots, replace it.

● Check the needle bearings.

○The rollers in a needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.

★If there is any doubt as to the condition of a needle bearing, replace it.

Oil Seal Inspection

● Inspect the oil seals.

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

Wheels/Tires

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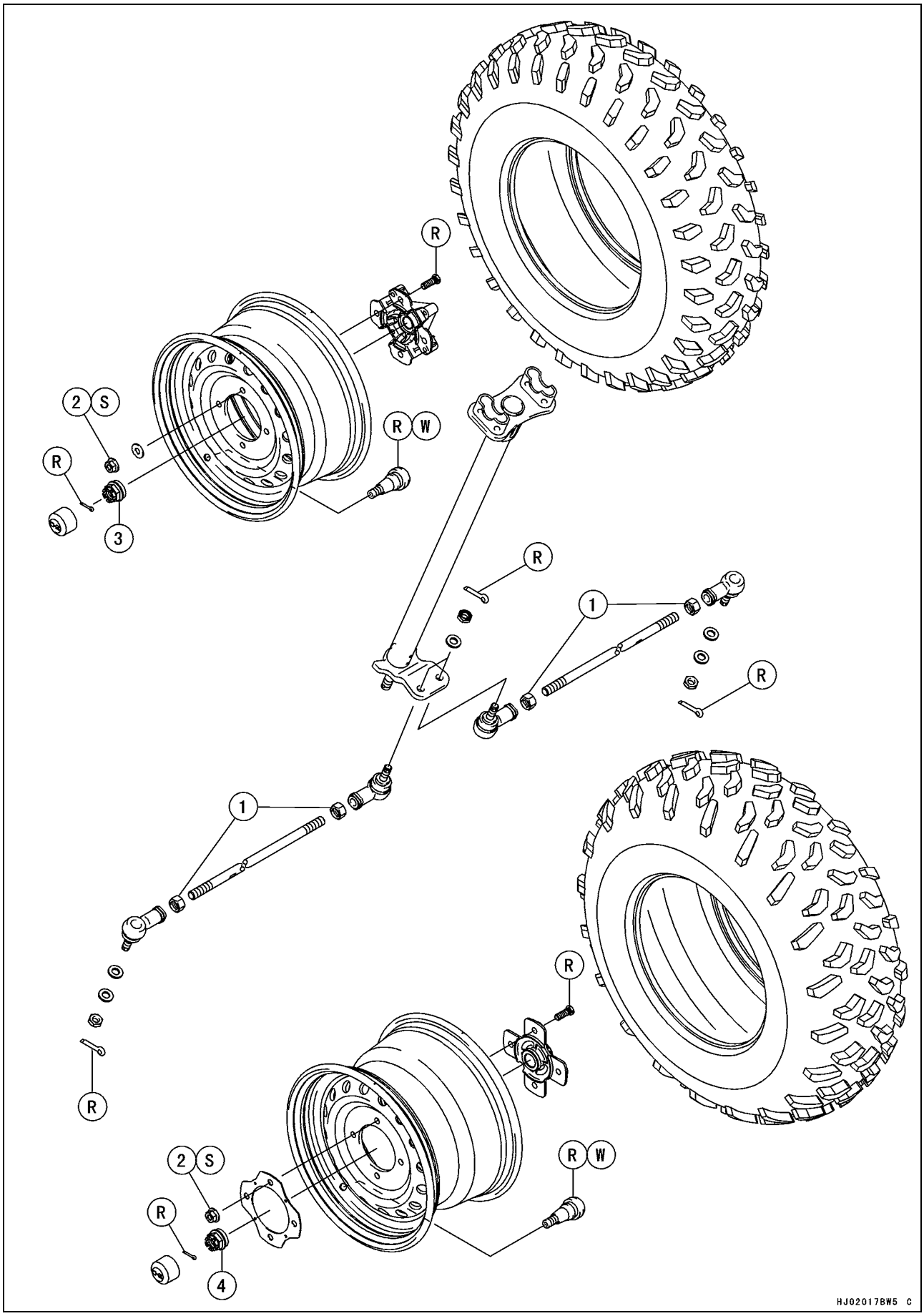
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Tie-rod Locknuts	37	3.8	27	
2	Wheel Nuts (First Torque)	15	1.5	11	S
2	Wheel Nuts (Final Torque)	76	7.7	56	S
3	Front Axle Nuts	197	20	145	
4	Rear Axle Nuts	265	27	195	

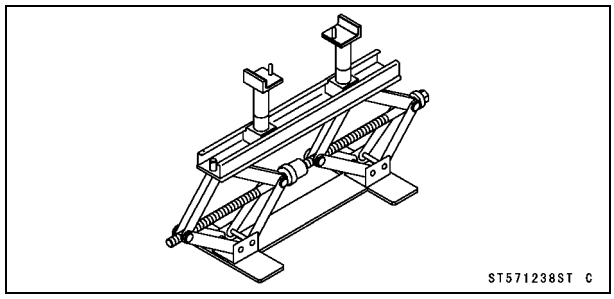
R: Replacement Parts
S: Follow the specific tightening sequence.
W: Apply water or soap and water solution.

Specifications

Item	Standard	Service Limit
Wheel Alignment		
Toe-in of front wheels:	–10 ~ 10 mm (–0.39 ~ 0.39 in.) at 1G	– – –
Wheels (Rims)		
Rim Size:		
Front	12 × 6.0	– – –
Rear	12 × 7.5	– – –
Tires		
Standard tire:		
Front	AT 25 × 8-12 DUNLOP, KT191, Tubeless	– – –
Rear	AT 25 × 10-12 DUNLOP, KT195, Tubeless	– – –
Tire air pressure (when cold):		
Front	35 kPa (0.35 kgf/cm², 5.0 psi)	– – –
Rear	35 kPa (0.35 kgf/cm², 5.0 psi)	– – –
Maximum tire air pressure (to seat beads, when cold)	250 kPa (2.5 kgf/cm², 36 psi)	– – –
Tire tread depth:		
Front	13.0 mm (0.51 in.)	3 mm (0.12 in.)
Rear	14.5 mm (0.57 in.)	4 mm (0.16 in.)

Special Tool

Jack:
57001-1238



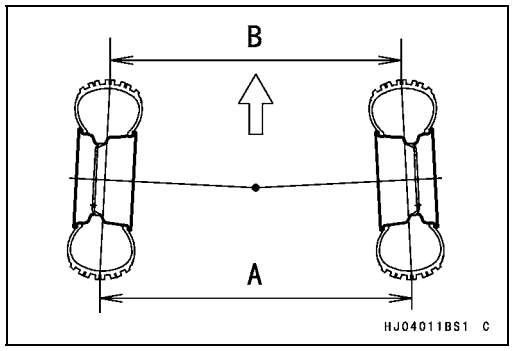
Wheel Alignment

Toe-in is the difference between the distance of front and the one of rear at the axle height position in the front wheels. When there is toe-in, the distance A (Rear) is the greater than B (Front) as shown.

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

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

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



Steering Centering Inspection

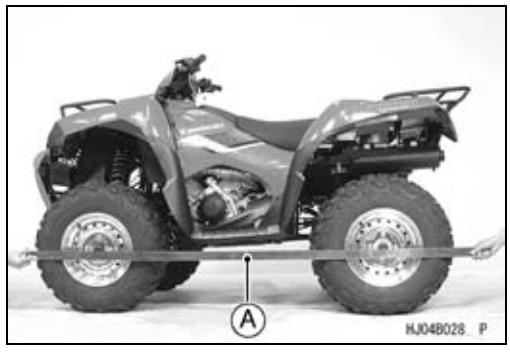
- Test ride the vehicle.

★If the handlebar is straight when the vehicle is traveling in a straight line, go on to the Toe-in Inspection procedure.

★Otherwise, go on to the Steering Centering Adjustment procedure.

Steering Centering Adjustment

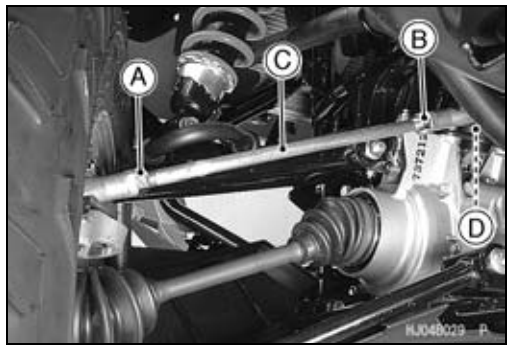
- Hold a straightedge [A] against the rear wheel rim on one side at axle height.



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

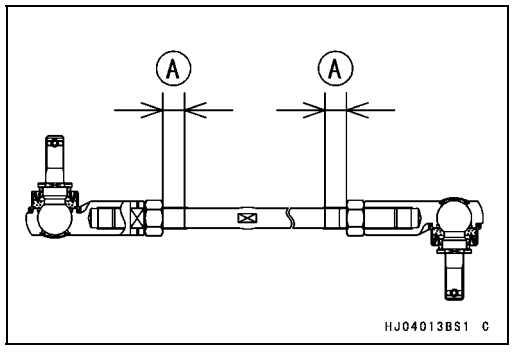
NOTE

○*The locknut [B] near the L mark [D] on the tie-rod has left-hand threads. Turn the wrench clockwise for loosening.*



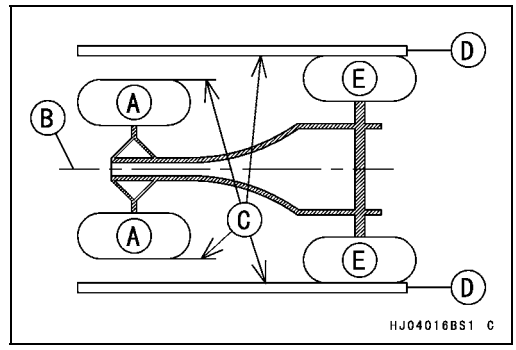
NOTICE

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



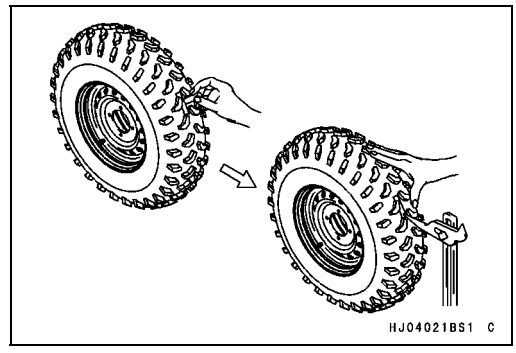
Wheel Alignment

- Repeat the straightedge procedure on the other side of the vehicle. Now the front wheels are parallel to each other and to the center line of the vehicle.
  Front Wheel [A]
  Vehicle Center Line [B]
  Parallel each other [C]
  Straightedges [D]
  Rear Wheels [E]
- Go on to the Toe-in Inspection procedure.



Toe-in Inspection

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



- With the front wheels on the ground, set the handlebar straight ahead.
- At the level of the axle height, measure the distance between the scribed or painted lines for both front and rear of the front tires.
- Subtract the measurement of the front from the measurement of the rear to get the toe-in.

★If the toe-in is not in the specified range, go on to the Toe-in Adjustment procedure.

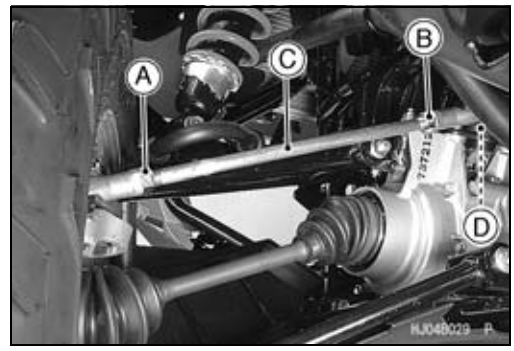
Toe-in of Front Wheels
Standard: –10 ~ 10 mm (–0.39 ~ 0.39 in.) at 1G

Toe-in Adjustment

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

NOTE

○*The locknut [B] near the L mark [D] on the tie-rod has left-hand threads. Turn the locknut clockwise for loosening.*



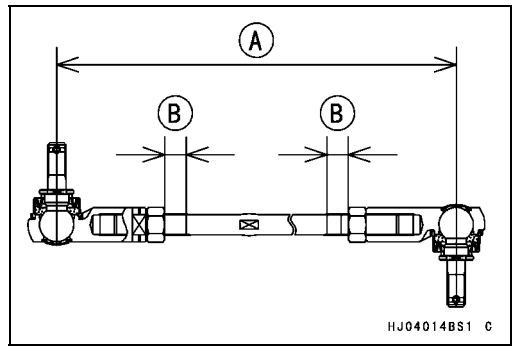
Wheel Alignment

NOTE

○*The toe-in will be near the specified value, if the tie-rod length [A] is 388.5 mm (15.30 in.) on each tie-rod.*

NOTICE

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



- Check the toe-in.
- Tighten:

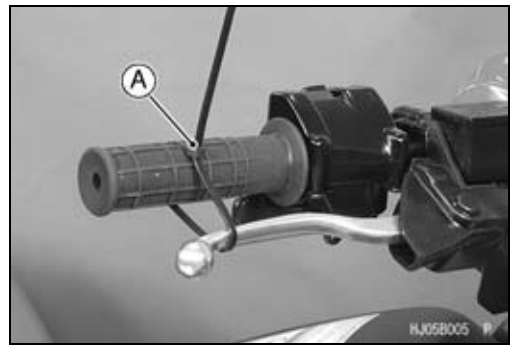
  Torque - Tie-rod Locknuts: 37 N·m (3.8 kgf·m, 27 ft·lb)

- Test ride the vehicle.

Wheels (Rims)

Wheel Removal

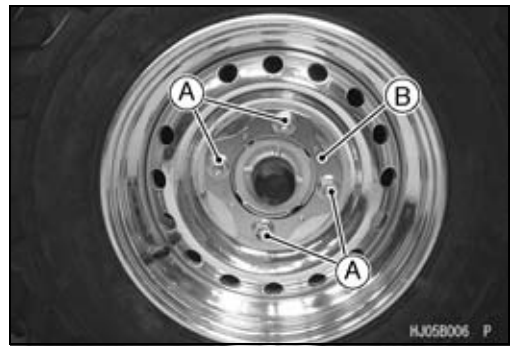
- Squeeze the brake lever slowly and hold it with a band [A].



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

  Special Tool - Jack: 57001-1238

- Remove:
  Wheel Nuts
  Washers (Front Wheel)
  Plate [B] (Rear Wheel)
  Wheel

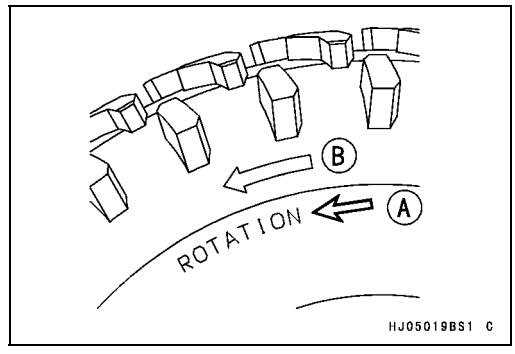


Wheel Installation

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

NOTE

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

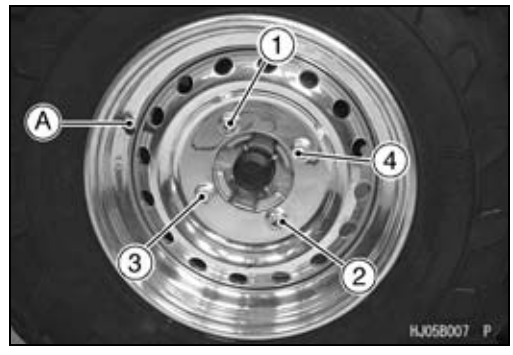


- Position the wheel so that the air valve [A] is toward the outside of the vehicle.
- Wipe dry the surface of the rim.
- Wipe dry the nuts, washers (Front Wheel) and plate (Rear Wheel).
- First tighten the wheel nuts in a criss-cross pattern.

  First Torque - Wheel Nuts: 15 N·m (1.5 kgf·m, 11 ft·lb)

- Finally tighten the wheel nuts in a criss-cross pattern.

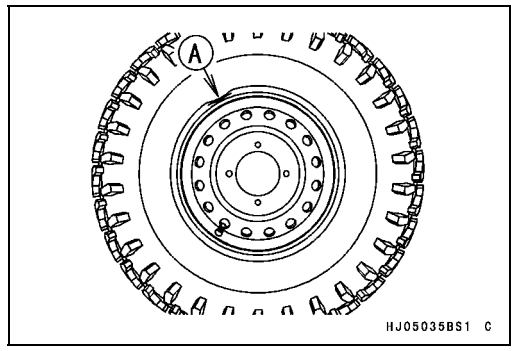
  Final Torque - Wheel Nuts: 76 N·m (7.7 kgf·m, 56 ft·lb)



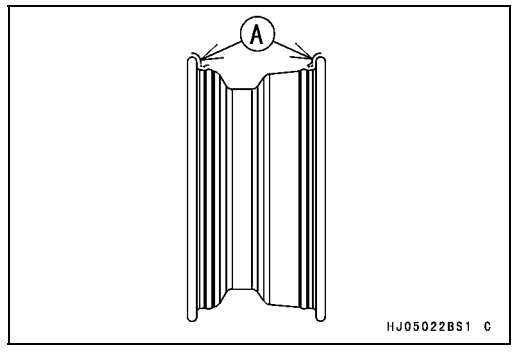
Wheels (Rims)

Wheel (Rim) Inspection

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



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

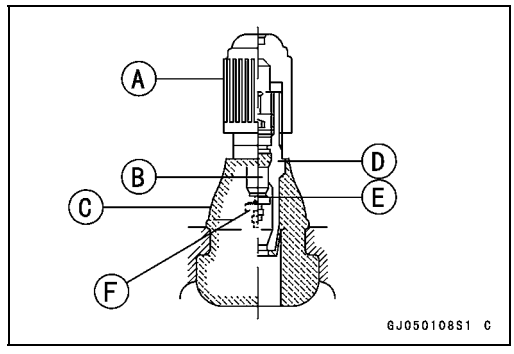


Wheel (Rim) Replacement

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

NOTICE

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

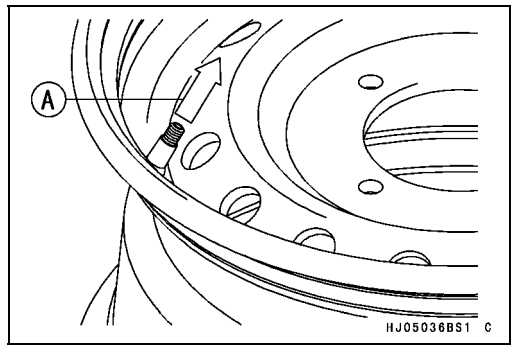


Plastic Cap [A]
Valve Core [B]
Stem Seal [C]
Valve Stem [D]
Valve Seat [E]
Valve Opened [F]

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

NOTICE

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



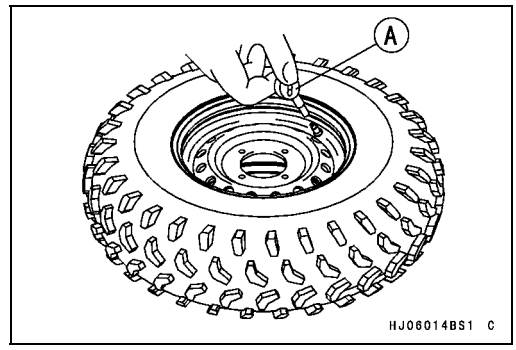
● Mount the tire on the new rim (see Tire Installation).
● Install the wheel (see Wheel Installation).
● Install the air valve cap.

Tires

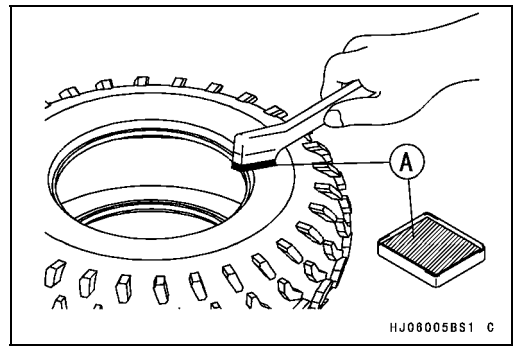
Tire Removal

- Remove the wheel.
- Unscrew the valve core to deflate the tire.

○Use a proper valve core tool [A].



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



NOTICE

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

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

NOTE

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

Tire Installation

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

NOTICE

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

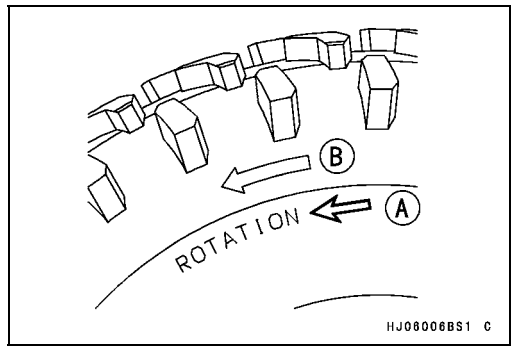
- Check the tire for wear and damage (see Tire Inspection in the Periodic Maintenance chapter).
- Lubricate the tire beads and rim flanges with a soap and water solution, or water.

⚠ WARNING

Lubricants other than water or a water and soap solution can cause the bead to separate from the rim and cause an accident resulting in serious injury or death. Use only water or a water and soap solution to lubricate the bead when installing the tire.

Tires

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

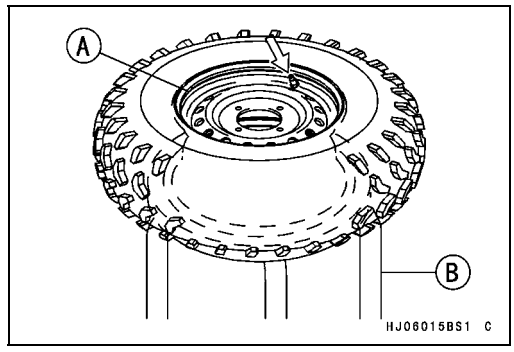


NOTE

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

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

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

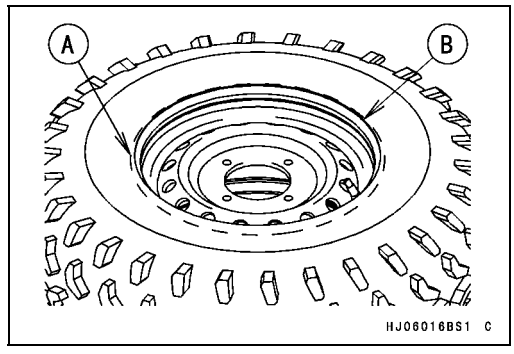


Maximum Tire Air Pressure (to seat beads when cold)
Front and Rear 250 kPa (2.5 kgf/cm², 36 psi)

⚠ WARNING

Overinflating a tire can cause it to explode, causing serious injury or death. Be sure to install the valve core whenever inflating the tire, and do not inflate the tire to more than maximum pressure.

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



NOTE

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

Tire Air Pressure (when cold)
Front 35 kPa (0.35 kgf/cm², 5.0 psi)
Rear 35 kPa (0.35 kgf/cm², 5.0 psi)

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

⚠ WARNING

Water or soap solution on the tire bead can cause tire separation and an accident resulting in serious injury or death. Do not operate the vehicle until any water or soap solution applied to the bead has completely dried.

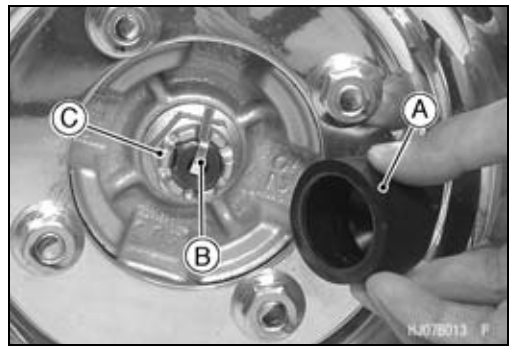
Tires

Tire Inspection

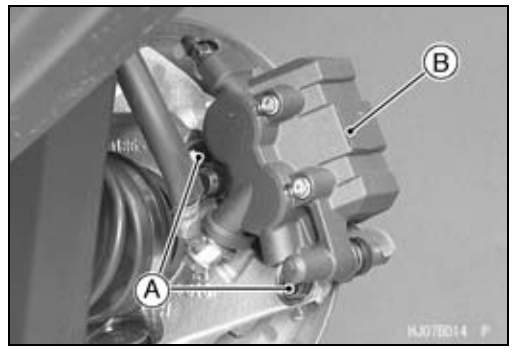
- Refer to the Tire Inspection in the Periodic Maintenance chapter.

Front Hub

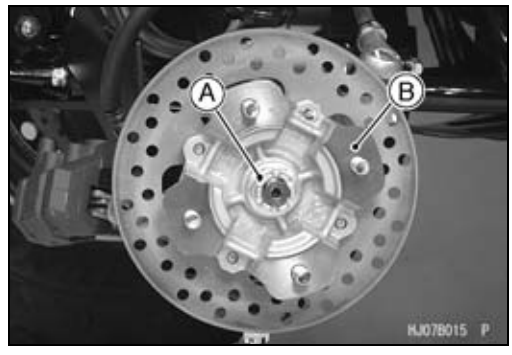
Front Hub Removal



- Remove:
  Cap [A]
  Cotter Pin [B] (cut)
- Loosen the axle nut [C].



- Remove the front wheel (see Wheel Removal).
- Remove the caliper by taking off the mounting bolts [A], and let the caliper [B] hang free.



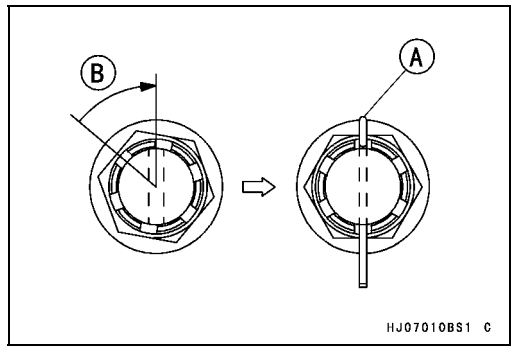
- Remove the axle nut [A], and pull off the front hub [B] together with the brake disc.
- Separate the brake disc from the front hub (see Front Brake Disc Removal in the Brakes chapter).

Front Hub Installation

- Install the front brake disc (see Front Brake Disc Installation in the Brakes chapter).
- Wipe dry the spline portion of the hub.
- Wipe dry the threads and seating surface of the nuts.
- Tighten:

Torque - Front Axle Nuts: 197 N·m (20 kgf·m, 145 ft·lb)

- Insert a new cotter pin [A].

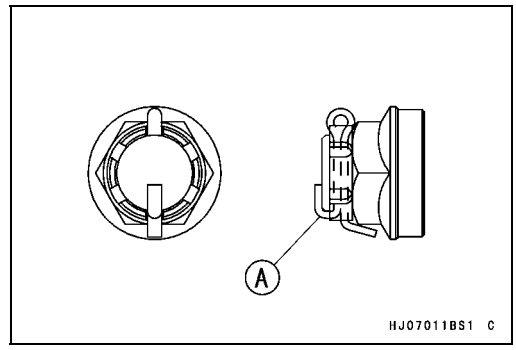


NOTE

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

Front Hub

● Bend the cotter pin [A] over the nut.

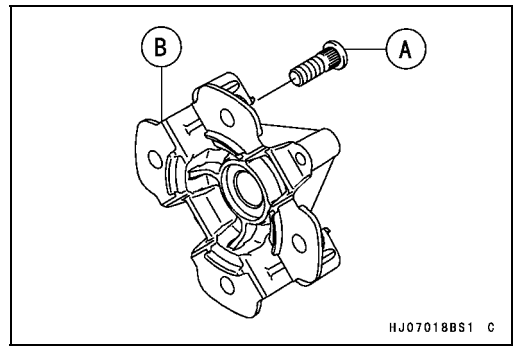


Front Hub Disassembly/Assembly

★If any hub bolt [A] is damaged, replace the hub [B] and bolts as a unit.

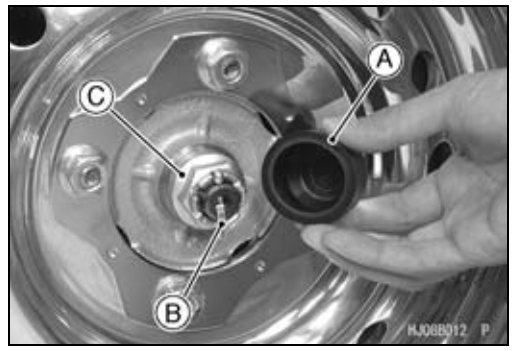
● Remove the hub bolt from the hub using a press.

● Press the hub bolt using a press.

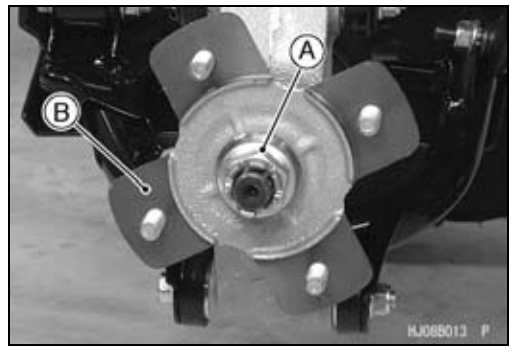


Rear Hub

Rear Hub Removal



- Remove:
  Cap [A]
  Cotter Pin [B]
- Loosen the axle nut [C].

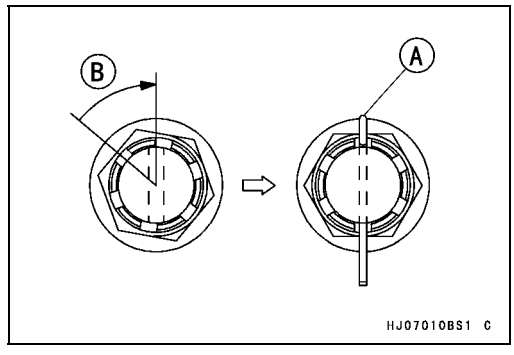


- Remove:
  Wheel (see Wheel Removal)
  Axle Nut [A]
  Rear Hub [B]

Rear Hub Installation

- Wipe dry the spline portion of the hub.
- Wipe dry the threads and seating surface of the nuts.
- Tighten:

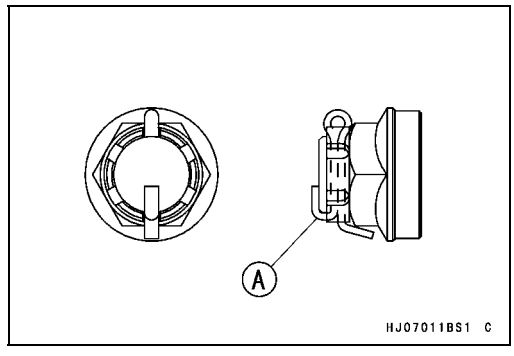
Torque - Rear Axle Nuts: 265 N·m (27 kgf·m, 195 ft·lb)



- Insert a new cotter pin [A].

NOTE

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



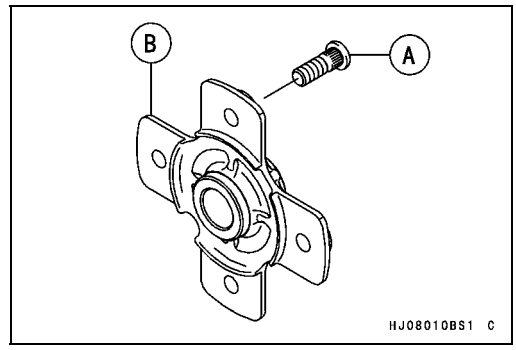
- Bend the cotter pin [A] over the nut.

Rear Hub

Rear Hub Disassembly/Assembly

★If any hub bolt [A] is damaged, replace the hub [B] and bolts as a unit.

- Remove the hub bolt from the hub using a press.
- Press the hub bolt using a press.



Final Drive

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Exploded View

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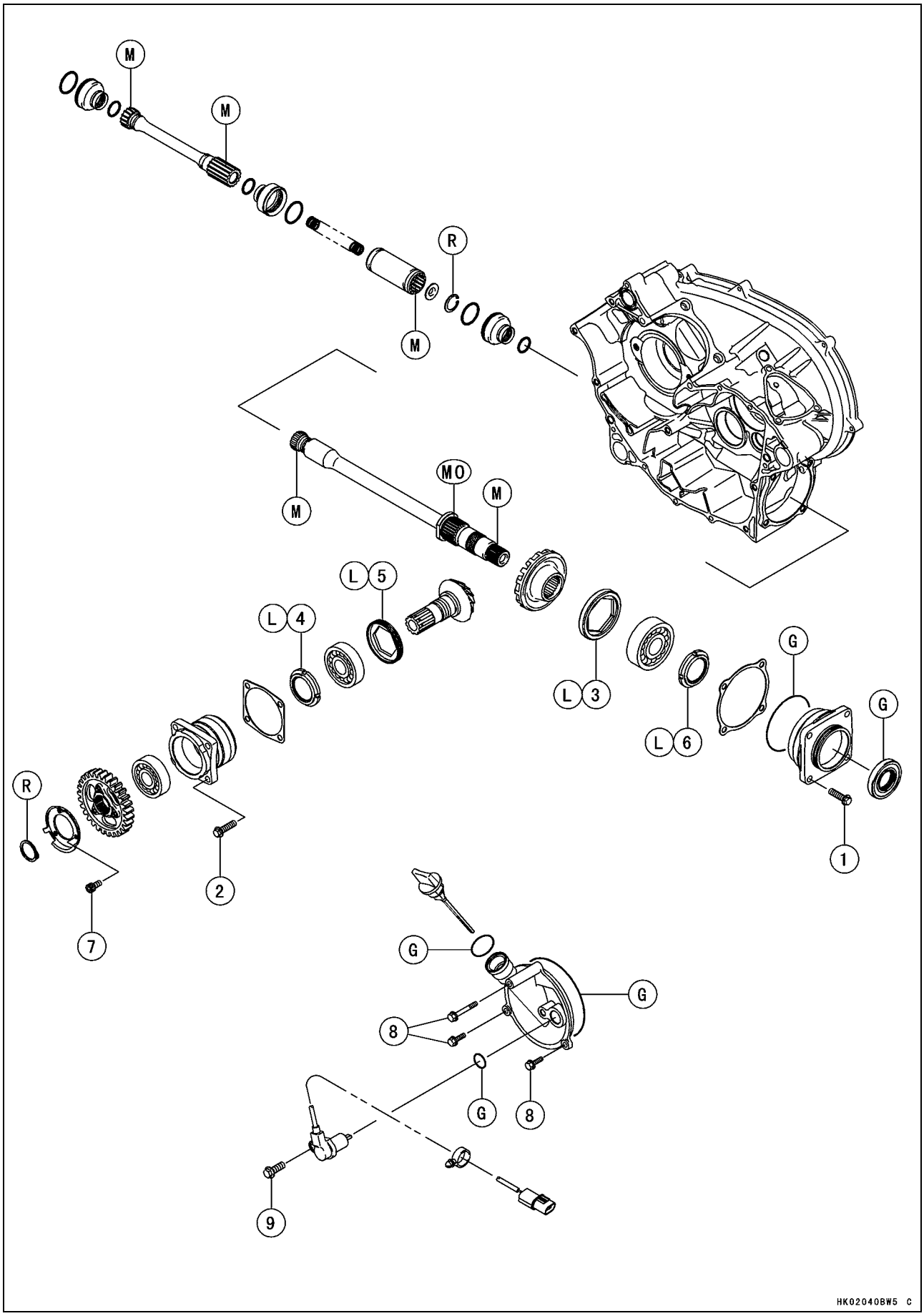
Exploded View

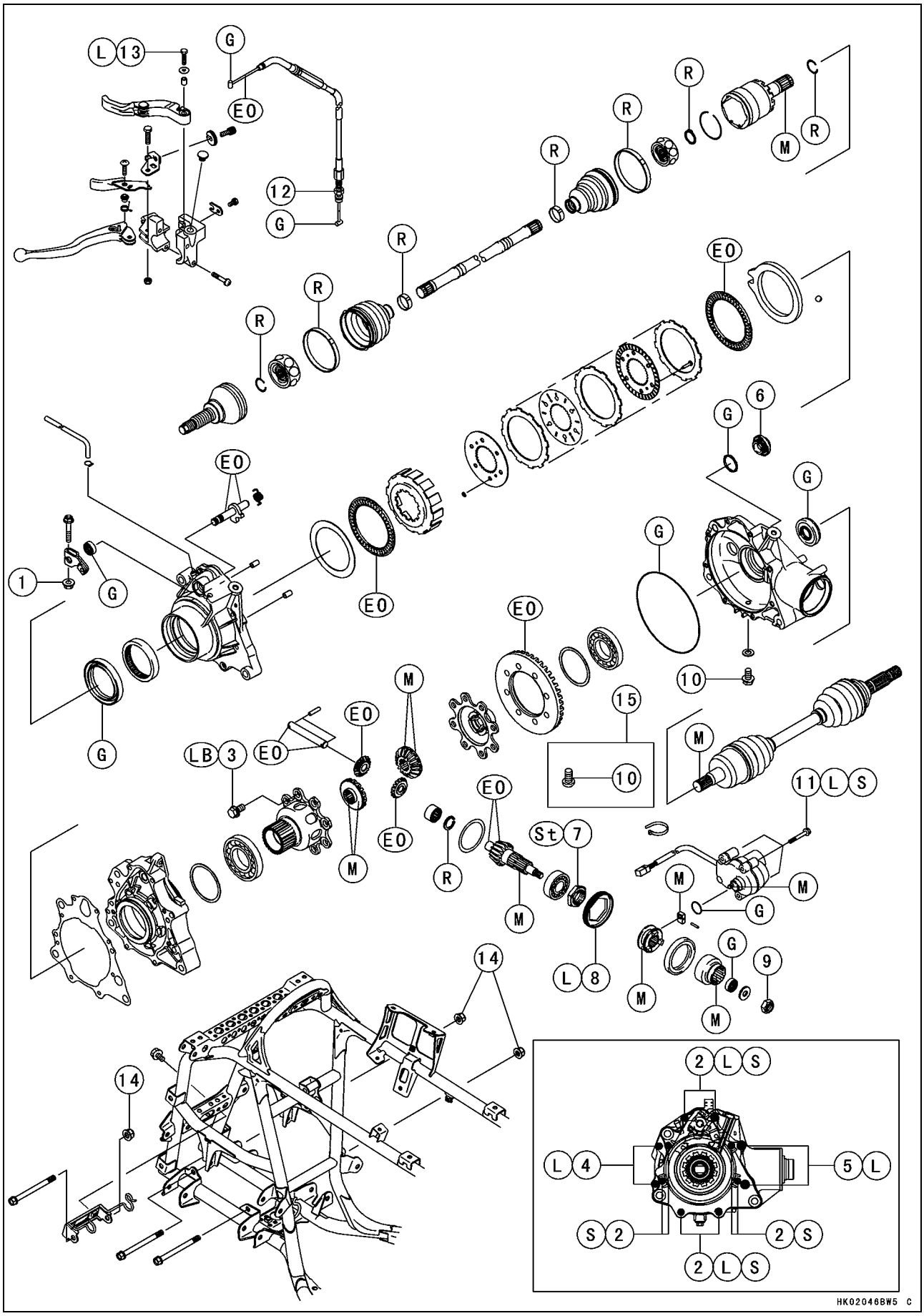


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Output Driven Bevel Gear Housing Bolts	26	2.6	20	
2	Output Drive Bevel Gear Housing Bolts	26	2.6	20	
3	Bearing Holder	250	25.5	184	L
4	Bevel Gear Holder Nut	200	20.4	148	L
5	Bearing Holder	120	12	88	L
6	Output Shaft Holder Nut	200	20.4	148	L
7	Rotor Mounting Bolts	12	1.2	106 in·lb	
8	Output Drive Bevel Gear Cover Bolts	8.8	0.90	78 in·lb	
9	Forward/Reverse Detecting Sensor Mounting Bolt	15	1.5	11	

G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil (mixture of the engine oil and molybdenum disulfide grease in a weight ratio: 10 : 1).
R: Replacement Parts

Exploded View

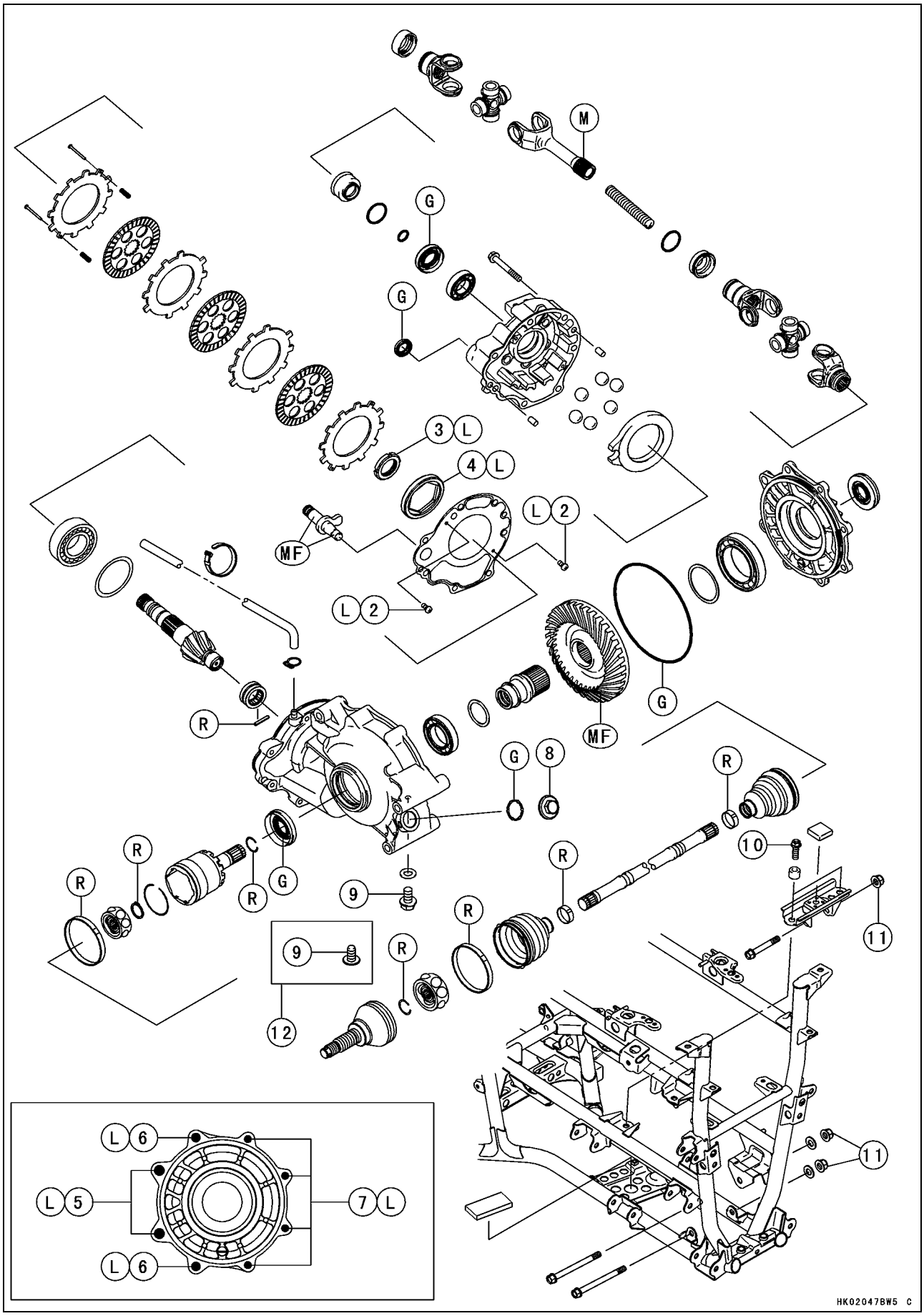


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Variable Differential Control Shift Shaft Lever Bolt	8.8	0.90	78 in·lb	
2	Front Final Gear Case Left Cover Bolts (M6)	9.8	1.0	87 in·lb	L (4), S
3	Ring Gear Bolts	57	5.8	42	LB
4	Front Final Gear Case Center Cover Bolts (M6)	9.8	1.0	87 in·lb	L
5	Front Final Gear Case Center Cover Bolts (M8)	24	2.4	17	L
6	Front Final Gear Case Oil Filler Cap	29	3.0	22	
7	Pinion Gear Bearing Holder Nut	127	13	94	St
8	Pinion Gear Bearing Holder	137	14	101	L
9	Front Final Gear Case Coupling Nut	25	2.5	18	
10	Front Final Gear Case Oil Drain Bolt	15	1.5	11	
11	2WD/4WD Actuator Mounting Bolts	9.8	1.0	87 in·lb	L, S
12	Variable Differential Control Cable Locknut	16	1.6	12	
13	Variable Differential Control Lever Bolt	3.4	0.35	30 in·lb	L
14	Front Final Gear Case Nuts	59	6.0	44	

15. KVF750D8F/E8F/E8FA/F8F Models
EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
LB: Apply a non-permanent locking agent (Three Bond TB2471 Blue).
M: Apply molybdenum disulfide grease.
R: Replacement Parts
S: Follow the specific tightening sequence.
St: Stake the fasteners to prevent loosening.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear Final Gear Case Front Cover Bolts	24	2.4	18	
2	Rear Final Gear Case Gasket Screws	1.25	0.13	11 in·lb	L
3	Pinion Gear Bearing Holder Nut	157	16	116	L
4	Pinion Gear Bearing Holder	137	14	101	L
5	Rear Final Gear Case Right Cover Bolts (M12)	95	9.7	70	L
6	Rear Final Gear Case Right Cover Bolts (M10)	49	5.0	36	L
7	Rear Final Gear Case Right Cover Bolts (M8)	24	2.4	18	L
8	Rear Final Gear Case Oil Filler Cap	29	3.0	21	
9	Rear Final Gear Case Oil Drain Bolt	15	1.5	11	
10	Rear Final Gear Case Bracket Bolts	59	6.0	44	
11	Rear Final Gear Case Nuts	91	9.3	67	

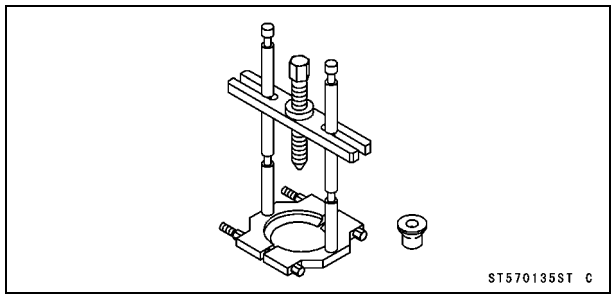
12. KVF750D8F/E8F/E8FA/F8F Models
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
MF: Apply gear oil (MOBIL FLUID 424) or equivalent oil.
R: Replacement Parts
S: Follow the specific tightening sequence.

Specifications

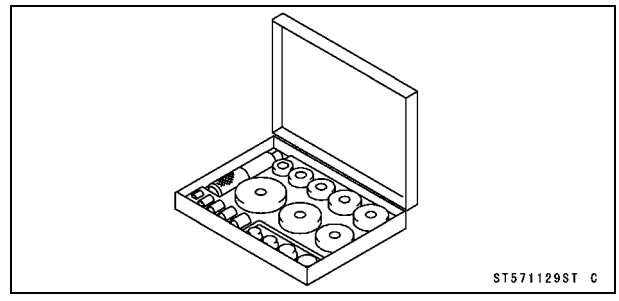
Item	Standard	Service Limit
Output Bevel Gear Case		
Output Bevel Gear Backlash	0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.) (at output drive shaft spline)	– – –
Front Final Gear Case		
Gear Case Oil (same engine oil):		
Type	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2	– – –
Viscosity	SAE 10W-40	– – –
Oil Level	Filler opening bottom	– – –
Capacity	0.40 L (0.42 US qt)	– – –
Coupling Bushing Inside Diameter	13.000 ~ 13.018 mm (0.5118 ~ 0.5125 in.)	13.048 mm (0.5137 in.)
LSD Clutch Torque:		
(when variable differential control lever is released.)	15 ~ 20 N·m (1.5 ~ 2.0 kgf·m, 11 ~ 14 ft·lb)	– – –
(when variable differential control lever is pulled in.)	157 N·m (16 kgf·m, 116 ft·lb) or more	– – –
Bevel Gear Backlash	0.10 ~ 0.20 mm (0.004 ~ 0.008 in.) (at pinion gear spline)	– – –
Rear Final Gear Case		
Gear Case Oil:		
Type	MOBIL Fluid 424, CITGO TRANSGARD TRACTOR HYDRAULIC FLUID, or EXXON HYDRAUL 560	– – –
Oil Level	Filler opening bottom	– – –
Capacity	0.72 L (0.76 US qt)	– – –
Rear Final Bevel Gear Backlash	0.04 ~ 0.17 mm (0.002 ~ 0.007 in.) (at pinion gear spline)	– – –

Special Tools

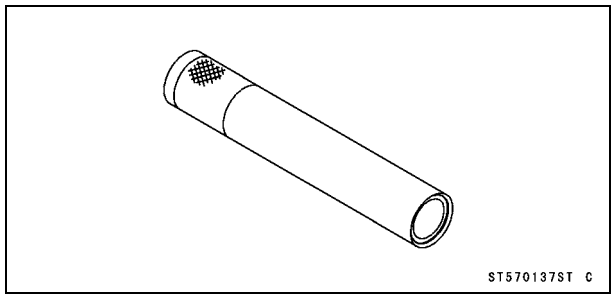
Bearing Puller:
57001-135



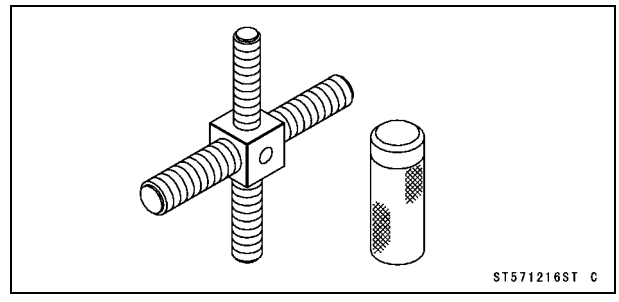
Bearing Driver Set:
57001-1129



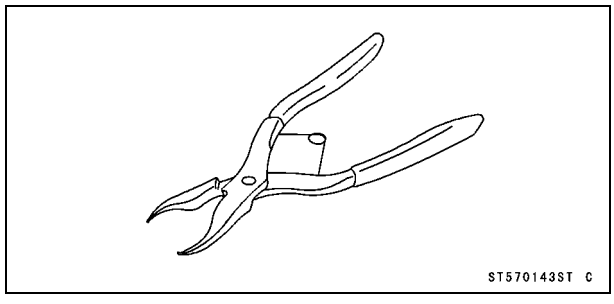
Steering Stem Bearing Driver:
57001-137



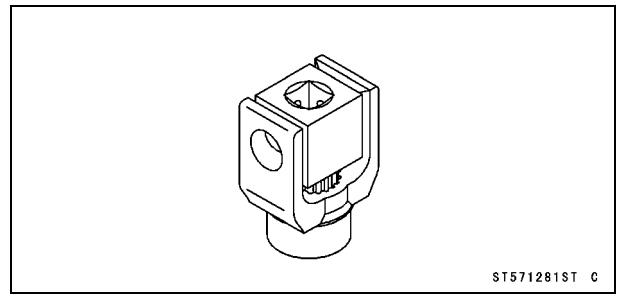
Rotor Puller, M16/M18/M20/M22 × 1.5:
57001-1216



Inside Circlip Pliers:
57001-143



Pinion Gear Holder, m1.0:
57001-1281



Outside Circlip Pliers:
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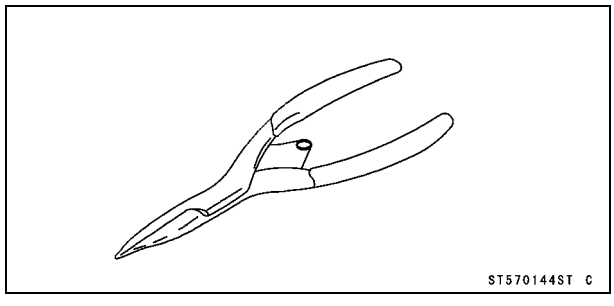
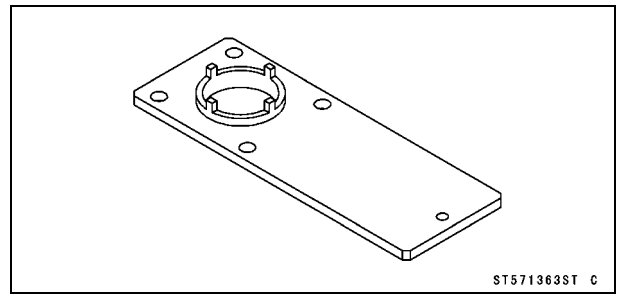
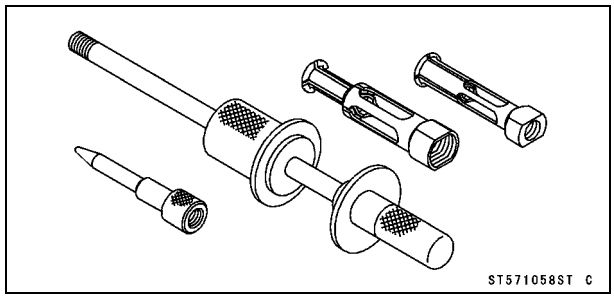


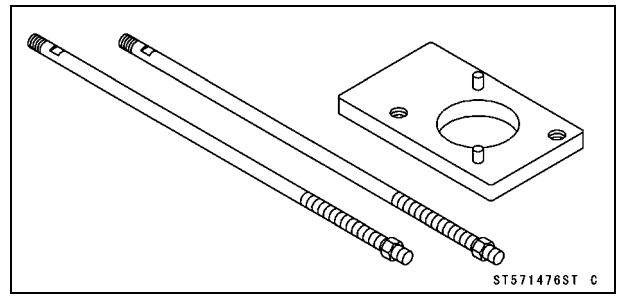
Socket Wrench:
57001-1363



Oil Seal & Bearing Remover:
57001-1058

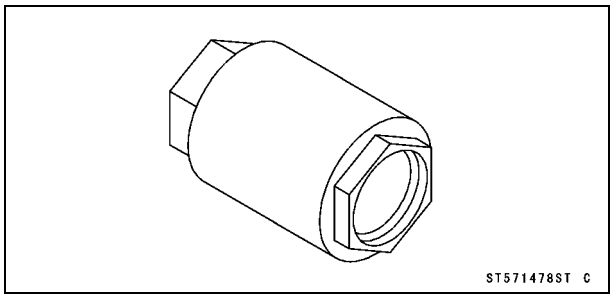


Holder & Guide Arbor:
57001-1476

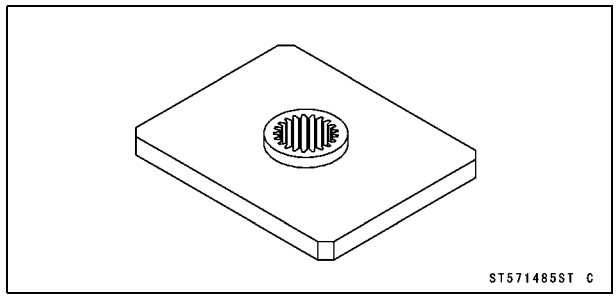


Special Tools

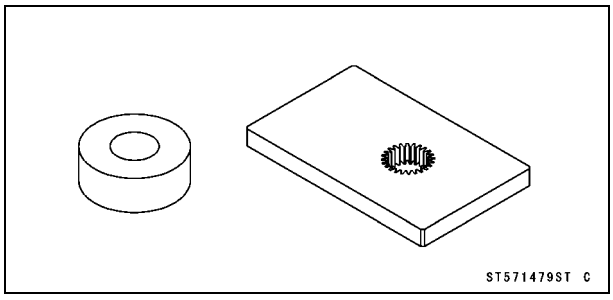
Socket Wrench, Hex 50:
57001-1478



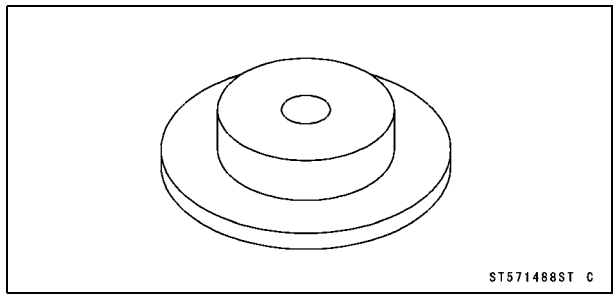
Pinion Gear Holder, m1.0:
57001-1485



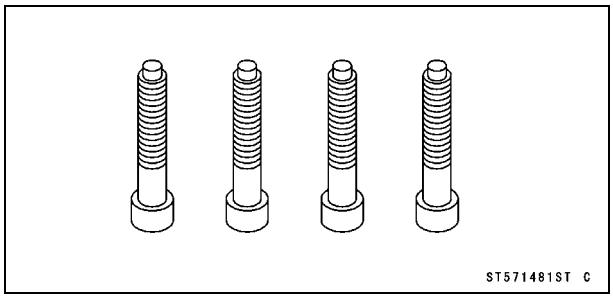
Output Shaft Holder & Spacer, m1.25:
57001-1479



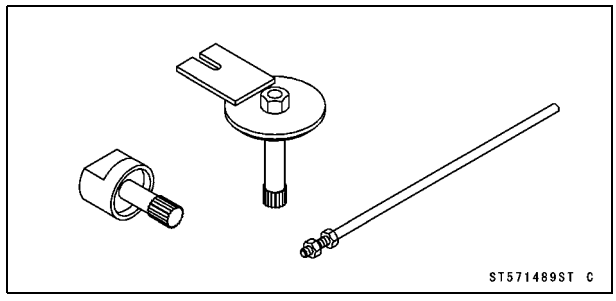
Bearing Driver, ϕ54.3:
57001-1488



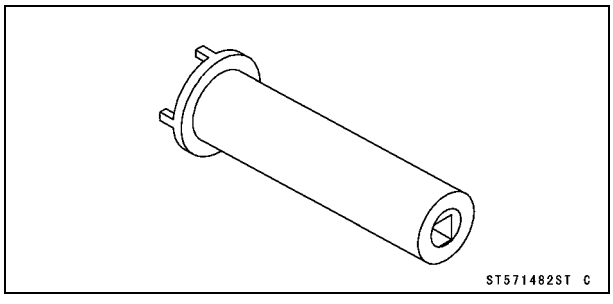
Nut Holding Bolts:
57001-1481



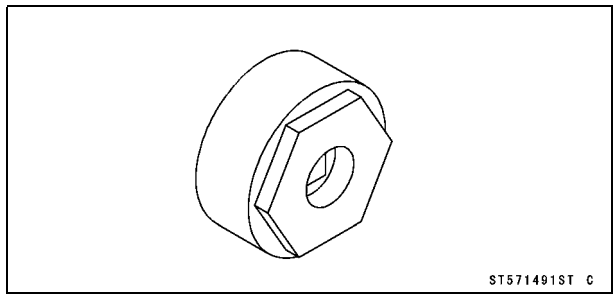
Gear Holder & Socket Wrench, Hex 24:
57001-1489



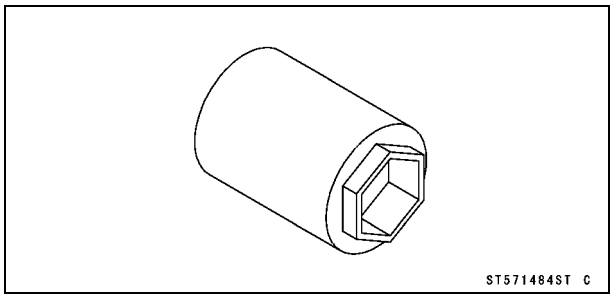
Socket Wench:
57001-1482



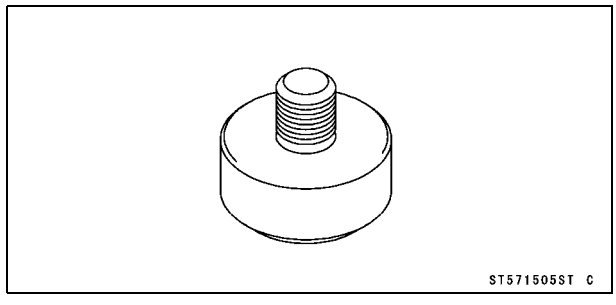
Hexagon Wench, Hex 41:
57001-1491



Socket Wrench, Hex 41:
57001-1484

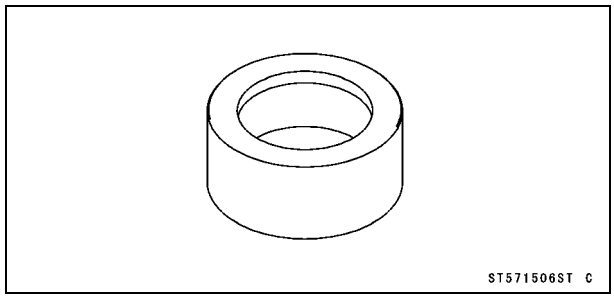


Oil Seal Driver, ϕ18.5:
57001-1505

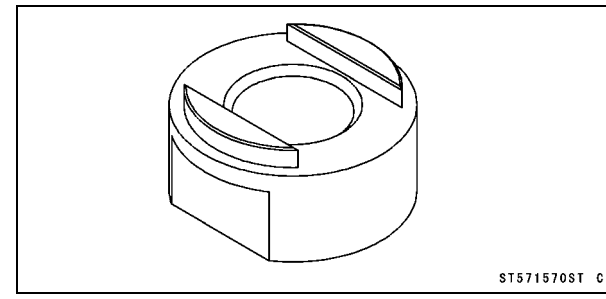


Special Tools

Oil Seal Driver, ϕ70:
57001-1506



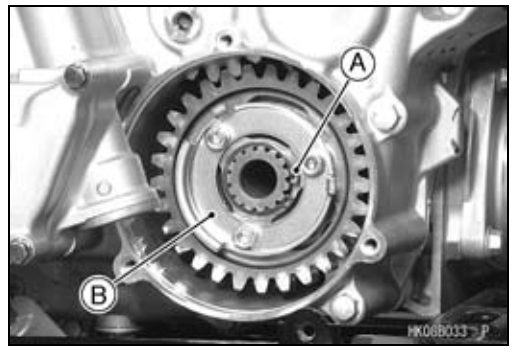
Output Shaft Holder:
57001-1570



Output Bevel Gears

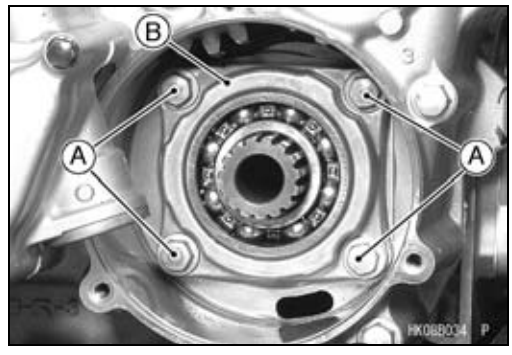
Output Drive Bevel Gear Removal

- Remove:
  Oil Pipe [A] (Engine Left and Outside, see Oil Pipe Removal in the Engine Lubrication System chapter)
  Output Drive Bevel Gear Cover Bolts [B]
  Output Drive Bevel Gear Cover [C]
  Forward/Reverse Detecting Sensor Mounting Bolt [D]



- Remove:
  Circlip [A]

  Special Tool - Outside Circlip Pliers: 57001-144
- Remove:
  Output Drive Idle Gear [B]

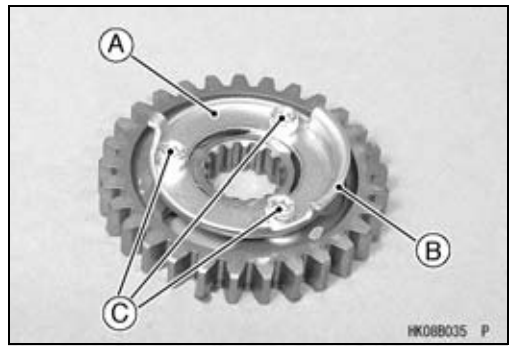


- Remove:
  Output Drive Bevel Gear Housing Bolts [A]
  Output Drive Bevel Gear Housing [B]

Output Drive Bevel Gear Installation

- Install the output drive bevel gear housing.
- Tighten:

  Torque - Output Drive Bevel Gear Housing Bolts: 26 N·m (2.6 kgf·m, 20 ft·lb)



- Install the rotor [A] so that the projections [B] face outward.
- Tighten:

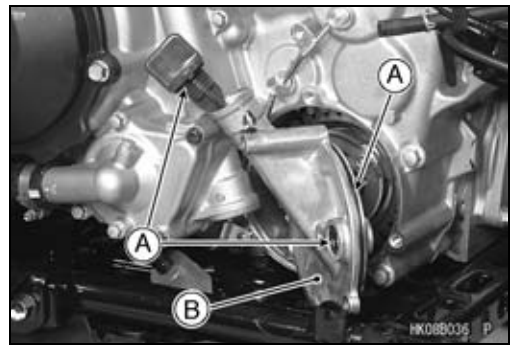
  Torque - Rotor Mounting Bolts [C]: 12 N·m (1.2 kgf·m, 106 in·lb)
- Install:
  Output Drive Idle Gear
  New Circlip

  Special Tool - Outside Circlip Pliers: 57001-144

Output Bevel Gears

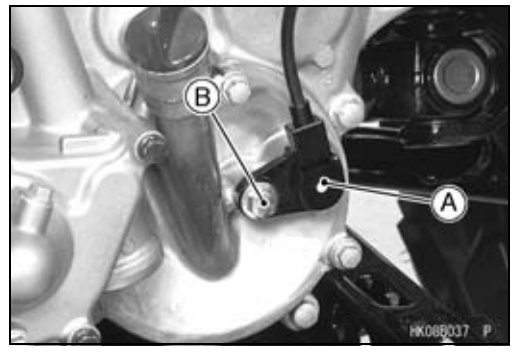
- Apply grease:
  O-rings [A]
- Install:
  Output Drive Bevel Gear Cover [B]
  Oil Pipe (see Oil Pipe Installation in the Engine Luburication chapter)
- Tighten:

Torque - Output Drive Bevel Gear Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)



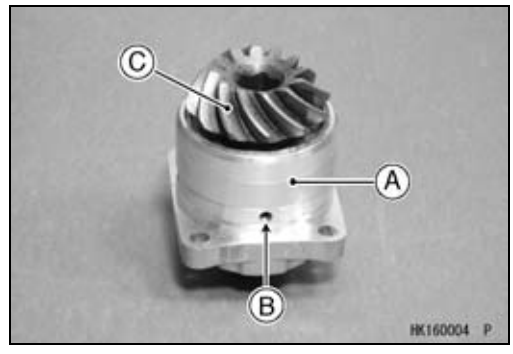
- Install:
  Forward/Reverse Detecting Sensor [A]
- Tighten:

Torque - Forward/Reverse Detecting Sensor Mounting Bolt [B]: 15 N·m (1.5 kgf·m, 11 ft·lb)



Output Drive Bevel Gear Disassembly

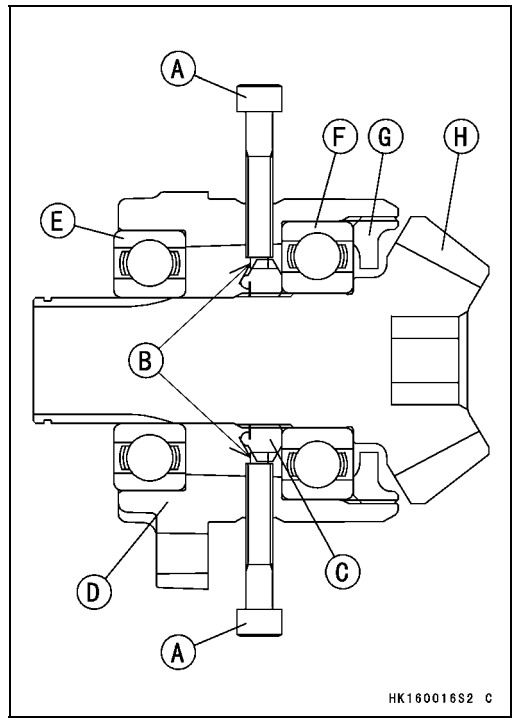
- Remove:
  Output Drive Bevel Gear Housing [A] (see Output Drive Bevel Gear Removal)
- Look through the hole [B] in the housing.
- Turn the bevel gear [C] until the groove of the output drive bevel gear holder nut is seen.



- Tighten the nut holding bolts [A] (4) securely into the grooves [B] of the bevel gear holder nut [C] in the output drive bevel gear housing.

Special Tool - Nut Holding Bolts: 57001-1481

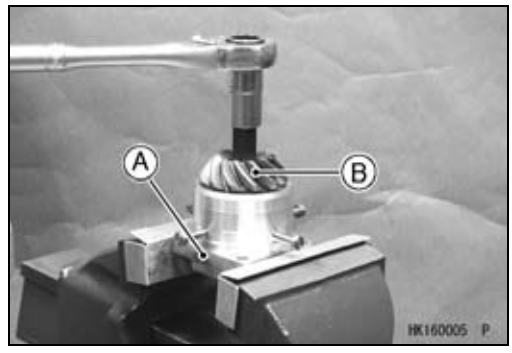
[D] Output Drive Bevel Gear Housing
[E] Outer Ball Bearing
[F] Inner Ball Bearing
[G] Bearing Holder
[H] Output Drive Bevel Gear



Output Bevel Gears

- Hold the output drive bevel gear housing [A] in a vise.
- Loosen the bevel gear [B] using an Allen wrench about four rotations.
- Remove one nut holding bolt, and look at through the hole.

★If the groove of the bevel gear holder nut is not seen, loosen the other three bolts.



- Drive the gear shaft end using a copper mallet until the grooves of the bearing holder nut can be seen again.
- Retighten the nut holding bolts (4) securely into the groove of the bevel gear holder nut in the output drive bevel gear housing.

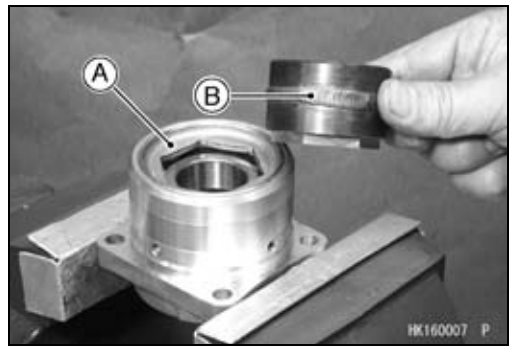
Special Tool - Nut Holding Bolts: 57001-1481

- Repeat the above procedure, and remove the bevel gear from the housing.

- Remove the bearing holder [A] using the hexagon wrench [B].

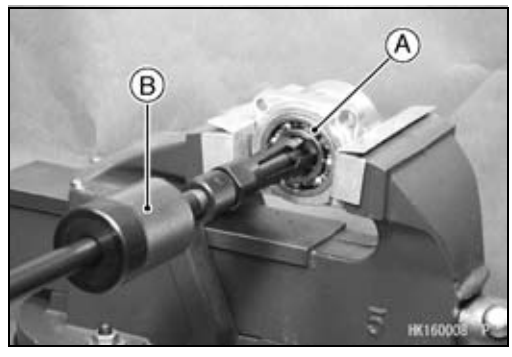
Special Tool - Hexagon Wrench, Hex 41: 57001-1491

○If it is difficult to break free the holder, apply the heat to it to softer the locking agent.



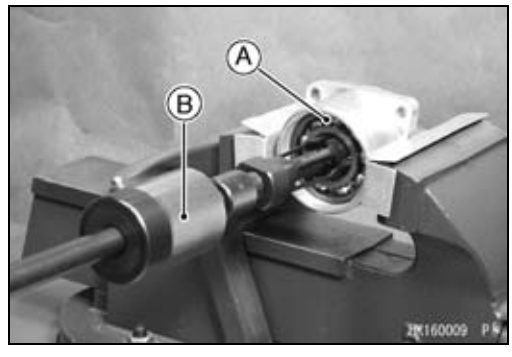
- Remove:
  Outer Ball Bearing [A]

Special Tool - Oil Seal & Bearing Remover [B]: 57001-1058



- Remove:
  Output Drive Bevel Gear Holder Nut
  Inner Ball Bearing [A]

Special Tool - Oil Seal & Bearing Remover [B]: 57001-1058

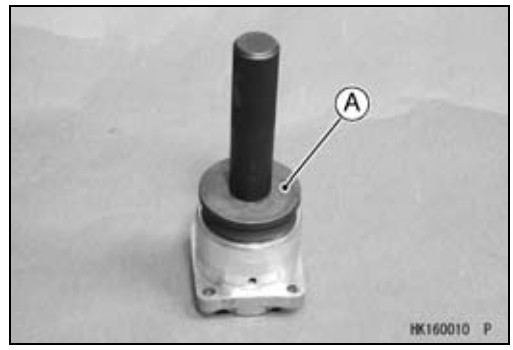


Output Bevel Gears

Output Drive Bevel Gear Assembly

- Press the new inner ball bearing until it is bottomed.

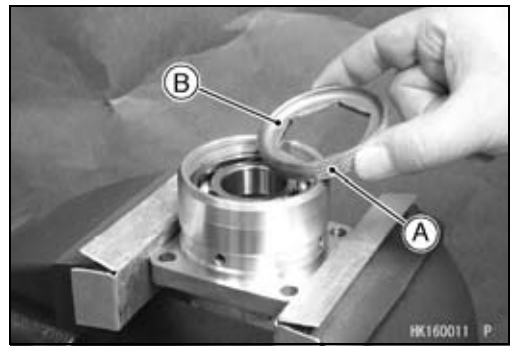
  Special Tool - Bearing Driver Set [A]: 57001-1129



- Apply a non-permanent locking agent to the threads of the bearing holder [A] and tighten it so that the deep side [B] faces outward.

  Torque - Bearing Holder: 120 N·m (12 kgf·m, 88 ft·lb)

- Press the output drive bevel gear until it is bottomed.

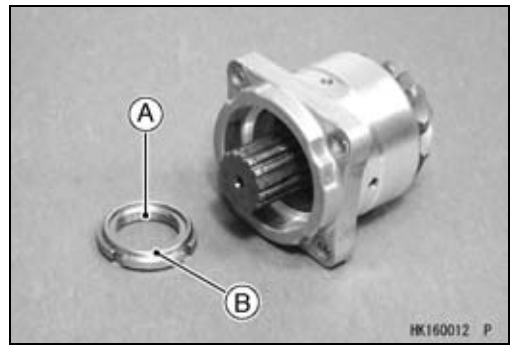


- Apply a non-permanent locking agent to the threads of the bevel gear holder nut [A] and tighten it so that the projection side [B] faces outward.

  Special Tool - Socket Wrench: 57001-1482 [C]

  Torque - Bevel Gear Holder Nut: 200 N·m (20.4 kgf·m, 148 ft·lb)

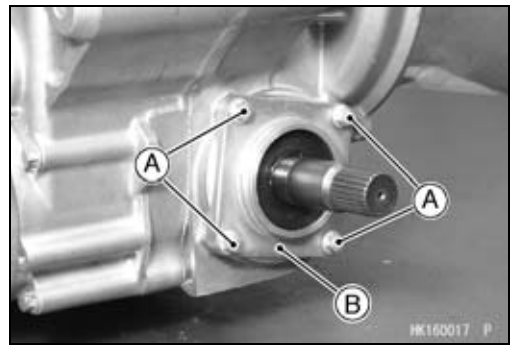
- Press the new outer ball bearing until it is bottomed.



Output Driven Bevel Gear Removal

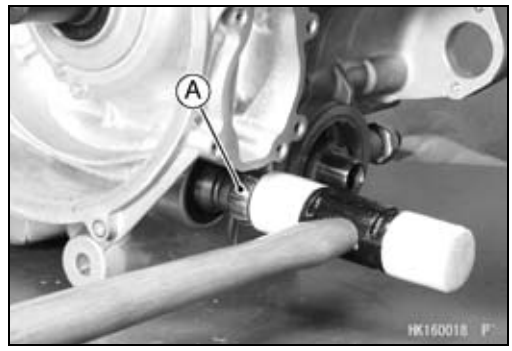
- Remove:

  Engine (see Engine Removal in the Engine Removal/Installation chapter)
  Output Driven Bevel Gear Housing Bolts [A]
  Output Driven Bevel Gear Housing [B]



Output Bevel Gears

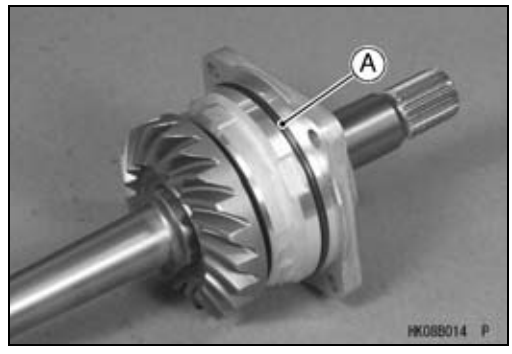
● Tap lightly the front end [A] of the output driven bevel gear shaft using a plastic mallet.
○The output driven bevel gear shaft assembly comes off with the housing.



Output Driven Bevel Gear Installation

● Apply grease:
O-ring [A]
● Install the output driven bevel gear shaft assembly.
● Tighten:

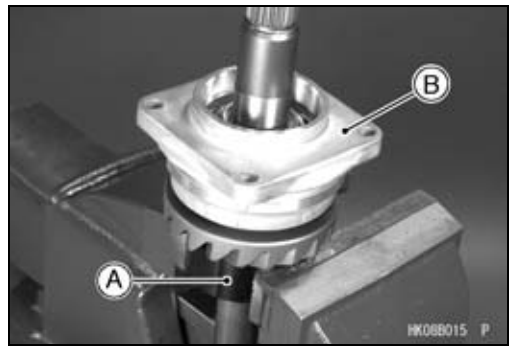
Torque - Output Driven Bevel Gear Housing Bolts: 26 N·m (2.6 kgf·m, 20 ft·lb)



Output Driven Bevel Gear Disassembly

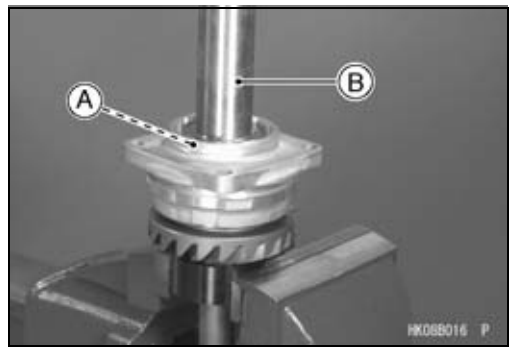
● Remove:
Output Driven Bevel Gear Housing Assembly (see Output Driven Bevel Gear Removal)
Oil Seal
● Hold the output shaft holder [A] in a vise, and set the housing assembly [B] on the holder.

Special Tool - Output Shaft Holder: 57001-1570

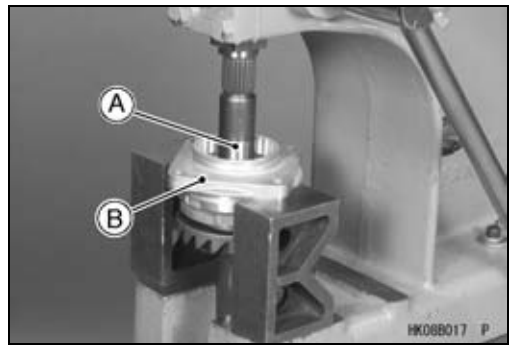


● Remove:
Output Shaft Holder Nut [A]

Special Tool - Socket Wrench [B]: 57001-1482



● Remove the output shaft [A] from the housing [B] using a press.



Output Bevel Gears

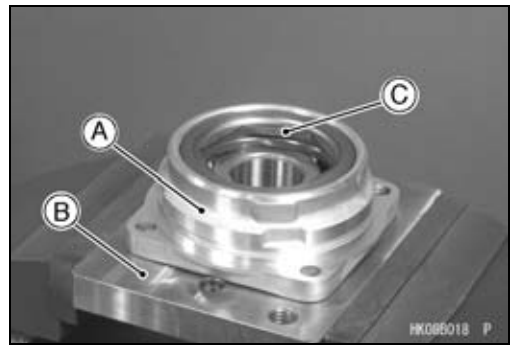
● Hold the housing assembly [A] with the holder [B] in a vise.

Special Tool - Holder & Guide Arbor: 57001-1476

● Remove:
Bearing Holder [C]

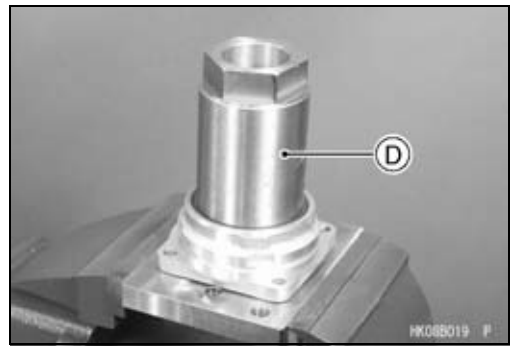
Special Tool - Socket Wrench, Hex 50 [D]: 57001-1478

○If the holder seems too difficult to break free, apply heat to softer the locking agent.



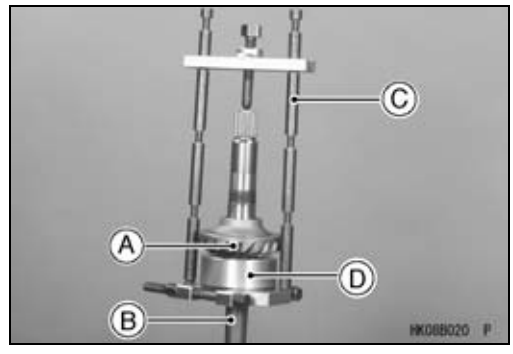
● Remove:
Ball Bearing

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



● Remove the output driven bevel gear [A] from the output shaft [B] using the bearing puller [C] and spacer [D].

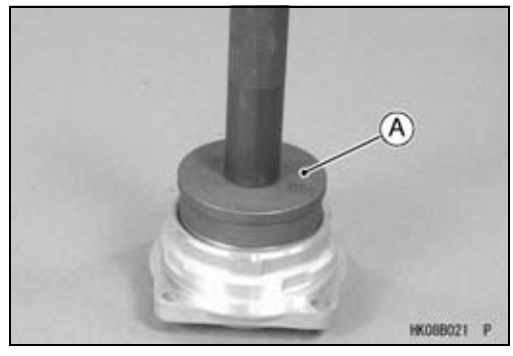
Special Tools - Bearing Puller: 57001-135
Output Shaft Holder & Spacer, m1.25: 57001 -1479



Output Driven Bevel Gear Assembly

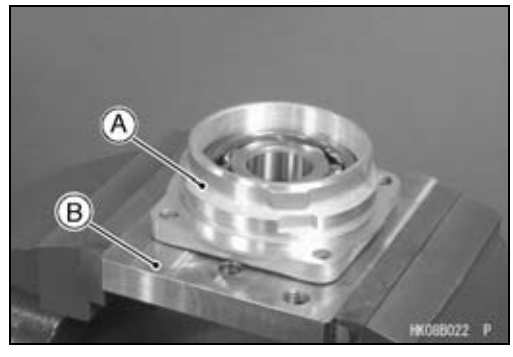
● Press the new ball bearing until it is bottomed.

Special Tool - Bearing Driver Set [A]: 57001-1129



● Hold the housing assembly [A] with the holder [B] in a vise.

Special Tool - Holder & Guide Arbor: 57001-1476

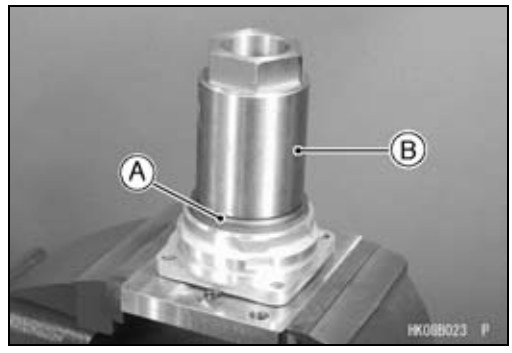


Output Bevel Gears

- Apply a non-permanent locking agent to the threads of the bearing holder [A] and tighten it.

  Special Tool - Socket Wrench, Hex 50 [B]: 57001-1478

  Torque - Bearing Holder: 250 N·m (25.5 kgf·m, 184 ft·lb)

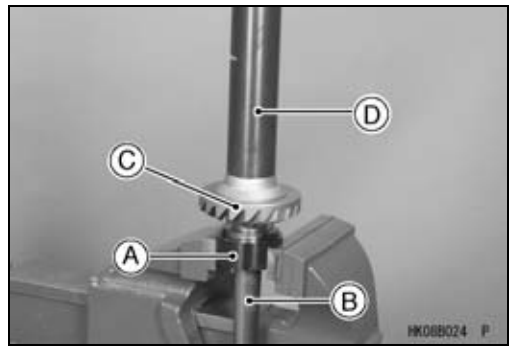


- Hold the output shaft holder [A] in a vise, and set the output shaft [B] on the holder.

  Special Tool - Output Shaft Holder: 57001-1570

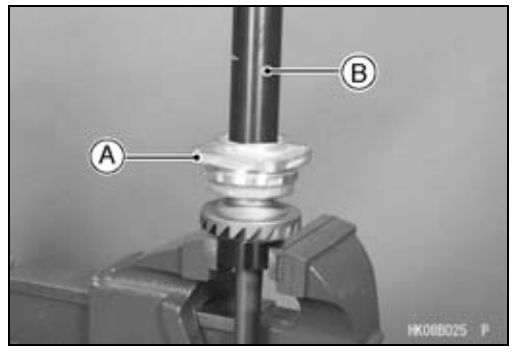
- Press the output driven bevel gear [C] using the steering stem bearing driver [D] until it is bottomed.

  Special Tool - Steering Stem Bearing Driver: 57001-137



- Press the housing assembly [A] using the steering stem bearing driver [B] until it is bottomed.

  Special Tool - Steering Stem Bearing Driver: 57001-137

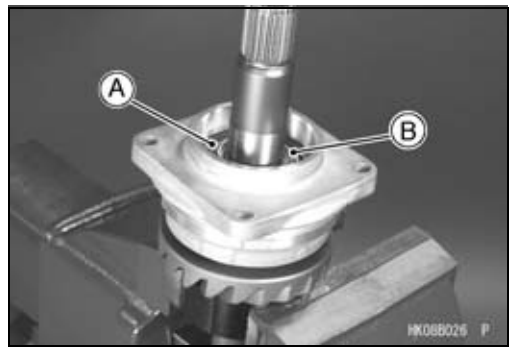


- Apply a non-permanent locking agent to the threads of the output shaft holder nut [A] and tighten it so that the projection side [B] faces outward.

  Special Tool - Socket Wrench: 57001-1482

  Torque - Output Shaft Holder Nut: 200 N·m (20.4 kgf·m, 148 ft·lb)

- Apply grease to the oil seal and press it so that it is flush with the end surface of the housing.

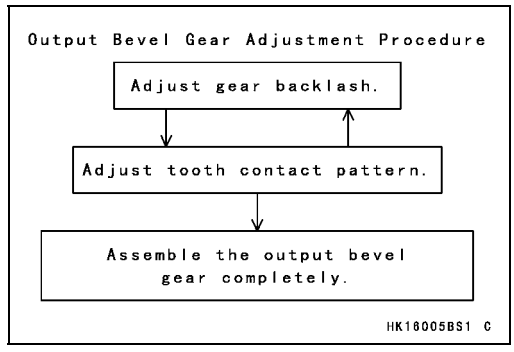


Output Bevel Gears Adjustment

The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

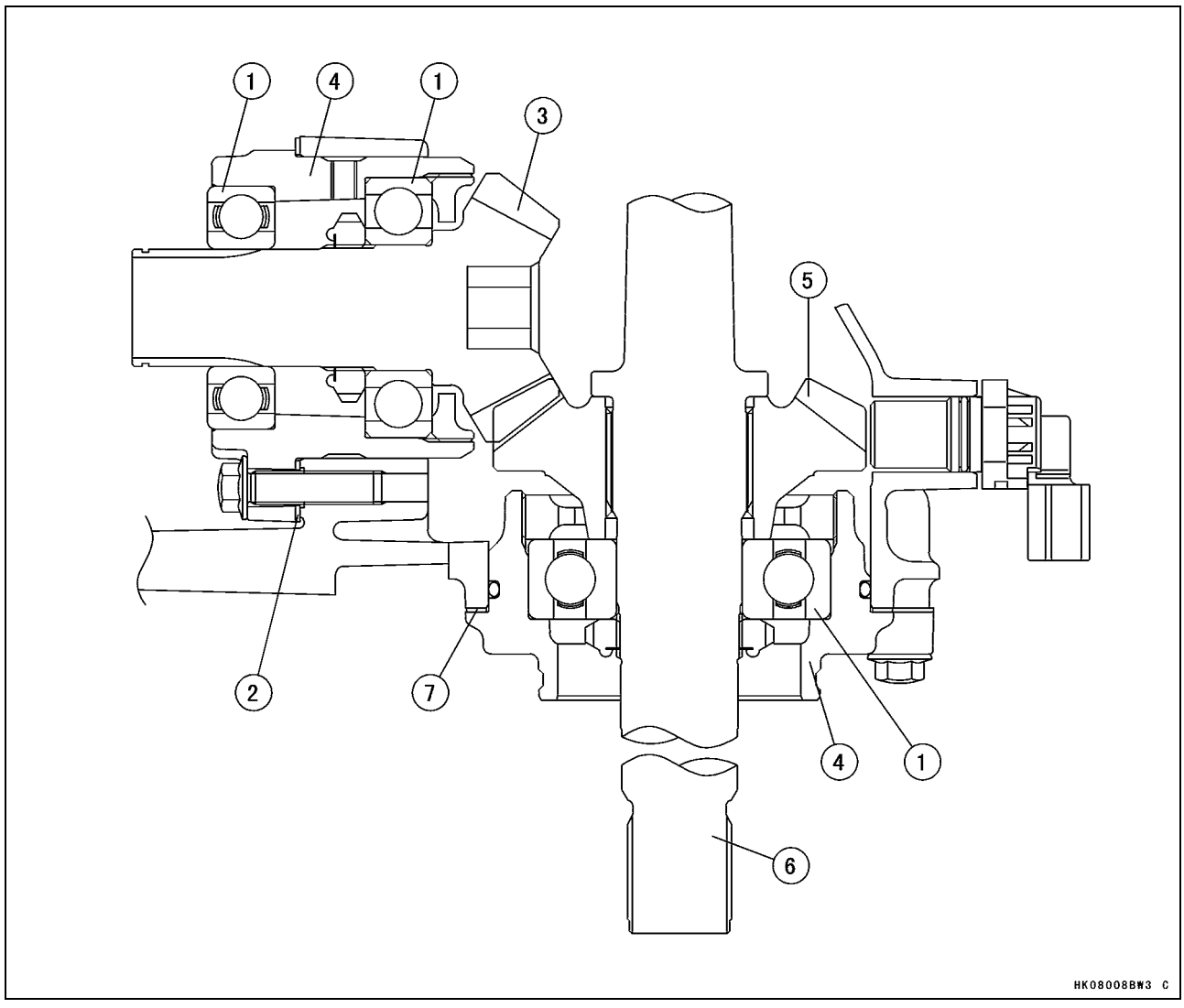
When replacing any one of the backlash-related parts, be sure to check and adjust the backlash and tooth contact. First adjust the backlash, and then tooth contact by replacing shims.

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



Output Bevel Gears

Output Bevel Gear (Backlash-related Parts)



1. Ball Bearings
2. Drive Bevel Gear Shims
3. Output Drive Bevel Gear
4. Bearing Housings
5. Output Driven Bevel Gear
6. Output Driven Shaft
7. Driven Bevel Gear Shims

Drive Bevel Gear Shims for Tooth Contact Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1311
0.2 mm (0.008 in.)	92180-1312
0.5 mm (0.020 in.)	92180-1313
0.8 mm (0.031 in.)	92180-1314
1.0 mm (0.039 in.)	92180-1351
1.2 mm (0.047 in.)	92180-1352

Driven Bevel Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1307
0.2 mm (0.008 in.)	92180-1308
0.5 mm (0.020 in.)	92180-1309
0.8 mm (0.031 in.)	92180-1310
1.0 mm (0.039 in.)	92180-1349
1.2 mm (0.047 in.)	92180-1350

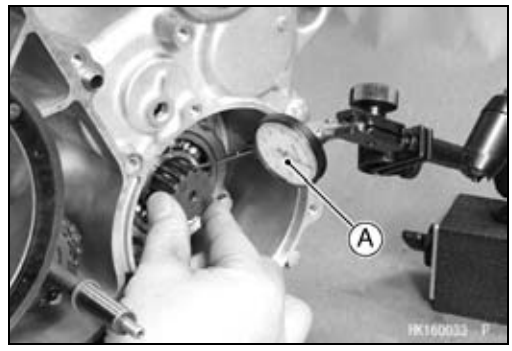
Output Bevel Gears

Bevel Gear Backlash Adjustment

○The amount of backlash is influenced by driven bevel gear position more than by drive bevel gear position.

● Remove the output drive idle gear (see Output Drive Bevel Gear Removal).

● Set up a dial gauge [A] against the output drive shaft spline groove to check gear backlash.



○To measure the backlash, turn the shaft clockwise and counterclockwise slightly so as not to move the mate gear. A rod can be inserted through the lower hole of the housing and into contact with driven gear. This may help to hold it still. The difference between the highest and lowest gauge reading is the amount of backlash.

★If the backlash is not within the limit, replace the shim(s) at the driven bevel gear.

★Change the thickness a little at a time.

● Recheck the backlash, and readjust as necessary.

Output Bevel Gear Backlash

Standard: 0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.) (at output drive shaft spline)

Tooth Contact Adjustment

○Tooth contact location is influenced by drive gear position more than by driven gear position.

● Clean any dirt and oil off the bevel gear teeth.

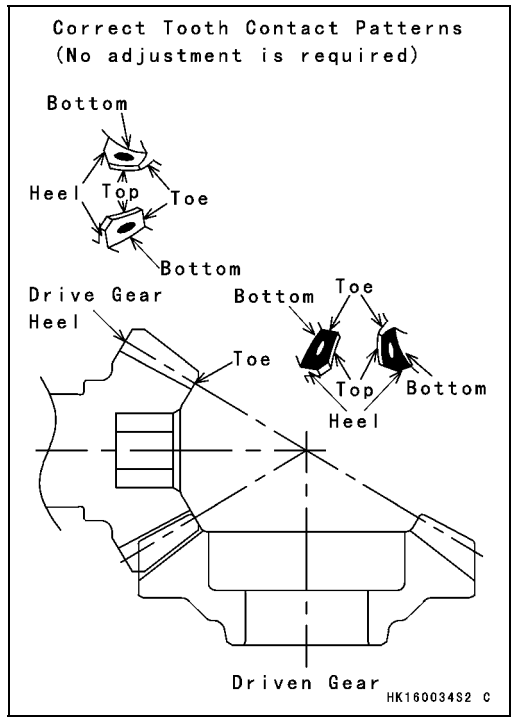
● Apply checking compound to 4 or 5 teeth on the output driven bevel gear.

NOTE

○*Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.*

○*The checking compound must be smooth and firm with the consistency of tooth paste.*

○*Special compounds are available from automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use this for checking the bevel gears.*



● Turn the output driven shaft for 3 or 4 turns in the drive and reverse (coast) directions, while creating a drag on the drive bevel gear shaft.

● Check the drive pattern and coast pattern of the bevel gear teeth. The tooth contact patterns of both drive and coast sides should be centrally located between the top and bottom of the tooth, and a little closer to the toe of the tooth.

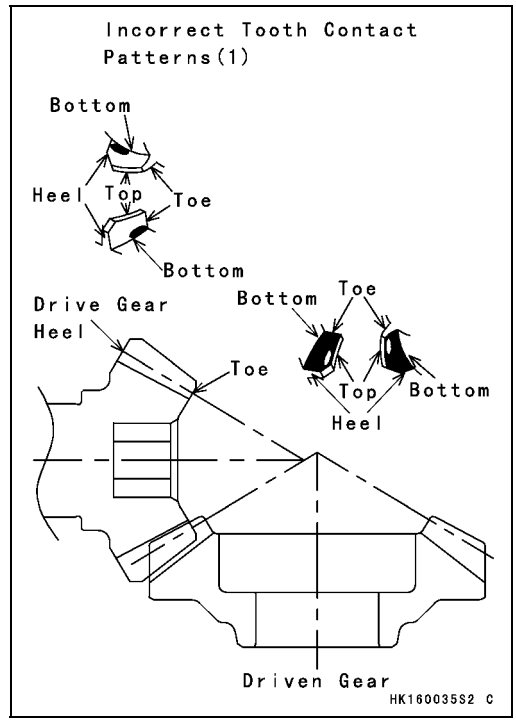
★If the tooth contact pattern is incorrect, replace the shim(s) at the drive bevel gear and shim(s) at the driven bevel gear, following the examples shown. Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shims are replaced. Repeat the shim change procedure as necessary.

NOTE

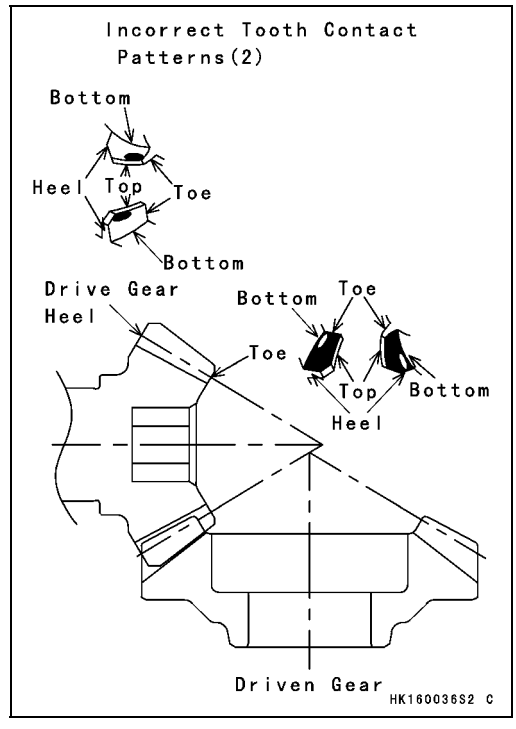
○*If the backlash is out of the standard range after changing shims, correct the backlash before checking the tooth contact pattern.*

Output Bevel Gears

Example 1: Decrease the thickness of the drive bevel gear shim(s) by 0.1 mm (0.004 in.), and/or increase the thickness of the driven bevel gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.



Example 2: Increase the thickness of the drive bevel gear shim(s) by 0.1 mm (0.004 in.), and/or decrease the thickness of the driven bevel gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.

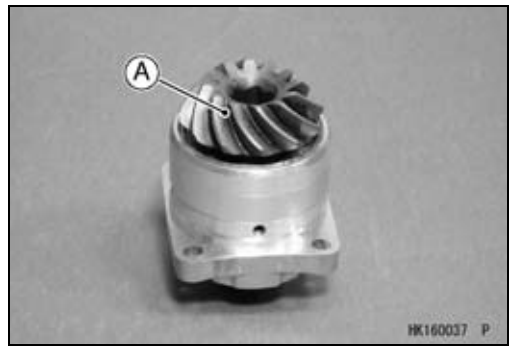


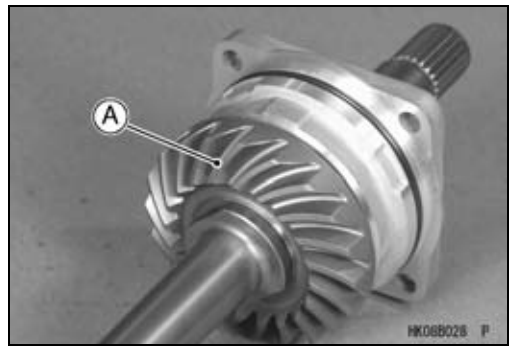
Output Bevel Gears

Bevel Gears Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.

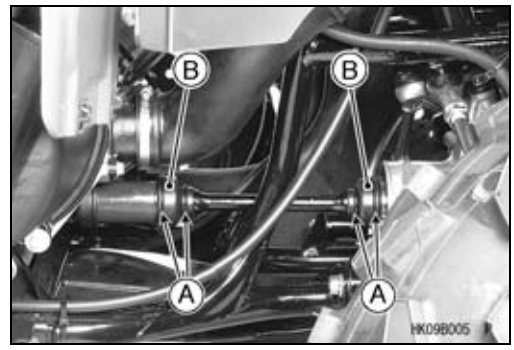
★Replace the bevel gears as a set if either gear is damaged.



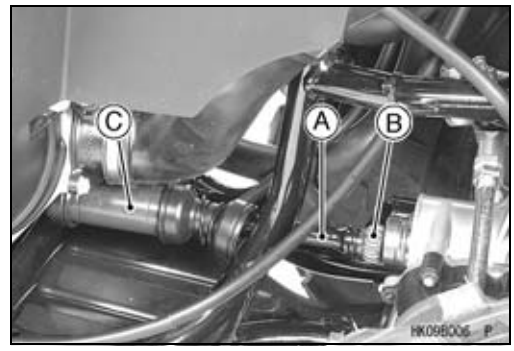


Front Propeller Shaft

Front Propeller Shaft Removal

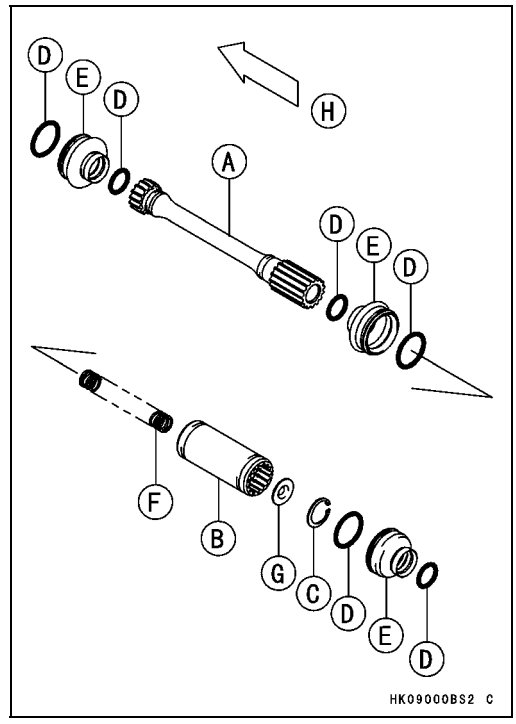


- Slip the O-ring clamps [A] off the grooves on the small rubber boots [B], and then pull the boot.



- Push the front propeller shaft [A] rearward, and remove the front end [B] from the front final gear case.
- Push the coupling [C] forward, and remove the rear end from the front final gear case.

Front Propeller Shaft Installation



- Wipe off any old grease on the splines of the propeller shaft [A] and the coupling [B].
- Inspect the splines of the propeller shaft and the coupling.

★If the splines are twisted or damaged in any way, replace the parts as needed.

- Apply molybdenum disulfide grease to all splines.
- Replace the circlip [C] with a new one, if it is removed.
- Wipe off any old grease on the splines of the shafts in the engine and front final gear case.
- Inspect the O-rings on those shafts for damage.

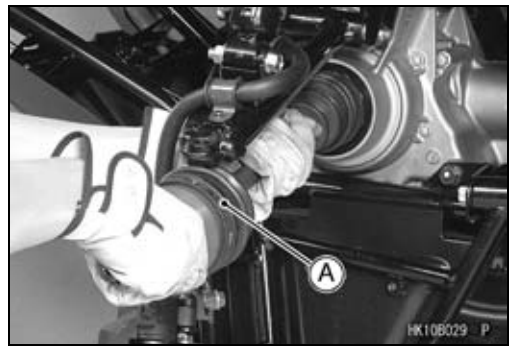
★If any doubt exists, replace the O-rings with new ones.

- Apply molybdenum disulfide grease to the splines of the shafts on the output bevel gear and front final gear case.
- First install the rear end, and then install the front end.
- Slip the two O-ring clamps into the groove on the small rubber boot.

O-rings [D]
Boots [E]
Spring [F]
Spring Seat [G]
Front [H]

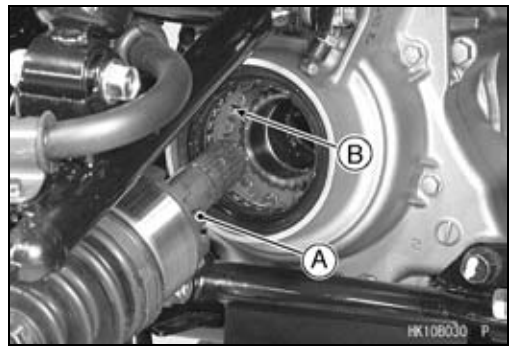
Front Axle

Front Axle Removal

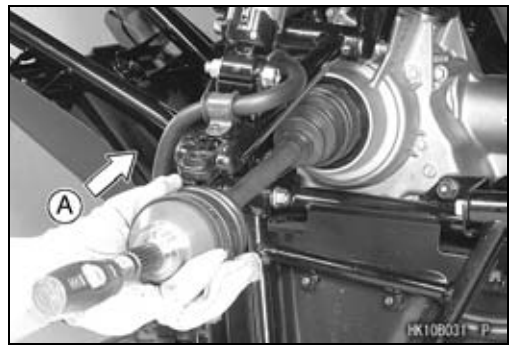


- Drain the front final gear case oil (see Front Final Gear Case Oil Change in the Periodic Maintenance chapter).
- Remove:
  Front Wheel (see Wheel Removal in the Wheels/Tires chapter)
  Steering Knuckle (see Steering Knuckle Removal in the Steering chapter)
- Pull the front axle [A] in a straight line out of the front final gear case.

Front Axle Installation



- Wipe the old grease off the splines of the axle and the gear case oil seal.
- Visually inspect the splines of the axle.
★If they are badly worn or chipped, replace the axle with a new one.
- Apply molybdenum disulfide grease to the axle splines.
- Apply grease to the gear case oil seal.
- Insert the left axle so that the teeth [A] fit in the grooves [B].



- Tap [A] the end of the front axle lightly and install the front axle.

NOTE

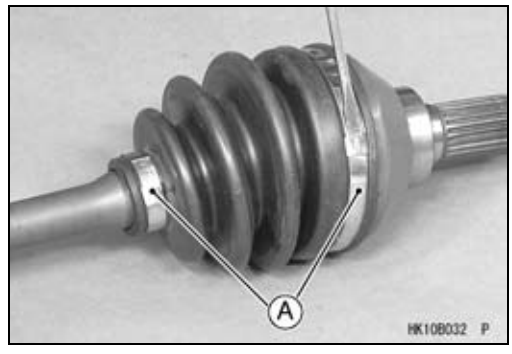
○*The axle shaft must not come off easily.*

Front Axle Joint Boot Inspection

- Refer to the Front Axle Joint Boot Inspection in the Periodic Maintenance chapter.

Front Axle Joint Boot Replacement

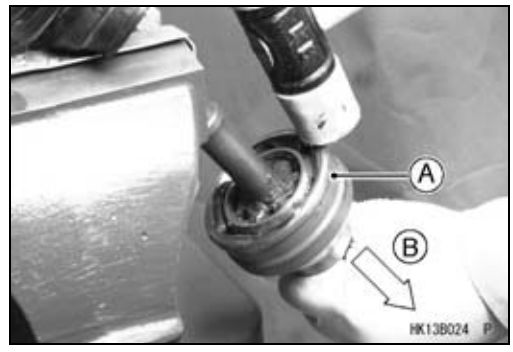
Outboard Joint Boot Removal



- Remove:
  Front Axle (see Front Axle Removal)
  Boot Bands [A]
- Scrap the removed boot bands.
- Slide the joint boot toward the inboard joint.

Front Axle

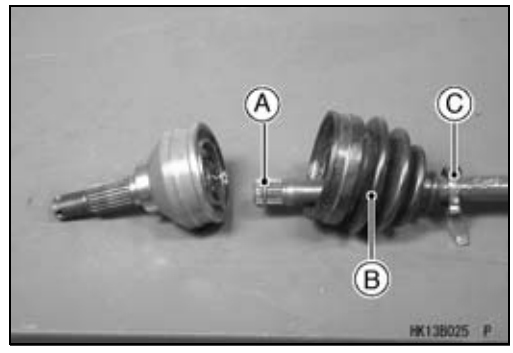
● Tap the bearing housing [A] straight [B] with a plastic hammer to separate it from the shaft.



NOTICE

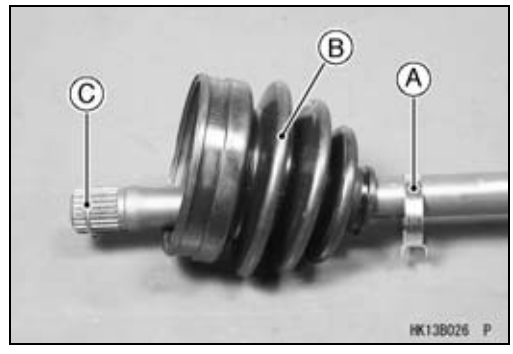
Do not tap on the cage. Be careful not get hurt when the housing comes out. If the splined portion of shaft cracked or damaged during disassembling of outboard joint, do not reuse the shaft.

● Remove:
Circlip [A]
Boot [B]
Small Band [C]



Outboard Joint Boot Installation

● Clean the axle shaft by wiping off the used grease on it.
● Wind the tape on the splines of the axle shaft in order to protect the joint boot.
● Install:
New Small Band [A]
New Boot [B]
○Apply the special grease slightly on the inside of the new boot small diameter, and install the boot on the axle shaft.

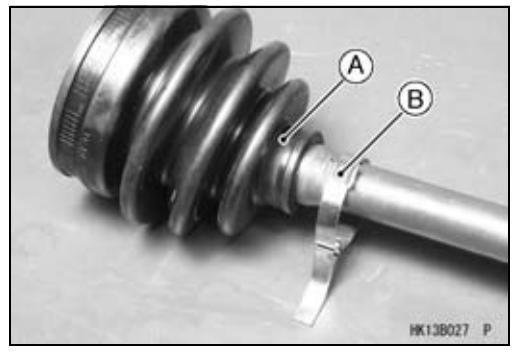


NOTICE

Only the special grease that is included with the boot kit can be applied to the boots.

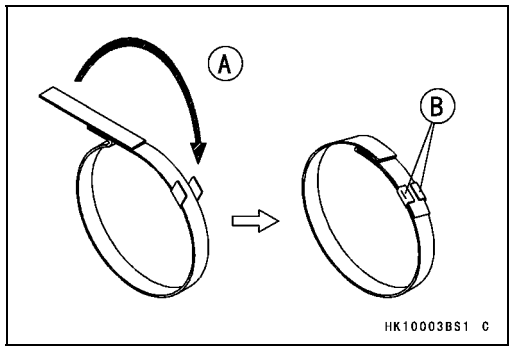
● Install:
New Circlip [C]

● Apply the special grease slightly on the part [A] of the band installation in order to make easy to install the boot band.
● Tighten the small boot band [B].



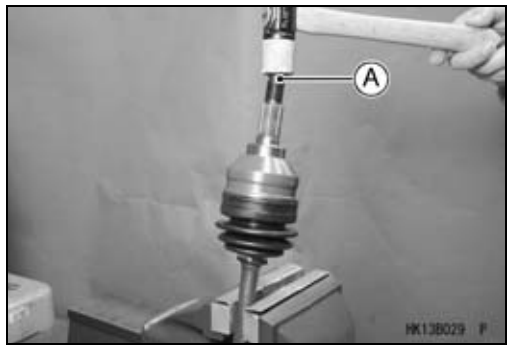
Front Axle

○Tighten the boot band [A] and bend the tangs [B] securely to hold down the end of the band.

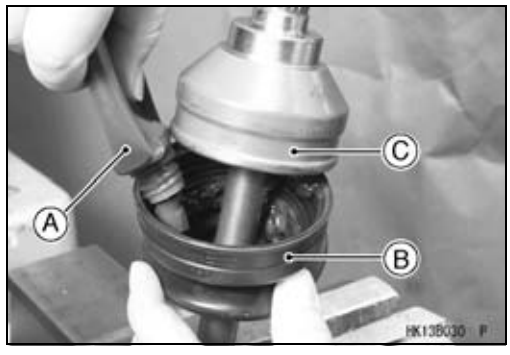


● Place the special grease tube nozzle in the bore of the housing and squeeze the tube [A] until the grease comes out from the joint bearing.

● Tap the shaft end [A] straight with a plastic hammer until it is locked by the circlip.

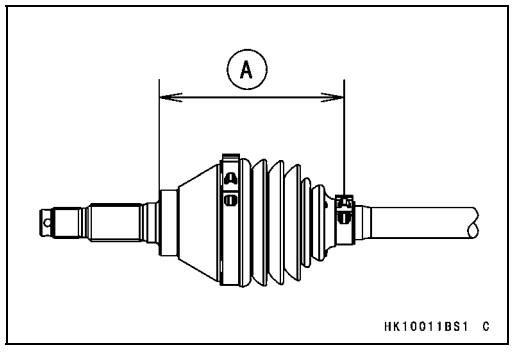


● Squeeze all of the special grease [A] into the new boot [B], and slide the boot onto the outboard joint [C].



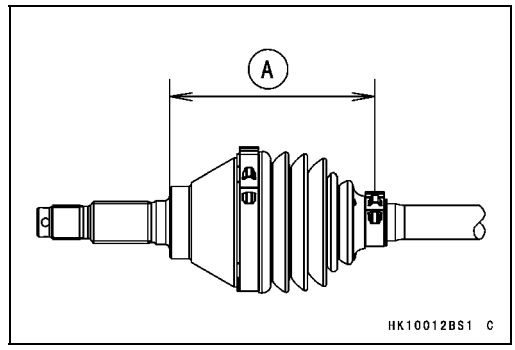
● Compress the axle assembly to the specified length while relieving the air pressure inside the inboard boot.
● Hold the axle at this setting.

Standard Length of Assembling:
Right Front Axle: 108.7 mm (4.28 in.) [A]

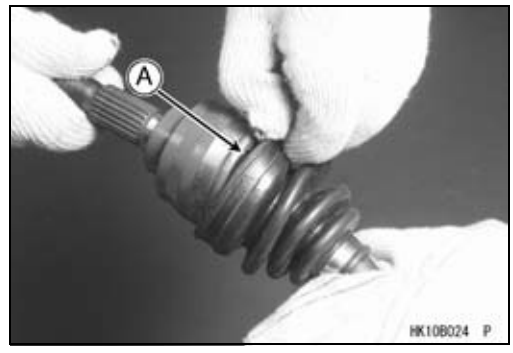


Front Axle

Left Front Axle: 108.7 mm (4.28 in.) [A]



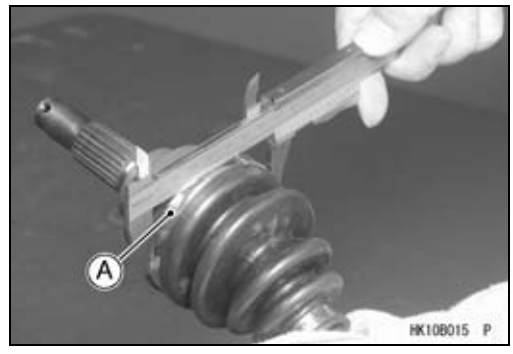
- Open the edge [A] of the boot in order to equalize the air pressures.



- Tighten the large band [A] and bend the tangs securely to hold down the end of the band.

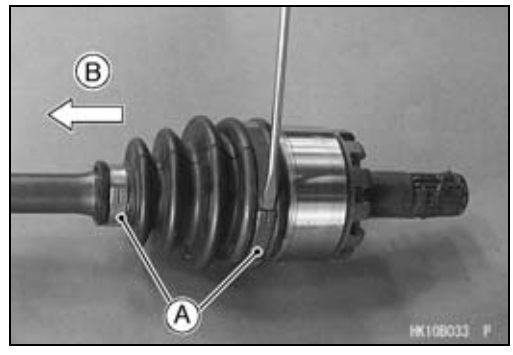
  Maximum Outside Diameter of Band: 80 mm (3.15 in.)

  (After tightening the outside diameter)

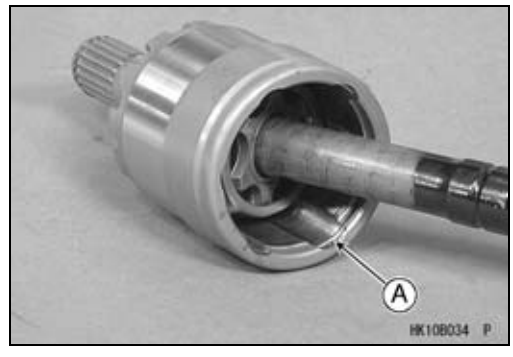


Inboard Joint Boot Removal

- Remove:
  Front Axle (see Front Axle Removal)
  Boot Bands [A]
- Scrap the removed boot bands.
- Slide the joint boot toward the outboard joint [B].

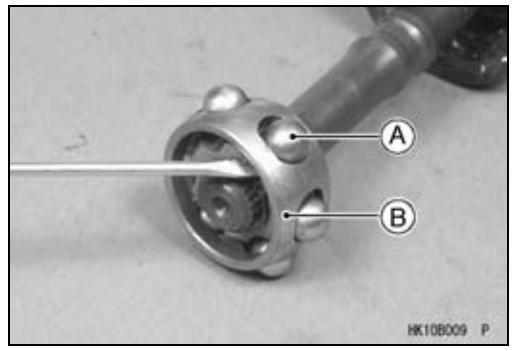


- Remove the retaining ring [A] (Left side only).
- Separate to the axle shaft.

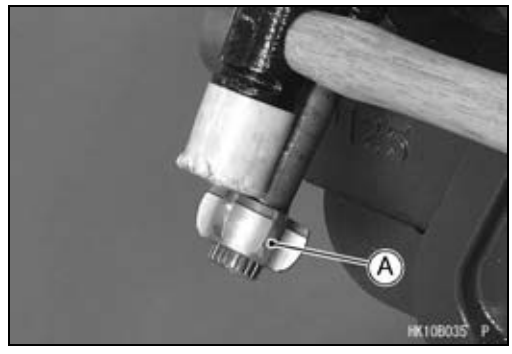


Front Axle

- Remove the steel balls [A].
- Slide the cage [B] toward the center of the axle.

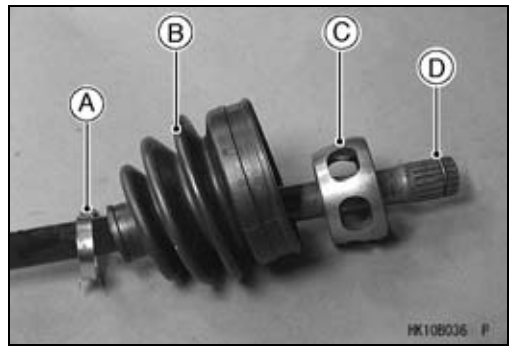


- Tap the inner race [A] straight with a plastic hammer until it is locked by the circlip.
- Remove the inboard joint boot.

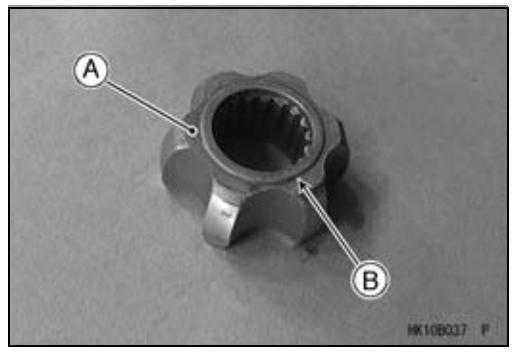


Inboard Joint Boot Installation

- Wind the tape on the splines of the axle shaft in order to protect the joint boot.
- Install:
  New Small Band [A]
  New Inboard Joint Boot [B]
  Cage [C]
  Circlip [D]

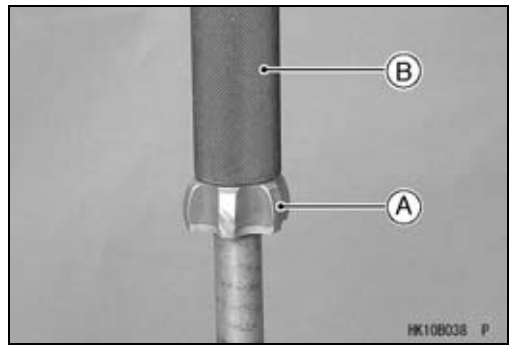


- Install the inner race [A] so that the stepped side [B] faces front final gear case.



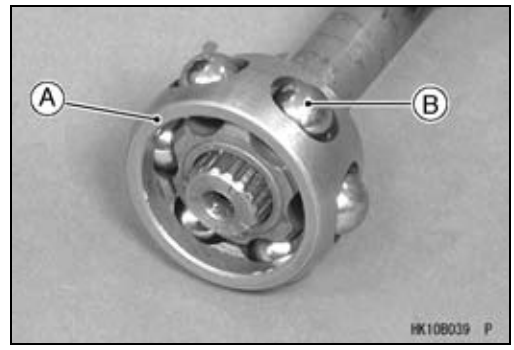
- Press the inner race [A] using the rotor puller [B] (57001 -1216) until it is bottomed.

Special Tool - Rotor Puller, M16/M18/M20/M22 × 1.5: 57001 -1216

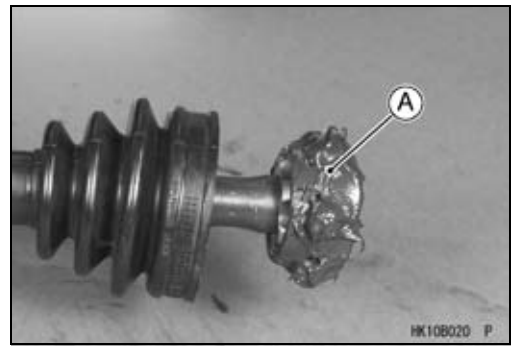


Front Axle

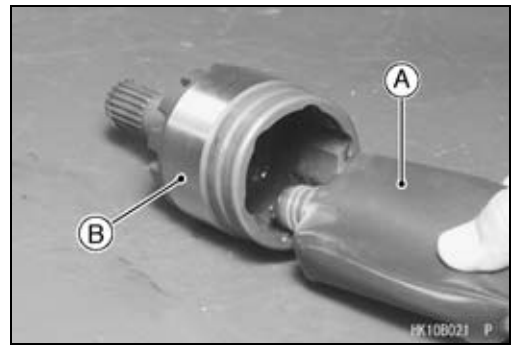
- Slide the cage [A] on the inner race and install the steel balls [B].



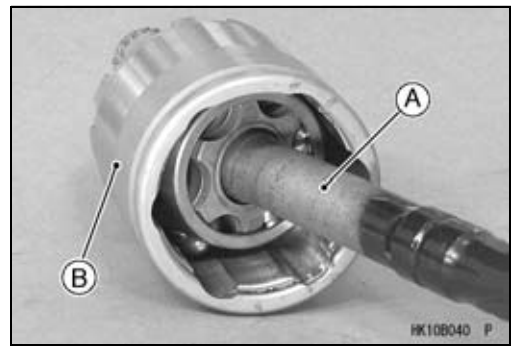
- Apply the special grease [A] to the steel balls and cage.



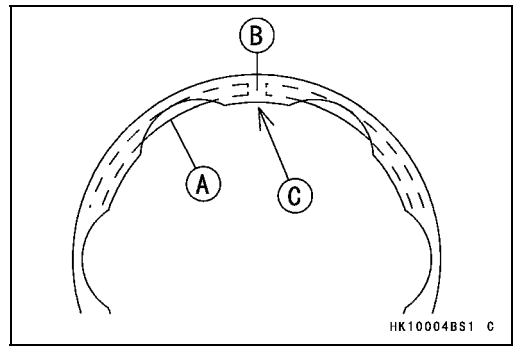
- Squeeze about half a tube (30 grams) of the special grease [A] into the bearing cup [B].



- Insert the balls and cage assembly [A] in the bearing cup [B] strongly.

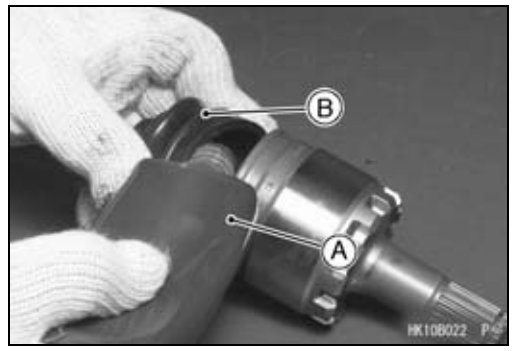


- For left side front axle, install the new retaining ring [A] so that the opening [B] is aligned with one of the projections [C].



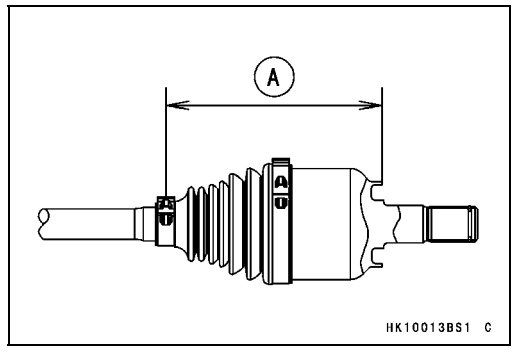
Front Axle

- Tighten the small band.
- Squeeze the remaining special grease [A] into the inboard joint boot [B].

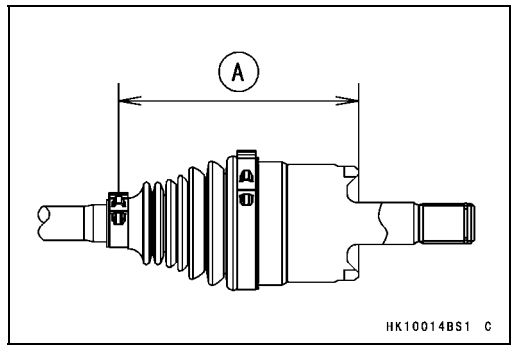


- Compress the axle assembly to the specified length while relieving the air pressure inside the inboard boot.
- Hold the axle at this setting.

Standard Length of Assembling
Right Front Axle: 127 mm (5.00 in.) [A]

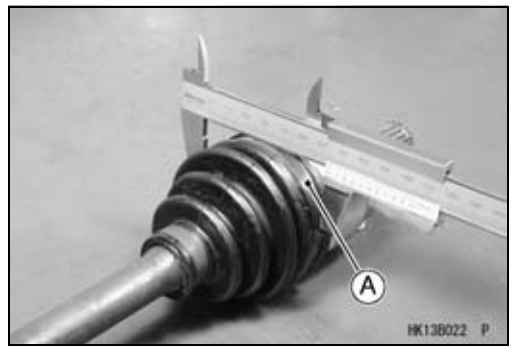


Left Front Axle: 127 mm (5.00 in.) [A]

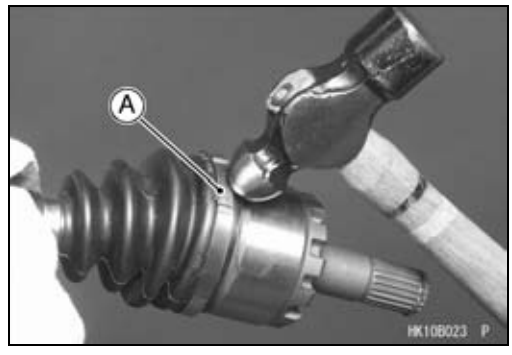


- Open the edge of the boot in order to eqalize the air pressures.
- Tighten the large band [A] and bend the tangs securely to hold down the end of the band.

Maximum Outside Diameter of Band: 77.2 mm (3.04 in.)
(After tightening the outside diameter)

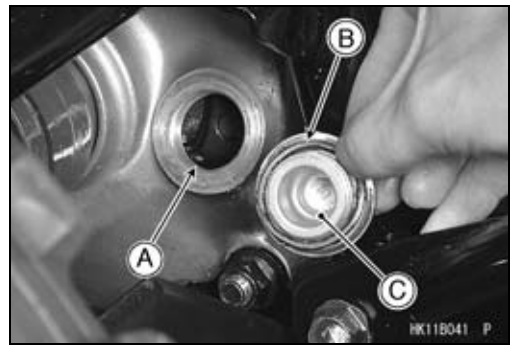


- While the band is held at the diameter above, tap down the tangs [A] of the clamp.



Front Final Gear Case

Front Final Gear Case Oil Level Inspection



- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- Remove the filler cap.

NOTICE

Be careful not to allow any dirt or foreign materials to enter the gear case.

- Check the oil level. The oil level should come to the bottom of the filler opening [A].

★If it is insufficient, first check the front 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.

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

○Apply grease to the O-ring.

Torque - Front Final Gear Case Oil Filler Cap: 29 N·m (3.0 kgf·m, 22 ft·lb)

Front Final Gear Case Oil Change

- Refer to the Front Final Gear Case Oil Change in the Periodic Maintenance chapter.

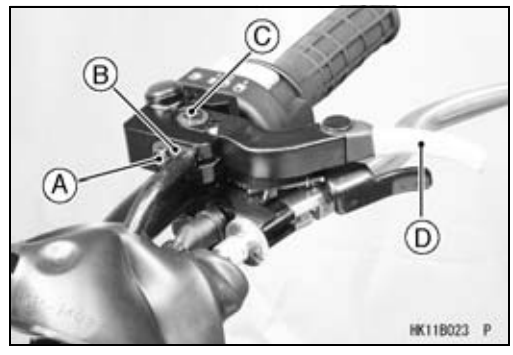
Variable Differential Control Lever Play Inspection

- Refer to the Variable Differential Control Lever Play Inspection in the Periodic Maintenance chapter.

Variable Differential Control Lever Play Adjustment

- Refer to the Variable Differential Control Lever Play Adjustment in the Periodic Maintenance chapter.

Variable Differential Control Lever Removal

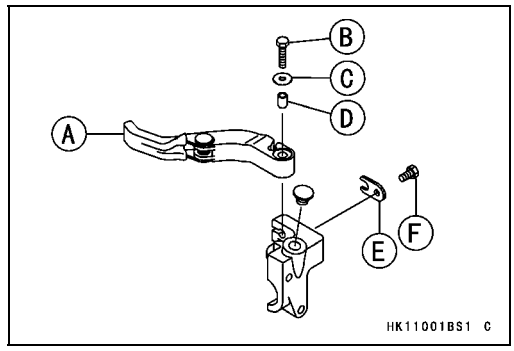


- Remove:

  Handlebar Cover
  Plate Bolt [A]
  Cable Stopper Plate [B]
  Variable Differential Control Lever Bolt [C], Washer and Collar
  Variable Differential Control Lever [D]
  Variable Differential Control Cable Upper End

Front Final Gear Case

Variable Differential Control Lever Installation



- Install:
  Variable Differential Control Cable Upper End
  Variable Differential Control Lever [A]
- Apply a non-permanent locking agent to the variable differential control lever bolt [B] and tighten it.

Torque - Variable Differential Control Lever Bolt: 3.4 N·m (0.35 kgf·m, 30 in·lb)

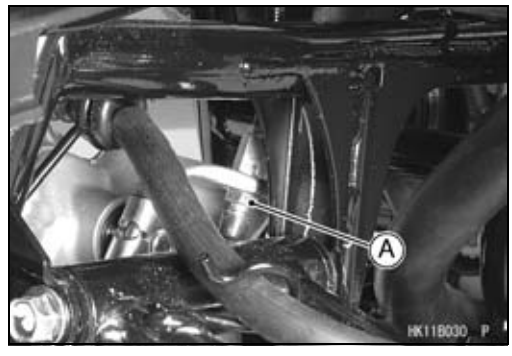
- Install:
  Variable Differential Control Lever Bolt, Washer [C] and Collar [D]
  Cable Stopper Plate [E]
  Plate Bolt [F]
- Check the variable differential control lever play (see Variable Differential Control Lever Play Inspection in the Periodic Maintenance chapter).

Variable Differential Control Cable Installation

- Lubrication the variable differential control cable before installation.
- Route the cable correctly according to the Cable, Wire, and Hose Routing in the Appendix chapter.

⚠ WARNING

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



- Tighten:

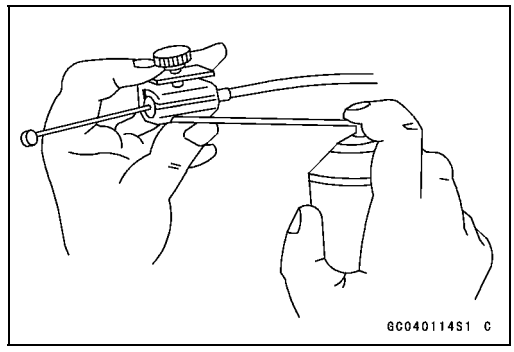
Torque - Variable Differential Control Cable Locknut [A]: 16 N·m (1.6 kgf·m, 12 ft·lb)

- Check the variable differential control lever play (see Variable Differential Control Lever Play Inspection in the Periodic Maintenance chapter).

Variable Differential Control Cable Lubrication

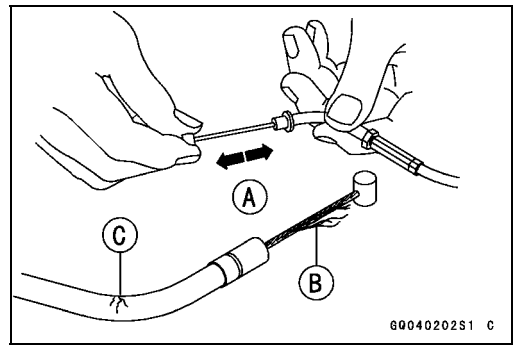
Whenever the variable differential control cable is removed, lubricate the cable as follows:

- Apply a small amount of multi-purpose grease to the cable (both ends).
- Lubricate the cable with a penetrating aerosol cable lubricant through the pressure cable luber.



Front Final Gear Case

Variable Differential Control Cable Inspection



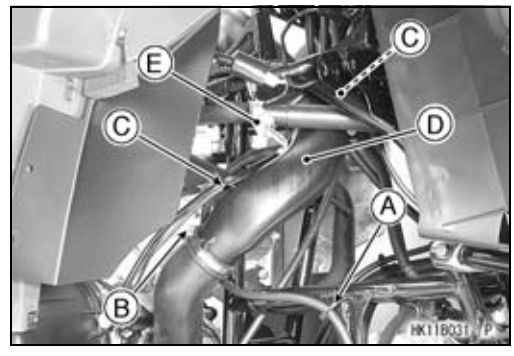
- With the variable differential control cable disconnected at both ends, the cable should move freely within the cable housing.

★If the cable does not move freely [A] after lubricating, if the cable is frayed [B], or if the housing is kinked [C], replace the cable.

Front Final Gear Case Removal

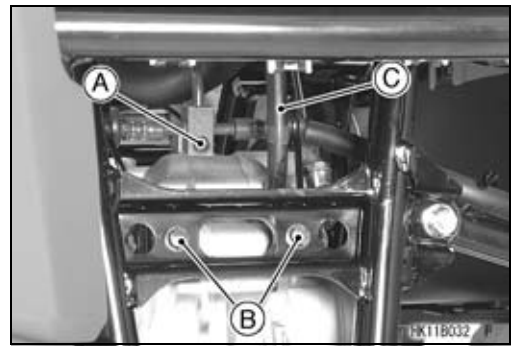
- Drain the gear case oil (see Front Final Gear Case Oil Change in the Periodic Maintenance chapter).
- Remove:

  Steering Stem (see Steering Stem Removal in the Steering chapter)
  Front Axles (see Front Axle Removal)
  Right Upper Suspension Arm (see Front Suspension Arm Removal in the Suspension chapter)
  Right Front Shock Absorber (see Front Shock Absorber Removal in the Suspension chapter)
  Front Propeller Shaft (see Front Propeller Shaft Removal)



- Cut the band [A].
- Loosen the clamp screw [B].
- Remove:

  Clamps [C]
  Air Duct [D]
  Actuator Lead Connector [E] (disconnect)

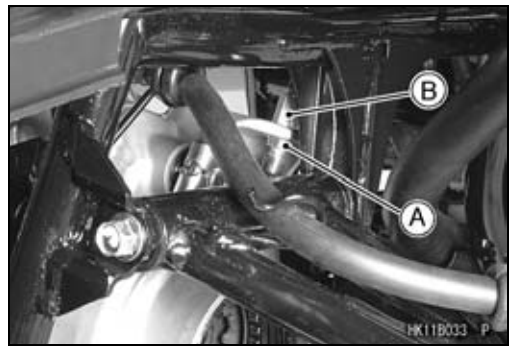


- Remove:

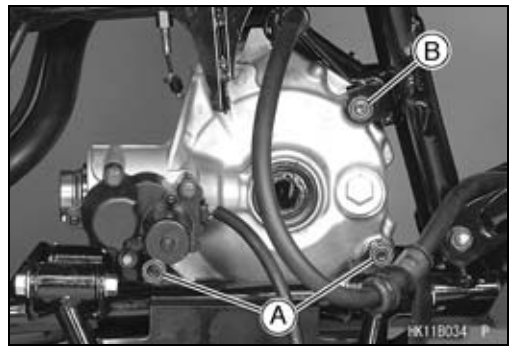
  Brake Hose Joint Bolt [A]
  Bracket Bolts [B]
  Vent Hose [C]

Front Final Gear Case

● Loosen the variable differential control cable locknut [A] and adjusting nut [B], and clear the cable lower end from the variable differential control lever.



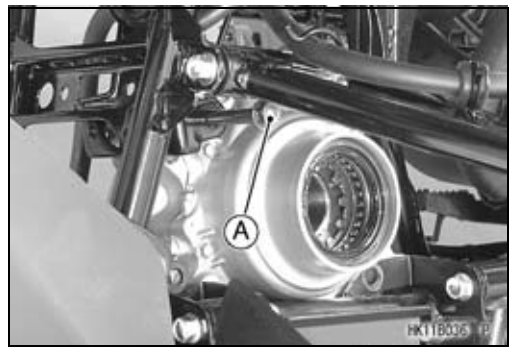
● Remove:
Front Final Gear Case Lower Bolts and Nuts [A]
● Remove the front final gear case upper nut [B].
● Lift up the rear portion of the front final final gear case, and remove the upper bolt.



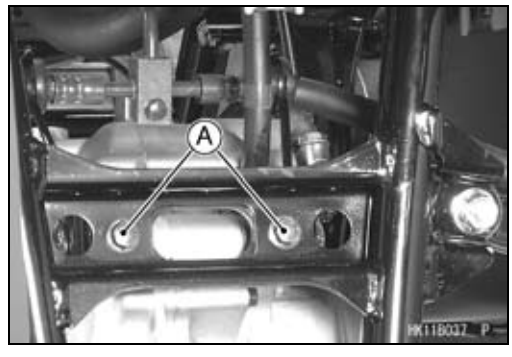
● Remove the rear final gear case [A] as shown.

Front Final Gear Case Installation

○Install the gear case bolts from the vehicle left side.
● Insert the upper front final gear case bolt [A] first.



● Tighten the bracket bolts [A].



Front Final Gear Case

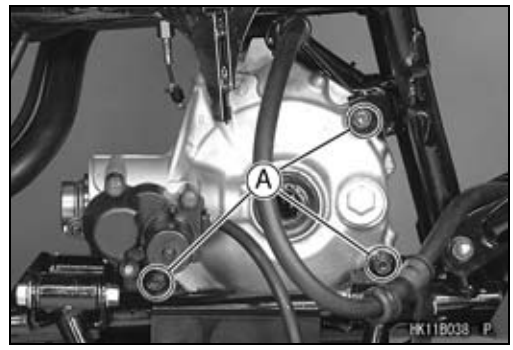
- Insert the lower front final gear case bolts.
- Tighten:

Torque - Front Final Gear Case Nuts [A]: 59 N·m (6.0 kgf·m, 44 ft·lb)

- Install the removed parts.

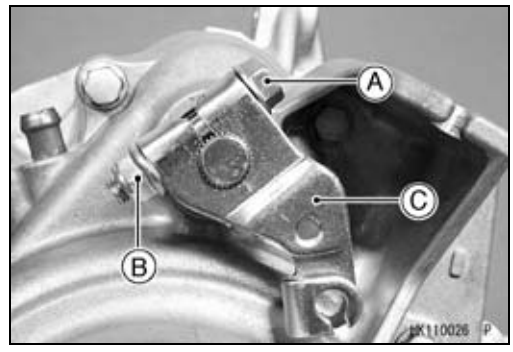
Torque - Front Final Gear Case Oil Drain Plug: 15 N·m (1.5 kgf·m, 11 ft·lb)

- Fill the front final gear case with the specified oil (see Front Final Gear Case Oil Change in the Periodic Maintenance chapter).



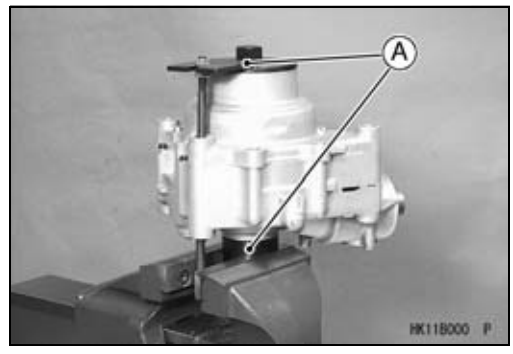
Front Final Gear Case Disassembly

- Remove:
  Front Final Gear Case (see Front Final Gear Case Removal)
  Variable Differential Control Shift Shaft Lever Bolt [A] and Nut [B]
  Variable Differential Control Shift Shaft Lever [C]
  2WD/4WD Actuator (see 2WD/4WD Actuator Removal in the Electrical System chapter)

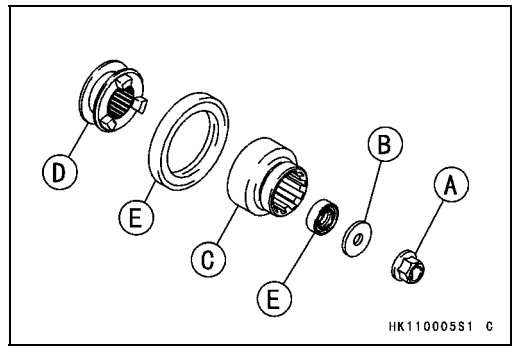


- Hold the front final gear case with the gear holder & socket wrench [A] in a vise.

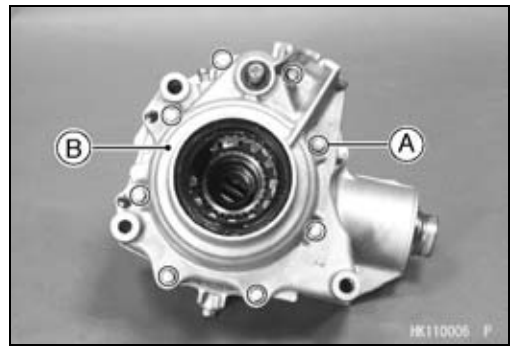
Special Tool - Gear Holder & Socket Wrench, Hex 24: 57001-1489



- Remove:
  Front Final Gear Case Coupling Nut [A]
  Washer [B]
  Front Final Gear Case Coupling [C]
  Shifter [D]
  Oil Seals [E]



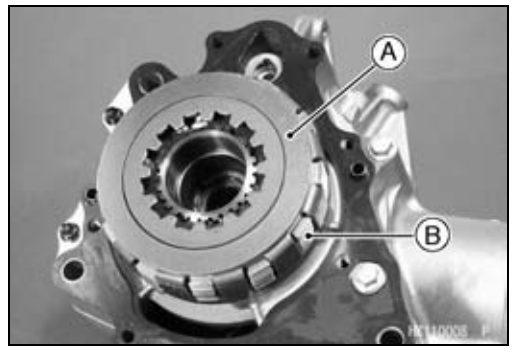
- Remove:
  Front Final Gear Case Left Cover Bolts [A]
  Front Final Gear Case Left Cover [B]
  Variable Differential Control Shift Shaft
  Spring



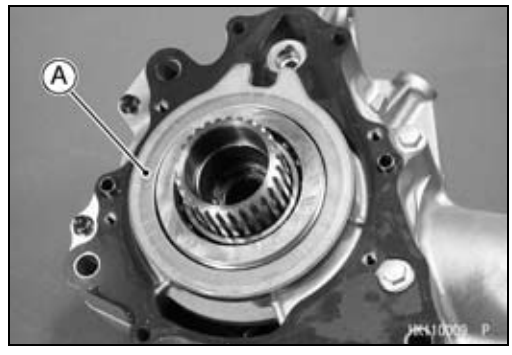
Front Final Gear Case

● Remove:
Outer Disc [A]
Needle Bearing

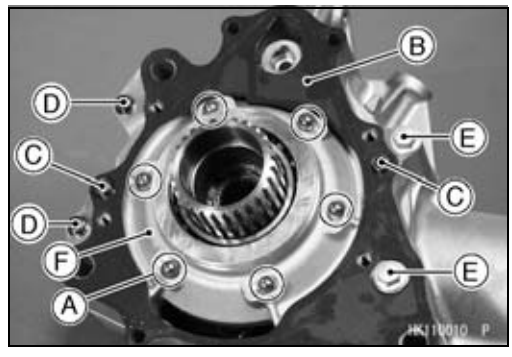
● Remove:
Housing [A] and Differential Disc Assembly [B]
Inner Disc
Needle Bearing



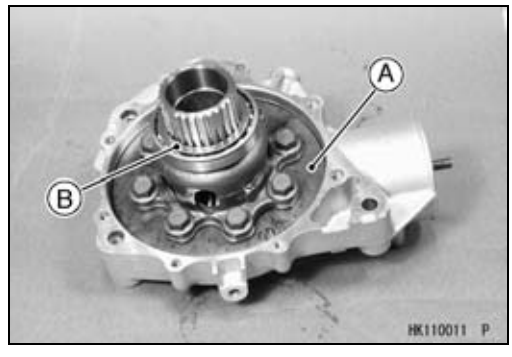
● Remove:
Cam Plate [A]



● Remove:
Steel Balls [A]
Gasket [B]
Dowel Pins [C]
Front Final Gear Case Center Cover Bolts (M6) [D]
Front Final Gear Case Center Cover Bolts (M8) [E]
Front Final Gear Case Center Cover [F]



● Remove:
Ring Gear Assembly [A]
Shim(s) [B]



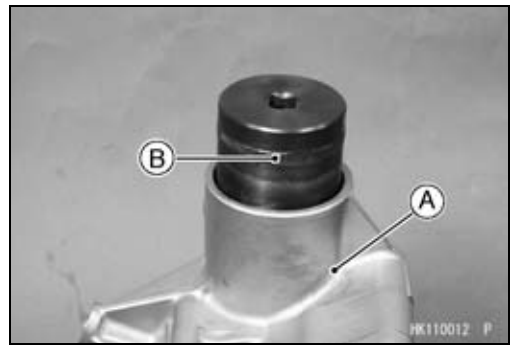
Front Final Gear Case

● Hold the front final gear case right cover [A] in a vise, and remove the bearing holder using the socket wrench [B].

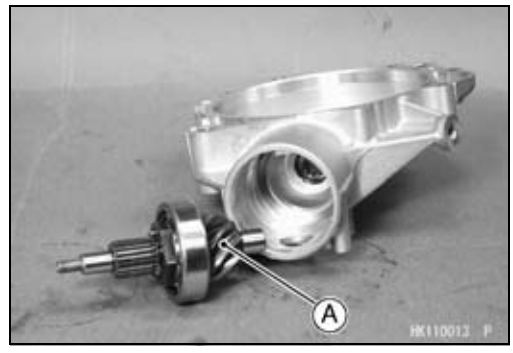
Special Tool - Socket Wrench, Hex 41: 57001-1484

○If the holder seems too difficult to break free, apply heat to softer the locking agent.

● Remove:
Pinion Gear Bearing Holder



● Remove:
Pinion Gear Unit [A]
Shim(s)



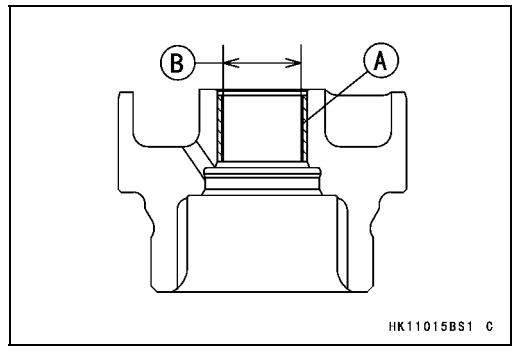
Front Final Gear Case Coupling Inspection

★If the coupling bushing [A] is damaged or worn, replace the front final gear case coupling.

Front Final Gear Case Coupling Bushing Inside Diameter [B]

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

Service Limit: 13.048 mm (0.5137 in.)



Front Final Gear Case Assembly

● Install:
Ball Bearing [A]
Needle Bearing [B]

○Press the ball bearing and needle bearing until they are bottomed.

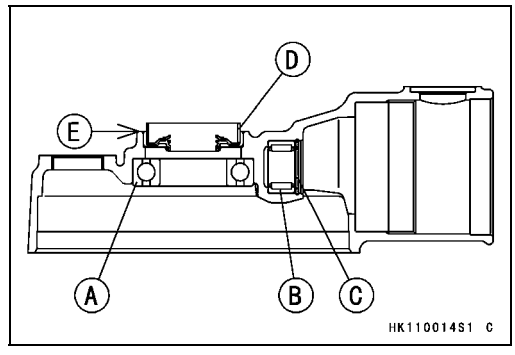
● Install:
Circlip [C]

Special Tool - Inside Circlip Pliers: 57001-143

● Install:
Oil Seal [D]

○Insert the oil seal so that the rubber surface is flush [E] with the end of hole.

○Apply grease to the oil seal lip.



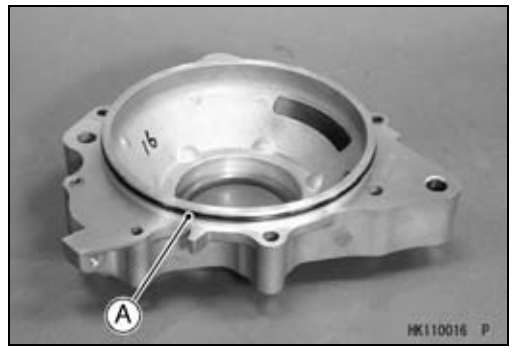
● Visually check the pinion gear and ring gear for scoring, chipping, or other damage.

★Replace the bevel gear as a set if either gear is damaged since they are lapped as a set in the factory to get the best tooth contact.

● Insert the pinion gear in the front final gear case right cover.

Front Final Gear Case

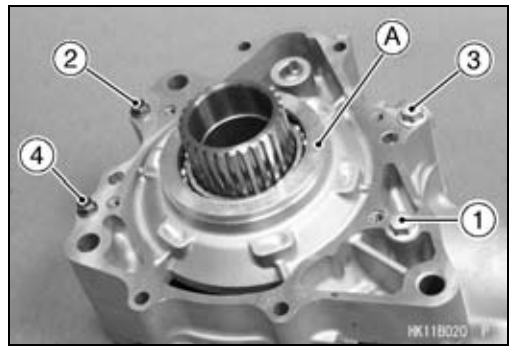
● Install:
Ring Gear Assembly
● Apply grease to the O-ring [A] on the front final gear case center cover.



● Install:
Front Final Gear Case Center Cover [A]
● Tighten the cover bolts following the tightening sequence as shown.

Torque - Front Final Gear Case Center Cover Bolts (M8) [1, 3]: 24 N·m (2.4 kgf·m, 17 ft·lb)
Front Final Gear Case Center Cover Bolts (M6) [2, 4]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

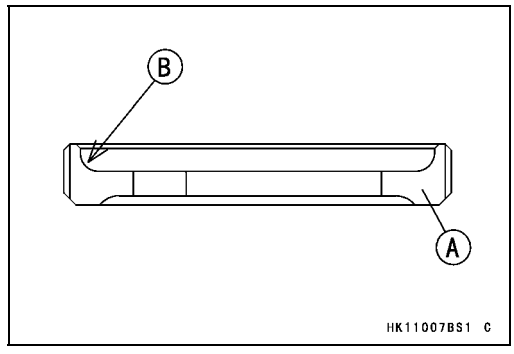
● Adjust the gear backlash and tooth contact pattern (see Front Final Bevel Gear Adjustment).
● Apply a non-permanent locking agent to the cover bolts, and tighten them to the specified torque in the tightening sequence [1 ~ 4].



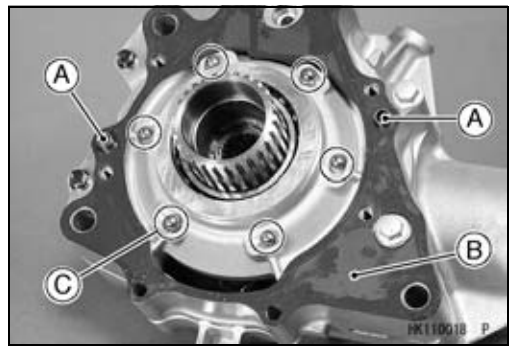
● Apply a non-permanent locking agent to the pinion gear bearing holder [A], and tighten it so that the deep recess [B] faces outward.

Special Tool - Socket Wrench, Hex 41: 57001-1484

Torque - Pinion Gear Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)

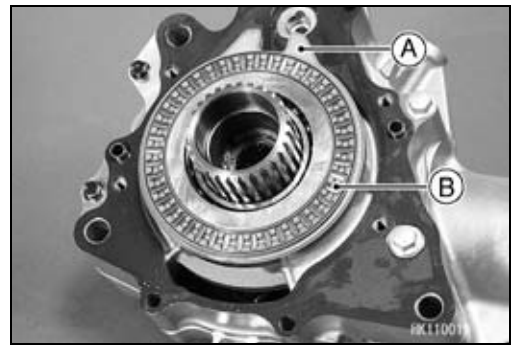


● Install:
Dowel Pins [A]
New Gasket [B]
Steel Balls [C]

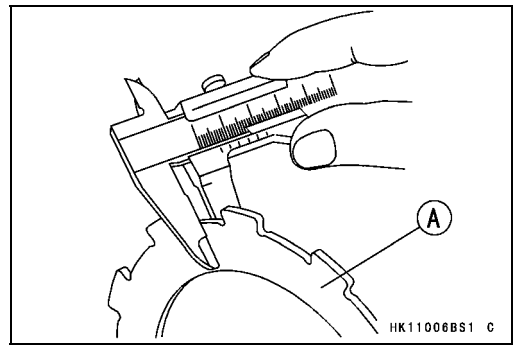


Front Final Gear Case

● Install:
Cam Lever [A]
Needle Bearing [B]
● Apply engine oil to the needle bearing.

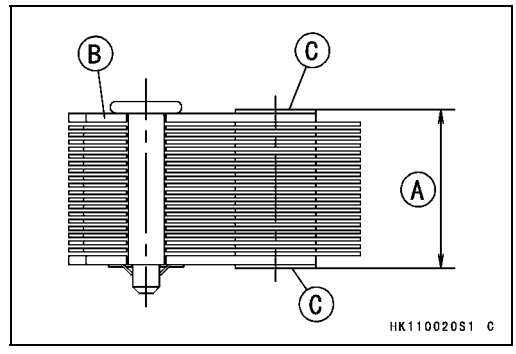


● Check the wear of the disc assembly as follows.
○Measure the thickness of the inner disc [A].



● Select the width [A] of the disc assembly [B] in accordance with the thickness of the inner disc, refer to the below table.

Thickness of Inner Disc Assembly	Width [A] of Disc Assembly
2.4 mm (0.0945 in.)	16.7 ~ 17.3 mm (0.6675 ~ 0.6811 in.)
1.8 mm (0.0709 in.)	17.31 ~ 17.9 mm (0.6815 ~ 0.7047 in.)
1.2 mm (0.0472 in.)	17.91 ~ 18.5 mm (0.7051 ~ 0.7283 in.)



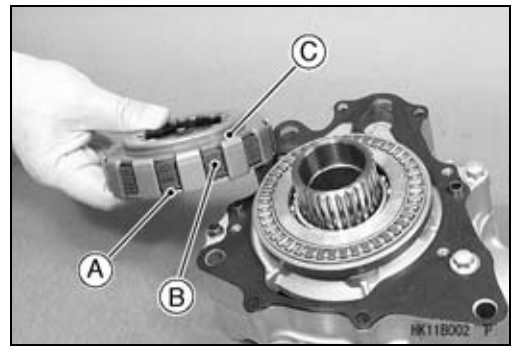
○Measure the width of the disc assembly at three locations, and calculate average for three points.

NOTE

○*Be careful not to damage the facing surface [C] on the outer plates.*

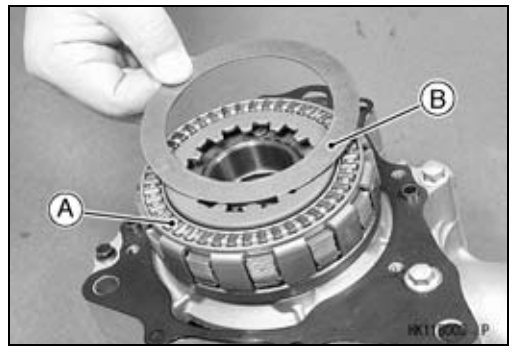
★If the width is within the specified range, install the inner disc and disc assembly.
★If the width is not within the specified range, replace the disc assembly.

● Install:
Inner Disc [A]
Disc Assembly [B] and Housing [C]

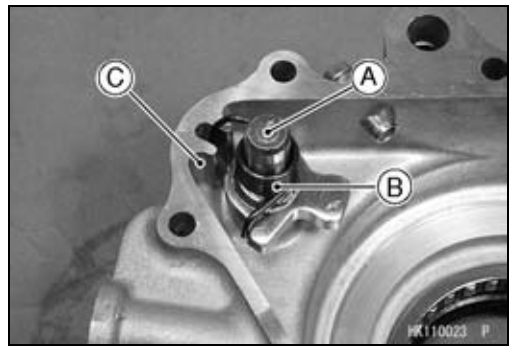


Front Final Gear Case

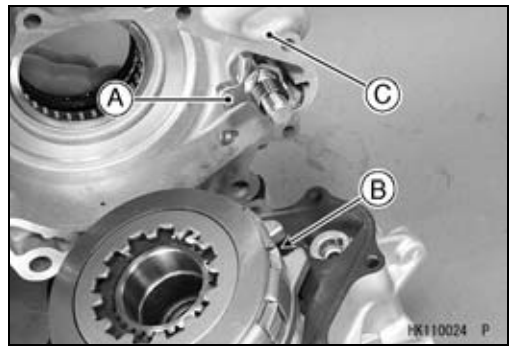
● Apply engine oil to the needle bearing [A].
● Install:
Needle Bearing
Outer Disc [B]



● Apply engine oil to the variable front differential control shift shaft [A].
● Install the shaft and spring [B] in the front final gear case left cover [C] as shown.



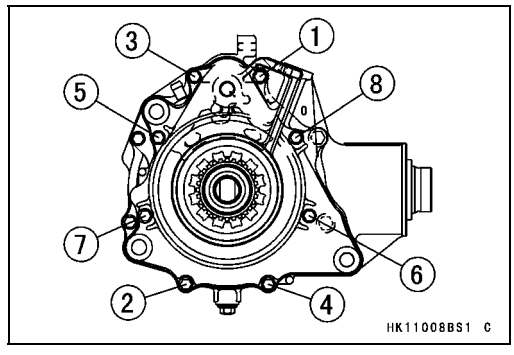
● Turn the shaft counterclockwise and insert the tab [A] of the shift shaft into the groove [B] of the cam plate.
● Install:
Front Final Gear Case Left Cover [C]



● Apply a non-permanent locking agent to the cover bolts [1 ~ 4], and tighten them following the tightening sequence as shown.

Torque - Front Final Gear Case Left Cover Bolts (M6)
[1 ~ 8]: 9.8 N·m (1.0 kgf·m, 87 ft·lb)

[1 ~ 4] L = 60 mm (2.4 in.)
[5 ~ 8] L = 30 mm (1.2 in.)

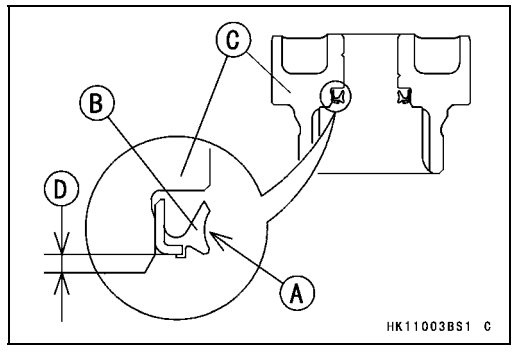


● Apply grease to the oil seal lip [A].
● Press the oil seal [B] in the coupling [C] to the specified position as shown.
[D] 1 mm (0.04 in.)

Special Tools - Oil Seal Driver, ϕ18.5: 57001-1505
Driver Holder: 57001-1132

NOTE

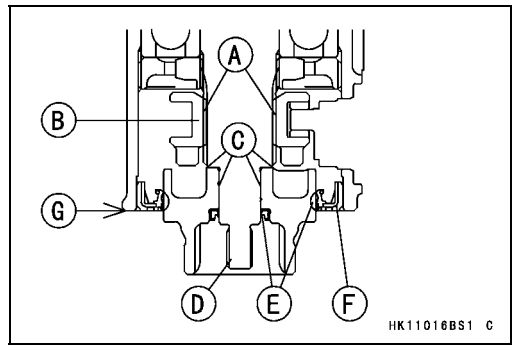
○*57001-1132 is included in Bearing Driver Set, 57001 -1129.*



Front Final Gear Case

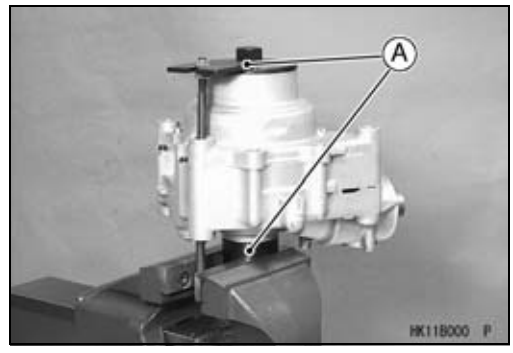
- Apply molybdenum disulfide grease to the spline [A] of the shifter [B] and inner surface [C] of the coupling.
- Install the shifter and coupling on the pinion gear shaft [D].
- Apply grease to the oil seal lip [E].
- Press the oil seal [F] in the front final gear case so that the oil seal surface is flush [G] with the case end.

Special Tool - Oil Seal Driver, ϕ70: 57001-1506



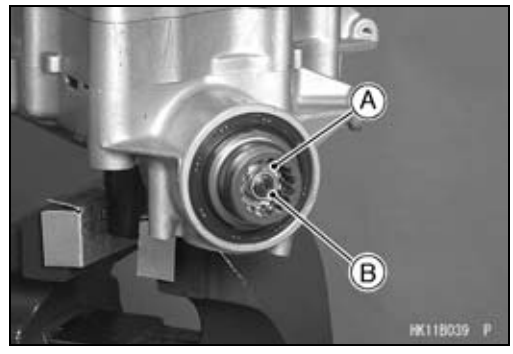
- Hold the front final gear case with the gear holder & socket wrench [A] in a vise.

Special Tool - Gear Holder & Socket Wrench, Hex 24: 57001-1489



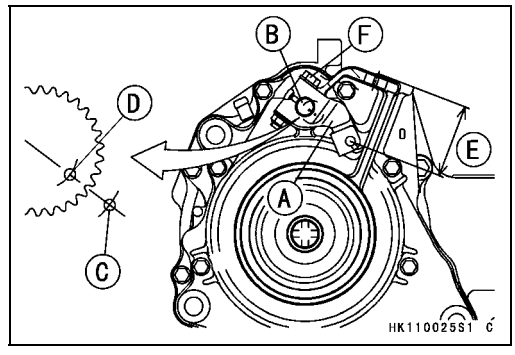
- Install:
  Washer [A]
- Tighten:

Torque - Front Final Gear Case Coupling Nut [B]: 25 N·m (2.5 kgf·m, 18 ft·lb)



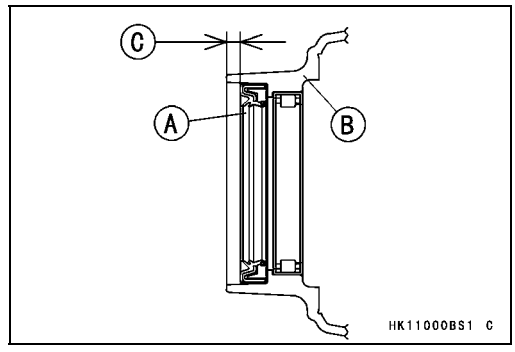
- Install the variable differential control shift shaft lever [A] on the shift shaft [B] so that the punch mark [C] on the lever aligns with the punch mark [D] on the shift shaft as shown.
  [E] 45.8 ~ 50.4 mm (1.80 ~ 1.98 in.)
- Tighten:

Torque - Variable Differential Control Shift Shaft Lever Bolt [F]: 8.8 N·m (0.90 kgf·m, 78 in·lb)
2WD/4WD Actuator Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



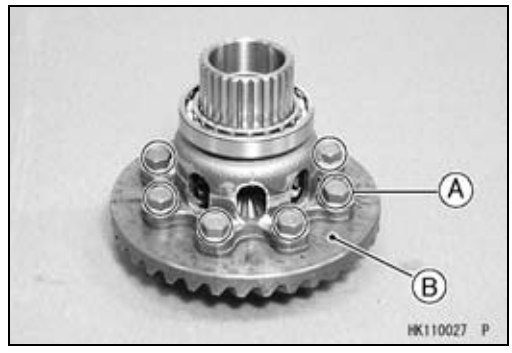
Oil Seal Installation

- Press the oil seal [A] in the front final gear case left cover [B] to the dimension as shown.
  [C] 4.6 ~ 5.6 mm (0.18 ~ 0.22 in.)

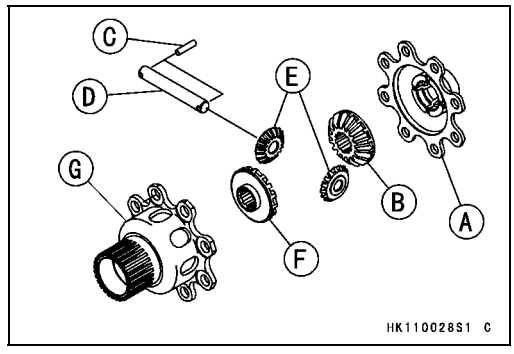


Front Final Gear Case

Ring Gear Disassembly

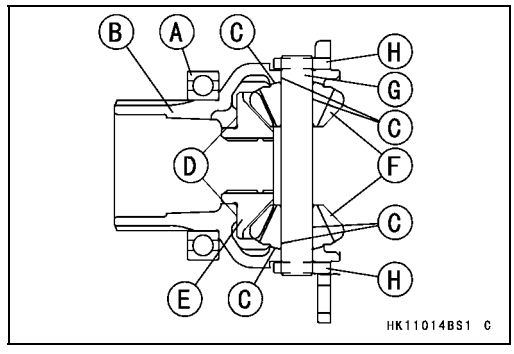


- Remove:
  Ring Gear Assembly (see Front Final Gear Case Disassembly)
  Ring Gear Bolts [A]
  Ring Gear [B]

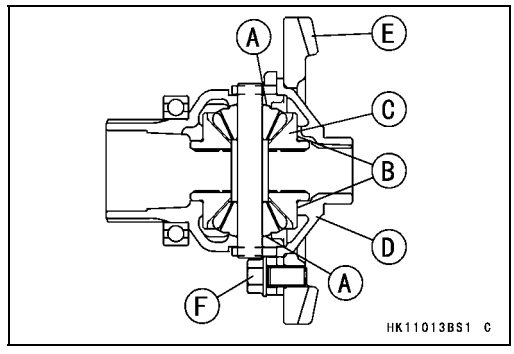


- Remove:
  Differential Gear Case Cover [A]
  Right Side Gear (16T) [B]
  Pins [C]
  Spider Gear Shaft [D]
  Spider Gears (10T) [E]
  Left Side Gear (16T) [F]
  Left Differential Gear Case [G]

Ring Gear Assembly



- Press the bearing [A] on the left differential gear case [B] until it is bottomed.
- Apply engine oil [C] to the spider gears and the spider gear shaft.
- Apply molybdenum disulfide grease [D] to the left side gear (16T) [E].
- Install:
  Left Side Gear (16T)
  Spider Gears (10T) [F]
  Spider Gear Shaft [G] and Pins [H]



- Apply engine oil [A] to the spider gears.
- Apply molybdenum disulfide grease [B] to the right side gear (16T) [C].
- Install:
  Right Side Gear (16T)
  Differential Gear Case Cover [D]
  Ring Gear [E]
- Apply a non-permanent locking agent (Three Bond: TB2471 Blue) to the ring gear bolts [F], and tighten them.

Torque - Ring Gear Bolts: 57 N·m (5.8 kgf·m, 42 ft·lb)

NOTE

○*Keep the ring gear assembly at more than 20°C (68°F) for six hours after tightening the bolts.*

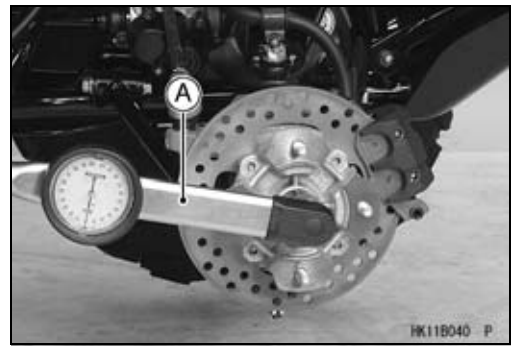
Front Final Gear Case

LSD Clutch Torque Inspection

★If the vehicle has the following symptoms, check the LSD (Limited Slip Differential) clutch torque.
-The handlebar is hard to turn.
-The front final gear case overheats.
-Abnormal noises come from the front final gear case when rounding a curve.

- Ensure 2WD mode.
- Support the vehicle so that the front wheels are off the ground.
- Remove:
  One Front Wheel (see Wheel Removal in the Wheels/Tires chapter)
  Front Axle Nut Cotter Pin
- Secure the other-side front wheel from rotating.
- Measure the clutch torque using a torque wrench [A]. Turn the wrench evenly.

○The clutch torque is the mean torque reading during about a quarter turn of the wrench.



LSD Clutch Torque
(When variable differential control lever is released.)
Standard: 15 ~ 20 N·m (1.5 ~ 2.0 kgf·m, 11 ~ 14 ft·lb)

LSD Clutch Torque
(When variable differential control lever is pulled in.)
Standard: 157 N·m (16 kgf·m, 116 ft·lb) or more

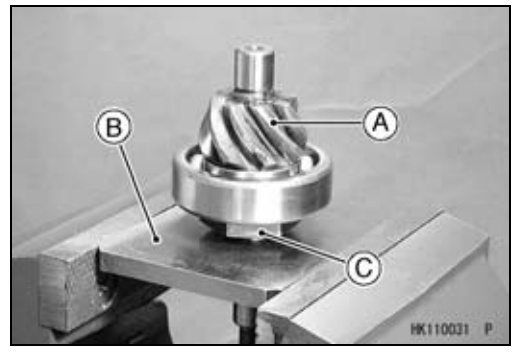
★If the clutch torque is out of the specified range, check the width of the disc assembly (see Front Final Gear Case Assembly).

NOTE

○*The correct type of oil must be installed.*

Pinion Gear Unit Disassembly

- Remove:
  Pinion Gear Unit (see Front Final Gear Case Disassembly)
- Pry open the staking of the pinion gear bearing holder nut with a small chisel.
- Hold the pinion gear unit [A] with the pinion gear holder [B] in a vise, and remove the pinion gear bearing holder nut [C].



Special Tool - Pinion Gear Holder, m1.0: 57001-1485

- Remove the ball bearing only if required.

Special Tool - Bearing Puller: 57001-135

Front Final Gear Case

Pinion Gear Unit Assembly

○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.

● Visually inspect the bearing for abrasion, color change, or other damage.

★If there is any doubt as to the condition of a bearing, replace the bearing.

● Be sure to check and adjust the bevel gear backlash and tooth contact, when any of the backlash-related parts are replaced (see Front Final Bevel Gear Adjustment).

● Press the bearing on the pinion gear until it is bottomed.

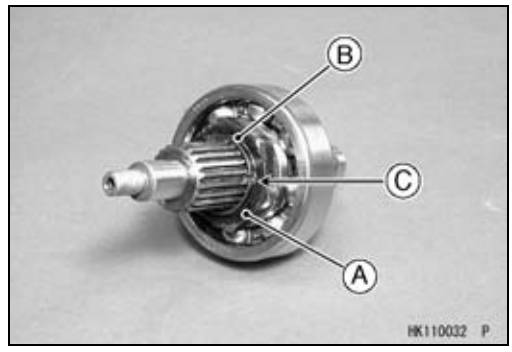
● Install the pinion gear bearing holder nut [A] so that the projection [B] faces outward.

● Tighten:

Special Tool - Pinion Gear Holder, m1.0: 57001-1485

Torque - Pinion Gear Bearing Holder Nut: 127 N·m (13 kgf·m, 94 ft·lb)

● Stake [C] the nut with a punch at three positions to secure it.



Front Final Bevel Gear Adjustment

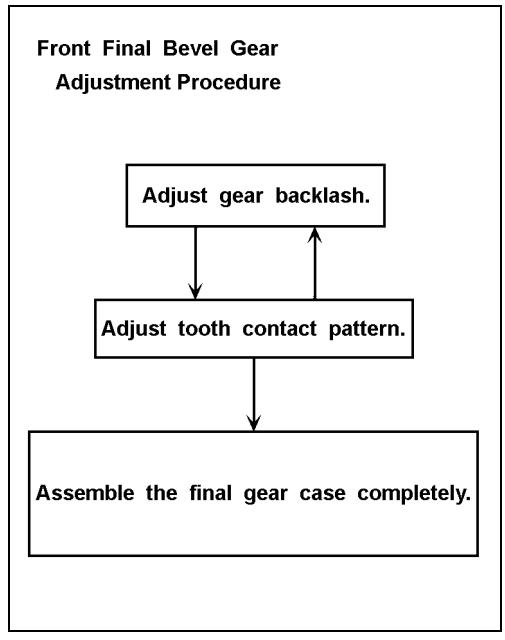
The **backlash** (distance one gear will move back and forth without moving the mate gear) and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

Above two adjustments are of critical importance and must be carried out following the correct sequence and method.

● When any one of the backlash-related parts are replaced, check and adjust the bevel gear backlash, and tooth contact by replacing shims.

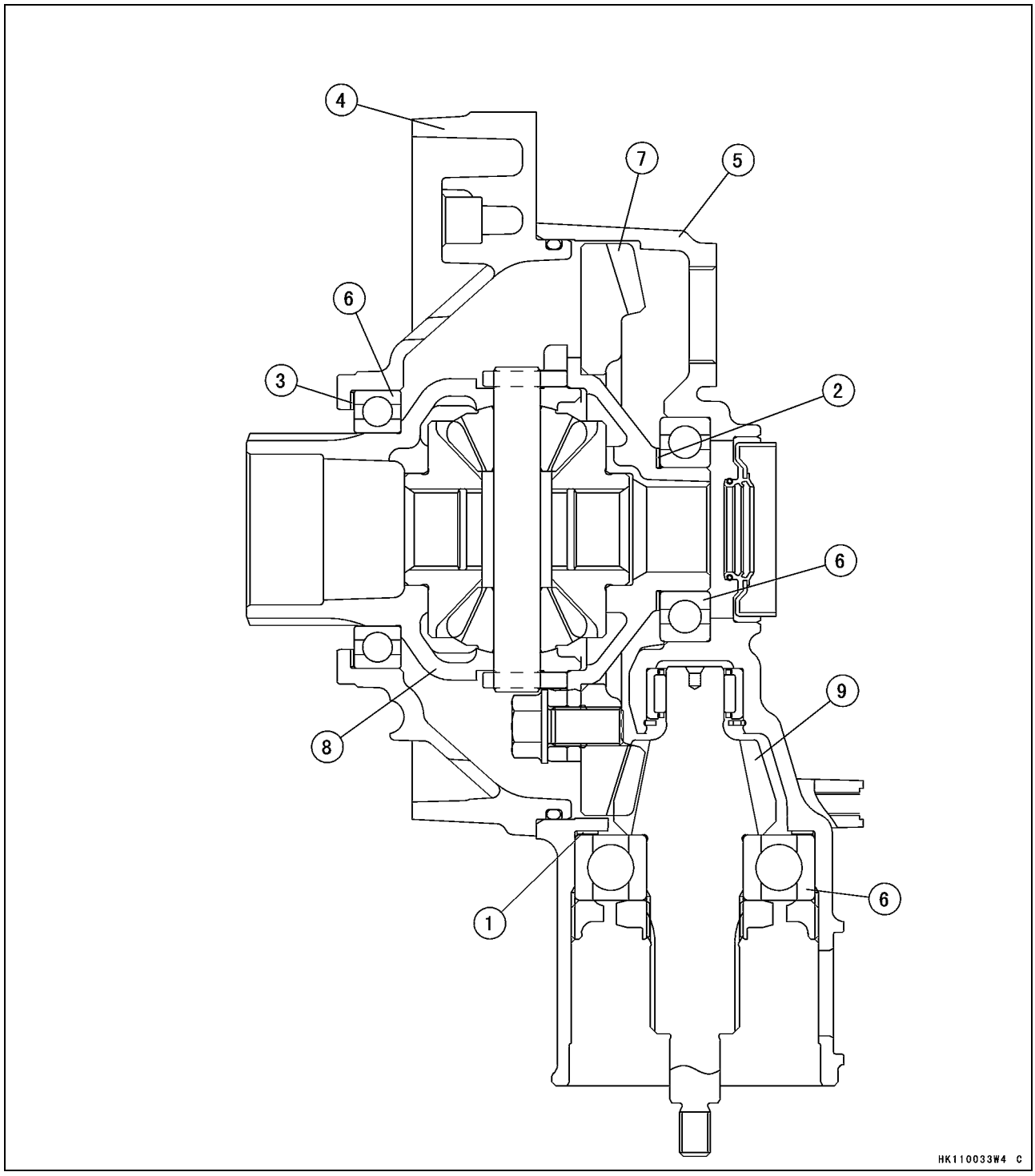
○The amount of backlash is influenced by the ring gear position more than by the pinion gear position.

○Tooth contact location is influenced by the pinion gear position more than by the ring gear position.



Front Final Gear Case

Front Final Gear Case (Backlash-related Parts)



1. Pinion Gear Shim(s)
2. Ring Gear Right Shim(s)
3. Ring Gear Left Shim(s)
4. Front Final Gear Case Center Cover
5. Front Final Gear Case Right Cover
6. Ball Bearings
7. Ring Gear
8. Ring Gear Assembly
9. Pinion Gear

Front Final Gear Case

1. Pinion Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1408
0.2 mm (0.008 in.)	92180-1409
0.5 mm (0.020 in.)	92180-1410
0.7 mm (0.028 in.)	92180-1411
0.8 mm (0.031 in.)	92180-1412
0.9 mm (0.035 in.)	92180-1413
1.0 mm (0.039 in.)	92180-1414
1.1 mm (0.043 in.)	92180-1415
1.2 mm (0.047 in.)	92180-1416

2. Ring Gear Right Shims for Tooth Contact Adjustment

Thickness	Parts Number
0.15 mm (0.006 in.)	92180-1399
0.2 mm (0.008 in.)	92180-1400
0.5 mm (0.020 in.)	92180-1401
0.7 mm (0.028 in.)	92180-1402
0.8 mm (0.031 in.)	92180-1403
0.9 mm (0.035 in.)	92180-1404
1.0 mm (0.039 in.)	92180-1405
1.1 mm (0.043 in.)	92180-1406
1.2 mm (0.047 in.)	92180-1407

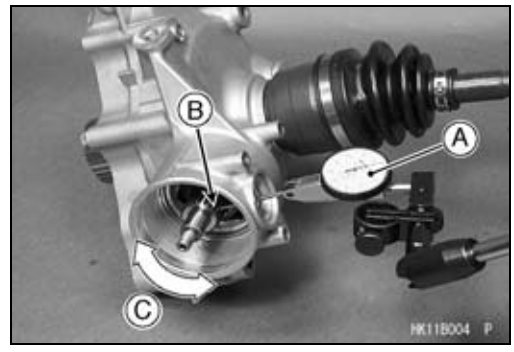
3. Ring Gear Left Shims for Tooth Contact Adjustment

Thickness	Parts Number
0.15 mm (0.006 in.)	92180-1390
0.2 mm (0.008 in.)	92180-1391
0.5 mm (0.020 in.)	92180-1392
0.7 mm (0.028 in.)	92180-1393
0.8 mm (0.031 in.)	92180-1394
0.9 mm (0.035 in.)	92180-1395
1.0 mm (0.039 in.)	92180-1396
1.1 mm (0.043 in.)	92180-1397
1.2 mm (0.047 in.)	92180-1398

Backlash Adjustment

- Check and adjust the gear backlash when any of the backlash-related parts are replaced with new ones.
- Clean any dirt and oil off the bevel gear teeth.
- Assemble the front final gear case (see Front Final Gear Case Assembly).
  - ○It is not necessary to install the variable front differential control unit.
  - ○Check the backlash during tightening of the front final gear case center cover bolts and stop tightening them immediately if the backlash disappears. Then, change the ring gear shim to a thicker one.
- Temporarily, install the right front axle in the gear case and hold it in a vise so that the ring gear is lower than the pinion gear.

Front Final Gear Case



- Mount a dial gauge [A] so that the tip of the gauge is against the splined portion [B] of the pinion gear shaft.
- To measure the backlash, move the pinion gear shaft back and forth [C] while holding the front axle steady. The difference between the highest and the lowest gauge reading is the amount of backlash.

○Measure backlash at three locations equally spaced on the splines.

Front Final Bevel Gear Backlash
Standard: 0.10 ~ 0.20 mm (0.004 ~ 0.008 in.) (at pinion gear spline)

★If the backlash is not within the limit, replace the pinion 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

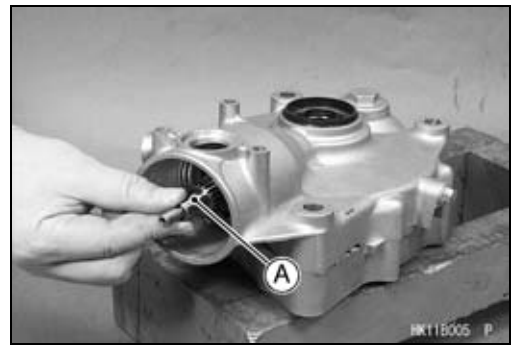
- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth on the pinion gear.

NOTE

○*Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.*

○*The checking compound must be smooth and firm, with the consistency of tooth paste.*

○*Special compounds are available from automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use one of these for checking the bevel gears.*



- Assemble the front final gear case (see Front Final Gear Case Assembly).

○It is not necessary to install the variable front differential control unit.

- Turn the pinion gear shaft [A] for one revolution in the drive and reverse (coast) direction, while creating a drag on the ring gear.
- Remove the ring gear and pinion gear unit to check the drive pattern and coast pattern of the bevel gear teeth.

Front Final Gear Case

○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 ring gear shim(s), following the examples shown.

● Then erase the tooth contact patterns and check them again. Also check the backlash every time the shim(s) are replaced. Repeat the shim change procedure as necessary.

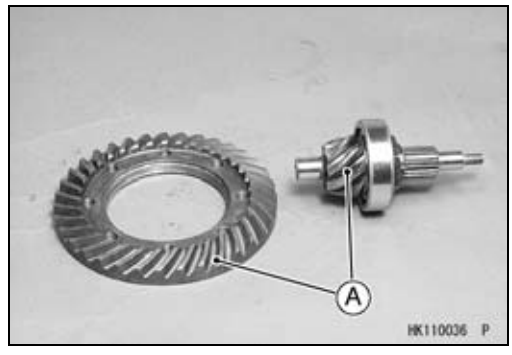
NOTE

○*If the backlash is out of the standard range after changing the ring gear shim(s), change the pinion gear shim(s) to correct the backlash before checking the tooth contact pattern.*

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.



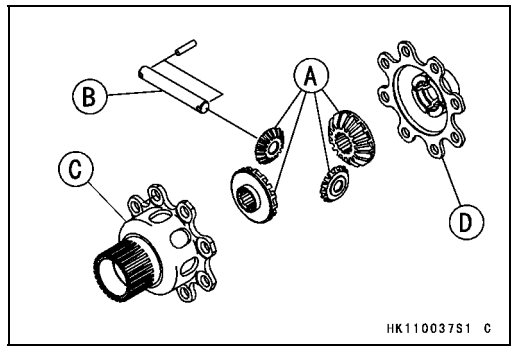
Differential Gear Inspection

● Visually check the differential gears [A] for scoring, chipping, or other damage.

★Replace the differential gears as a set if either gear is damaged.

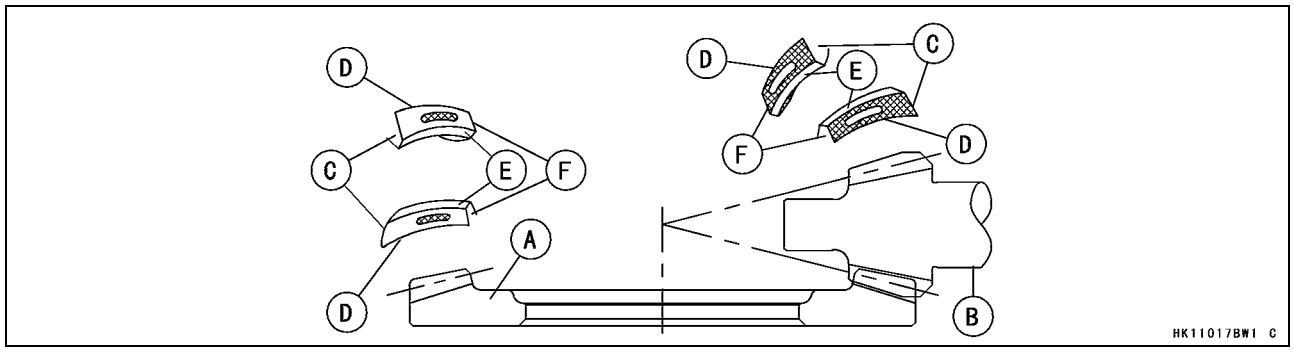
● Also, inspect the differential gear shaft [B], gear case [C], and cover [D] where the differential gears rub.

★If they are scored, discolored, or otherwise damaged, replace them as a set.



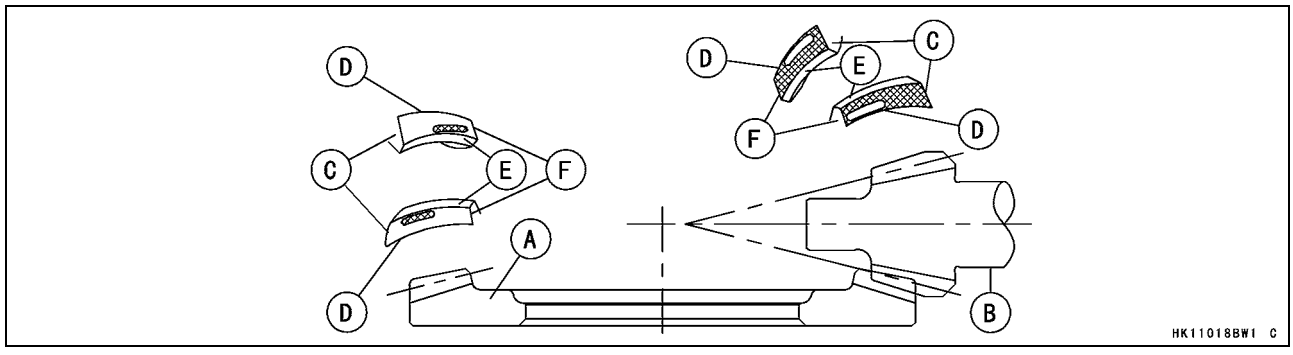
Front Final Gear Case

Correct Tooth Contact Pattern: No adjustment is required.



A. Ring Gear C. Heel E. Top
B. Pinion Gear D. Bottom F. Toe

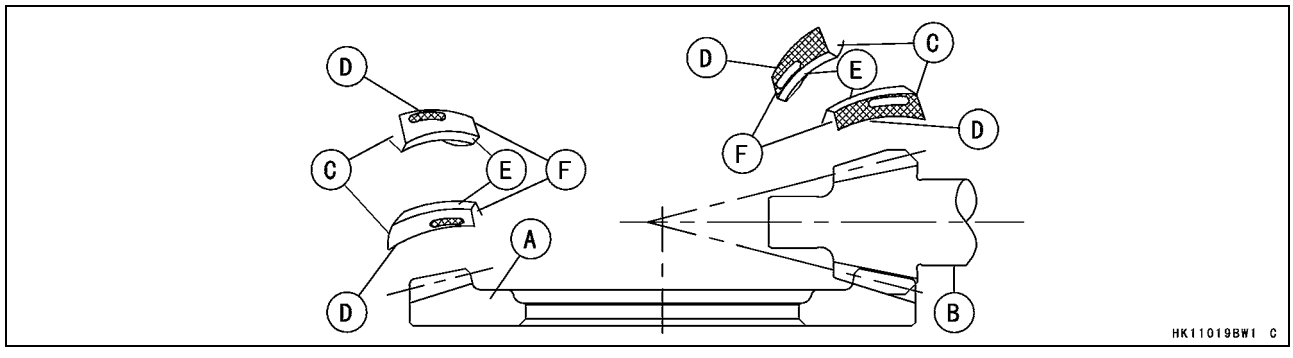
Incorrect Tooth Contact Patterns (Example 1)



○Decrease the thickness of the pinion gear shim(s) by **0.1 mm (0.004 in.)** to correct the pattern shown above. Repeat in 0.1 mm (0.004 in.) steps if necessary.

A. Ring Gear C. Heel E. Top
B. Pinion Gear D. Bottom F. Toe

Incorrect Tooth Contact Patterns (Example 2)

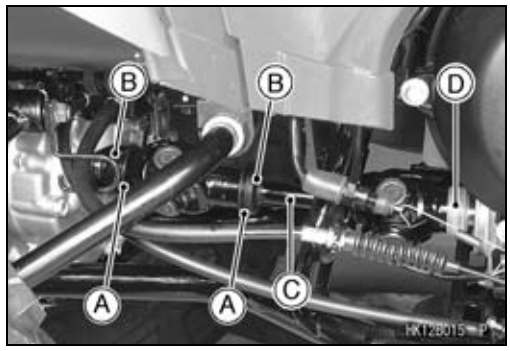


○Increase the thickness of the pinion gear shim(s) by **0.1 mm (0.004 in.)** to correct the pattern shown above. Repeat in 0.1 mm (0.004 in.) steps if necessary.

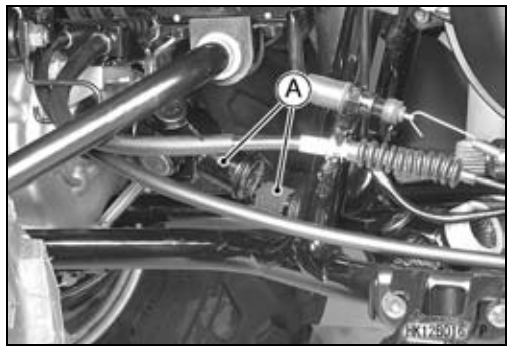
A. Ring Gear C. Heel E. Top
B. Pinion Gear D. Bottom F. Toe

Rear Propeller Shaft

Rear Propeller Shaft Removal

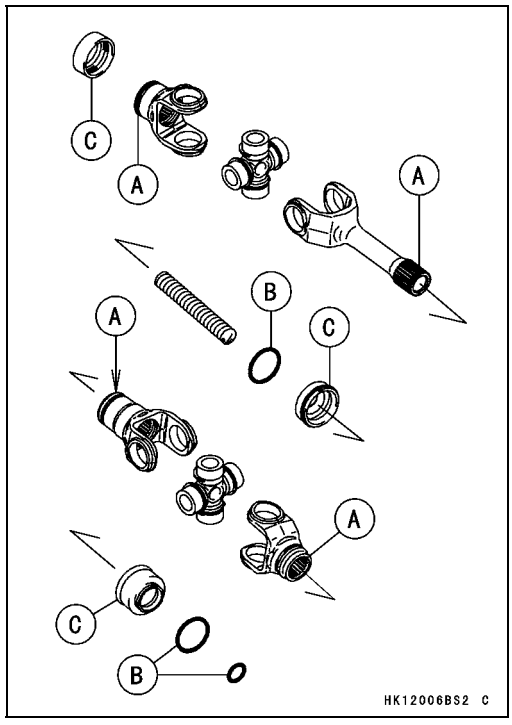


- Remove:
  Footboard (see Left and Right Footboard Removal in the Frame chapter)
- Slip the O-ring clamps [A] off the grooves on the rubber boots [B].
- Slide the rubber boot.
- Push the front universal joint [C] rearward, and remove the front end [D] from the engine.



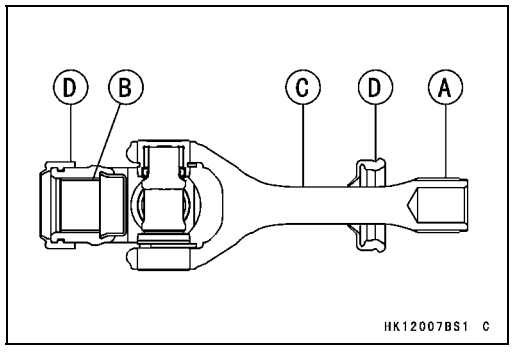
- Remove the rear propeller shaft [A] from the vehicle.

Rear Propeller Shaft Installation



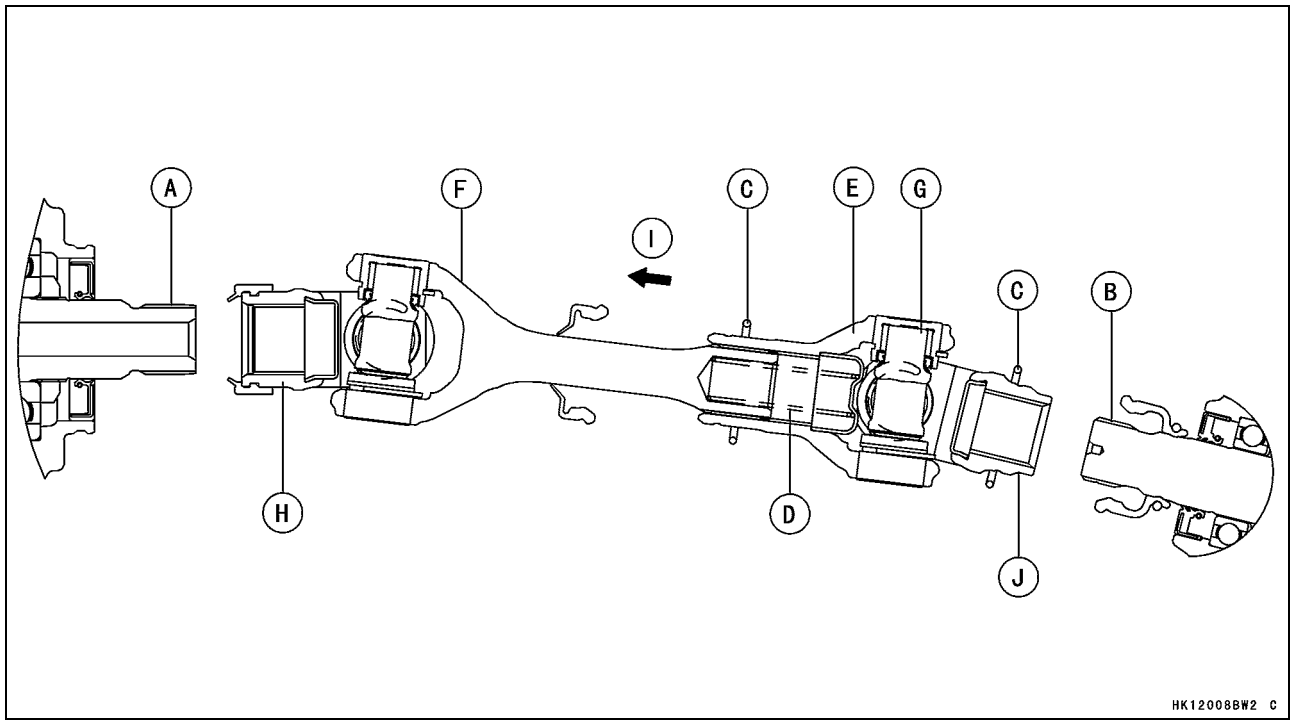
- Wipe off any old grease:
  Splines [A] of Propeller Shaft and Universal Joint Output Shaft of Engine
  Pinion Gear of Rear Final Gear Case
- Inspect O-rings [B] and boots [C] for damage.

★If any doubt exists, replace it with a new one.



- Apply molybdenum disulfide grease to the spline [A] and inside [B] of propeller shaft [C].
- Install:
  Boots [D]

Rear Propeller Shaft



- Apply molybdenum disulfide grease:
  Spline [A] on Output Shaft of Engine
  Spline [B] on Pinion Gear of Rear Final Gear Case
- Install:
  O-rings [C]
  Spring [D]
  Rear Universal Joint [E]
- Align the front universal joint yoke [F] with the rear universal joint yoke [G] as shown.
- Install the front end [H] of the propeller shaft.
- Push the rear universal joint forward [I], and install the rear end [J] of the rear universal joint on the pinion gear of rear final gear case.
- Install the rubber boots and fit the O-rings in the groove of the boots.

Rear Propeller Shaft Joint Boot Inspection

- Refer to the Rear Propeller Shaft Joint Boot Inspection in the Periodic Maintenance chapter.

Rear Propeller Shaft Inspection

- Remove the rear propeller shaft (see Rear Propeller Shaft Removal).
- Check that the universal joints [A] work smoothly without rattling or sticking.

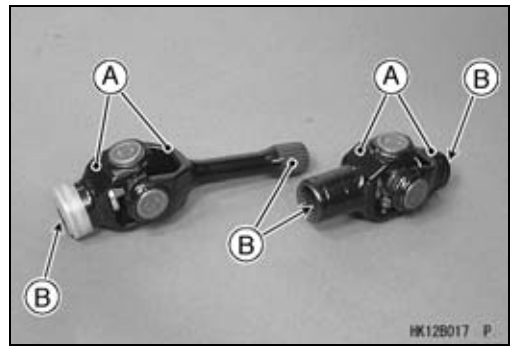
★If it does rattle or stick, the universal joint is damaged. Replace the propeller shaft with a new one.

- Visually inspect the splines [B] on the propeller shaft.

★If they are badly worn, chipped, or loose, replace the propeller shaft.

- Also, inspect the splines on the rear end of the output shaft and the pinion gear in the final gear case.

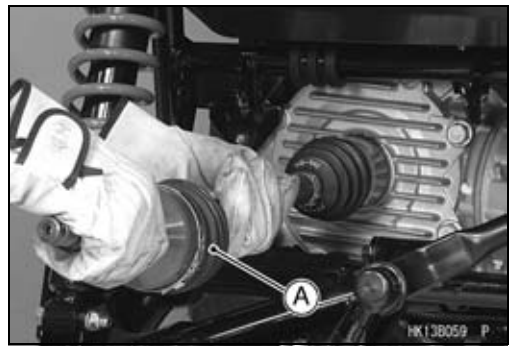
★If splines are badly worn, chipped, or loose, replace the output shaft and the pinion gear.



Rear Axle

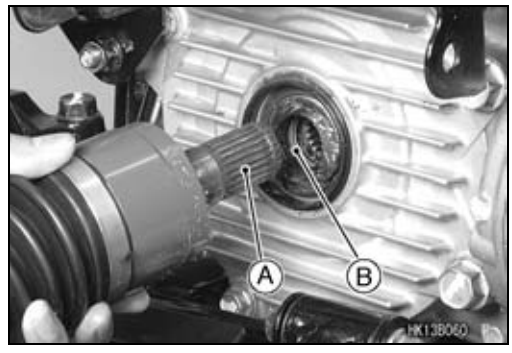
Rear Axle Removal

- Drain the rear final gear case oil (see Rear Final Gear Case Oil Change in the Periodic Maintenance chapter).
- Remove:
  Rear Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Rear Knuckle (see Rear Suspension Arm Removal in the Suspension chapter)
  Upper Suspension Arm (see Rear Suspension Arm Removal in the Suspension chapter)
- Pull the rear axle [A] in a straight line out of the rear final gear case.



Rear Axle Installation

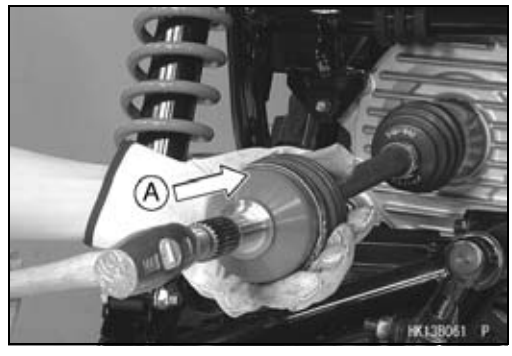
- Wipe off any old grease:
  Splines [A] of Axle
  Gear Case Oil Seal [B]
- Visually inspect the splines of the axle.
- ★If they are badly worn or chipped, replace the axle with a new one.
- Apply molybdenum disulfide grease to the axle splines.
- Apply grease top the gear case oil seal.



- Tap [A] the end of the rear axle straight and install the rear axle.

NOTE

○*The axle shaft must not come off easily.*



Rear Axle Joint Boot Inspection

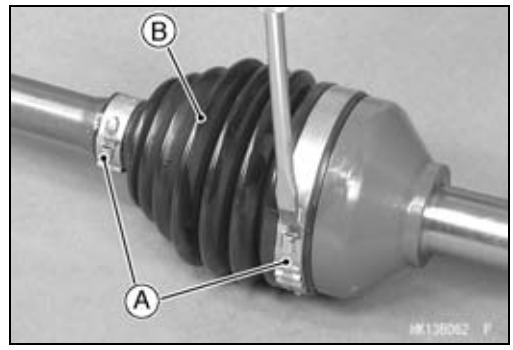
- Refer to the Axle Joint Boot Inspection in the Periodic Maintenance chapter.

Rear Axle

Rear Axle Joint Boot Replacement

Outboard Joint Boot Removal

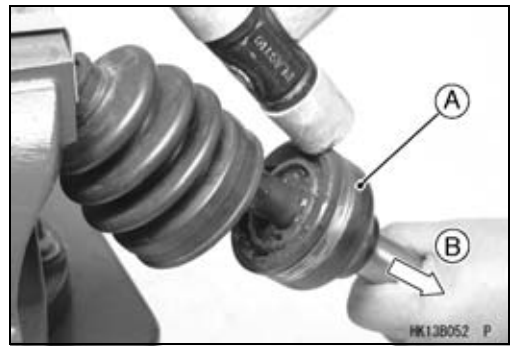
- Remove:
  Rear Axle (see Rear Axle Removal)
- Tap the joint portion of the bands [A] with a suitable tool.
- Scrap the removed boot bands.
- Slide the joint boot [B] toward the inboard joint.



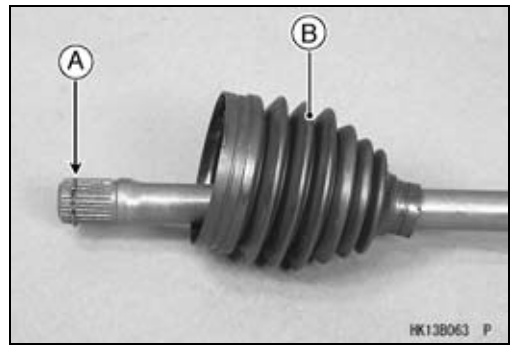
- Tap the bearing housing [A] straight [B] with a plastic hammer to separate it from the shaft.

NOTICE

Do not tap on the cage. Be careful not get hurt when the housing comes out. If the splined portion of shaft cracked or damaged during disassembling of outboard joint, do not reuse the shaft.



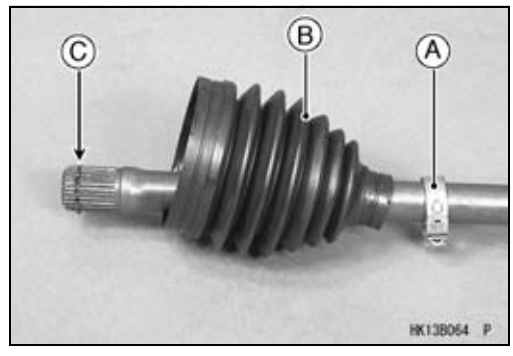
- Remove:
  Circlip [A]
  Boot [B]



Outboard Joint Boot Installation

- Clean the axle shaft by wiping off the used grease on it.
- Wind the tape on the splines of the axle shaft in order to protect the joint boot.
- Install:
  New Small Band [A]
  New Boot [B]

○Apply the special grease slightly on the inside of the new boot small diameter, and install the boot on the axle shaft.



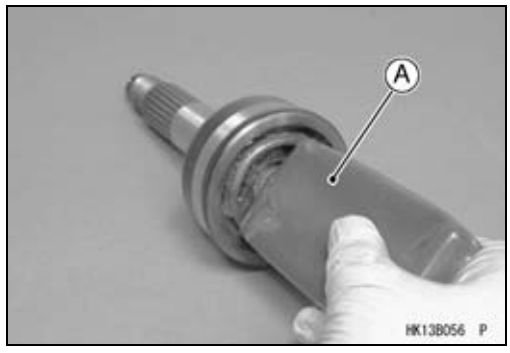
NOTICE

Only the special grease that is included with the boot kit can be applied to the boots.

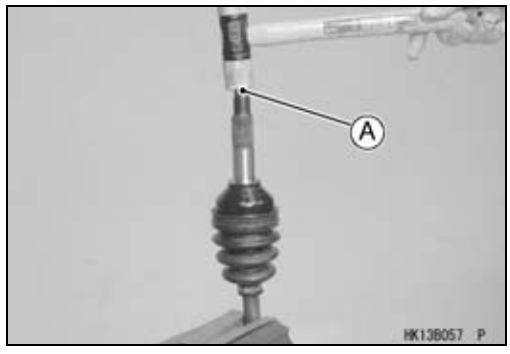
- Install:
  New Circlip [C]

Rear Axle

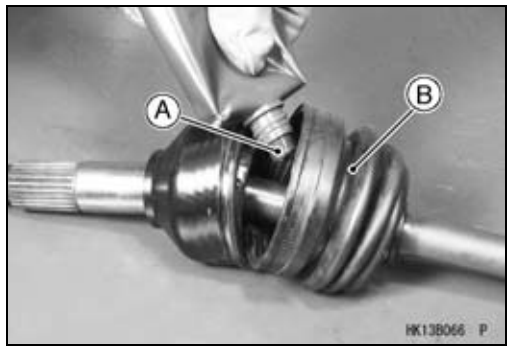
- Place the special grease tube nozzle in the bore of the housing and squeeze the tube [A] until the grease comes out from the joint bearing.



- Tap the shaft end [A] straight with a plastic hammer until it is locked by the circlip.

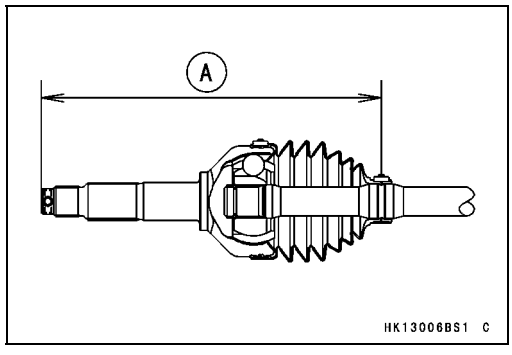


- Squeeze all of the special grease [A] into the new boot [B].



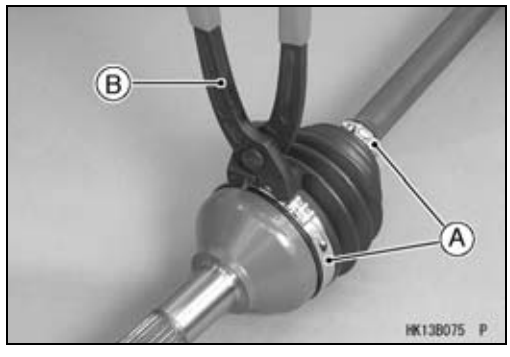
- Compress the axle assembly to the specified length while relieving the air pressure inside the inboard boot.
- Hold the axle at this setting.

Standard Length of Assembling:
Outboard: 224.82 mm (8.850 in.) [A]



- Pinch the boot bands [A] with a suitable tool [B] to install them.

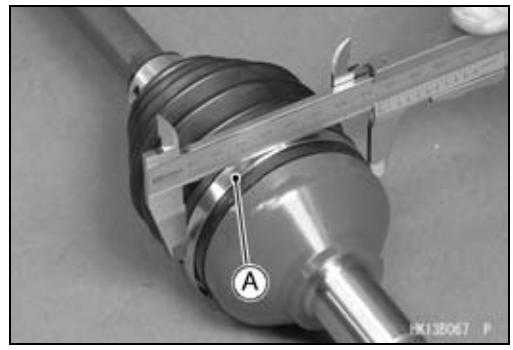
Recommend Tool: OETIKER 192



Rear Axle

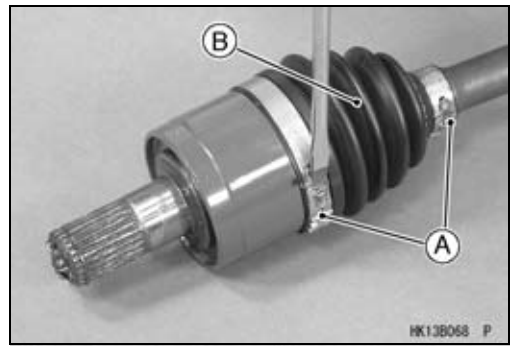
- Be sure outside diameter of the band [A] is less than the maximum diameter.

Maximum Outside Diameter of Band: 82.9 mm (3.26 in.)

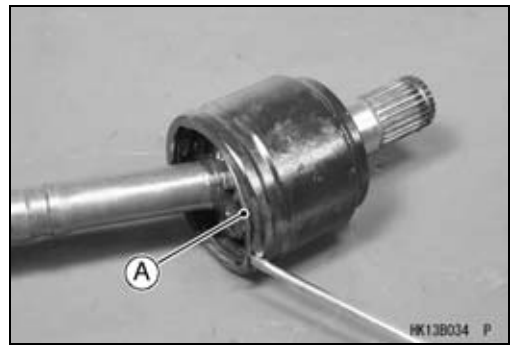


Inboard Joint Boot Removal

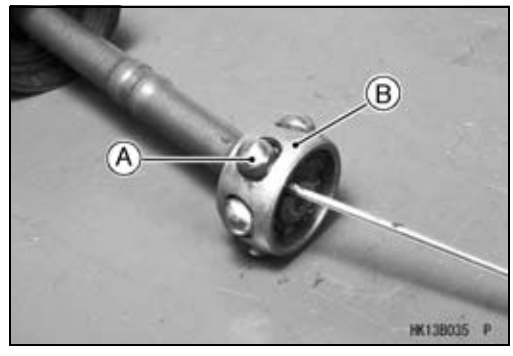
- Remove:
  Rear Axle (see Rear Axle Removal)
- Tap the joint portion of the bands [A] with a suitable tool.
- Scrap the removed boot bands.
- Slide the joint boot [B] toward the outboard joint.



- Remove the retaining ring [A].
- Separate the bearing cup from the axle shaft.

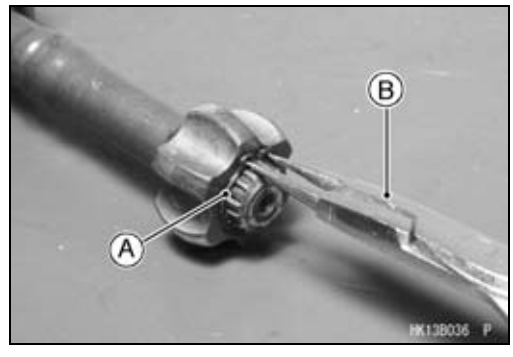


- Remove the steel balls [A].
- Slide the cage [B] toward the outboard joint.



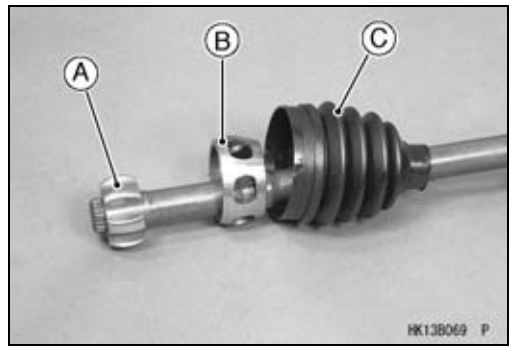
- Remove:
  Circlip [A]

Special Tool - Outside Circlip Pliers [B]: 57001-144



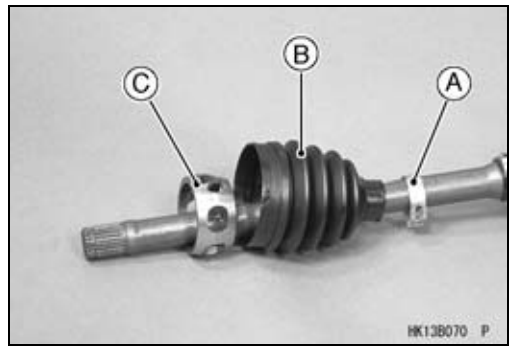
Rear Axle

- Remove:
  Inner Race [A]
  Cage [B]
  Inboard Joint Boot [C]

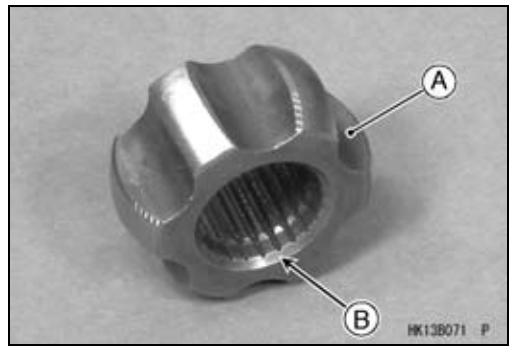


Inboard Joint Boot Installation

- Install:
  New Small Band [A]
  New Inboard Joint Boot [B]
  Cage [C]



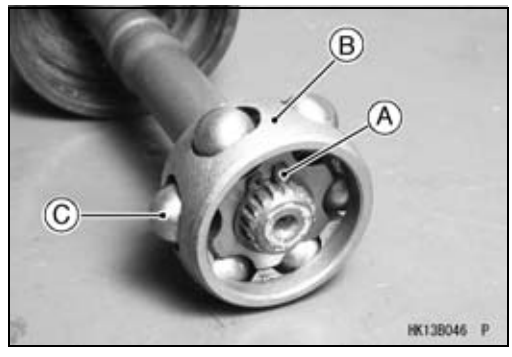
- Install the inner race [A] so that the tapered side [B] faces outboard joint.



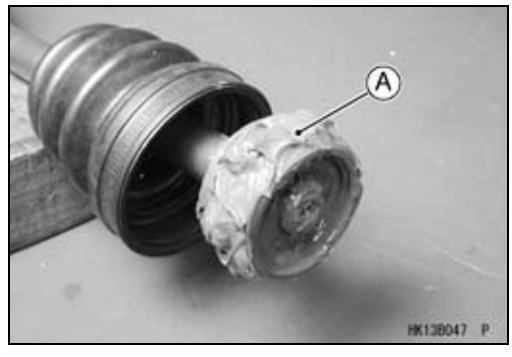
- Install:
  Circlip [A]

  Special Tool - Outside Circlip Pliers: 57001-144

- Slide the cage [B] on the inner race and install the steel balls [C].

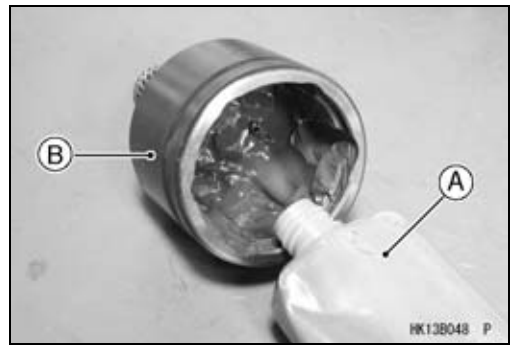


- Apply the special grease [A] to the steel balls and cage.

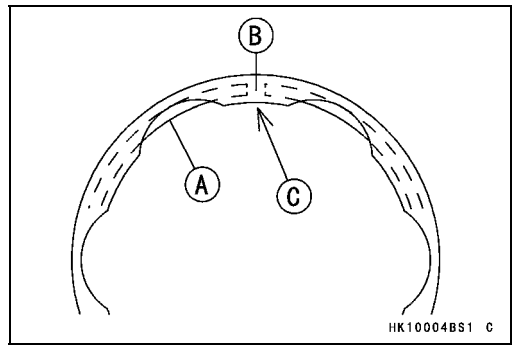


Rear Axle

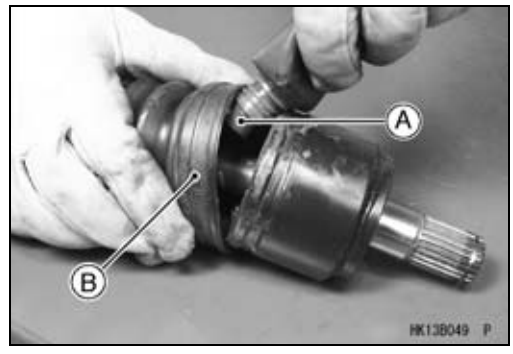
- Squeeze about half a tube (30 grams) of the special grease [A] into the bearing cup [B].
- Insert the balls and cage assembly in the bearing cup strongly.



- Install the new retaining ring [A] so that the opening [B] is aligned with one of the projections [C].

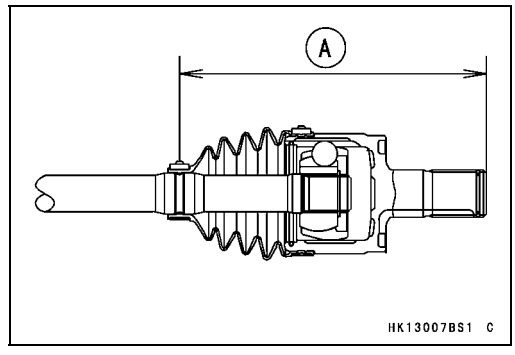


- Squeeze the remaining special grease [A] into the inboard joint boot [B].



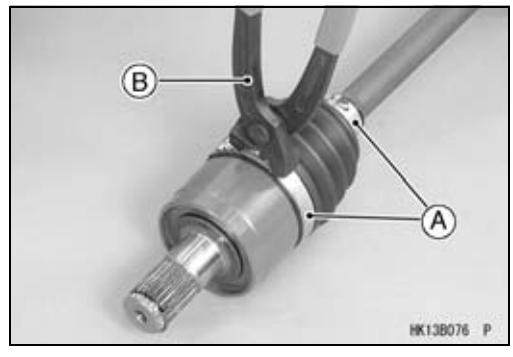
- Compress the axle assembly to the specified length while relieving the air pressure inside the inboard boot.
- Hold the axle at this setting.

Standard Length of Assembling:
Inboard: 162.2 mm (6.386 in.) [A]



- Pinch the boot bands [A] with a suitable tool [B] to install them.

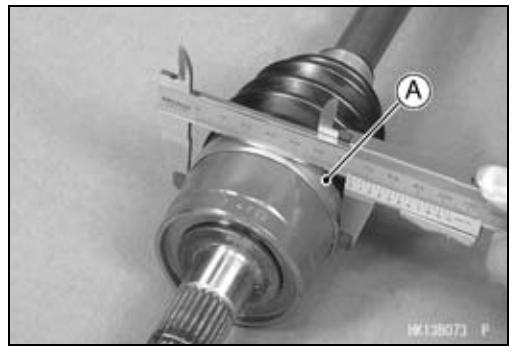
Recommend Tool: OETIKER 192



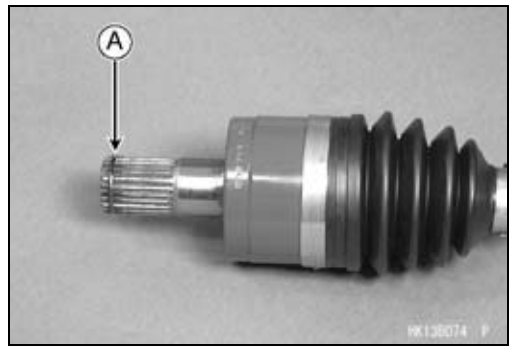
Rear Axle

- Be sure the outside diameter of the band [A] is less than the maximum diameter.

  Maximum Outside Diameter of Band: 73.4 mm (2.89 in.)



- Install the new circlip [A] to the shaft of the bearing cup.



Rear Final Gear Case

Rear Final Gear Case Oil Level Inspection

- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- Remove the filler cap.

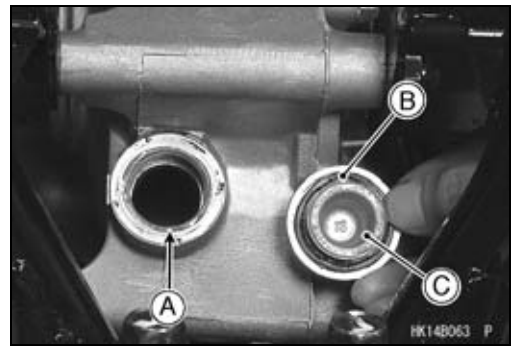
NOTICE
Be careful not to allow any dirt or foreign materials to enter the gear case.

- Check the oil level. The oil level should come to the bottom of the filler opening [A].

★If it is insufficient, first check the rear 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.

- Apply grease to the O-ring [B].
- Be sure the O-ring is in place.

Torque - Rear Final Gear Case Oil Filler Cap [C]: 29 N·m (3.0 kgf·m, 21 ft·lb)



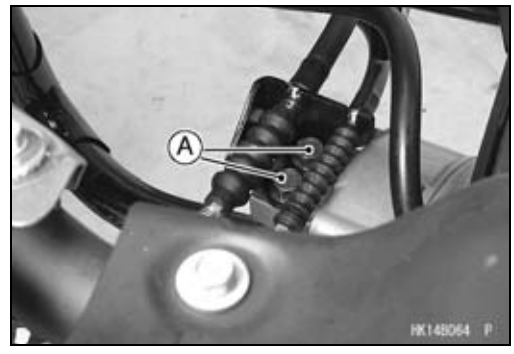
Rear Final Gear Case Oil Change

- Refer to the Rear Final Gear Case Oil Change in the Periodic Maintenance chapter.

Rear Final Gear Case Removal

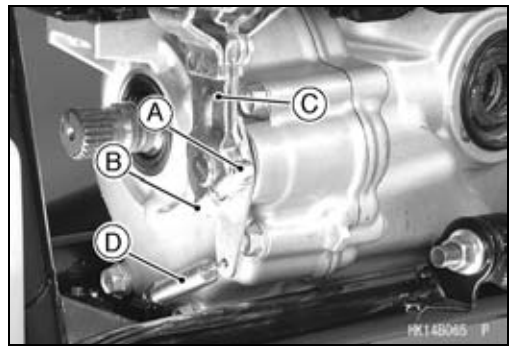
- Remove:
  Rear Fender (see Rear Fender Removal in the Frame chapter)
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  Rear Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Rear Propeller Shaft (Rear Propeller Shaft Removal)
  Rear Axles (see Rear Axle Removal)
  Stabilizer (see Stabilizer Removal in the Suspension chapter)

- Remove:
  Brake Cable Bracket Bolts [A]

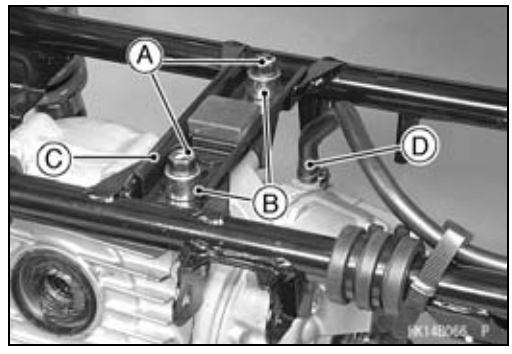


Rear Final Gear Case

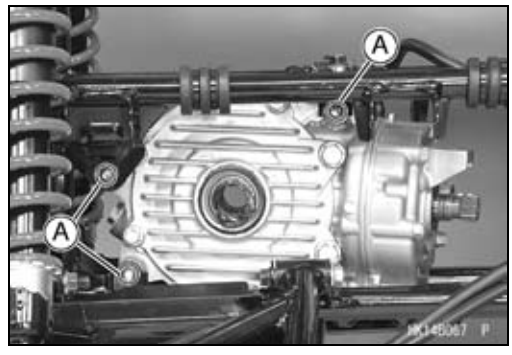
● Remove:
Bolts [A] and Nut [B]
Brake Cam Lever [C]
Spring [D]



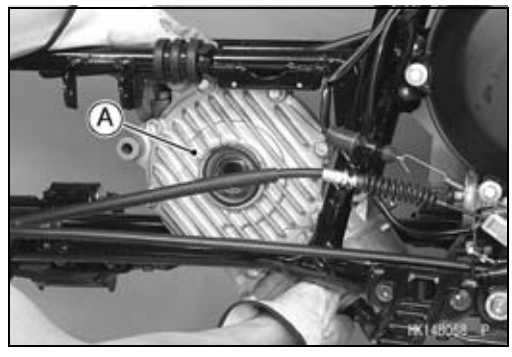
● Remove:
Bracket Bolts [A]
Collars [B]
Bracket [C]
Vent Hose [D]



● Remove:
Rear Final Gear Case Bolts and Nuts [A]

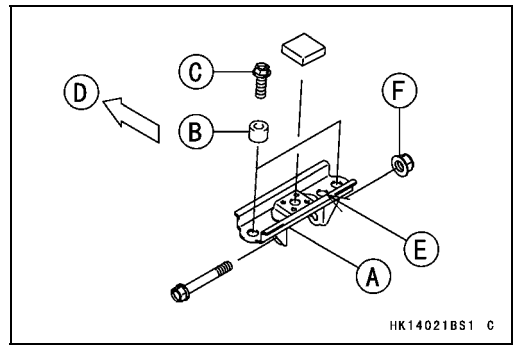


● Remove the rear final gear case [A] as shown.



Rear Final Gear Case

Rear Final Gear Case Installation

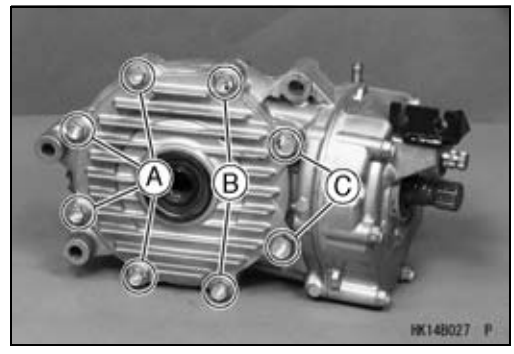


- Install:
  Rear Final Gear Case
  Bracket [A]
  Collars [B]
  Bracket Bolts [C]
  [D] Front
  [E] Hole
  Washers (rear side)
- Tighten:

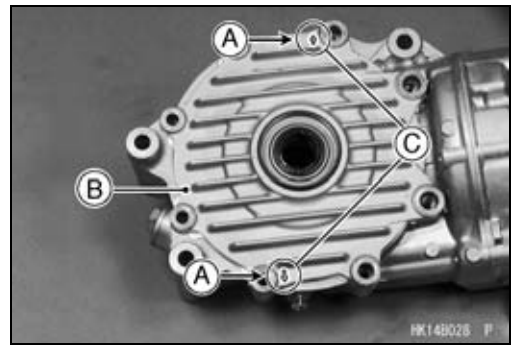
Torque - Rear Final Gear Case Nuts [F]: 91 N·m (9.3 kgf·m, 67 ft·lb)
Rear Final Gear Case Bracket Bolts: 59 N·m (6.0 kgf·m, 44 ft·lb)

- Install:
  Removed Parts (see applicable chapters)

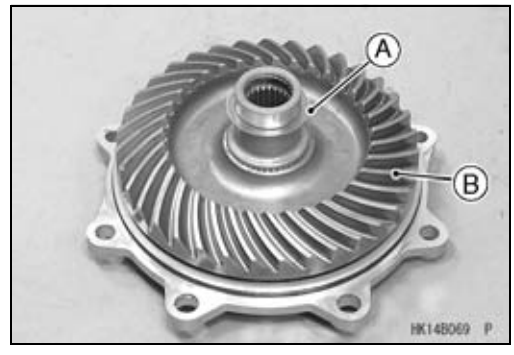
Rear Final Gear Case Disassembly



- Remove:
  Rear Final Gear Case (see Rear Final Gear Case Removal)
  Rear Final Gear Case Right Cover Bolts (M8) [A]
  Rear Final Gear Case Right Cover Bolts (M10) [B]
  Rear Final Gear Case Right Cover Bolts (M12) [C]



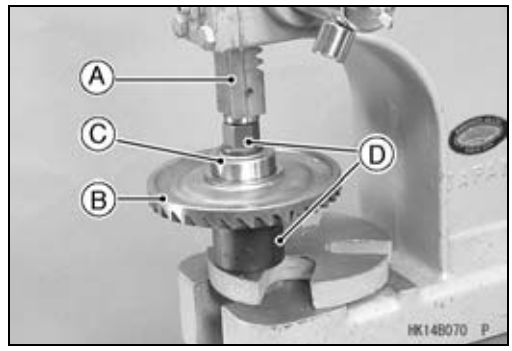
- Using the pry points [A], remove the rear final gear case right cover [B].
  [C] Arrow Marks



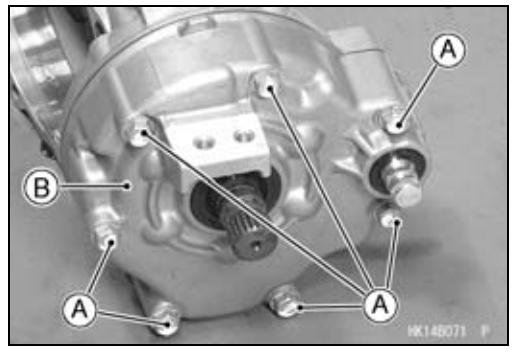
- Remove:
  Shim(s) [A]
  Ring Gear [B]

Rear Final Gear Case

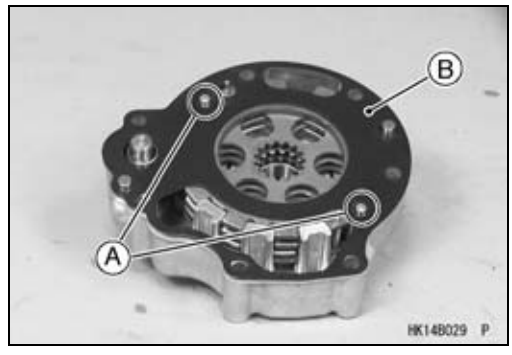
● Using a press [A], sparate the ring gear [B] and coupling [C].
[D] Suitable Tools



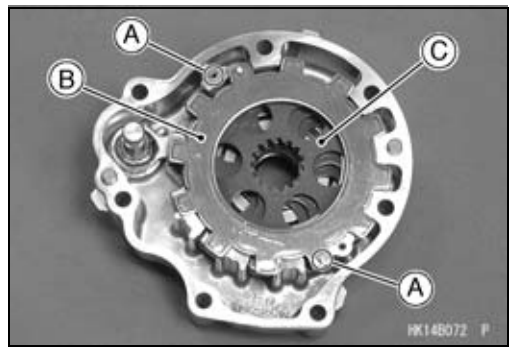
● Remove:
Rear Final Gear Case Front Cover Bolts [A]
Rear Final Gear Case Front Cover Assembly [B]



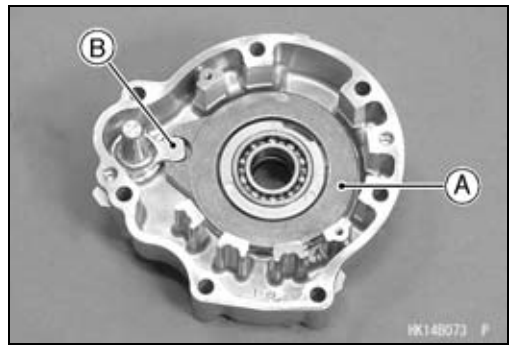
● Remove:
Gasket Screws [A]
Gasket [B]



● Remove:
Set Pins [A] with Steel Plates [B], Friction plates [C] and spring

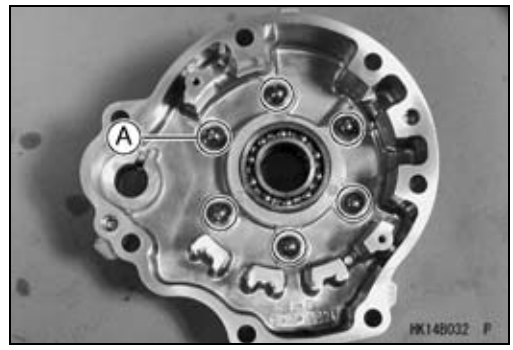


● Remove:
Brake Cam Plate [A]
Brake Camshaft [B]

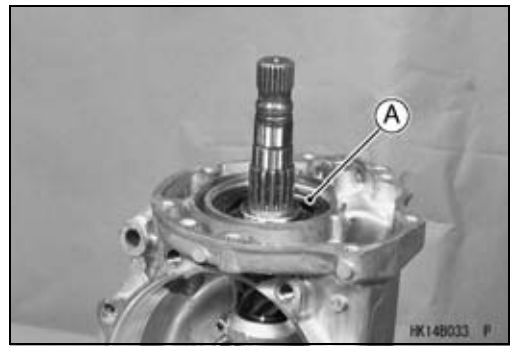


Rear Final Gear Case

● Remove:
Steel Balls [A]



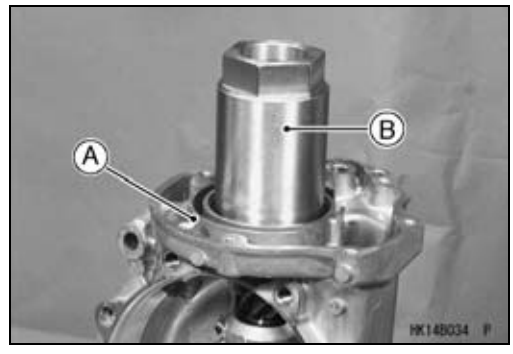
● Remove:
Pinion Gear Bearing Holder [A]



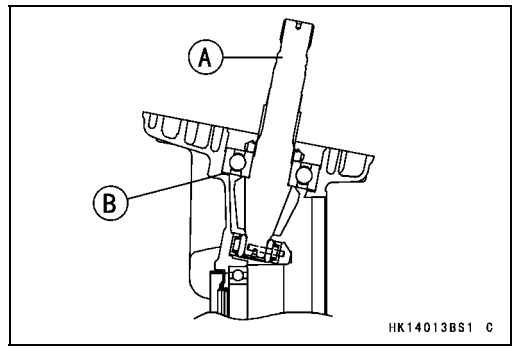
○Hold the rear final gear case [A] in a vise, and remove the bearing holder using the socket wrench [B].

Special Tool - Socket Wrench, Hex 50: 57001-1478

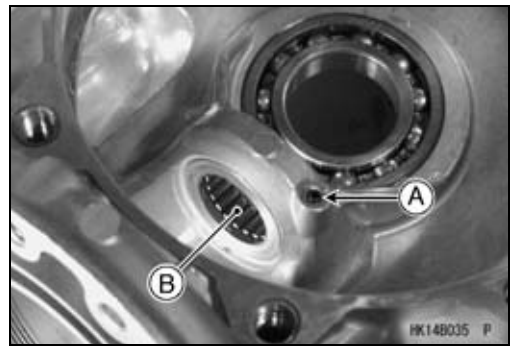
○If it is difficult to break free the holder, apply the heat to it to softer the locking agent.



● Remove:
Pinion Gear Unit [A]
Shim(s) [B]

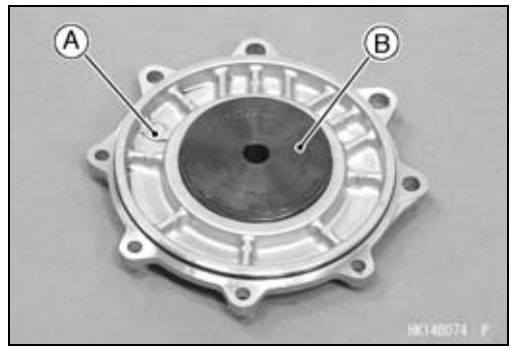


● Drill out the spring pin [A] with a drill bit of 3 mm (0.12 in.) diameter and remove it.
● Remove the needle bearing [B].



Rear Final Gear Case

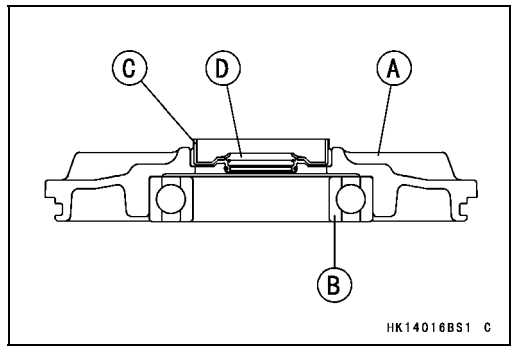
Rear Final Gear Case Right Cover Assembly



[A] Rear Final Gear Case Right Cover

● Press:
Ball Bearing (until bottomed)

Special Tool - Bearing Driver, ϕ54.3 [B]: 57001-1488



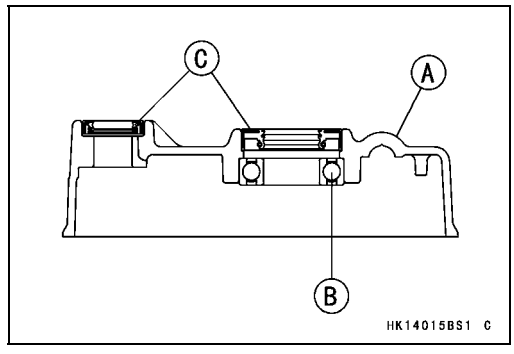
[A] Rear Final Gear Case Right Cover
[B] Ball Bearing

● Press:
Oil Seal [C] (until bottomed)

Special Tool - Bearing Driver Set: 57001-1129

● Apply Grease:
Oil Seal Lips [D]

Rear Final Gear Case Front Cover Assembly



[A] Rear Final Gear Case Front Cover

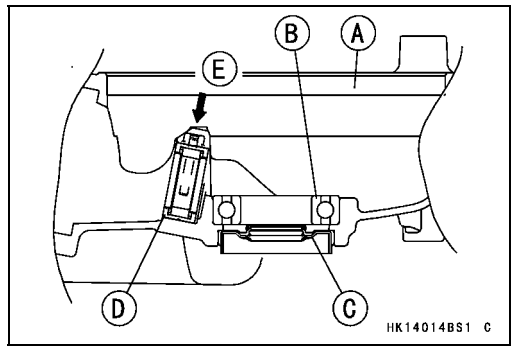
● Press:
Ball Bearing [B] (until bottomed)

Special Tool - Bearing Driver Set: 57001-1129

● Press the faces of the oil seals [C] are flush with the ends of the housing.

● Apply Grease:
Oil Seal Lips

Rear Final Gear Case Assembly



[A] Rear Final Gear Case

● Press:
Ball Bearing [B] (until bottomed)
Oil Seal [C] (until bottomed)

Special Tool - Bearing Driver Set: 57001-1129

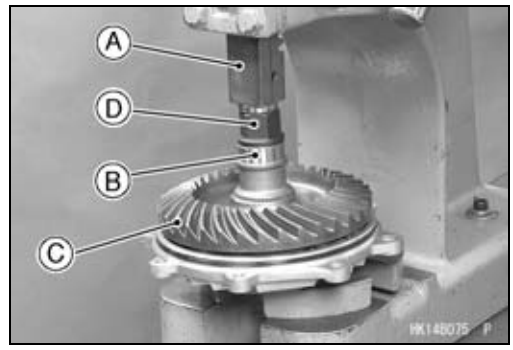
● Apply Grease:
Oil Seal Lip

● Press the face of the needle bearing [D] so that its surface is flush with the end of the housing.

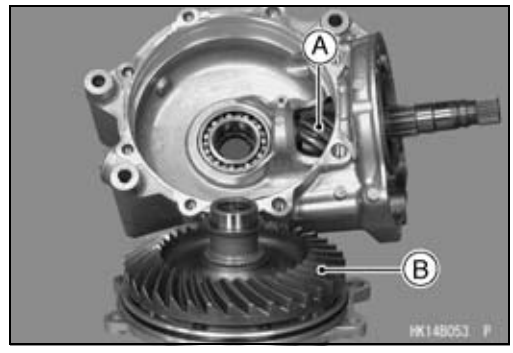
● Insert the spring pin [E].

Rear Final Gear Case

● Using a press [A], press the coupling [B] to the ring gear [C] until it bottom out.
[D] Suitable Tool



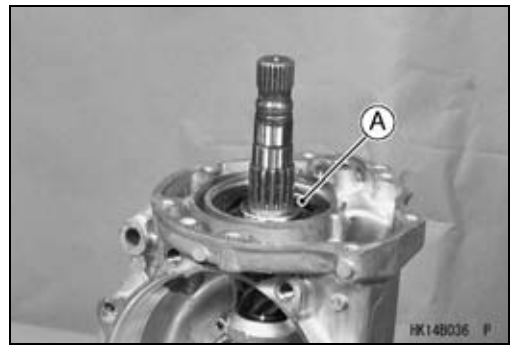
● Visually check the pinion gear [A] and ring gear [B] for scoring, chipping, or other damage.
★Replace the bevel gear as a set if either gear is damaged since they are lapped as a set in the factory to get the best tooth contact.
● Be sure to check and adjust the bevel gear backlash and tooth contact when any of the backlash-related parts are replaced (see Rear Final Bevel Gear Adjustment).



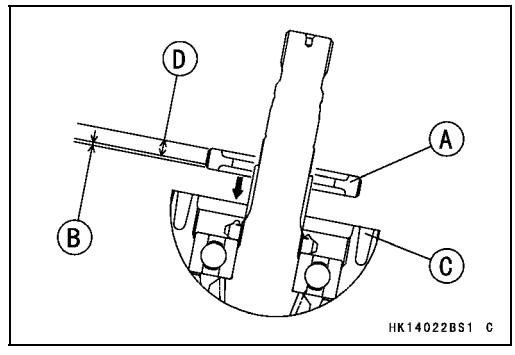
● Insert the shim(s) and pinion gear unit [A].
● Apply a non-permanent locking agent to the pinion gear bearing holder, and tighten it.

Special Tool - Socket Wrench, Hex 50: 57001-1478

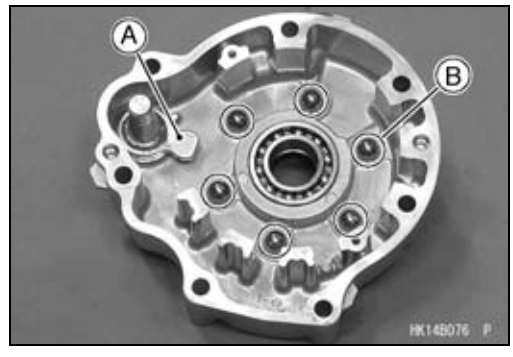
Torque - Pinion Gear Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)



★When installing a new pinion gear bearing holder [A], install the holder so that the no coating area [B] (one pitch thread) faces gear case [C].
[D] Locking Agent Coating Area

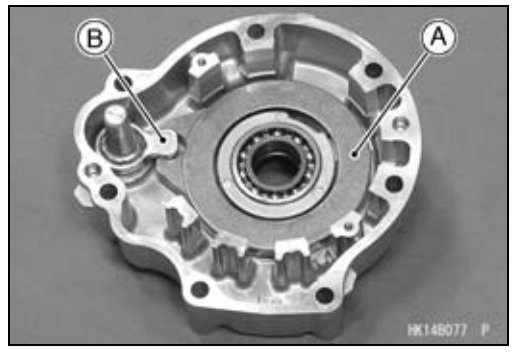


● Install:
Brake Camshaft [A]
Steel Balls [B]

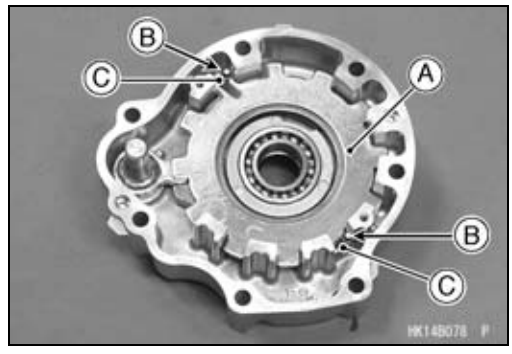


Rear Final Gear Case

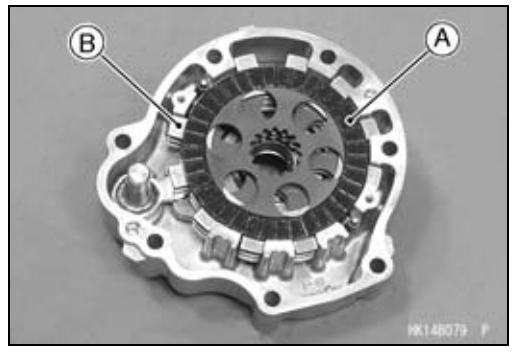
● Install:
Brake Cam Plate [A]
○Fit the cam plate and brake camshaft [B] as shown.



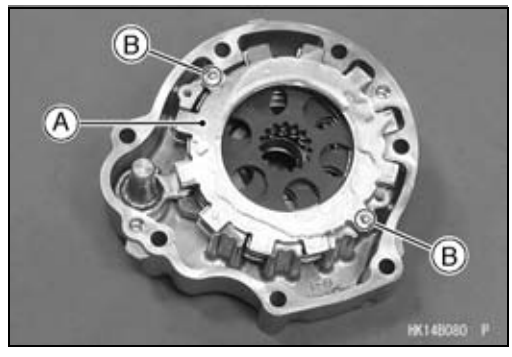
● Install:
Steel Plate [A] (P/No. 41080-1483, two holes)
Set Pins [B] and Springs [C]



● Install (alternately):
Friction Plates [A]
Steel Plates [B](P/No. 41080-1484, without holes)

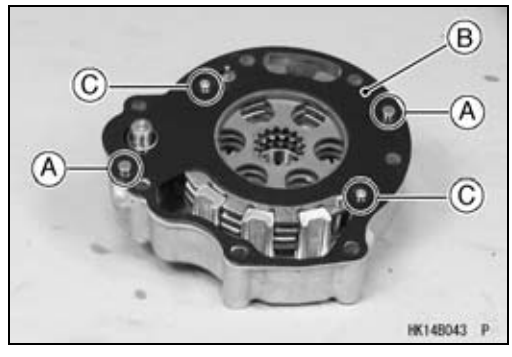


● Install:
Steel Plate [A] (P/No. 41080-1483, two holes)
○Insert the pins [B] into the holes of steel plate.



● Install:
Dowel Pins [A]
New Gasket [B]
● Apply a non-permanent locking agent to the rear final gear case gasket screws.
● Tighten:

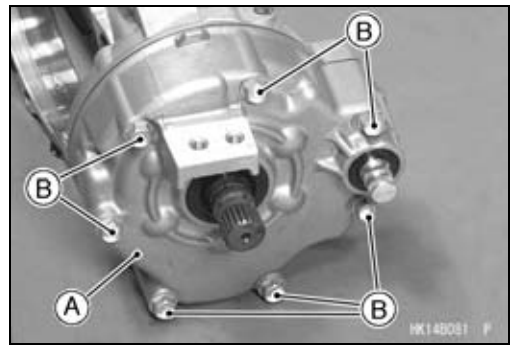
Torque - Rear Final Gear Case Gasket Screws [C]: 1.25 N·m (0.13 kgf·m, 11 in·lb)



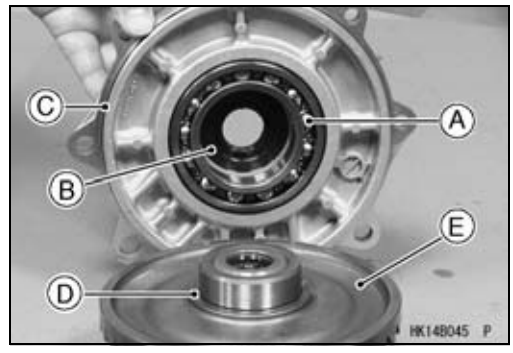
Rear Final Gear Case

● Install:
Rear Final Gear Case Front Cover [A]
● Tighten:

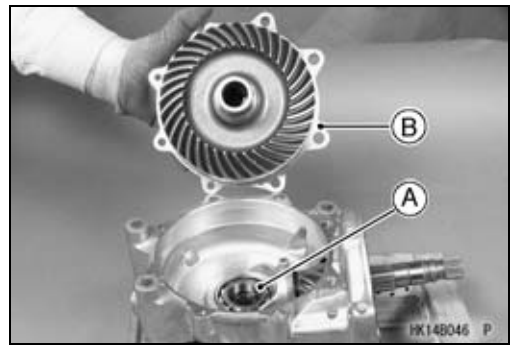
Torque - Rear Final Gear Case Front Cover Bolts [B]: 24 N·m (2.4 kgf·m, 18 ft·lb)



● Inspect:
Ball Bearing [A] (see Bearing and Oil Seal section)
Oil Seal [B] (see Bearing and Oil Seal section)
★If they are damaged, replace them.
● Apply grease to the oil seal lips and O-ring [C].
● Install:
Shim [D]
Ring Gear [E]

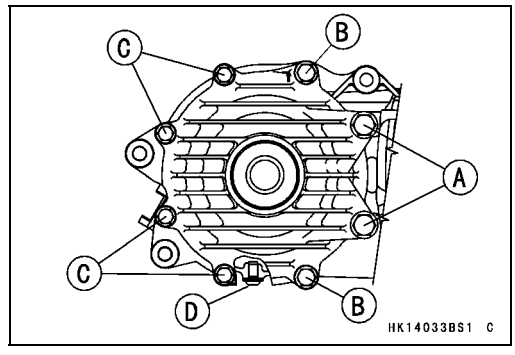


● Install:
Shim [A]
Rear Final Gear Case Right Cover [B]



● Apply a non-permanent locking agent to the rear final gear case right cover bolts.
● Tighten:

Torque - Rear Final Gear Case Right Cover Bolts (M12) [A]: 95 N·m (9.7 kgf·m, 70 ft·lb)
Rear Final Gear Case Right Cover Bolts (M10) [B]: 49 N·m (5.0 kgf·m, 36 ft·lb)
Rear Final Gear Case Right Cover Bolts (M8) [C]: 24 N·m (2.4 kgf·m, 18 ft·lb)
Rear Final Gear Case Oil Drain Plug [D]: 15 N·m (1.5 kgf·m, 11 ft·lb)

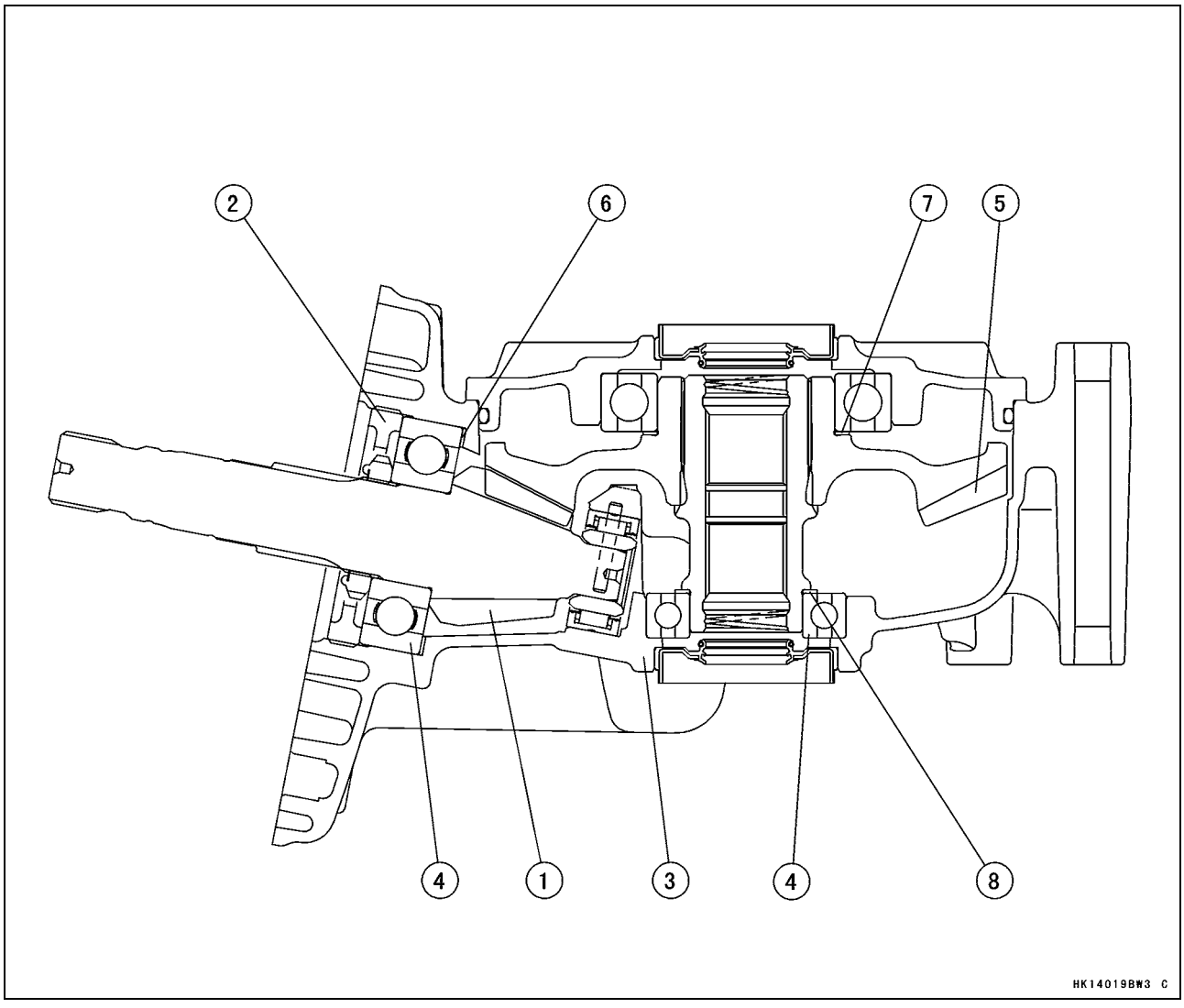


Rear Final Bevel Gear Adjustment

○The **backlash** and **tooth contact pattern** of the bevel gears must be adjust to prevent the gears from making noise and being damaged.
● After replacing any of the backlash-related parts, be sure to check and adjust the backlash and tooth contact of the bevel gears. First, adjust backlash, and then tooth contact by replacing shims.
○The amount of backlash is influenced by the ring gear position more than by the pinion gear position.
○Tooth contact locations is influenced by the pinion gear position more than by the ring gear position.

Rear Final Gear Case

Rear Final Gear Case (Backlash-related Parts)



1. Pinion Gear
2. Pinion Gear Bearing Holder
3. Gear Case Right Cover
4. Ball Bearings
5. Ring Gear
6. Pinion Gear Shim(s)
7. Ring Gear Shim(s)
8. Ring Gear Shim(s)

Rear Final Gear Case

6. Pinion Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1423
0.2 mm (0.008 in.)	92180-1424
0.5 mm (0.020 in.)	92180-1425
0.8 mm (0.031 in.)	92180-1426
1.0 mm (0.039 in.)	92180-1427
1.2 mm (0.047 in.)	92180-1428

7. Ring Gear Shims for Tooth Contact Adjustment

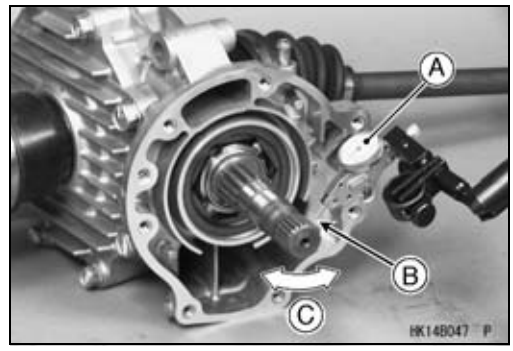
Thickness	Part Number
0.15 mm (0.006 in.)	92180-1417
0.2 mm (0.008 in.)	92180-1418
0.5 mm (0.020 in.)	92180-1419
0.8 mm (0.031 in.)	92180-1420
1.0 mm (0.039 in.)	92180-1421
1.2 mm (0.047 in.)	92180-1422

8. Ring Gear Shims for Tooth Contact Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-0166
0.2 mm (0.008 in.)	92180-0165
0.5 mm (0.020 in.)	92180-0164
0.8 mm (0.031 in.)	92180-0163
1.0 mm (0.039 in.)	92180-0162
1.2 mm (0.047 in.)	92180-0161

Backlash Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Install the pinion gear assembly with the primary shim **1.0 mm (0.039 in.) thickness.**
- Assemble the rear final gear case (see Rear Final Gear Case Assembly).
  - ○Install the ring gear with the primary shims **1.0 mm (0.039 in.) thickness.**
  - ○Check the backlash during tightening the cover bolts, and stop tightening them immediately if the backlash disappears. Then, change the ring gear shim to a thinner one.
- Temporarily, install the rear axle in the gear case and hold it with a vise so that the ring gear is lower than the pinion gear.
- Mount a dial gauge [A] so that the tip of the gauge is against the splined portion [B] of the pinion gear joint.
- To measure the backlash, move the pinion gear shaft back and forth [C] while holding the rear axle steady. The difference between the highest and the lowest gauge reading is the amount of backlash.
  - ○Measure backlash at three locations equally spaced on the splines.



Rear Final Bevel Gear Backlash

Standard: **0.04 ~ 0.17 mm (0.002 ~ 0.007 in.) at pinion gear spline**

★If the backlash is not within the standard, replace the pinion gear shim(s). 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.
● Apply checking compound to 4 or 5 teeth of the pinion gear.

NOTE

○*Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.*
○*The checking compound must be smooth and firm, with the consistency of tooth paste.*
○*Special compounds are available at automotive supply stores for the purpose of checking gear tooth patterns and contact. Use one of these for checking the bevel gears.*

● Assemble the rear final gear case (see Rear Final Gear Case Assembly).
● Turn the pinion gear for one revolution in the drive and reverse (coast) direction, while creating drag on the ring gear.
● Remove the ring gear and pinion gear unit 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.

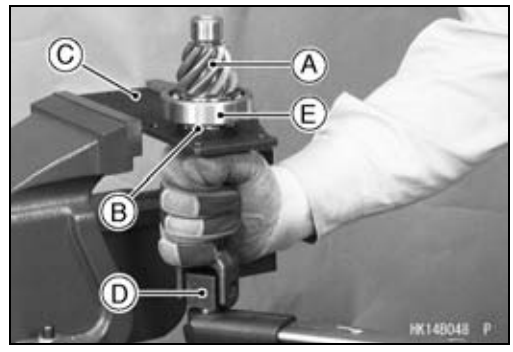
★If the tooth contact pattern is incorrect, replace the pinion gear shim(s), following the examples shown (see Correct Tooth Contact Pattern in the Front Final Bevel Gear Adjustment section).
● Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shim(s) are replaced. Repeat the shim change procedure as necessary.

NOTE

○*If the backlash is out of the standard range after changing the pinion gear shim(s), change the ring gear shim(s) to correct the backlash before checking the tooth contact pattern.*

Rear Final Gear Case

Pinion Gear Unit Disassembly



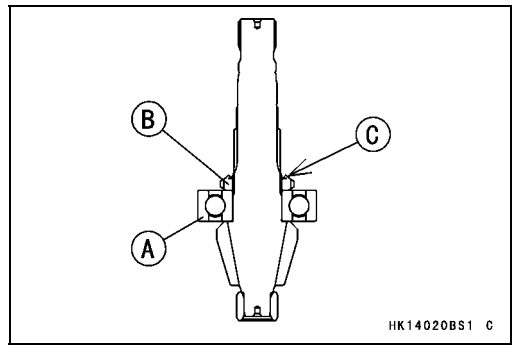
- Remove:
  Pinion Gear Unit [A] (see Rear Final Gear Case Disassembly)
- Hold the pinion gear bearing holder nut [B] with the socket wrench [C] in a vise, and loosen the pinion gear shaft using the pinion gear holder [D].

Special Tools - Socket Wrench: 57001-1363
Pinion Gear Holder, m1.0: 57001-1281

- Remove the ball bearing [E] as necessary.

Special Tool - Bearing Puller: 57001-135

Pinion Gear Unit Assembly

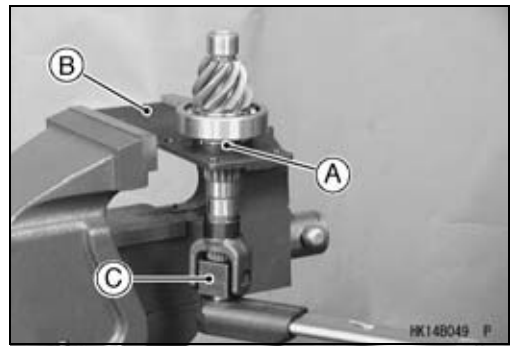


○The pinion gear and ring gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.

- Visually inspect the bearing for abrasion, color change, or other damage.

★If there is any doubt as to the condition of a bearing, replace the bearing.

- Be sure to check and adjust the bevel gear backlash and tooth contact, when any of the backlash-related parts are replaced (see Front Final Bevel Gear Adjustment).
- Press the bearing [A] on the pinion gear until it is bottomed.
- Install the pinion gear bearing holder nut [B] so that the projection [C] faces outward.



- Apply a non-permanent locking agent to the pinion gear bearing holder nut [A], and tighten it.

Special Tools - Socket Wrench [B]: 57001-1363
Pinion Gear Holder, m1.0 [C]: 57001-1281

Torque - Pinion Gear Bearing Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)

Bearing and Oil Seal

Ball or Needle Bearing Inspection

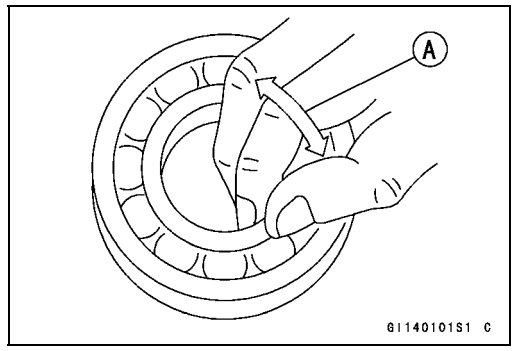
Since the bearings are made to extremely close tolerances, the clearance cannot normally be measured.

NOTICE

Do not remove any bearings for inspection except the right rear axle bearing.

● Turn each bearing in the case or hub back and forth [A] while checking for plays, roughness, or binding.

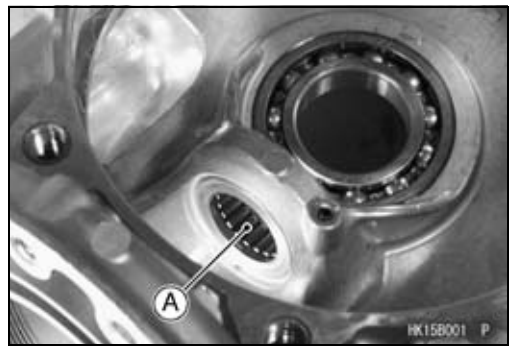
★If bearing play, roughness, or binding is found, replace the bearing.



● Check the needle bearings [A].

○The rollers in the needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.

★If the bearing is damaged, replace the bearing.

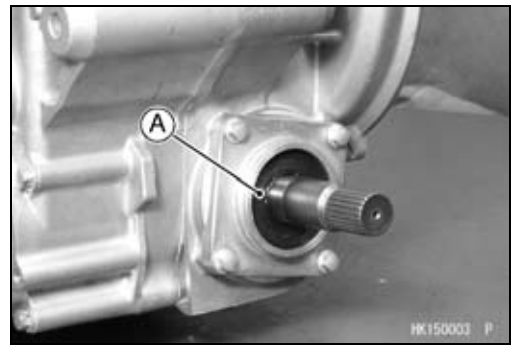


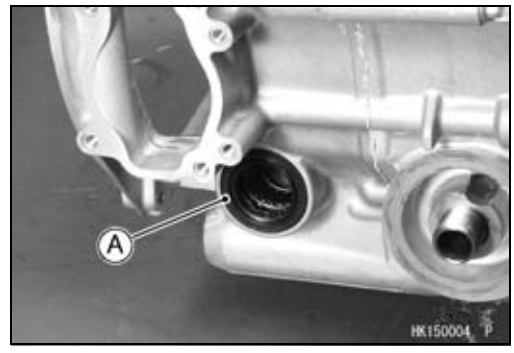
Bearing and Oil Seal

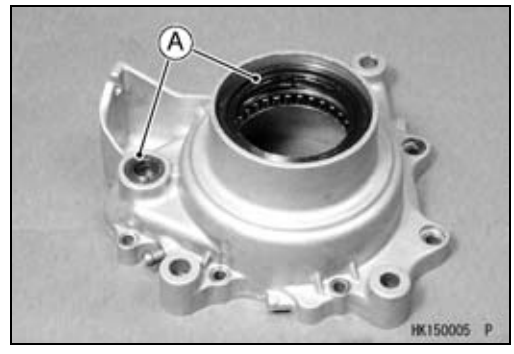
Oil Seal Inspection

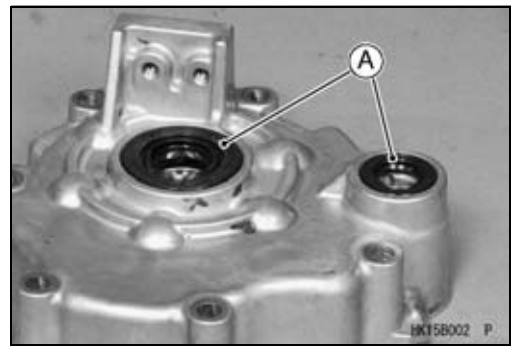
● Inspect the oil seals [A].

★Replace any if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened, or been otherwise damaged.









Brakes

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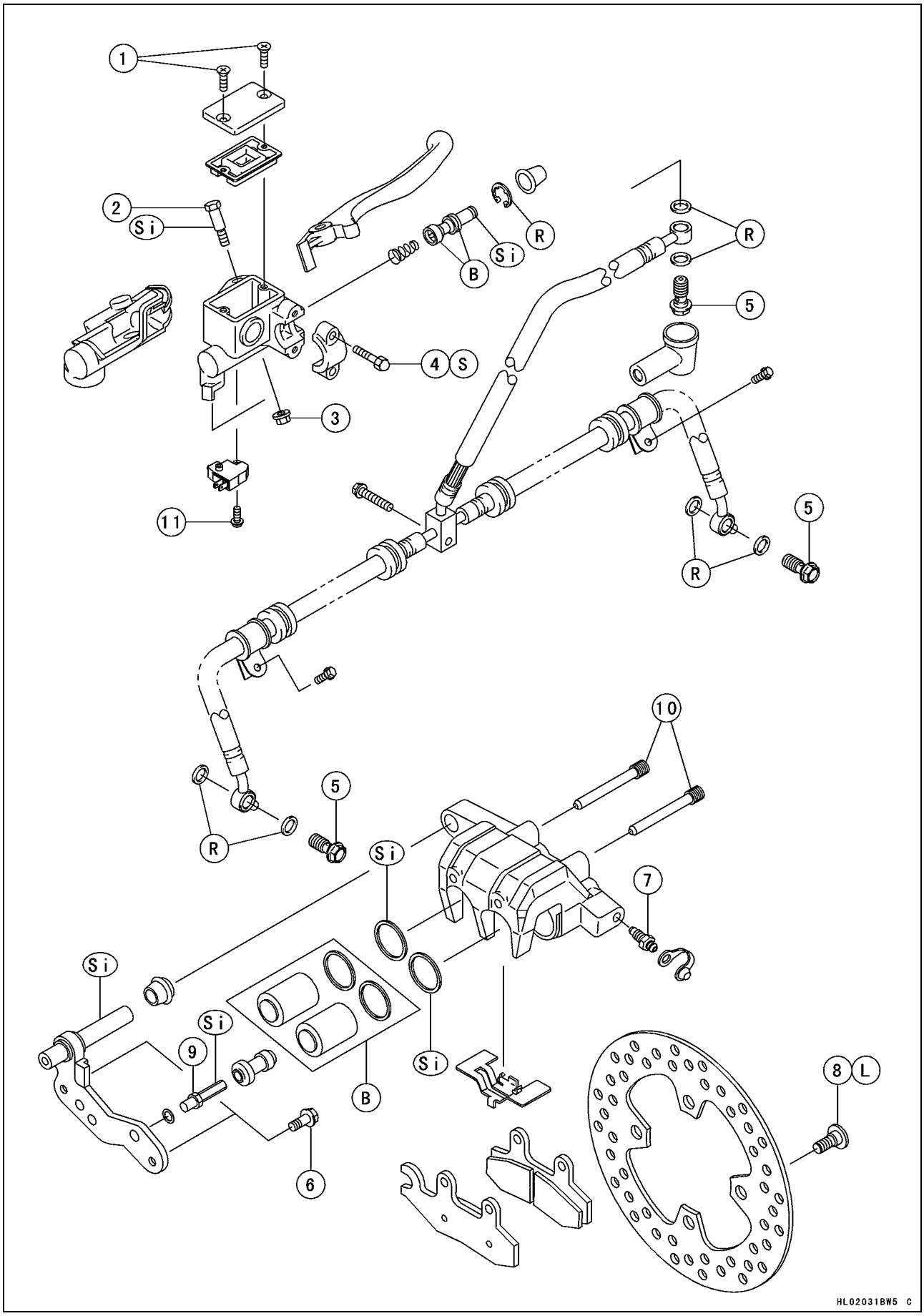
Exploded View

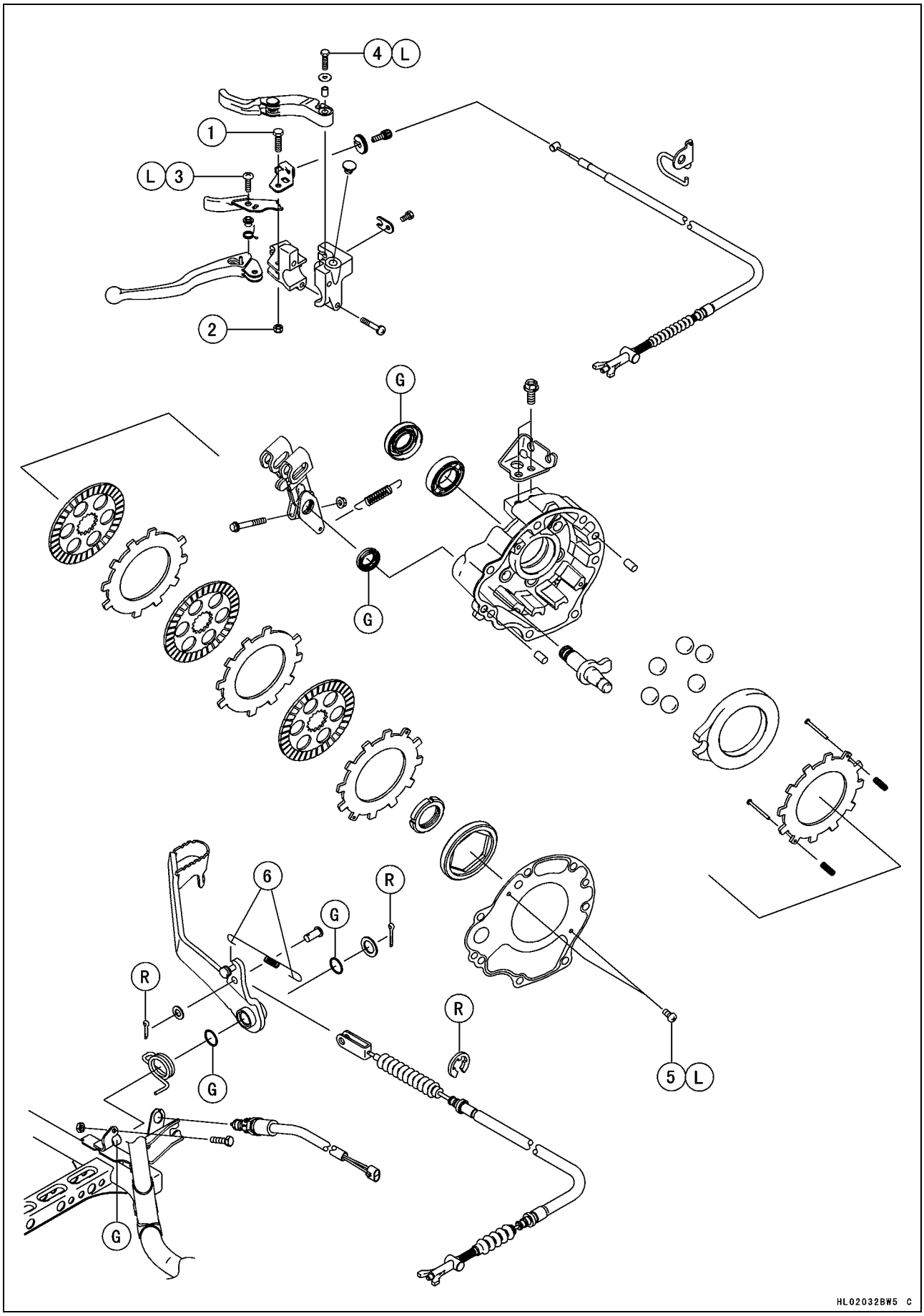


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Reservoir Cap Screws	1.5	0.15	13 in·lb	
2	Front Brake Lever Pivot Bolt	5.9	0.60	52 in·lb	
3	Front Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
4	Front Brake Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S
5	Brake Hose Banjo Bolts	34	3.5	25	
6	Front Brake Caliper Mounting Bolts	25	2.5	18	
7	Bleed Valves	7.8	0.80	69 in·lb	
8	Front Brake Disc Mounting Bolts	37	3.8	27	L
9	Front Brake Caliper Holder Shafts	17	1.7	12	Si
10	Front Brake Pad Mounting Bolts	17	1.7	12	
11	Front Brake Light Switch Mounting Screw	1.2	0.12	11 in·lb	

B: Apply brake fluid.
L: Apply a non-permanent locking agent.
R: Replacement Parts
S: Follow the specific tightening sequence.
Si: Apply silicone grease.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear (Parking) Brake Lever Pivot Bolt	2.2	0.22	19 in·lb	
2	Rear (Parking) Brake Lever Pivot Nut	3.4	0.35	30 in·lb	
3	Rear Brake Lock Lever Pivot Screw	2.2	0.22	19 in·lb	L
4	Variable Differential Control Lever Bolt	3.4	0.35	30 in·lb	L
5	Rear Final Gear Case Gasket Screws	1.25	0.13	12 in·lb	L

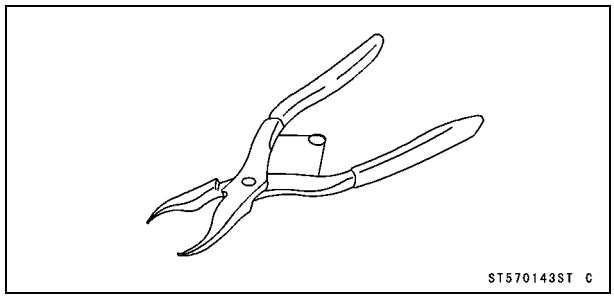
6. Bend both hooks after installing the spring.
G: Apply grease.
L: Apply a non-permanent locking agent.
MF: Apply gear oil (MOBILE FLUID 424) or equivalent oil.
O: Apply engine oil.
R: Replacement Parts

Specifications

Item	Standard	Service Limit
Brake Fluid		
Type	DOT 3 or DOT 4	– – –
Front Brake		
Pad Lining Thickness	4.0 mm (0.16 in.)	1 mm (0.04 in.)
Disc Thickness	3.3 ~ 3.7 mm (0.13 ~ 0.14 in.)	3 mm (0.12 in.)
Disc Runout	TIR 0.4 mm (0.016 in.) or less	TIR 0.5 mm (0.020 in.)
Rear Brake Lever, Pedal and Cables		
Rear Brake Pedal Position	see text	– – –
Rear Brake Lever Free Play	1 ~ 2 mm (0.04 ~ 0.08 in.)	– – –
Rear Brake Pedal Free Play	15 ~ 25 mm (0.6 ~ 1.0 in.)	– – –

Special Tool

Inside Circlip Pliers:
57001-143



Brake Fluid

⚠ WARNING

When working with the disc brake, observe the precautions listed below.

1. Never reuse old brake fluid.
2. Do not use fluid from a container that has been left unsealed or that has been open for a long time.
3. Do not mix two types and brands of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective. It may also cause the rubber brake parts to deteriorate.
4. Don't leave the reservoir cap off for any length of time to avoid moisture contamination of the fluid.
5. Don't change the fluid in the rain or when a strong wind is blowing.
6. Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually deteriorate the rubber used in the disc brake.
7. When handling the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high-flash point solvent. Do not use one which will leave an oily residue. Replace the pads with new ones if they cannot be cleaned satisfactorily.
8. Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely washed away immediately.
9. If any of the brake line fittings or the bleed valve is opened at any time, the **AIR MUST BE BLED FROM THE BRAKE LINE.**

Front Brake Fluid Recommendation

Use extra heavy-duty brake fluid only from a container marked DOT3 or DOT4.

Recommended Disc Brake Fluid
Type DOT 3 or DOT 4

Front Brake Fluid Level Inspection

- Refer to the Brake Fluid Level Inspection in the Periodic Maintenance chapter.

Front Brake Fluid Change

- Refer to the Brake Fluid Change in the Periodic Maintenance chapter.

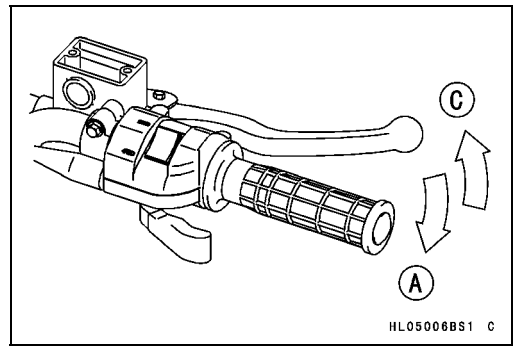
Brake Fluid

Front Brake Line Air Bleeding

- Bleed the air whenever brake parts are replaced or reassembled.
- Remove the reservoir cap and fill the reservoir with new brake fluid.
- Slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from the hose at the bottom of the reservoir. This bleeds the air from the master cylinder and the brake line.

NOTE

○*Tap the brake hose lightly going from the caliper to the reservoir side and bleed the air off at the reservoir.*



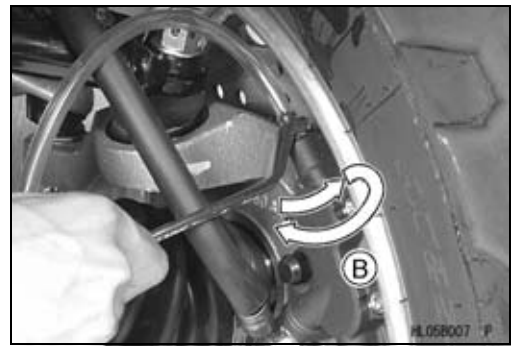
- Attach a clear plastic hose to the bleed valve on the caliper, and run the other end of the hose into a container.
- Bleed the brake line and the caliper as follows:

○Hold the brake lever applied [A].
○Quickly open and close the valve [B].
○Release the brake lever [C].

- The fluid level must be checked several times during the bleeding operation and replenished as necessary.

NOTE

○*If the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.*
○*If the brake lever action still feels soft or "spongy", tap the brake hose from bottom to top and air will rise up to the top part of the hose. Slowly pump the brake lever in the same manner as above.*



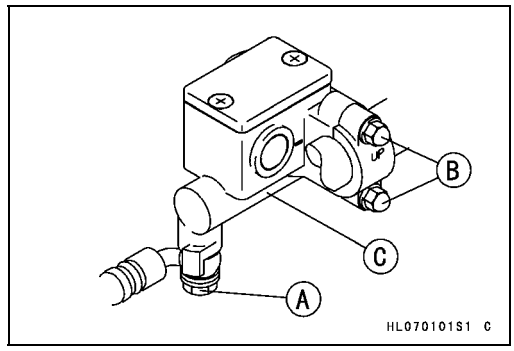
- Tighten:

Torque - Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

- Apply the brake lever forcefully for a few seconds, and check for fluid leakage around the fittings.

Master Cylinder

Front Brake Master Cylinder Removal

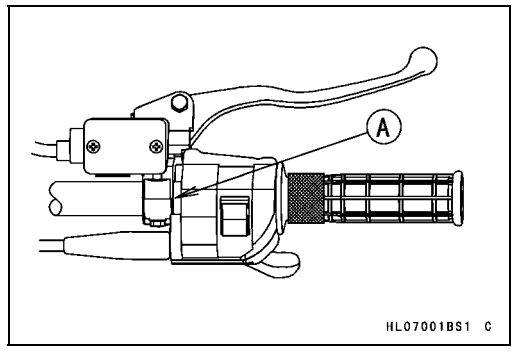


- Remove:
  Brake Hose Banjo Bolt [A]
  Master Cylinder Clamp Bolts [B]
  Master Cylinder [C]

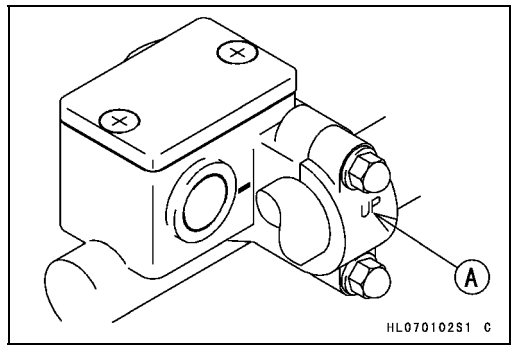
NOTICE

Brake fluid quickly ruins painted surface; any spilled fluid should be completely washed away immediately.

Front Brake Master Cylinder Installation



- Align the punch mark [A] on the handlebar with the mating surface end of the master cylinder clamp.



- The master cylinder clamp must be installed with the “UP” mark [A] upwards.
- Tighten the upper clamp bolt first, and then the lower clamp bolt. There will be a gap at the lower part of the clamp after tightening.

  Torque - Front Brake Master Cylinder Clamp Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Use a new flat washer on each side of the brake hose fitting, and tighten the banjo bolt.

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

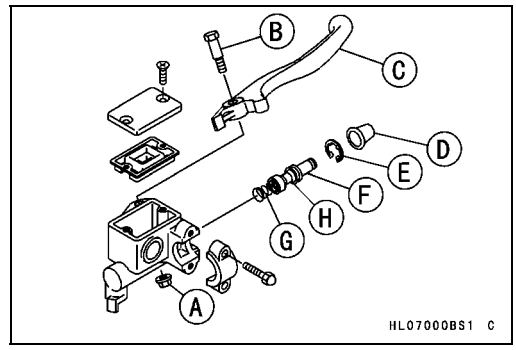
- Bleed the brake line after master cylinder installation (see Front Brake Line Air Bleeding).
- Check the brake for good braking power, no braking brag, and no fluid leakage.

⚠ WARNING

After servicing, it takes several applications of the brake lever before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the motorcycle until a firm brake lever is obtained by pumping the lever until the pads are against the disc.

Master Cylinder

Front Brake Master Cylinder Disassembly



- Remove:
  Front Brake Master Cylinder (see Front Brake Master Cylinder Removal)
  Brake Lever Pivot Bolt Locknut [A]
  Brake Lever Pivot Bolt [B]
  Brake Lever [C]
  Dust Cover [D]
  Circlip [E]
  Piston [F]
  Spring [G]

Special Tool - Inside Circlip Pliers: 57001-143

NOTICE

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

Front Brake Master Cylinder Assembly

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

NOTICE

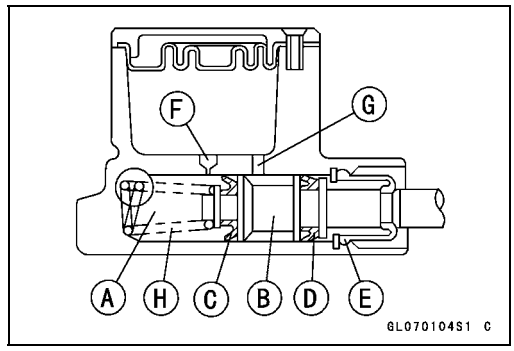
Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part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

- Take care not to scratch the piston or the inner wall of the cylinder.
- Apply brake fluid to the removed parts and to the inner wall of the cylinder.
- Tighten:

Torque - Front Brake Lever Pivot Bolt: 5.9 N·m (0.60 kgf·m, 52 in·lb)
Front Brake Lever Pivot Bolt Locknut: 5.9 N·m (0.60 kgf·m, 52 in·lb)

Master Cylinder

Front Master Cylinder Inspection (Visual Inspection)



- Disassemble the master cylinder (see Front Brake Master Cylinder Disassembly).
- Check that there are no scratches, rust or pitting on the inner wall 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 [C] and secondary [D] cups.

★If a cup is worn, damaged, softened (rotted), or swollen, the piston assembly should be replaced to renew the cups.

★If fluid leakage is noted at the brake lever, the piston assembly should be replaced to renew the cups.

- Check the dust cover [E] for damage.

★If it is damaged, replace it.

- Check that the relief [F] and supply [G] ports are not plugged.

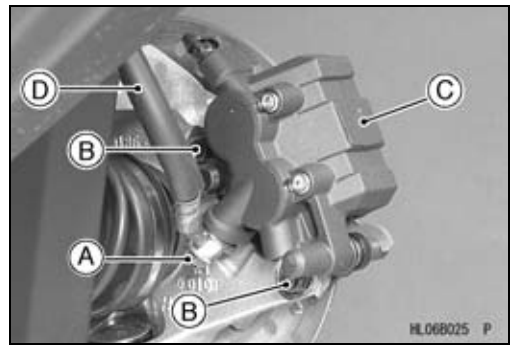
★If the relief port becomes plugged, the brake pads will drag on the disc. Blow the ports clean with compressed air.

- Check the piston return spring [H] for any damage.

★If the spring is damaged, replace it.

Calipers

Front Brake Caliper Removal



- Remove the front wheel (see Wheel Removal in the Wheels/Tires chapter).
- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Unscrew the caliper mounting bolts [B], and detach the caliper [C] from the disc.
- Unscrew the banjo bolt and remove the brake hose [D] from the caliper.

NOTICE

Immediately wash away any brake fluid that spills.

NOTE

○*If the caliper is to be disassembled after removal and if compressed air is not available, disassemble the caliper before the brake hose is removed (see Front Brake Caliper Disassembly).*

Front Brake Caliper Installation

- Install the caliper and brake hose lower end.

○Replace the washers that are on each side of hose fitting with new ones.

- Tighten:

Torque - Front Brake Caliper Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)
Brake Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)

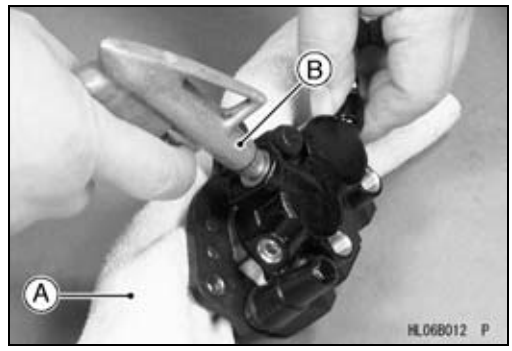
- Check the fluid level in the brake reservoir.
- Bleed the brake line (see Front Brake Line Air Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.

⚠ WARNING

After servicing, it takes several applications of the brake lever before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the motorcycle until a firm brake lever is obtained by pumping the lever until the pads are against the disc.

Calipers

Front Brake Caliper Disassembly



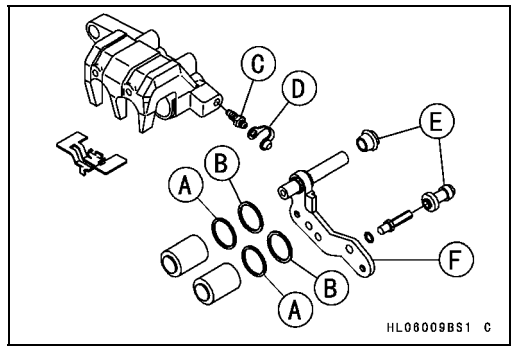
● Remove:
Caliper (see Front Brake Caliper Removal)
Pads (see Front Brake Pad Removal)
Anti-rattle Spring
● Using compressed air, remove the piston.
○Cover the caliper opening with a clean, heavy cloth [A].
○Remove the piston by lightly applying compressed air [B] to where the brake line fits into the caliper.

⚠ WARNING

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

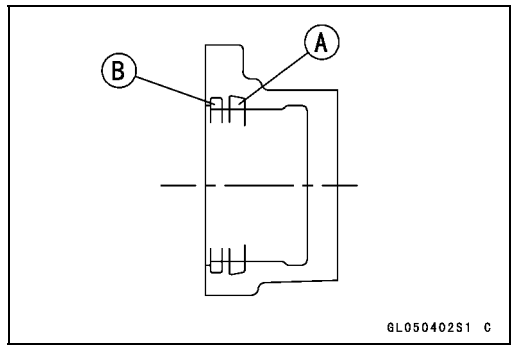
NOTE

○*If compressed air is not available, do as follows with the brake hose connected to the caliper.*
○*Prepare a container for brake fluid.*
○*Remove the pads (see Front Brake Pad Removal) and anti-rattle spring.*
○*Pump the brake lever to remove the caliper piston.*



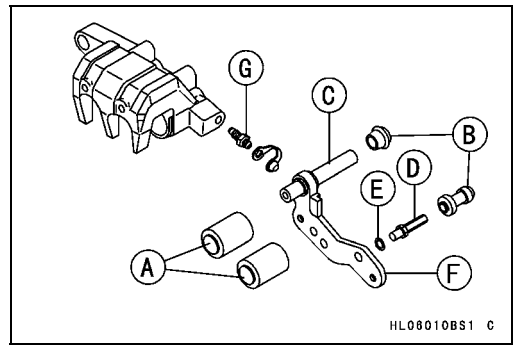
● Remove:
Dust Seals [A]
Fluid Seals [B]
Bleed Valve [C] and Rubber Cap [D]
Boots [E] and Caliper Holder [F]

Front Brake Caliper Assembly



● Replace the fluid seal [A] with a new one.
○Apply brake fluid to the fluid seal, and install it into the cylinder by hand.
● Replace the dust seal [B] with a new one if it is damaged.
○Apply brake fluid to the dust seal, and install it into the cylinder by hand.

Calipers

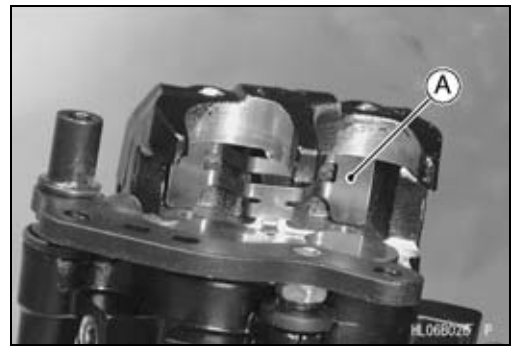


- Apply brake fluid to the outside of the pistons [A], and push them into the cylinder by hand. Take care that neither the cylinder nor the piston skirt gets scratched.
- Replace the rubber boots [B] if they are damaged.
- Apply a thin coat of silicone grease to the caliper holder shafts [C] [D] (Silicone grease is a special high temperature, water-resistant grease).
- Install:
  Wave Washer [E]
- Tighten:

Torque - Front Brake Caliper Holder Shaft [D]: 17 N·m (1.7 kgf·m, 12 ft·lb)

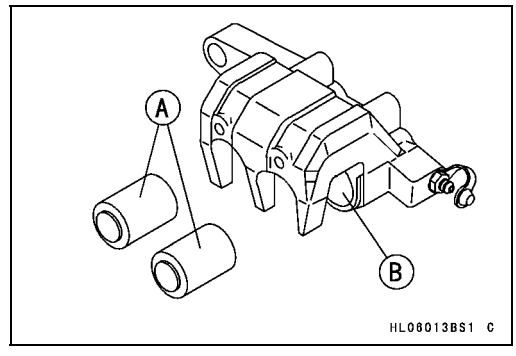
- Install:
  Caliper Holder [F]
  Bleed Valve [G] and Rubber Cap

Torque - Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Install the anti-rattle spring [A] in the caliper as shown.
- Install the pads (see Front Brake Pad Installation).

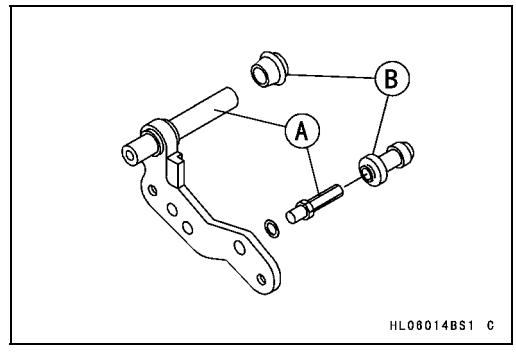
Front Brake Caliper Piston and Cylinder Damage Inspection



- Visually inspect the piston [A] and cylinder surfaces [B].

★Replace the caliper if the cylinder and piston are badly scored or rusty.

Front Brake Caliper Holder Shaft Wear Inspection



The caliper body must slide smoothly on the caliper holder shafts [A]. If the body does not slide smoothly, one pad will wear more than the other, pad wear will increase, and constant drag on the disc will raise brake and brake fluid temperature.

- Check to see that the caliper holder shafts are not badly worn or stepped, and that the rubber boots [B] are not damaged.

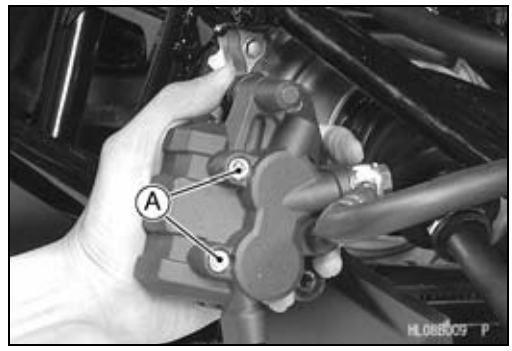
★If the rubber boot is damaged, replace the rubber boot.

★If caliper holder shaft is damaged, replace the caliper holder shaft and rubber boot as a unit.

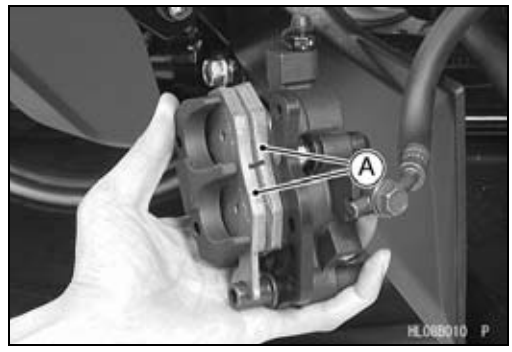
Brake Pads

Front Brake Pad Removal

- Detach the caliper from the disc (see Front Brake Caliper Removal).
- Remove:
  Pad Mounting Bolts [A]



- Remove:
  Brake Pads [A]



Front Brake Pad Installation

- Push the caliper piston in by hand as far as it will go.
- Be sure that the anti-rattle spring is in place.
- Install:
  Brake Pads
  Pad Mounting Bolts
- Tighten:

Torque - Front Brake Pad Mounting Bolts: 17 N·m (1.7 kgf·m, 12 ft·lb)

⚠ WARNING

After servicing, it takes several applications of the brake lever before the brake pads contact the disc, which could result in increased stopping distance and cause an accident resulting in injury or death. Do not attempt to ride the vehicle until a firm brake lever is obtained by pumping the lever until the pads are against the disc.

Front Brake Pad Wear Inspection

- Refer to the Front Brake Pad Wear Inspection in the Periodic Maintenance chapter.

Brake Discs

Front Brake Disc Cleaning

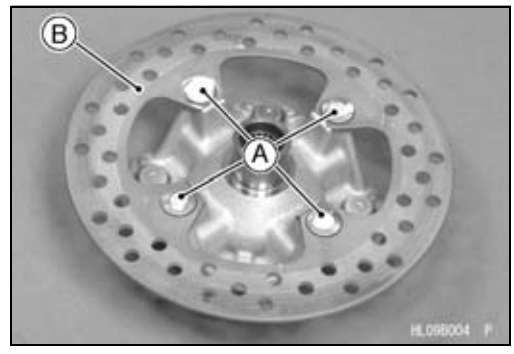
Poor braking can be caused by oil on a disc. Oil on a disc must be cleaned off with an oilless cleaning fluid such as trichloroethylene or acetone.

⚠ WARNING

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

Front Brake Disc Removal

- Remove:
  Front Hub (see Front Hub Removal in the Wheels/Tires chapter)
  Brake Disc Mounting Bolts [A]
  Brake Disc [B]

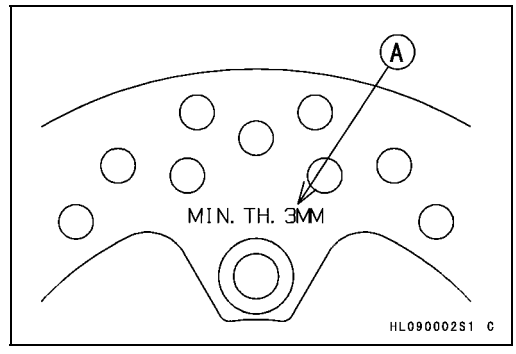


Front Brake Disc Installation

- The disc must be installed with the marked side [A] facing toward the steering knuckle.
- Apply a non-permanent locking agent to the brake disc mounting bolts.
- Tighten:

Torque - Front Brake Disc Mounting Bolts: 37 N·m (3.8 kgf·m, 27 ft·lb)

- After installing the discs, check the disc runout. Completely clean off any grease that has gotten on either side of the disc with a high-flash point solvent. Do not use one which will leave an oily residue.

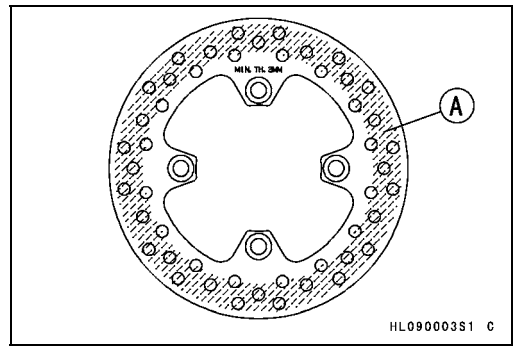


Front Brake Disc Wear Inspection

- Measure the thickness of each disc at the point [A] where it has worn the most.

★Replace the disc if it has worn past the service limit.

Disc Thickness
Standard: 3.3 ~ 3.7 mm (0.13 ~ 0.14 in.)
Service Limit: 3 mm (0.12 in.)

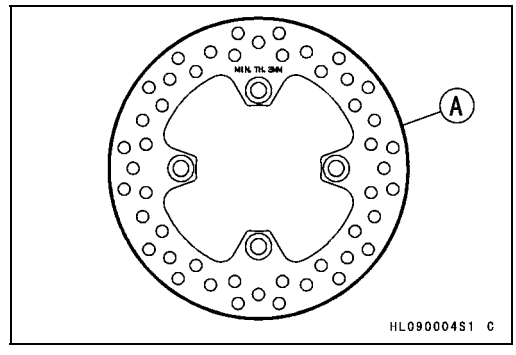


Front Brake Disc Runout Inspection

- Jack up the vehicle so that the wheels are off the ground.
- Remove the front wheels and turn the handlebar fully to one side.
- Set up a dial gauge against the disc [A], and measure the disc runout.

★If the runout exceeds the service limit, replace the disc.

Disc Runout
Standard: TIR 0.4 mm (0.016 in.) or less
Service Limit: TIR 0.5 mm (0.020 in.)



Brake Hoses

Front Brake Hose Inspection

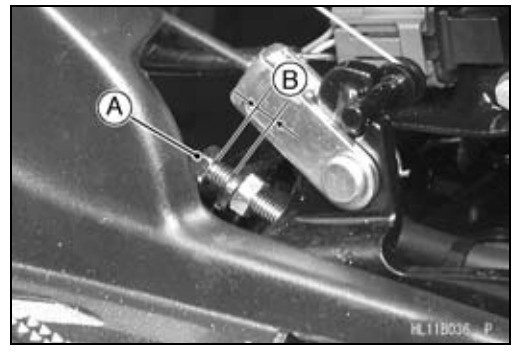
- Refer to the Front Brake Hose and Connections Inspection in the Periodic Maintenance chapter.

Front Brake Hose Replacement

- Refer to the Front Brake Hose Replacement in the Periodic Maintenance chapter.

Rear Brake Lever, Pedal and Cables

Rear Brake Pedal Position Inspection



NOTE

○*The position of the brake pedal has been decided by the position of the adjusting bolt [A].*

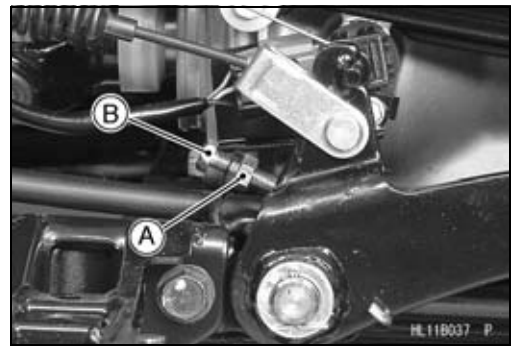
● Check that the adjusting bolt is in the correct position as shown.

Adjusting Bolt Position [B]

Standard: 5 ~ 6 mm (0.20 ~ 0.24 in.) (between Frame and Adjusting Bolt Head)

★If it is incorrect, adjust the adjusting bolt.

Rear Brake Pedal Position Adjustment



● Remove:
Right Footboard (see Right Footboard Removal in the Frame chapter)
● Loosen the locknut [A], and turn the adjusting bolt [B] until the brake pedal is correctly positioned.
● Tighten the locknut.
● Check the brake pedal free play (see Rear Brake Pedal Free Play Inspection in the Periodic Maintenance chapter).

Rear Brake Lever Free Play Inspection

● Refer to the Rear Brake Lever Free Play Inspection in the Periodic Maintenance chapter.

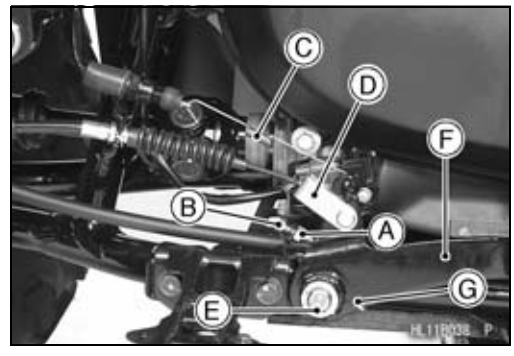
Rear Brake Pedal Free Play Inspection

● Refer to the Rear Brake Pedal Free Play Inspection in the Periodic Maintenance chapter.

Rear Brake Lever and Brake Pedal Free Play Adjustment

● Refer to the Rear Brake Lever and Pedal Free Play Adjustment in the Periodic Maintenance chapter.

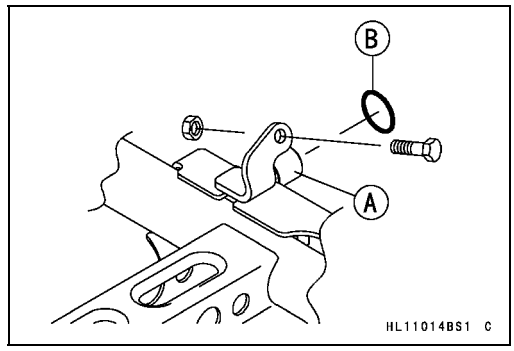
Rear Brake Pedal Removal



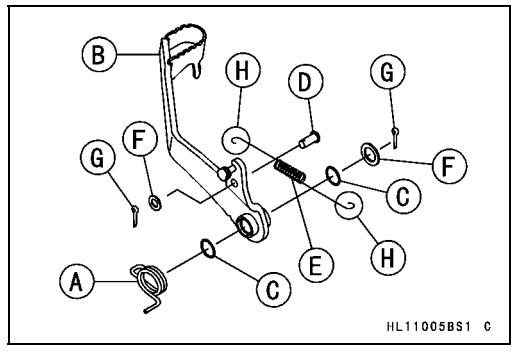
● Remove:
Right Footboard (see Right Footboard Removal in the Frame chapter)
● Loosen the locknut [A] and the adjusting bolt [B].
● Remove:
Brake Switch Spring [C]
Cotter Pin, Washer, Pin and Brake Cable Joint [D]
Cotter Pin and Washer [E]
O-ring and Brake Pedal [F]
Spring [G]

Rear Brake Lever, Pedal and Cables

Rear Brake Pedal Installation

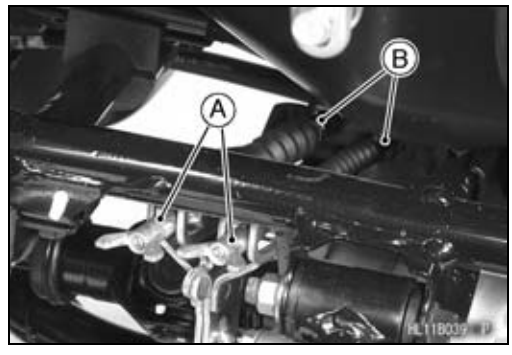


- Apply grease:
  Brake Pedal Pivot [A]
  O-ring [B]

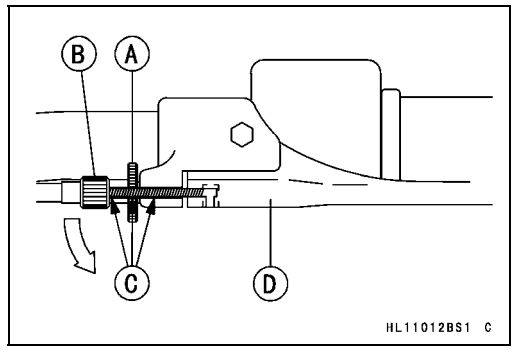


- Install:
  Spring [A]
  Brake Pedal [B]
- Apply grease:
  O-rings [C]
- Install:
  Brake Cable Joint and Pin [D]
  Brake Switch Spring [E]
  Washers [F]
- Replace the cotter pins [G] with new ones.
- Bend both side hooks [H] of switch spring [E] after installing the spring.
- Adjust the brake pedal position (see Rear Brake Pedal Position Adjustment).

Rear Brake Cable Removal



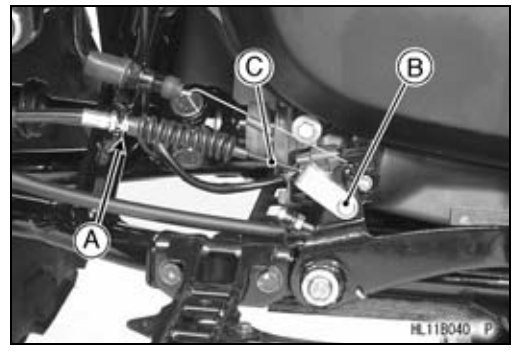
- Unscrew the adjusters [A] at the rear ends of the cables, and pull the cables out of the joints [B] and cable mounts.



- Loosen the knurled locknut [A] at the rear brake lever and screw in the adjuster [B].
- Line up the slots [C] in the brake lever, knurled locknut, and adjuster, and then free the cable from the lever [D].
- Remove the brake lever cable from the frame.

Rear Brake Lever, Pedal and Cables

- Remove:
  Circlip [A]
  Cotter Pin, Washer and Pin [B]
  Brake Pedal Cable [C]



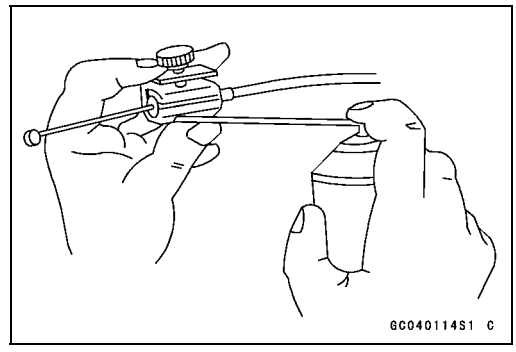
Rear Brake Cable Installation

- Grease the brake cable front ends.
- Replace the cotter pin with a new one.
- Route the brake cables according to the Cable, Wire, and Hose Routing section in the Appendix chapter.
- Adjust the rear brake pedal and rear brake lever.

Rear Brake Cable Lubrication

Whenever the brake cable is removed, lubricate the cable as follows:

- Lubricate the cable with an aerosol cable lubricant through the pressure cable luber.



Internal Wet Brake

Internal Wet Brake Disassembly

- Refer to Rear Final Gear Case section in the Final Drive chapter.

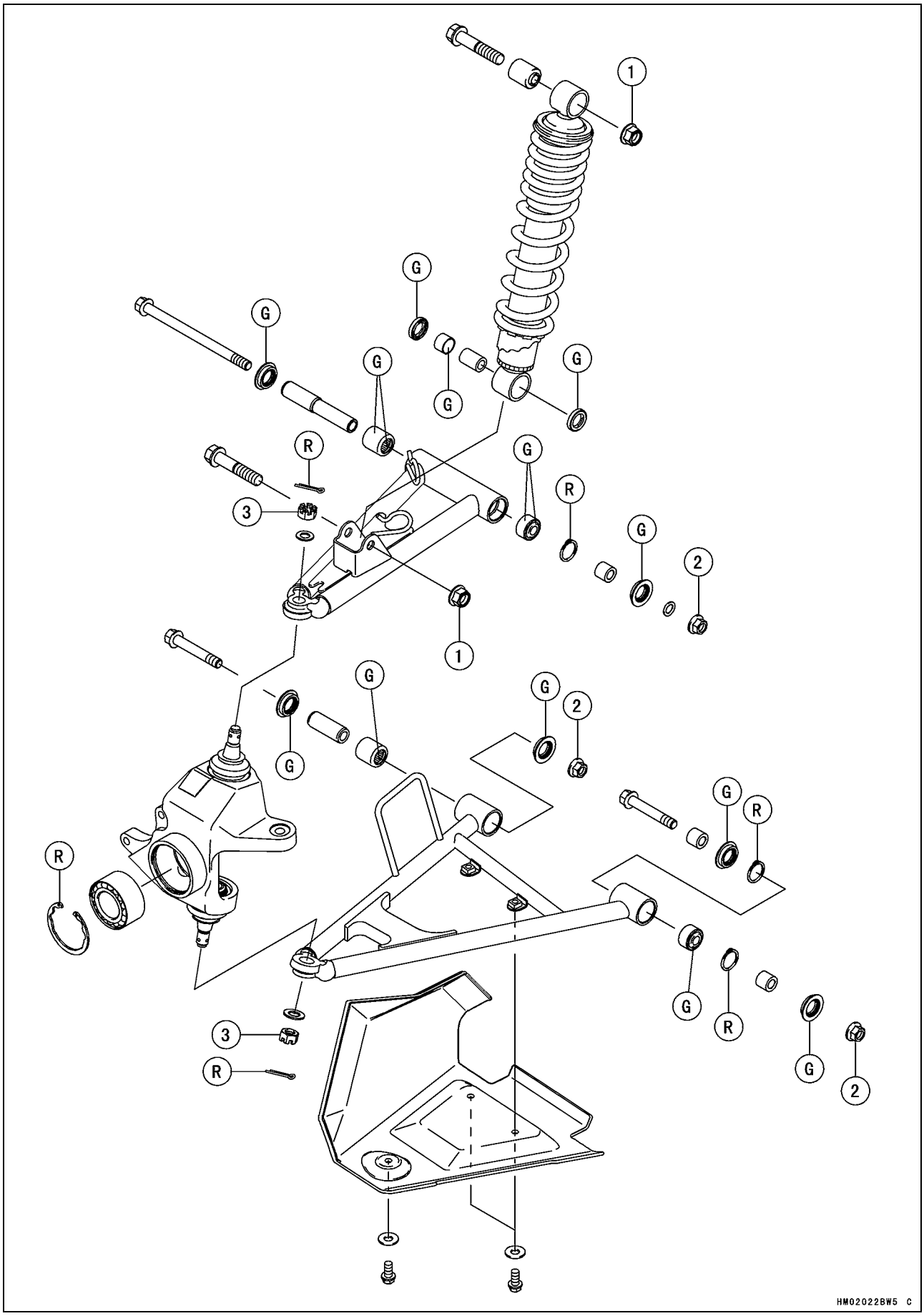
Internal Wet Brake Assembly

- Refer to Rear Final Gear Case section in the Final Drive chapter.

Suspension

Table of Contents

Exploded View

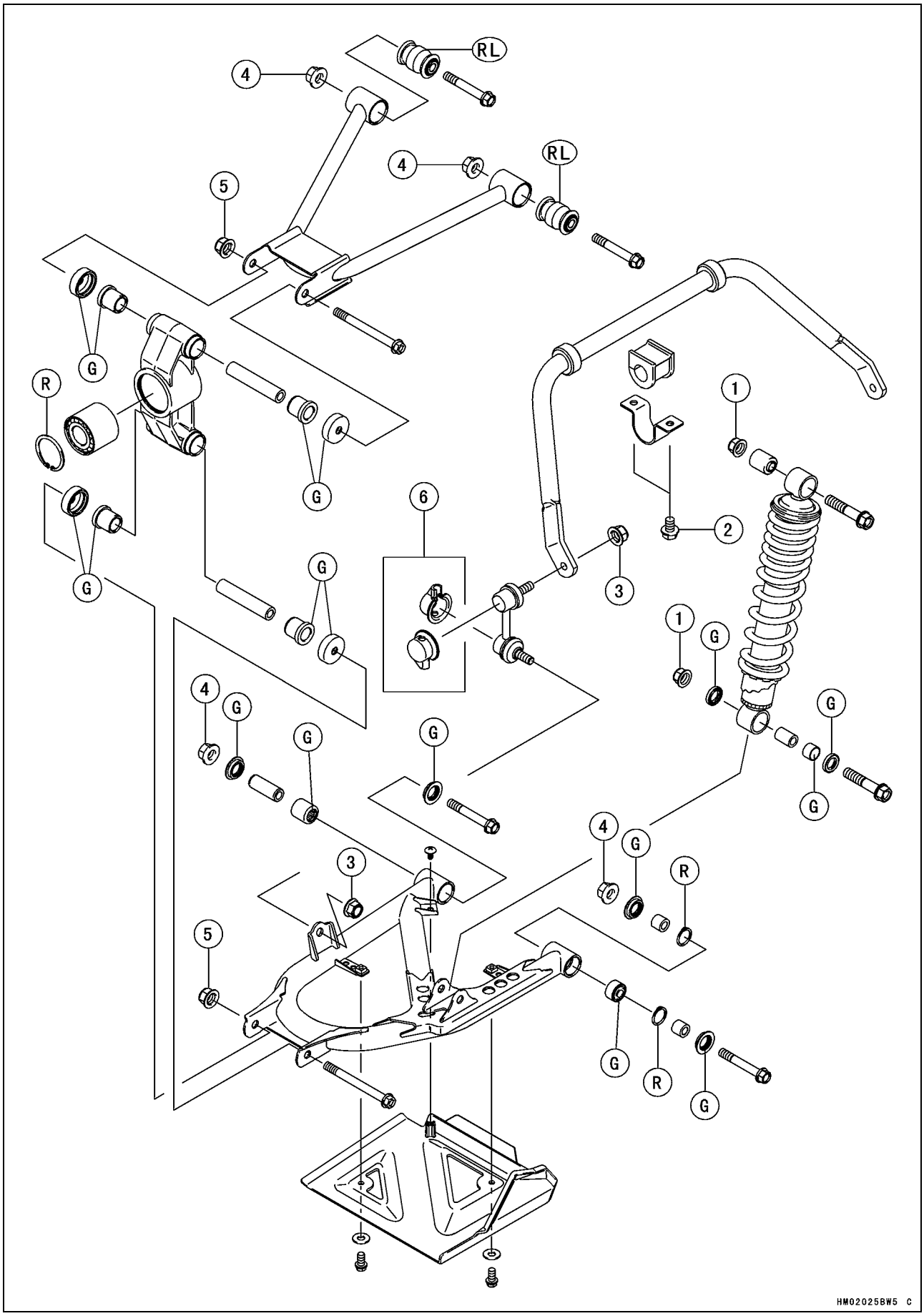


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Shock Absorber Mounting Nuts	34	3.5	25	
2	Front Suspension Arm Pivot Nuts	42	4.3	31	
3	Steering Knuckle Joint Nuts	29	3.0	21	

G: Apply grease.
R: Replacement Parts

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear Shock Absorber Mounting Nuts	34	3.5	25	
2	Stabilizer Holder Bolts	22	2.2	16	
3	Stabilizer Joint Nuts	46	4.7	34	
4	Rear Suspension Arm Pivot Nuts	46	4.7	34	
5	Rear Knuckle Mounting Nuts	46	4.7	34	

6. KVF750D8F ~ DAF/E8F ~ E9F/F8F ~ FAF

G: Apply grease.

R: Replacement Parts

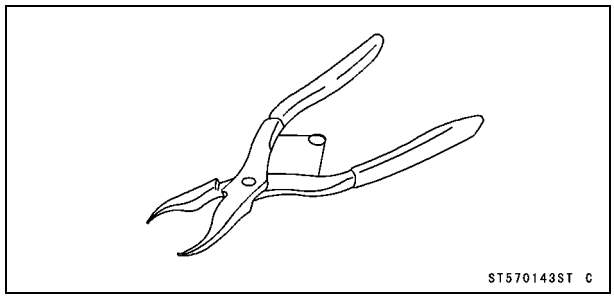
RL: Apply rubber lubricant.

Specifications

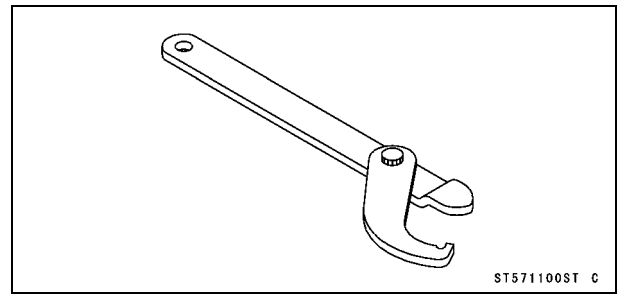
Item	Standard	Service Limit
Shock Absorbers		**(Usable Range)**
Spring Preload Setting Position:		
Front	2nd Step	1 ~ 5
Rear	3rd Step	1 ~ 5

Special Tools

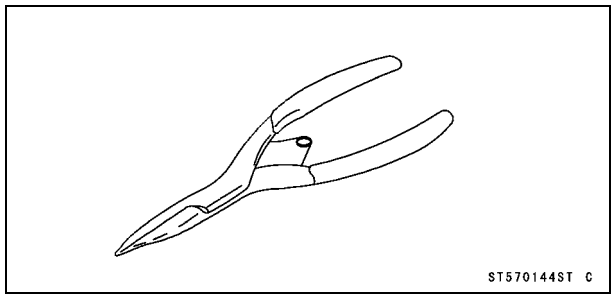
Inside Circlip Pliers:
57001-143



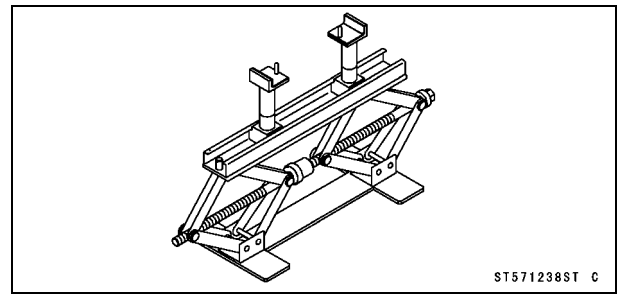
Steering Stem Nut Wrench:
57001-1100



Outside Circlip Pliers:
57001-144



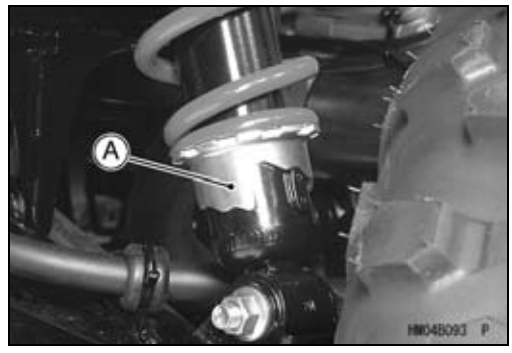
Jack:
57001-1238



Shock Absorbers

Front Shock Absorber Preload Adjustment

The spring adjusting sleeve [A] on the front shock absorber has 5 positions so that the spring can be adjusted for different terrain and loading conditions. If the spring action feels too soft or too stiff, adjust it in accordance with the following table.



Spring Action

Position	Spring Force	Setting	Load	Terrain	Speed
1	Weak	Soft	Light	Smooth	Low
2 (STD)	↑	↑	↑	↑	↑
3					
4	↓	↓	↓	↓	↓
5	Strong	Hard	Heavy	Rough	High

- Turn the adjusting sleeve on the front shock absorber to the desired position with the wrench.

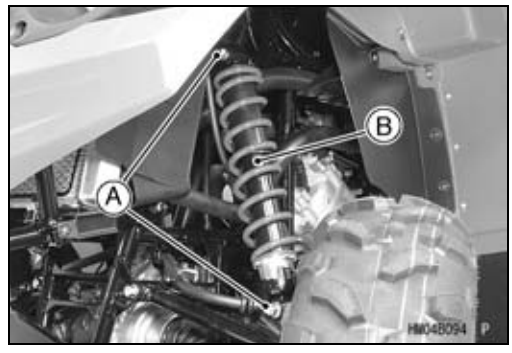
  Special Tool - Steering Stem Nut Wrench: 57001-1100

Front Shock Absorber Removal

- Support the vehicle on a stand or a jack so that the front wheels are off the ground.

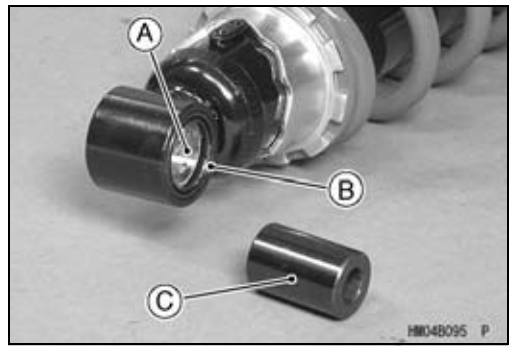
  Special Tool - Jack: 57001-1238

- While holding the front wheels, remove the lower and upper shock absorber mounting bolts [A] and nuts.
- Remove the front shock absorber [B].



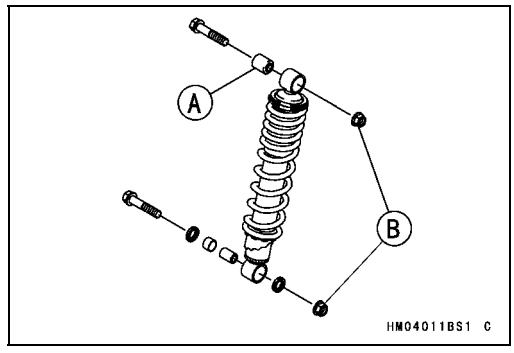
Front Shock Absorber Installation

- Apply grease to the inside of bushing [A] and grease seal lips [B].
- Install:
  Collar [C]



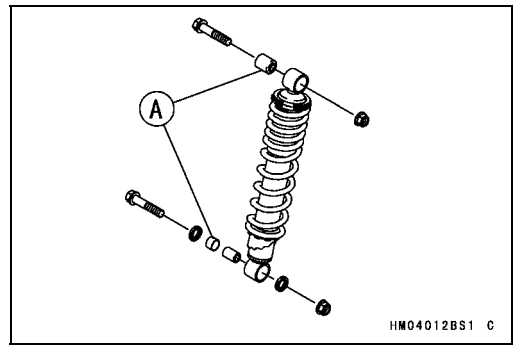
- Install:
  Bushing [A] (press)
- Tighten:

  Torque - Front Shock Absorber Mounting Nuts [B]: 34 N·m (3.5 kgf·m, 25 ft·lb)



Shock Absorbers

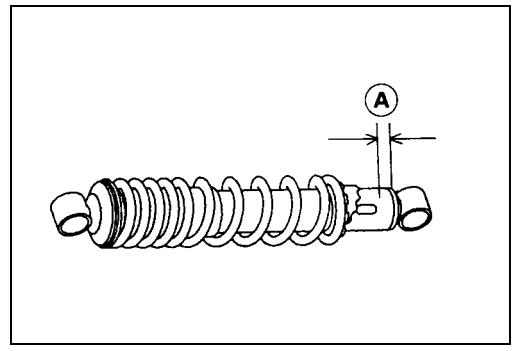
Front Shock Absorber Inspection



- Check the bushings [A] in the upper and lower pivots.

★If bushings are worn, cracked, hardened, or otherwise damaged, replace them.

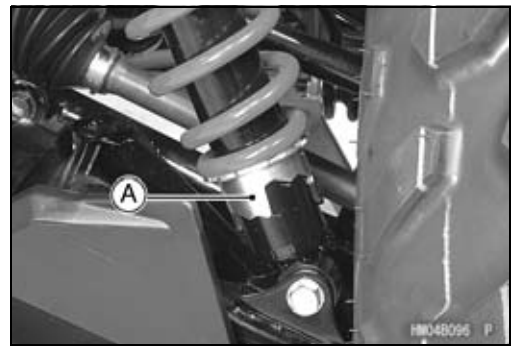
Front Shock Absorber Scrapping



⚠ WARNING

Since the front shock absorber contains nitrogen gas, do not incinerate or disassemble the front shock absorber.
Before a front shock absorber is scrapped, drill a hole at a point about 15 mm (0.59 in.) [A] up from the bottom of the cylinder to release the nitrogen gas completely. Wear safety glasses when drilling the hole, as the gas may blow out bits of drilled metal when the hole opens.

Rear Shock Absorber Preload Adjustment



The spring adjusting sleeve [A] on the rear shock absorber has 5 positions so that the spring can be adjusted for different terrain and loading conditions. If the spring action feels too soft or too stiff, adjust it in accordance with the following table.

Spring Action

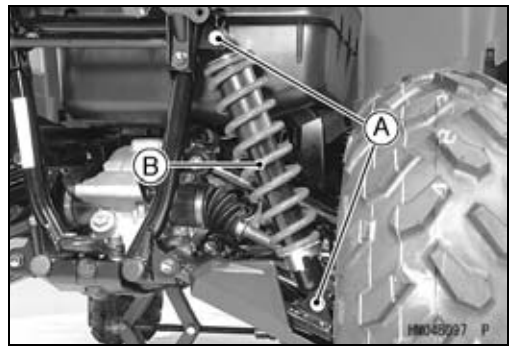
Position	Spring Force	Setting	Load	Terrain	Speed
1	Weak	Soft	Light	Smooth	Low
2	↑	↑	↑	↑	↑
3 (STD)					
4	↓	↓	↓	↓	↓
5	Strong	Hard	Heavy	Rough	High

- Remove the axle guard.
- Turn the adjusting sleeve on the rear shock absorber to the desired position with the wrench.

Special Tool - Steering Stem Nut Wrench: 57001-1100

Shock Absorbers

Rear Shock Absorber Removal

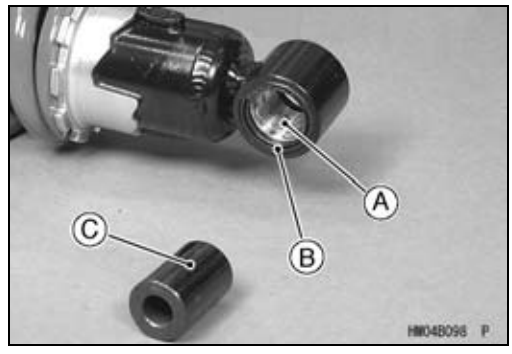


- Support the vehicle on a stand or a jack so that the rear wheels are off the ground.

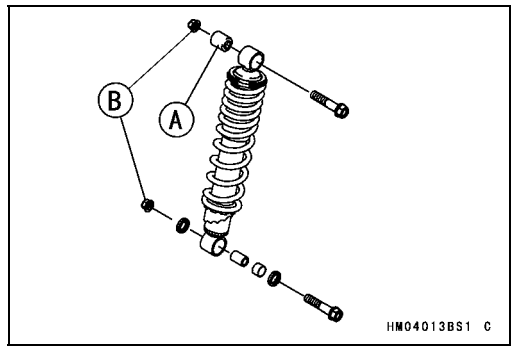
  Special Tool - Jack: 57001-1238

- While holding the rear wheels, remove the lower and upper shock absorber mounting bolts [A] and nuts.
- Remove the rear shock absorber [B].

Rear Shock Absorber Installation



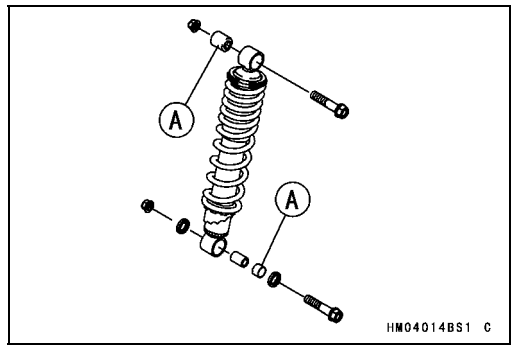
- Apply grease to the inside of bushing [A] and grease seal lips [B].
- Install:
  Collar [C]



- Install:
  Bushing [A] (press)
- Tighten:

  Torque - Rear Shock Absorber Mounting Nuts [B]: 34 N·m (3.5 kgf·m, 25 ft·lb)

Rear Shock Absorber Inspection



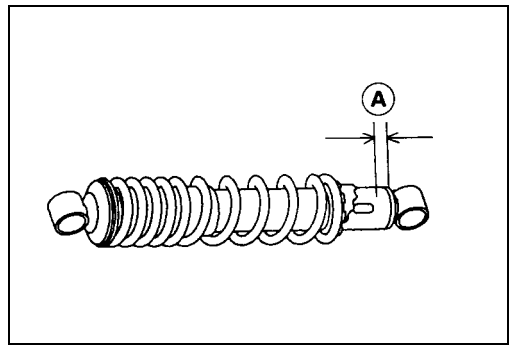
- Check the bushings [A] in the upper and lower pivots.

★If bushings are worn, cracked, hardened, or otherwise damaged, replace them.

Rear Shock Absorber Scrapping

⚠ WARNING

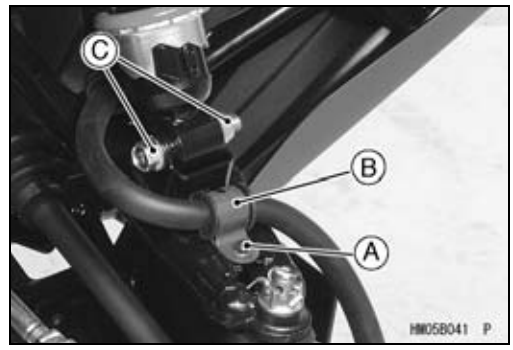
Since the rear shock absorber contains nitrogen gas, do not incinerate or disassemble the rear shock absorber. Before a rear shock absorber is scrapped, drill a hole at a point about 15 mm (0.59 in.) [A] up from the bottom of the cylinder to release the nitrogen gas completely. Wear safety glasses when drilling the hole, as the gas may blow out bits of drilled metal when the hole opens.



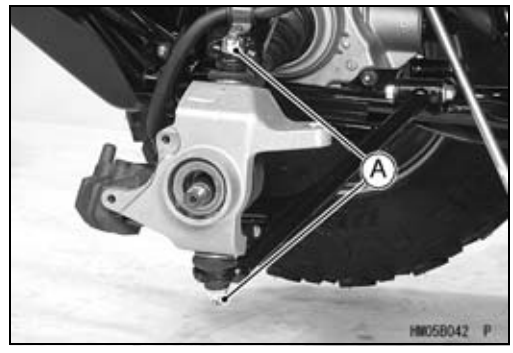
Suspension Arms

Front Suspension Arm Removal

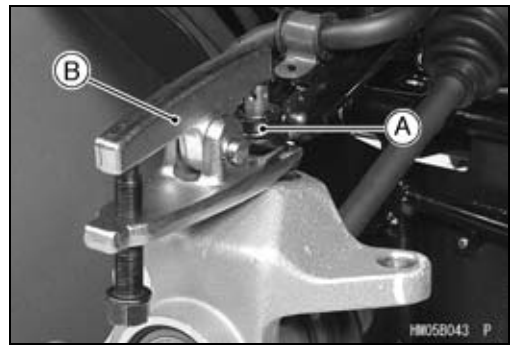
- Remove:
  Wheel Hub (see Front Hub Removal in the Wheels/Tires chapter)
  Bolt [A] and Brake Hose Clamp [B]
  Front Shock Absorber Mounting Bolt and Nut [C] (lower)



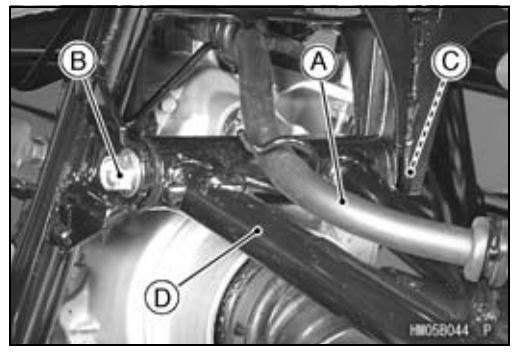
- Remove:
  Cotter Pins, Knuckle Joint Nuts [A] and Washers



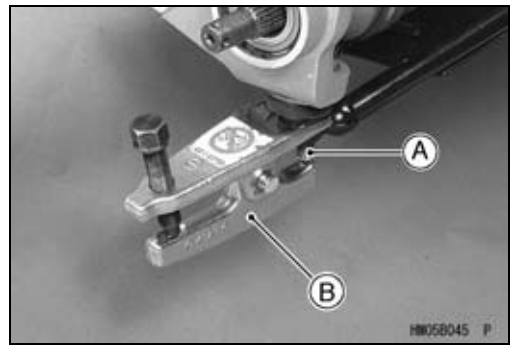
- Remove the knuckle joint [A] from the lower suspension arm using a suitable joint remover [B].



- Clear the brake hose [A] from the front upper suspension arm.
- Remove:
  Suspension Arm Pivot Bolt [B] and Nut [C]
  Front Upper Suspension Arm [D]

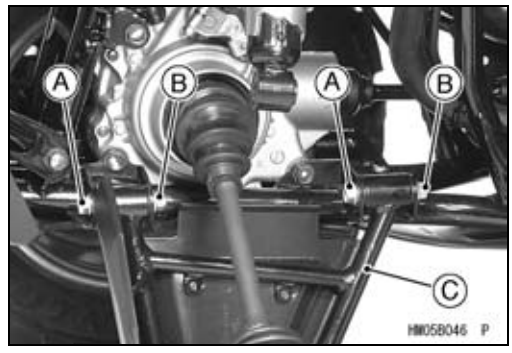


- Remove the knuckle joint [A] from the upper suspension arm using a suitable joint remover [B].



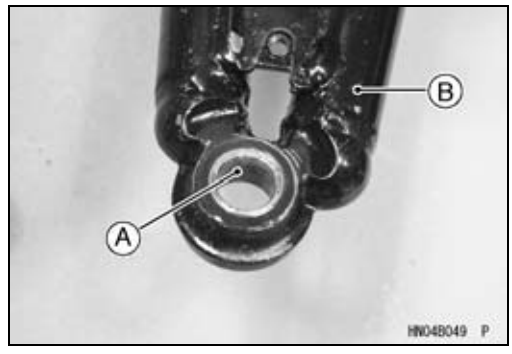
Suspension Arms

● Remove:
Suspension Arm Pivot Bolts [A] and Nuts [B]
Front Lower Suspension Arm [C]



Front Suspension Arm Installation

● Clean the taper surface [A] of the suspension arm [B] and shank of the knuckle joint.
● Install:
Front Upper Suspension Arm
Front Lower Suspension Arm
Suspension Arm Pivot Bolts and Nuts (temporary)
Steering Knuckle Joint (see Steering Knuckle Installation in the Steering chapter)
Front Shock Absorber Mounting Bolt and Nut (lower)



● Tighten:

Torque - Front Suspension Arm Pivot Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)
Steering Knuckle Joint Nuts: 29 N·m (3.0 kgf·m, 21 ft·lb)
Front Shock Absorber Mounting Bolt: 34 N·m (3.5 kgf·m, 25 ft·lb)

● Install:
Brake Hose
Front Wheels (see Wheel Installation in the Wheels/Tires chapter)

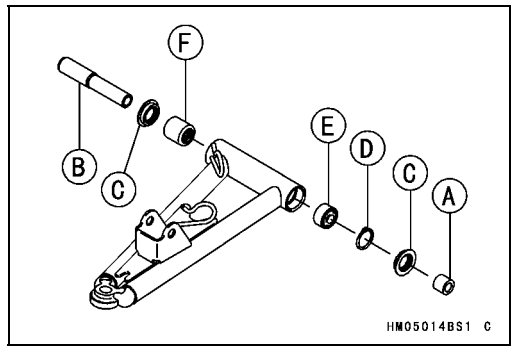
Front Suspension Arm Disassembly

Front Upper Suspension Arm

● Remove:
Collar [A] (rear side)
Sleeve [B] (front side)
Oil Seals [C]
Circlip [D]

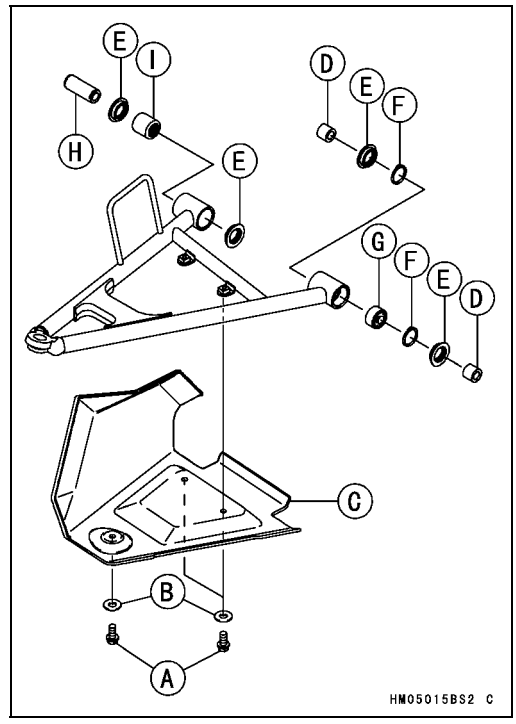
Special Tool - Inside Circlip Pliers: 57001-143

● Remove:
Ball Joint Bearing [E] (rear side)
Needle Bearing [F] (front side)



Suspension Arms

Front Lower Suspension Arm

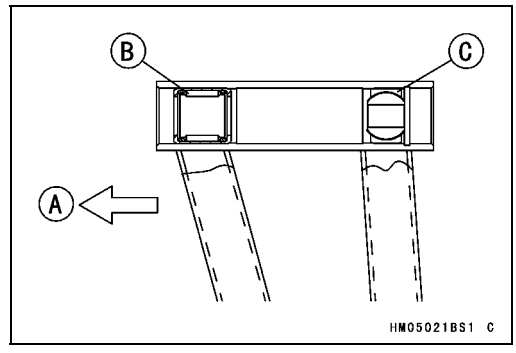


- Remove:
  Bolts [A]
  Collar [B]
  Axle Guard [C]
  Collars [D] (rear side)
  Oil Seals [E]
  Circlips [F]

  Special Tool - Inside Circlip Pliers: 57001-143
- Remove:
  Ball Joint Bearing [G] (rear side)
  Sleeve [H] (front side)
  Needle Bearing [I] (front side)

Front Suspension Arm Assembly

- Apply grease:
  Ball Joint Bearing
  Needle Bearing



- Install the following parts as shown.

Front Upper Suspension Arm
  Front [A]

- Press the needle bearing [B] until it is stopped.
- Press the ball joint bearing [C] until it is stopped.

- Install:
  New Circlip

  Special Tool - Inside Circlip Pliers: 57001-143

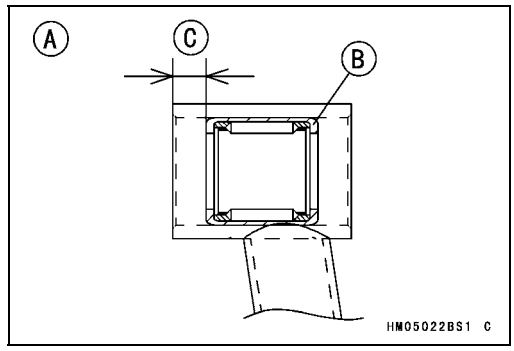
- Apply grease:
  Oil Seal Lips
- Install:
  Sleeve (front side)
  Collar (rear side)

Suspension Arms

● Install the following parts as shown.

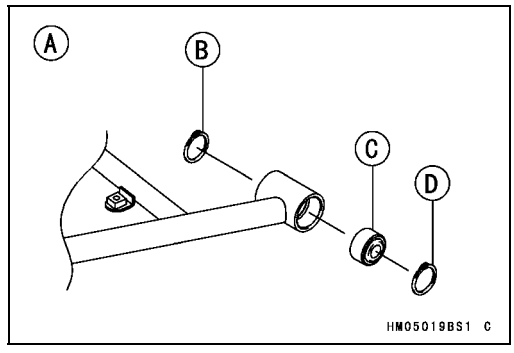
Front Lower Suspension Arm

Front Side [A]:
Needle Bearing [B]
7.5 ±0.1 mm (0.295 ±0.004 in.) [C]



Rear Side [A]:
Circlip [B] (front side)
Ball Joint Bearing [C]
Circlip [D] (rear side)

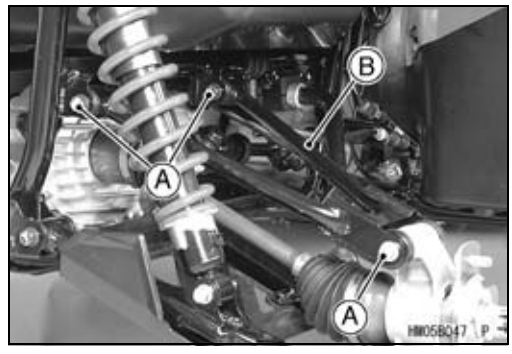
Special Tool - Inside Circlip Pliers: 57001-143



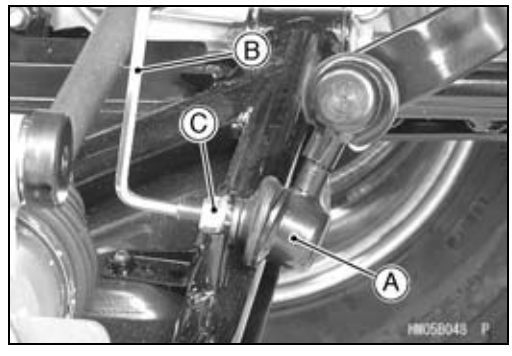
● Apply grease:
Oil Seal Lips
● Install:
Sleeve (front side)
Collars (rear side)

Rear Suspension Arm Removal

● Remove:
Rear Wheels (see Wheel Removal in the Wheels/Tires chapter)
Suspension Arm Bolts [A] and Nuts
Rear Upper Suspension Arm [B]

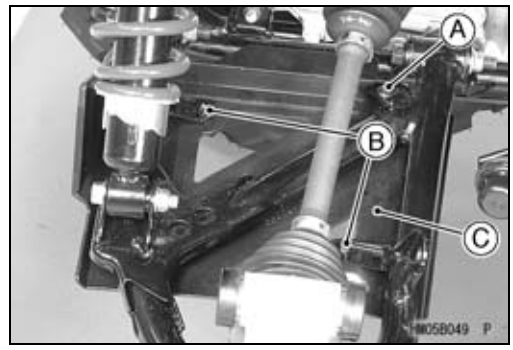


● Remove:
Stabilizer Joint [A]
○Hold the joint bolt with an Allen wrench [B], and remove the nut [C].

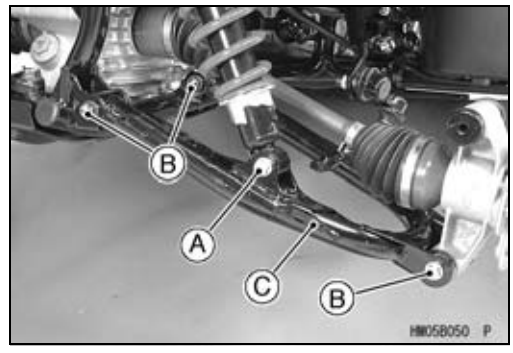


Suspension Arms

● Remove:
Screw [A]
Bolts [B]
Axle Guard [C]



● Remove:
Rear Shock Absorber Mounting Bolt [A] and Nut (lower)
Suspension Arm Bolts and Nuts [B]
Rear Lower Suspension Arm [C]



Rear Suspension Arm Installation

● Install:
Rear Upper Suspension Arm
Rear Lower Suspension Arm
Suspension Arm Pivot Bolts and Nut (temporary)
Rear Shock Absorber Mounting Bolt (lower)
Stabilizer Joint
● Tighten:

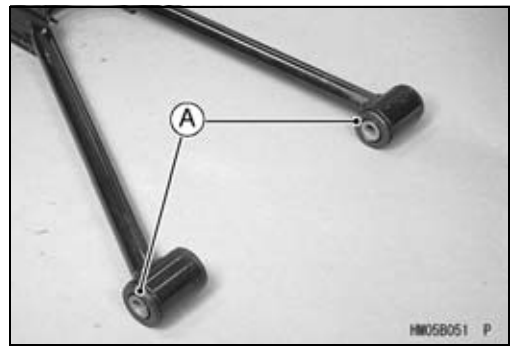
Torque - Rear Suspension Arm Pivot Nuts: 46 N·m (4.7 kgf·m, 34 ft·lb)
Rear Shock Absorber Mounting Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)
Stabilizer Joint Nut: 46 N·m (4.7 kgf·m, 34 ft·lb)
Rear Knuckle Mounting Nuts: 46 N·m (4.7 kgf·m, 34 ft·lb)

○Hold the joint bolt with an Allen wrench, and tighten the nut.
● Install:
Front Wheels (see Wheel Installation in the Wheels/Tires chapter)

Rear Suspension Arm Disassembly

Rear Upper Suspension Arm

● Remove out the bushings [A].



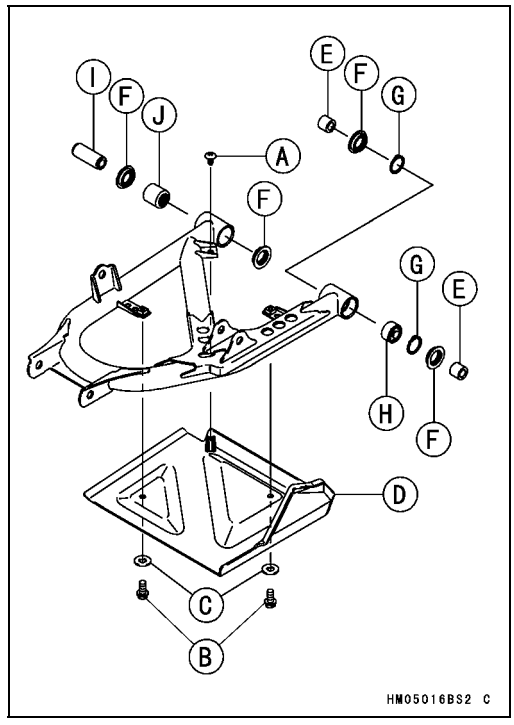
Suspension Arms

Rear Lower Suspension Arm

● Remove:
Screw [A]
Bolts [B]
Collars [C]
Axle Guard [D]
Collars [E] (rear side)
Oil Seals [F]
Circlips [G]

Special Tool - Outside Circlip Pliers: 57001-144

● Remove:
Ball Joint Bearing [H] (rear side)
Sleeve [I] (front side)
Needle Bearing [J] (front side)

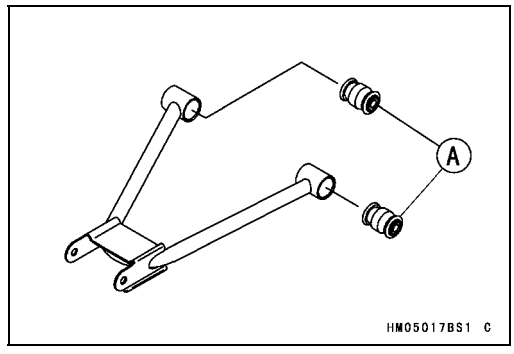


Rear Suspension Arm Assembly

● Apply grease:
Ball Joint Bearing
Needle Bearing

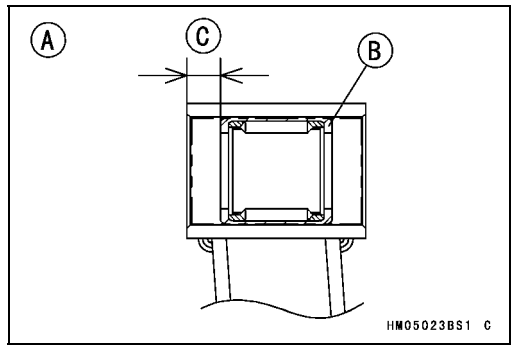
Rear Upper Suspension Arm

● Install the bushings [A] using a press.



Rear Lower Suspension Arm

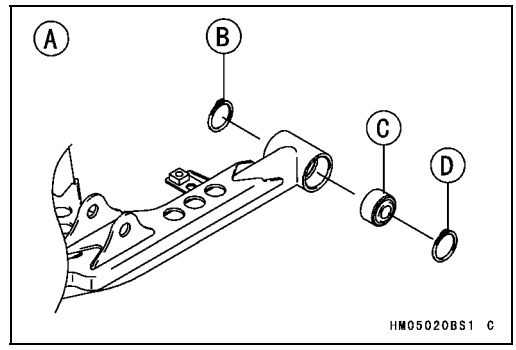
● Install the following parts as shown.
Front Side [A]:
Needle Bearing [B]
7.5 ±0.1 mm (0.295 ±0.004 in.) [C]



Suspension Arms

Rear Side [A]:
Circlip [B] (front side)
Ball Joint Bearing [C]
Circlip [D] (rear side)

Special Tool - Inside Circlip Pliers: 57001-143

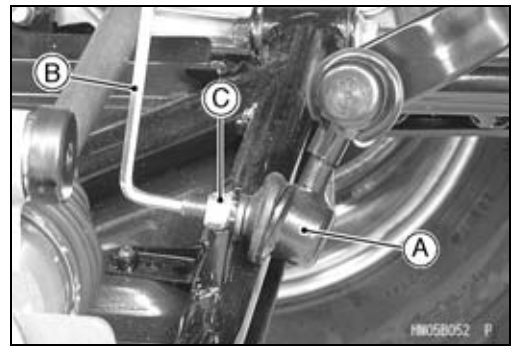


- Apply grease:
  Oil Seal Lips
- Install:
  Sleeve (front side)
  Collars (rear side)

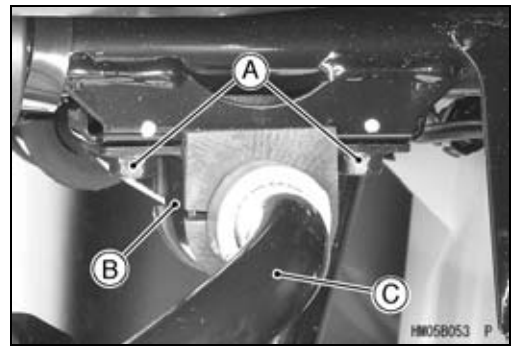
Stabilizer Removal

- Remove:
  Rear Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Stabilizer Joint [A]

○Hold the joint bolt with an Allen wrench [B], and remove the nut [C].



- Remove:
  Stabilizer Holder Bolts [A]
  Stabilizer Holders [B]
  Dampers and Stabilizer [C]



Stabilizer Installation

- Install:
  Dampers [A] and Stabilizer [B]
  Stabilizer Holders [C] and Bolts
- Tighten:

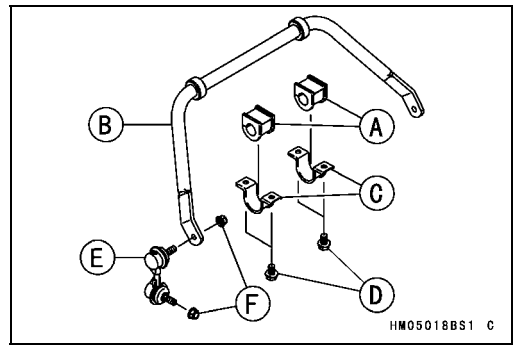
Torque - Stabilizer Holder Bolts [D]: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Install:
  Stabilizer Joints [E]

○Hold the joint bolt with an Allen wrench, and tighten the nut.

Torque - Stabilizer Joint Nuts [F]: 46 N·m (4.7 kgf·m, 34 ft·lb)

- Install:
  Rear Wheels (see Wheel Installation in the Wheels/Tires chapter)



Steering

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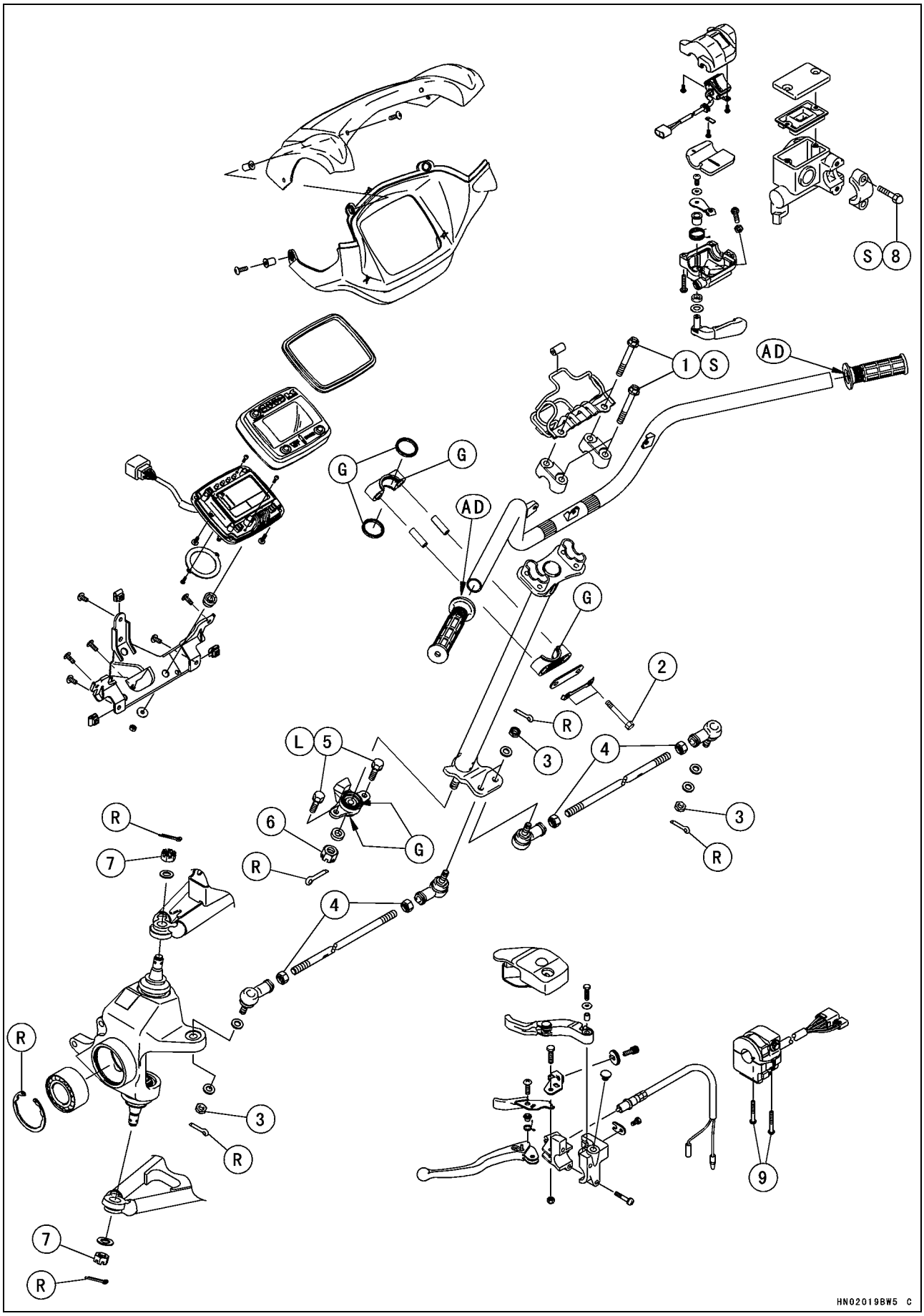
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar Holder Bolts	29	3.0	21	S
2	Steering Stem Clamp Bolts	25	2.5	18	
3	Tie-rod End Nuts	42	4.3	31	
4	Tie-rod Locknuts	37	3.8	27	
5	Steering Stem Bearing Joint Bolts	22	2.2	16	L
6	Steering Stem Bottom End Nut	62	6.3	46	
7	Steering Knuckle Joint Nuts	29	3.0	21	
8	Front Brake Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S
9	Left Handlebar Switch Housing Screws	3.5	0.36	31 in·lb	

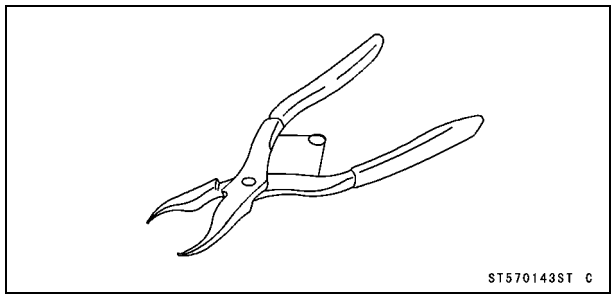
AD: Apply adhesive agent.
G: Apply grease.
L: Apply a non-permanent locking agent.
R: Replacement Parts
S: Follow the specific tightening sequence.

Specifications

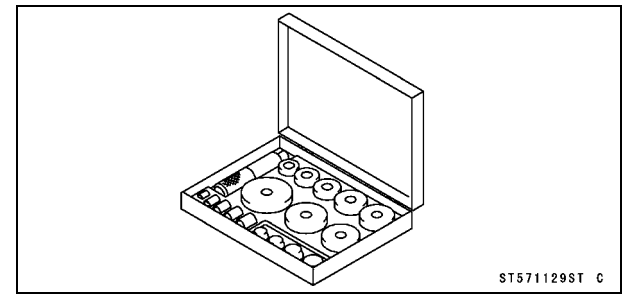
Item	Standard	Service Limit
Tie-rods		
Tie-rod Length	388.5 mm (15.30 in.)	– – –

Special Tools

Inside Circlip Pliers:
57001-143

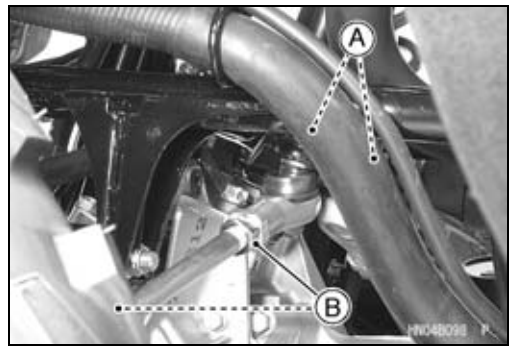


Bearing Driver Set:
57001-1129



Steering

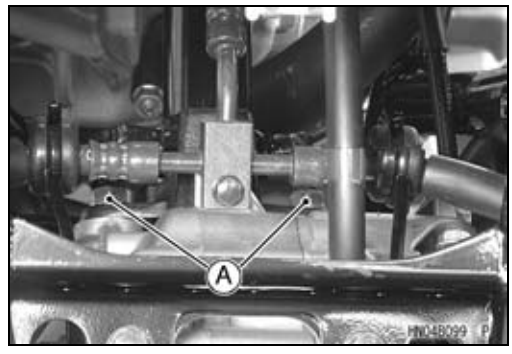
Steering Stem Removal



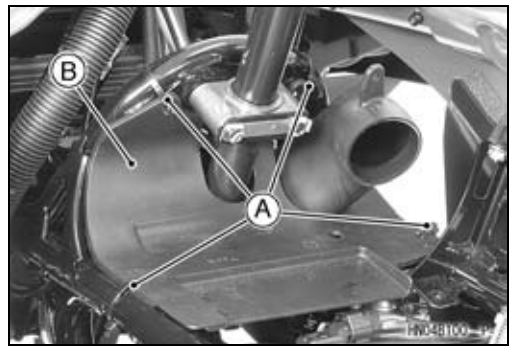
- Remove:
  Handlebar (see Handlebar Removal)
  Cotter Pins and Tie-rod End Nuts [A]

NOTICE

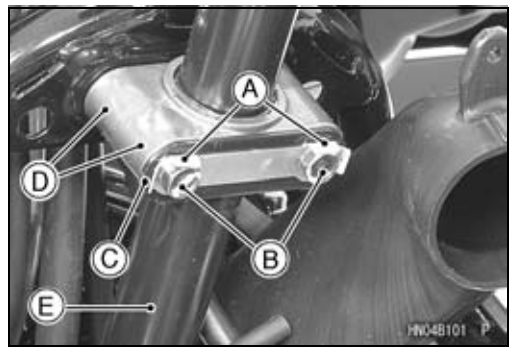
Do not loosen the locknuts [B] at the ends of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.



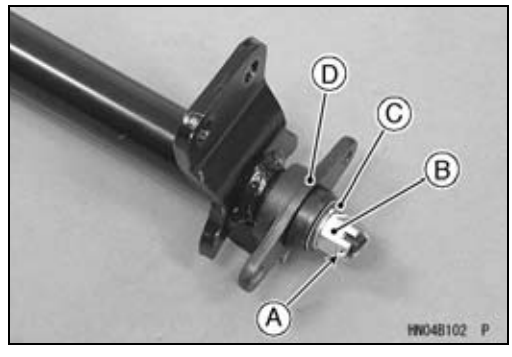
- Remove:
  Steering Stem Bearing Joint Bolts [A]
  Air Cleaner Housing (see Air Cleaner Housing Removal in the Fuel System (DFI) chapter)



- Cut the bands [A] to remove the heat guard [B]



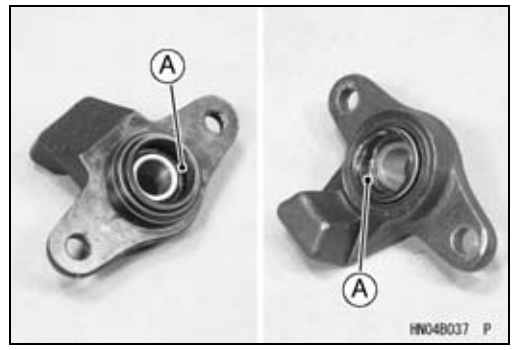
- Flatten out the bended washer [A].
- Remove:
  Steering Clamp Bolts [B]
  Water and Plate [C]
  Steering Clamps [D]
  Collars
  Grease Seals
- Pull the steering stem [E] out of the frame.



- Remove:
  Cotter Pin [A]
  Steering Stem Bottom End Nut [B]
  Collar [C]
  Steering Stem Bearing [D]

Steering

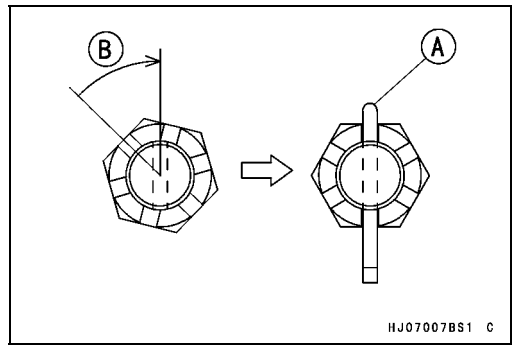
Steering Stem Installation



- Fill grease up the seal grooves [A] in the steering stem bearing.
- Install:
  Collar
- Tighten:

Torque - Steering Stem Bottom End Nut: 62 N·m (6.3 kgf·m, 46 ft·lb)

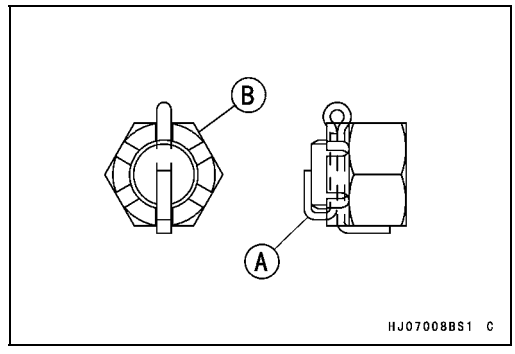
- Insert a new cotter pin [A].



NOTE

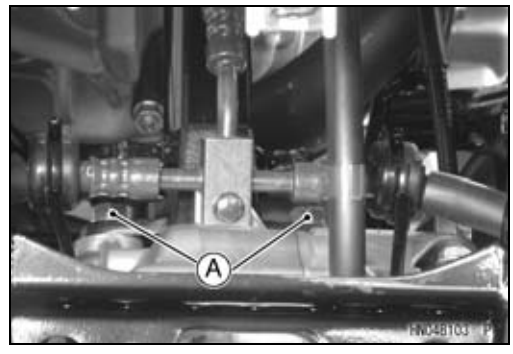
○When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the steering stem, tighten the nut clockwise [B] up to next alignment.
○It should be within 30 degree.
○Loosen once and tighten again when the slot goes past the nearest hole.

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

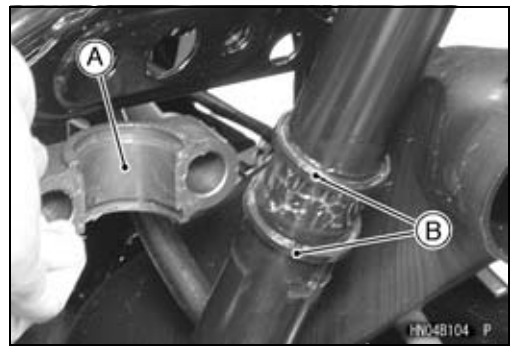


- Apply a non-permanent locking agent to the steering stem bearing joint bolts [A].
- Tighten:

Torque - Steering Stem Bearing Joint Bolts: 22 N·m (2.2 kgf·m, 16 ft·lb)

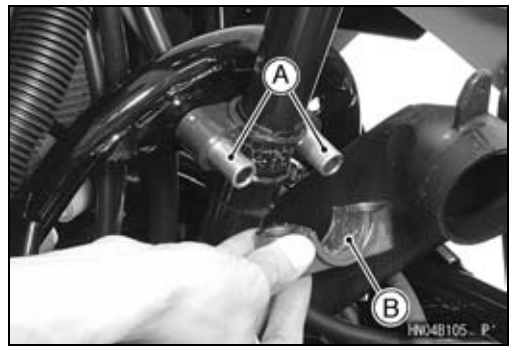


- Apply grease to the inside of steering clamp [A].
- Install:
  Grease Seals [B]



Steering

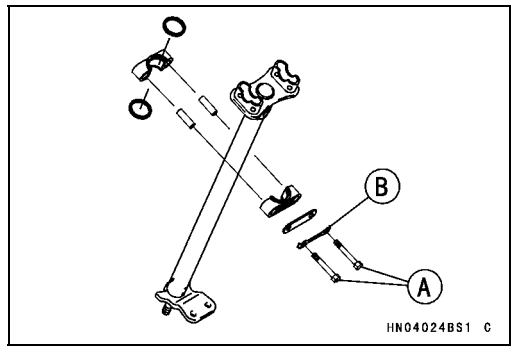
● Install:
Collars [A]
● Apply above grease to the inside of steering clamp [B].



● Tighten:

Torque - Steering Stem Clamp Bolts [A]: 25 N·m (2.5 kgf·m, 18 ft·lb)
Tie-rod End Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)

● Bend the tabs of the washer [B] toward the bolt head.
● Inspect the toe-in (see Toe-in Inspection in the Wheels/Tires chapter).

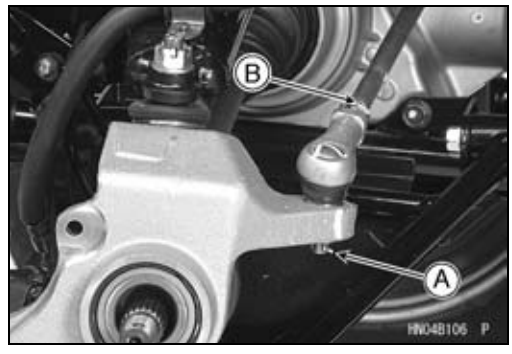


Steering Knuckle Removal

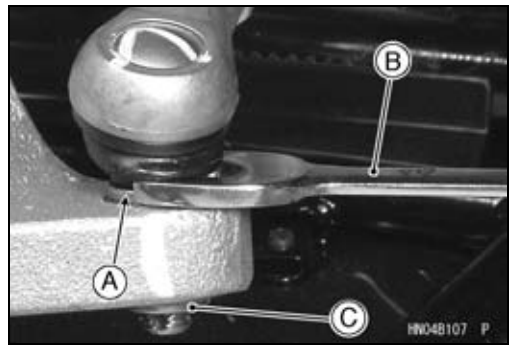
● Remove:
Front Hub (see Front Hub Removal in the Wheel/Tiers chapter)
Cotter Pin [A]

NOTICE

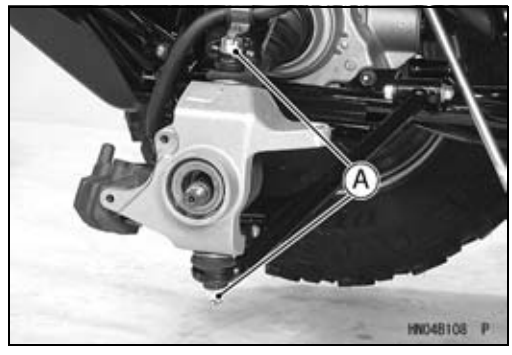
Do not loosen the locknuts [B] at the ends of the tie-rod, or the toe-in of the front wheels will be changed.



● Hold the flat surfaces [A] of the tie-rod end with a thin wrench [B], and remove the tie-rod end nut [C] and washers.
● Tap the tie-rod end shaft lightly and remove the tie-rod end from the knuckle.

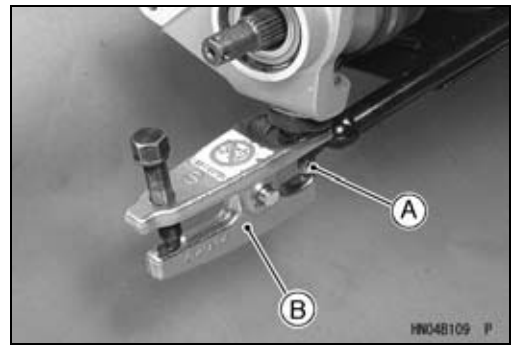


● Remove:
Cotter Pins and Steering Knuckle Joint Nuts [A]

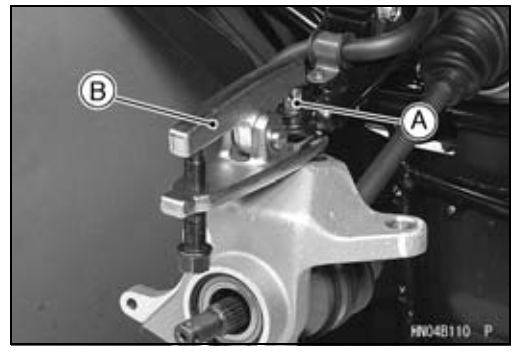


Steering

- Remove the knuckle joint [A] from the lower suspension arm using a suitable joint remover [B].



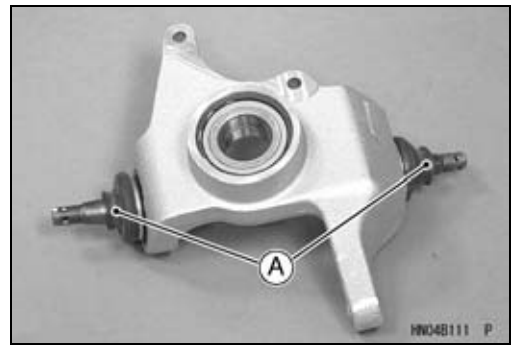
- Remove the knuckle joint [A] from the upper suspension arm using a suitable joint remover [B].



Steering Knuckle Installation

- Inspect the spherical bearings in the knuckle joints [A].

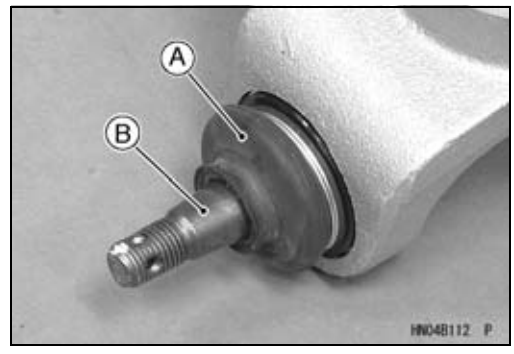
★If roughness, excessive play, or seizure is found, replace the knuckle joint.



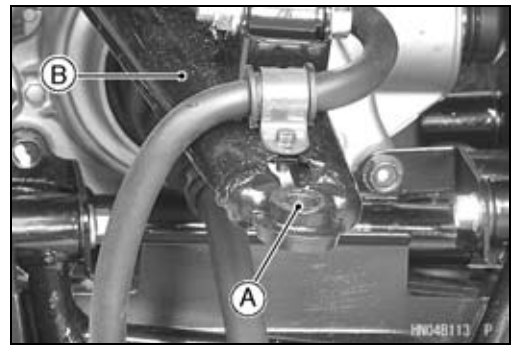
- Check the joint boot [A] is not torn, worn, deteriorated, or is leaking grease.

★If it is found, replace the knuckle joint.

- Using a cleaning fluid, clean off any oil or dirt on the shanks [B] of the knuckle joint and dry it with a clean cloth.



- Using a cleaning fluid, clean off any oil or dirt on the taper surface [A] in the front suspension arm [B] and dry it with a clean cloth.

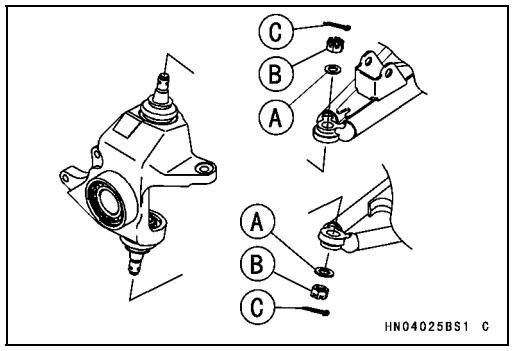


Steering

● Install:
Washers [A] and Knuckle Joint Nuts [B]
● Tighten:

Torque - Steering Knuckle Joint Nuts: 29 N·m (3.0 kgf·m, 21 ft·lb)
Tie-rod End Nuts: 42 Nm (4.3 kgfm, 31 ftlb)

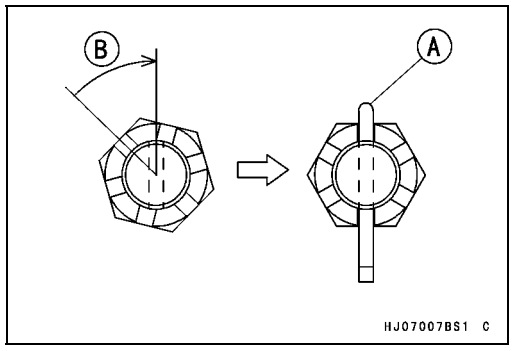
Cotter Pins [C]



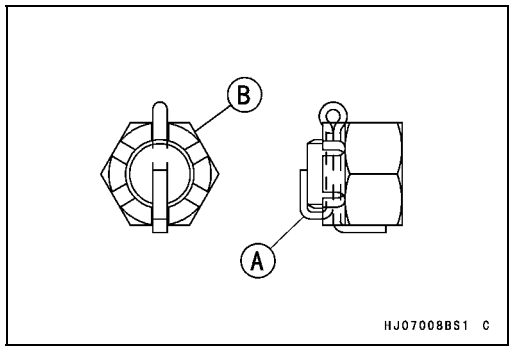
● Insert new cotter pins [A].

NOTE

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



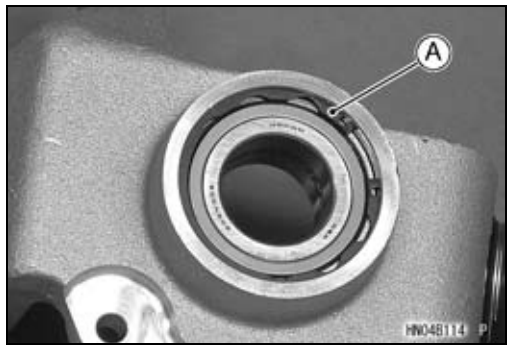
● Bend the cotter pin [A] over the nut.



Steering Knuckle Bearing Removal

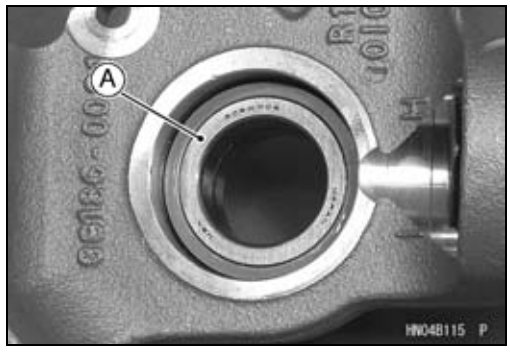
● Remove:
Steering Knuckle (see Steering Knuckle Removal)
Circlip [A]

Special Tool - Inside Circlip Pliers: 57001-143



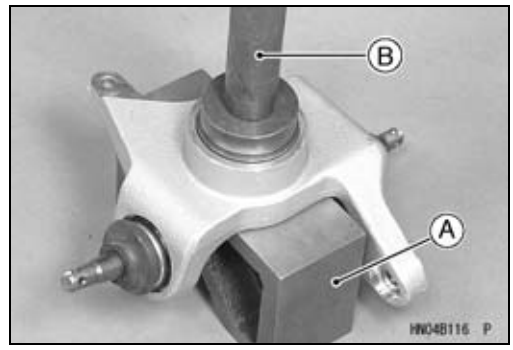
● Drive the bearing [A] out using a suitable bearing driver from the bearing driver set.

Special Tool - Bearing Driver Set: 57001-1129



Steering

Steering Knuckle Bearing Installation

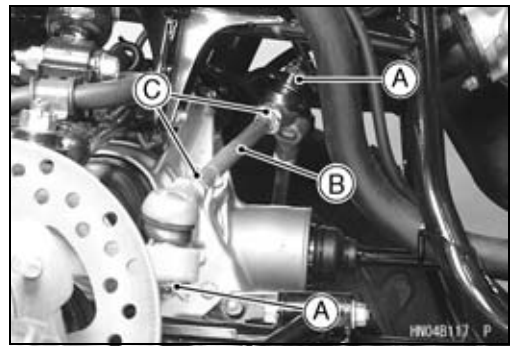


- The marked side of the bearing faces outward.
- Press in the bearing until it is bottomed.
  [A] V Block

  Special Tool - Bearing Driver Set [B]: 57001-1129
- Replace the circlip with a new one.

  Special Tool - Inside Circlip Pliers: 57001-143

Tie-rod Removal



- Remove:
  Front Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Cotter Pins
- Hold the flat surfaces of the tie-rod end with a thin wrench, and remove the tie-rod nuts [A] and washers (see Steering Knuckle Removal).
- Remove:
  Tie-rod [B]

NOTICE

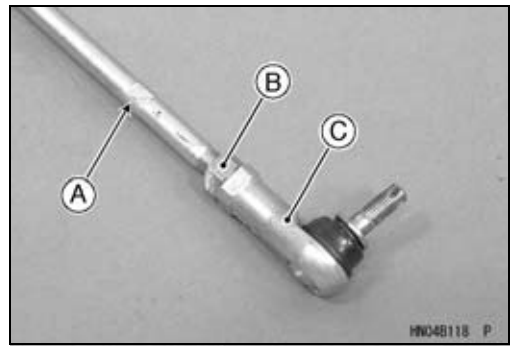
When removing the tie-rod, be careful not to bend it. Do not loosen the locknuts [C] at the end of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.

Tie-rod Installation

- The right and left tie-rods are identical.
- Tighten:

  Torque - Tie-rod End Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)
- Inspect the toe-in (see Toe-in Inspection in the Wheels/Tires chapter).

Tie-rod End Removal



- Remove the tie-rod (see Tie-rod Removal).
- Holding the tie-rod flattened area [A], loosen the locknut [B] and unscrew the tie-rod end [C].

NOTE

○*The locknut near the L mark on the tie-rod has left-hand threads. Turn the wrench clockwise for loosening.*

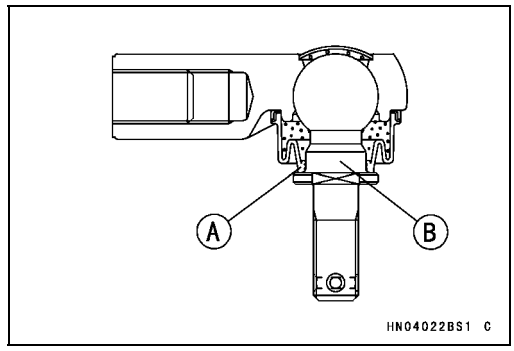
NOTICE

Do not remove the grease seal. It is packed with grease.

Steering

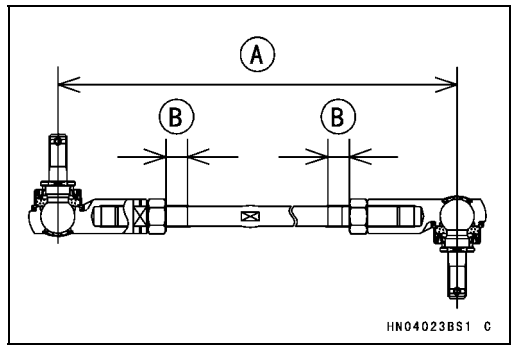
Tie-rod End Installation

- Check that the boot lip [A] is on the shank [B].

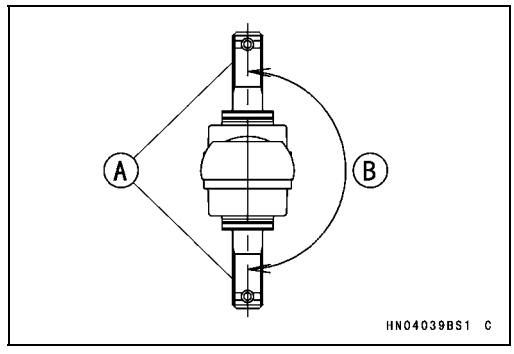


- Install the tie-rod ends so that the tie-rod has the correct length [A], and both visible thread lengths [B] are approximately equal.

Tie-rod Length
Standard: 388.5 mm (15.30 in.)

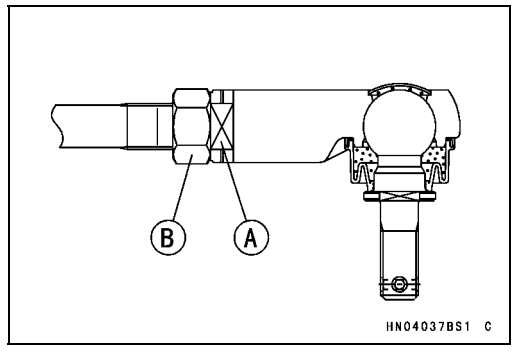


- Install the tie-rod ends so that the thread portions [A] of the tie-rod ends are opposite direction 180° [B] as shown.



- Hold the flat surface [A] of the tie-rod end with a wrench, and tighten the locknut [B].

Torque - Tie-rod Locknuts: 37 N·m (3.8 kgf·m, 27 ft·lb)



Steering Maintenance

Steering Inspection

● Refer to the Steering Inspection in the Periodic Maintenance chapter.

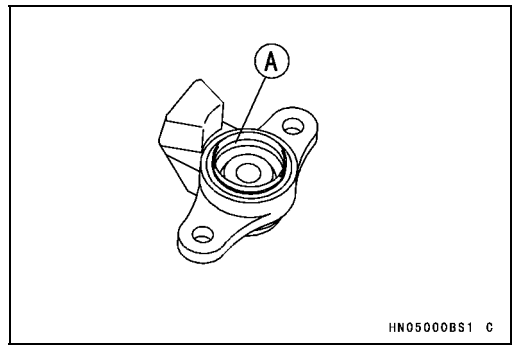
Steering Stem Straightness Inspection

● Remove the steering stem (see Steering Stem Removal).
● Check the steering stem for straightness.
○Use a straightedge along the stem.
★If the steering stem is bent, replace the steering stem.

Steering Bearing Sleeve Lubrication

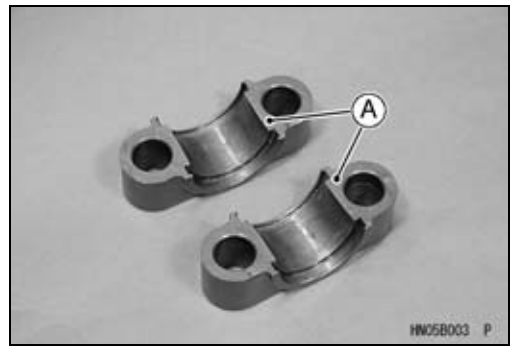
● Lubricate the steering stem bearings.
○Remove the steering stem (see Steering Stem Removal).
○Wipe all the old grease off the steering stem, bearing sleeves, and out of the grease seals.
○Apply grease to the steering stem [A] and the inside [B] of the both clamps.

● Lubricate the steering stem bearing [A].
○Remove the steering stem bearing.
○Pack the grease seal lips with grease.



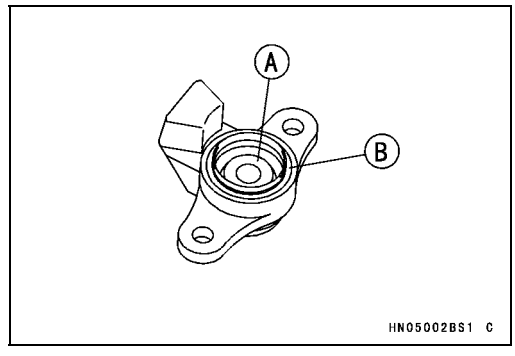
Steering Stem Clamp Inspection

● Inspect the steering stem clamps [A].
★If roughness, excessive play, or seizure is found, replace both clamps.



Steering Stem Bearing Inspection

● Inspect the spherical bearing [A].
★If roughness, excessive play, or seizure is found, replace the steering stem bearing.
● Inspect the upper and lower grease seals [B].
★If damage, wear or deterioration is found, replace the steering stem bearing.

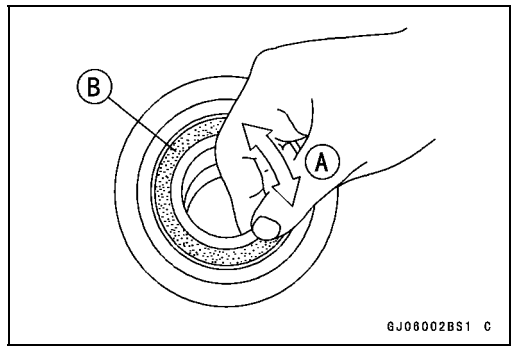


Steering Maintenance

Steering Knuckle Bearing Inspection

NOTICE

Do not remove any bearings for inspection.



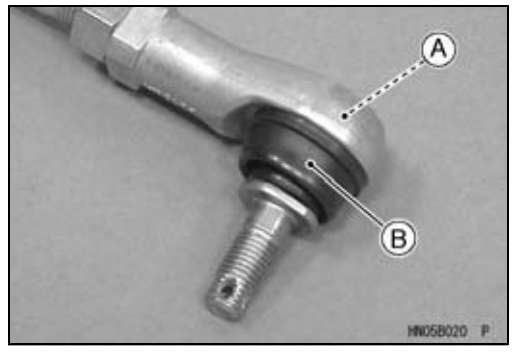
- Remove the steering knuckle (see Steering Knuckle Removal).
- Turn [A] the bearing back and forth while checking for roughness or binding.

★If 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.

Tie-rod End Inspection



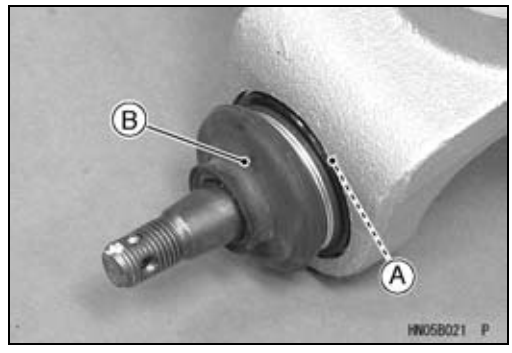
- Inspect each spherical bearing [A].

★If roughness, excessive play, or seizure is found, replace the tie-rod end.

- Inspect each boot [B].

★If damage, wear or deterioration is found, replace the tie-rod end.

Steering Knuckle Joint Inspection



- Inspect each spherical bearing [A].

★If roughness, excessive play, or seizure is found, replace the steering knuckle joint.

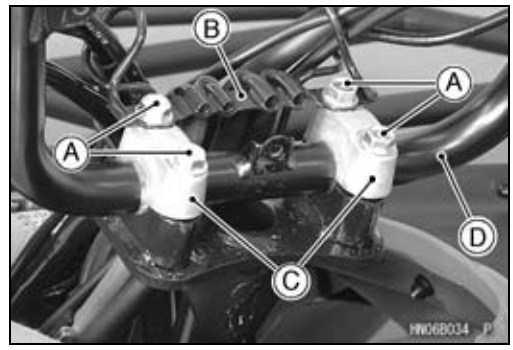
- Inspect each boot [B].

★If damage, wear or deterioration is found, replace the steering knuckle joint.

Handlebar

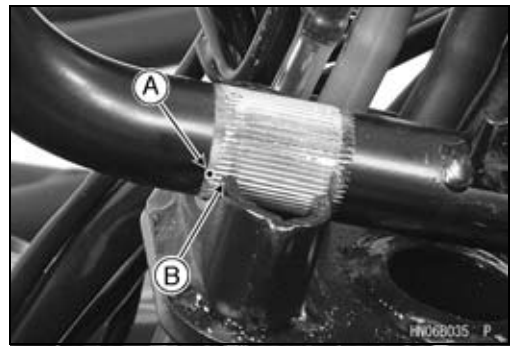
Handlebar Removal

● Remove:
Multifunction Meter Unit (see Multifunction Meter Unit Removal in the Electrical System chapter)
Throttle Case
Front Brake Master Cylinder
Left-hand Switch Housing
Rear Brake Lever Assembly
Handlebar Holder Bolts [A] and Bracket [B]
Handlebar Holders [C]
Handlebar [D]



Handlebar Installation

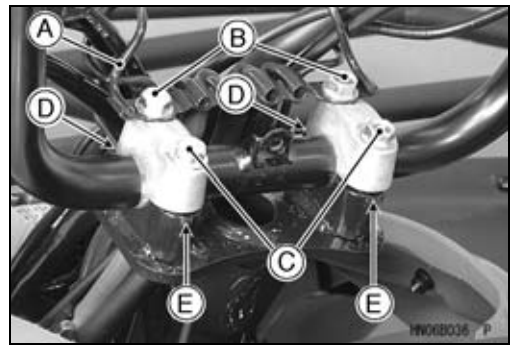
● Align the punch mark [A] on the handlebar with the mating surface end [B] of the steering stem.



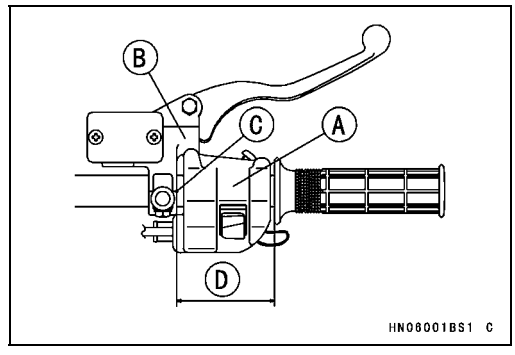
● Install the bracket [A].
● Tighten the holder front bolts [B] first and then the rear bolts [C].

Torque - Handlebar Holder Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)

○If the holder is correctly installed, there will be no gap [D] at the front and an even gap [E] at the rear after tightening.



● Install:
Right Switch Housing (Throttle Case) [A]
Front Master Cylinder [B] (see Front Master Cylinder Installation in the Brakes chapter)
Punch Mark [C]
[D] = 70 mm (2.76 in.)



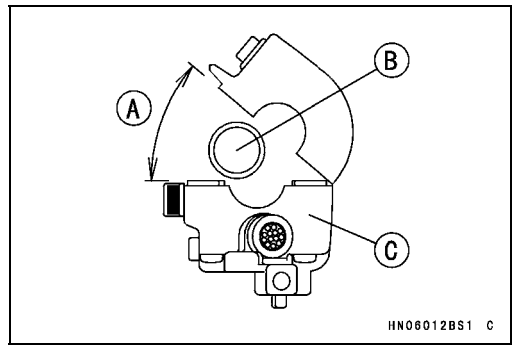
● Install the left switch housing [C] on the handlebar [B] so that the opening angle is 40° [A] or less.

NOTE

○*Do not open the housing more than 40°, the built-in parts in the housing may be damaged.*

● Tighten:

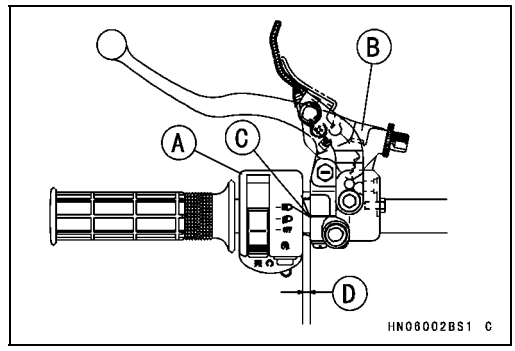
Torque - Left Handlebar Switch Housing Screws: 3.5 N·m (0.36 kgf·m, 31 in·lb)



Handlebar

● Install:
Left Switch Housing [A]
Rear Brake Lever Assembly [B]
Punch Mark [C]
[D] = 6 mm (0.24 in.)

○Apply a non-permanent locking agent to the thread of the variable differential control lever bolt, and tighten it securely.



Frame

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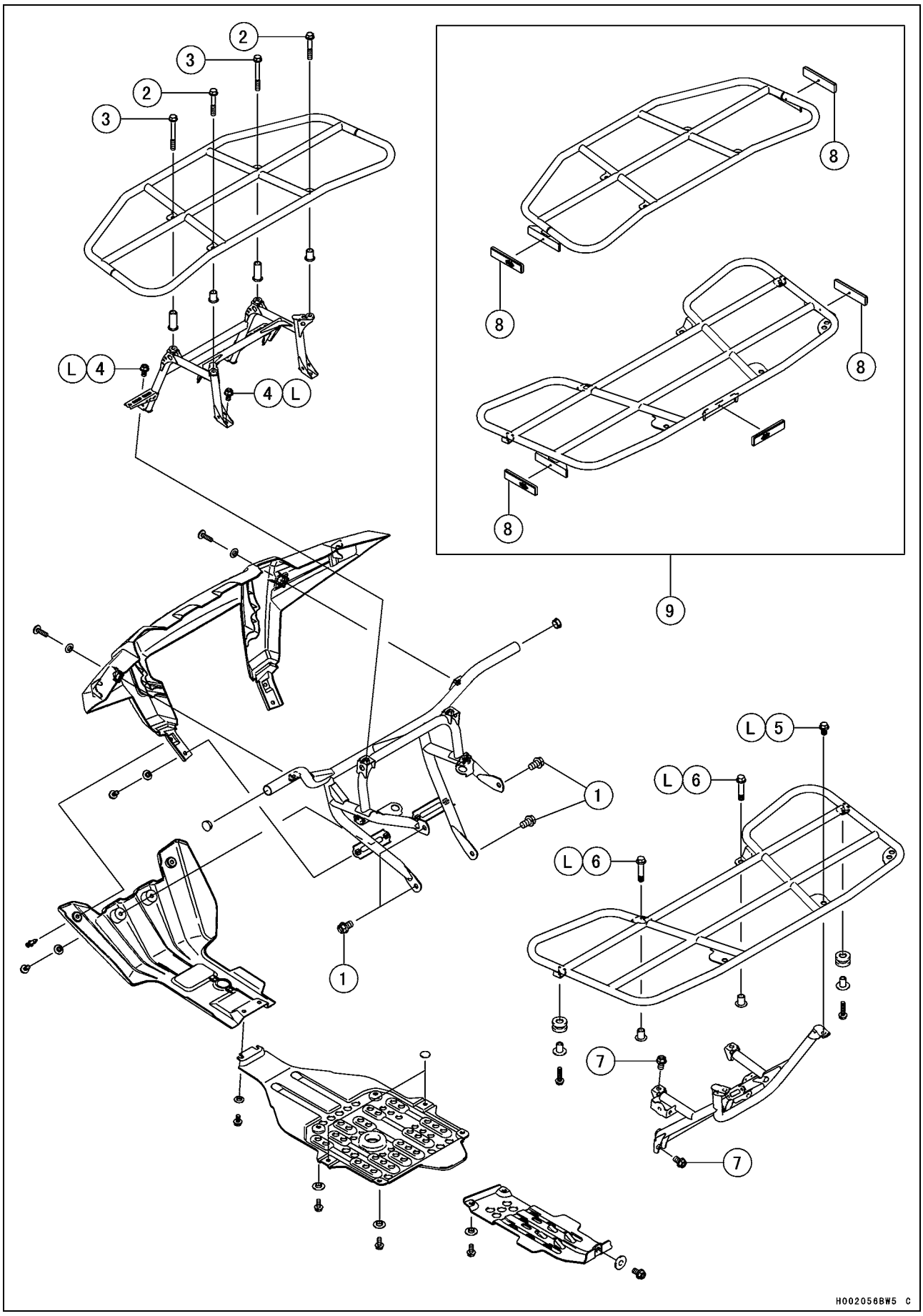
Exploded View

KVF750D8F ~ D9F/E8F ~ E9F/F8F



Exploded View

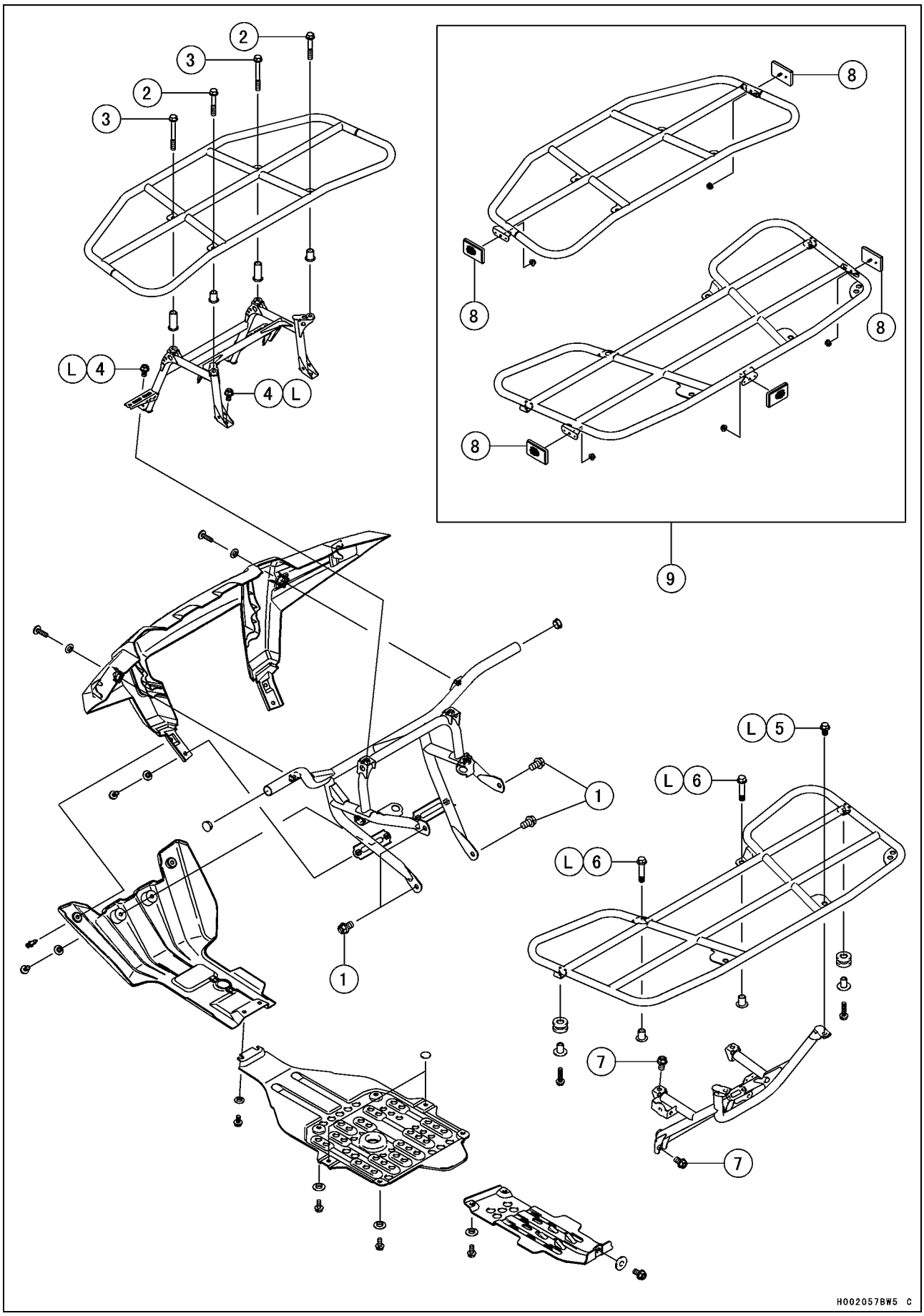
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Guard Bolts	46	4.7	34	
2	Front Carrier Bolts, L = 50 mm (2.0 in.)	32	3.3	24	L
3	Front Carrier Bolts, L = 70 mm (2.8 in.)	32	3.3	24	L
4	Front Carrier Bracket Bolts	32	3.3	24	L
5	Rear Carrier Bolts, L = 14 mm (0.55 in.)	54	5.5	40	L
6	Rear Carrier Bolts, L = 44 mm (1.7 in.)	54	5.5	40	L
7	Rear Carrier Bracket Bolts	46	4.7	34	

8. CA Model
9. CA, EUR and GB Models

L: Apply a non-parmanent locking agent.

Exploded View

KVF750DAF/EAF/FAF ~



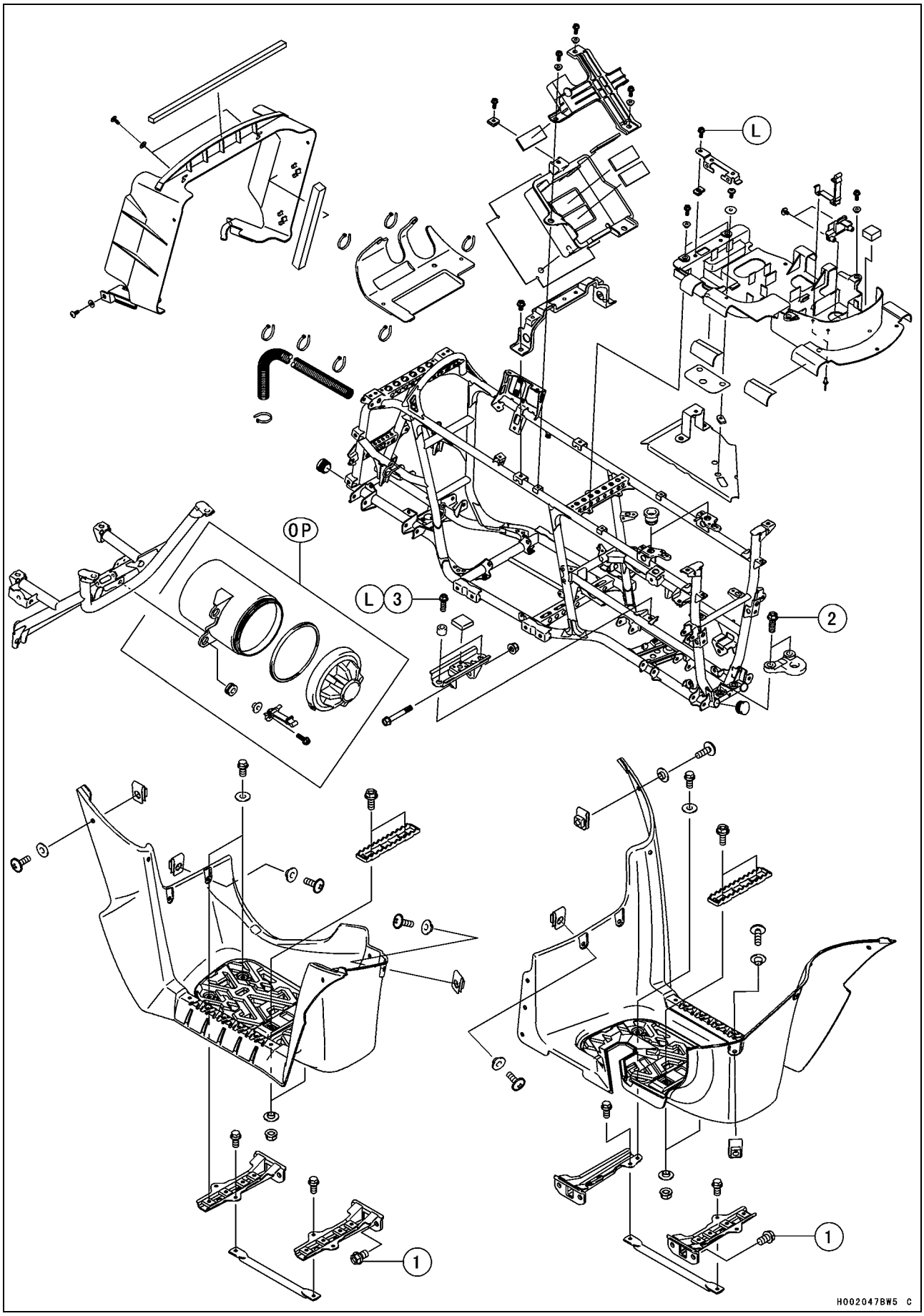
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Guard Bolts	46	4.7	34	
2	Front Carrier Bolts, L = 50 mm (2.0 in.)	32	3.3	24	L
3	Front Carrier Bolts, L = 70 mm (2.8 in.)	32	3.3	24	L
4	Front Carrier Bracket Bolts	32	3.3	24	L
5	Rear Carrier Bolts, L = 14 mm (0.55 in.)	54	5.5	40	L
6	Rear Carrier Bolts, L = 44 mm (1.7 in.)	54	5.5	40	L
7	Rear Carrier Bracket Bolts	46	4.7	34	

8. CA Model
9. CA, EUR and GB Models

L: Apply a non-parmanent locking agent.

Exploded View

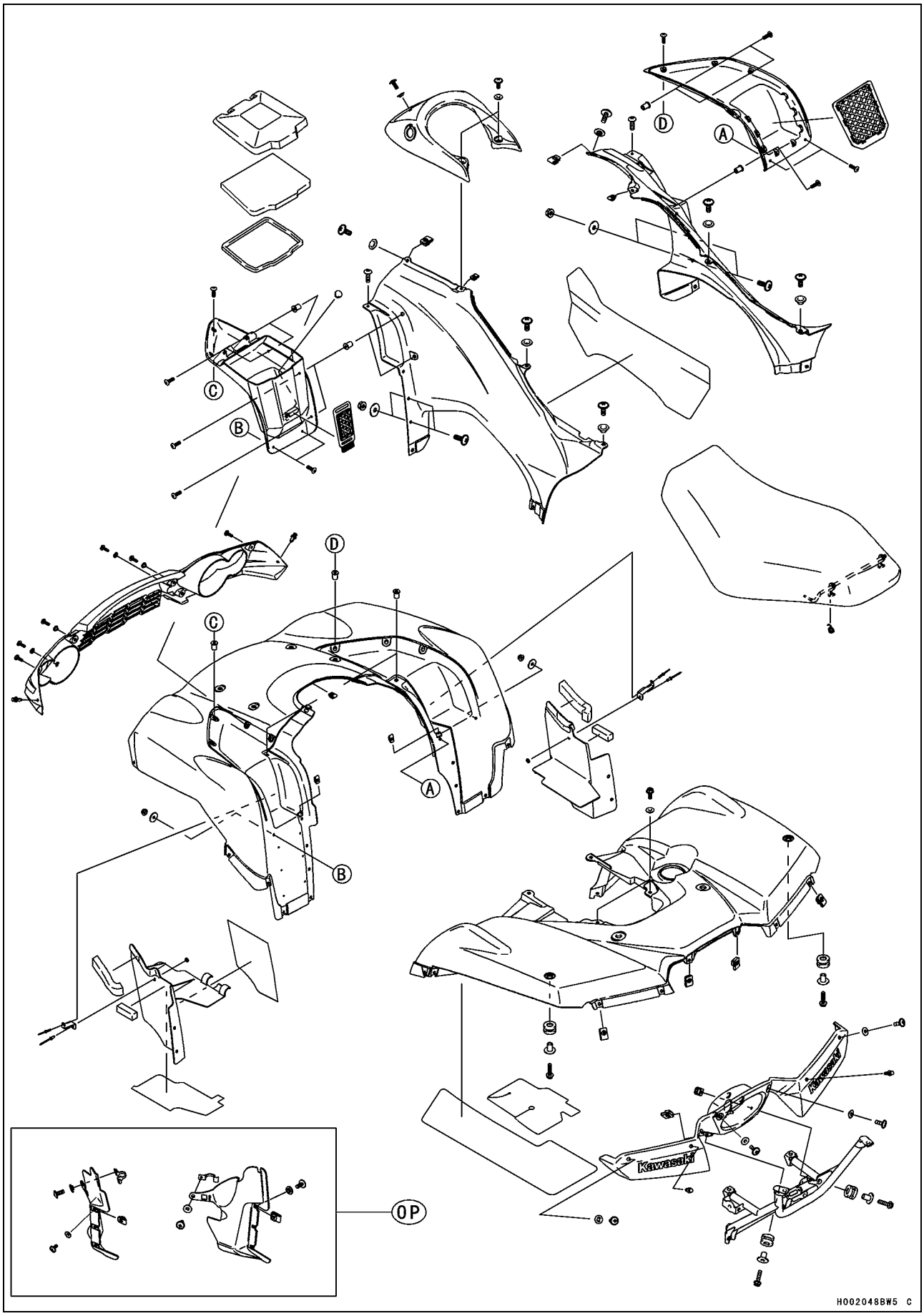


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Footboard Bracket Bolts	46	4.7	34	
2	Trailer Hitch Bracket Bolts	82	8.4	60	L
3	Rear Final Gear Case Mounting Bracket Bolts	59	6.0	44	L

L: Apply a non-permanent locking agent.
OP: Optional Parts

Exploded View



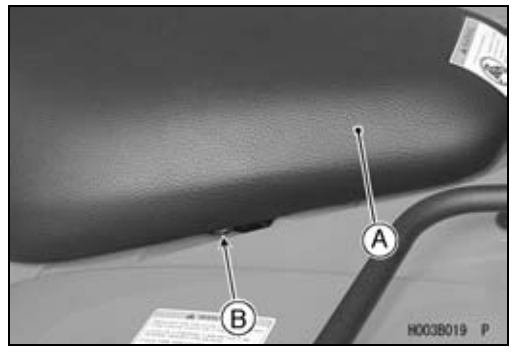
Exploded View

OP: Optional Parts

Seat

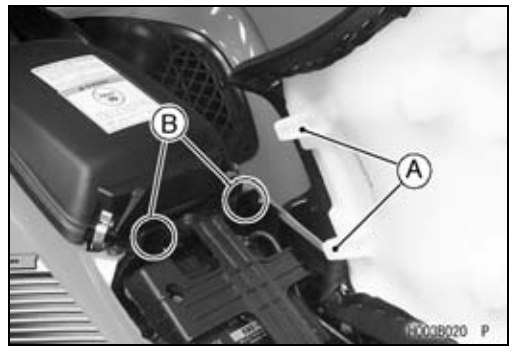
Seat Removal

- Remove the seat [A] by lifting the latch lever [B] and then pulling the seat up to the rear.

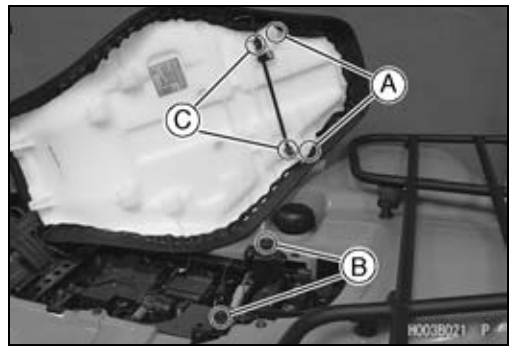


Seat Installation

- Insert the front seat hooks [A] into the receivers [B] in the bracket.

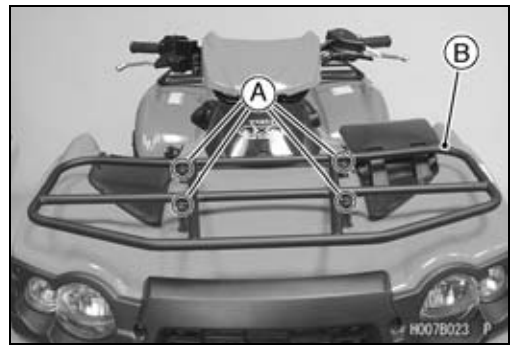


- Insert the rear seat hooks [A] into the dampers [B].
- Push the rear part of the seat down to engage the latches [C].



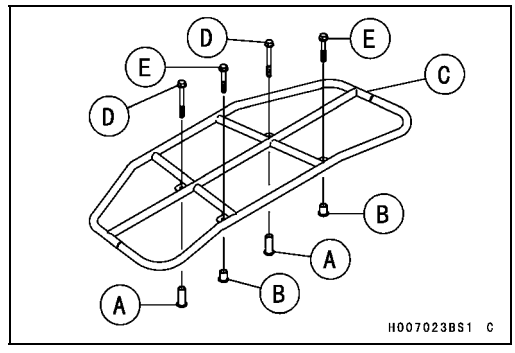
Carriers

Front Carrier Removal



- Remove:
  Front Carrier Bolts [A]
  Collars
  Front Carrier [B]

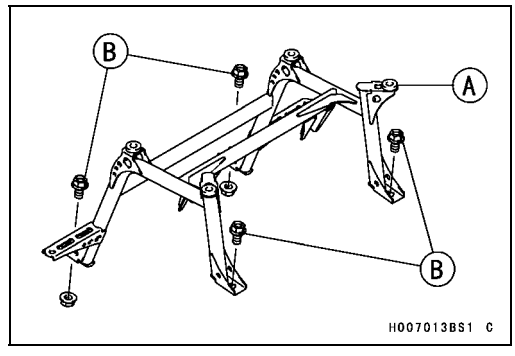
Front Carrier Installation



- Install:
  Long Collars, L = 44.6 mm (1.8 in.) [A]
  Short Collars, L = 21.6 mm (0.9 in.) [B]
  Front Carrier [C]
- Apply a non-parmanent locking agent to the front carrier bolts.
- Tighten:

Torque - Front Carrier Bolts [D], L = 70 mm (2.8 in.): 32 N·m (3.3 kgf·m, 24 ft·lb)
Front Carrier Bolts [E], L = 50 mm (2.0 in.): 32 N·m (3.3 kgf·m, 24 ft·lb)

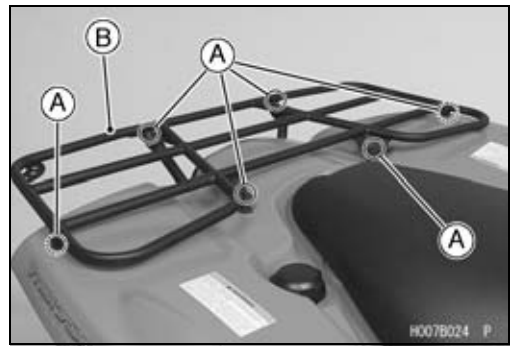
Front Carrier Bracket Installation



- Install:
  Front Carrier Bracket [A]
- Apply a non-permanent locking agent on the thread of the front carrier bracket bolts and tighten them with a specified torque.

Torque - Front Carrier Bracket Bolts [B]: 32 N·m (3.3 kgf·m, 24 ft·lb)

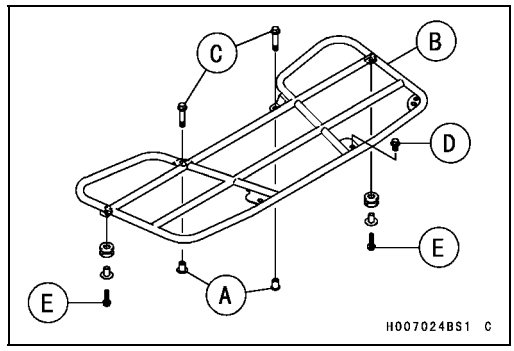
Rear Carrier Removal



- Remove:
  Rear Carrier Bolts [A]
  Collars
  Rear Carrier [B]

Carriers

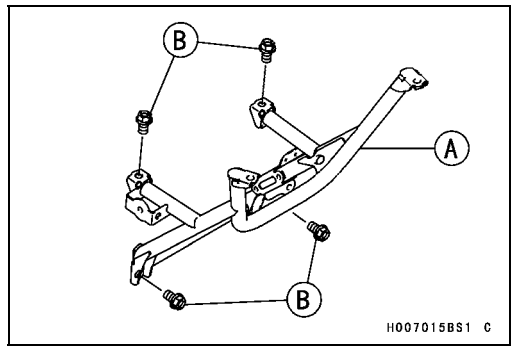
Rear Carrier Installation



- Install:
  Collar [A]
  Rear Carrier [B]
  Rear Carrier Bolts, L = 44 mm (1.7 in.) [C]
  Rear Carrier Bolts, L = 14 mm (0.55 in.) [D]
  Rear Carrier Bolts, L = 25 mm (0.98 in.) [E]
- Apply a non-permanent locking agent on the thread of the rear carrier bolts [C], [D], and tighten them with a specified torque.

Torque - Rear Carrier Bolts [C] [D]: 54 N·m (5.5 kgf·m, 40 ft·lb)

Rear Carrier Bracket Installation

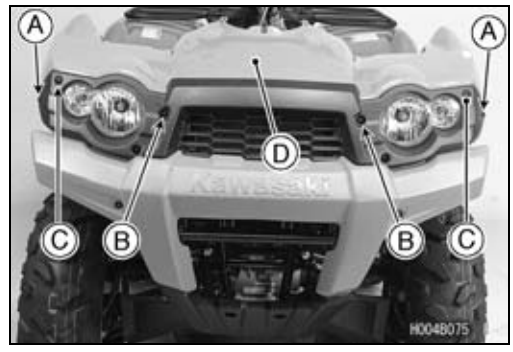


- Install:
  Rear Carrier Bracket [A]
- Tighten:

Torque - Rear Carrier Bracket Bolts [B]: 46 N·m (4.7 kgf·m, 34 ft·lb)

Fenders

Front Fender Removal

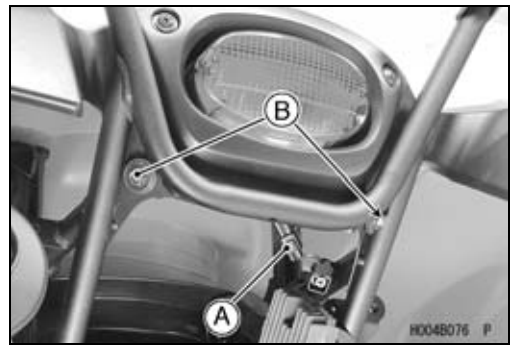


- Remove:
  - Seat (see Seat Removal)
  - Front Carrier (see Front Carrier Removal)
  - Footboard (see each Footboard Removal)
  - Middle Cover (see Middle Cover Removal)
  - Quick Rivets [A] (both sides)
  - Bolts [B] and Collars
  - Bolts [C]
- While pulling the front fender [D] backward, remove it.

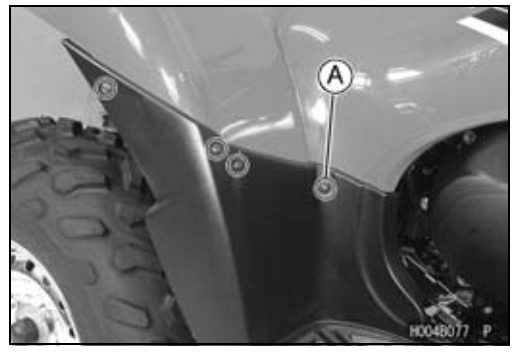
Front Fender Installation

- Install:
  - Front Fender
  - Screws and Collars
  - Quick Rivets

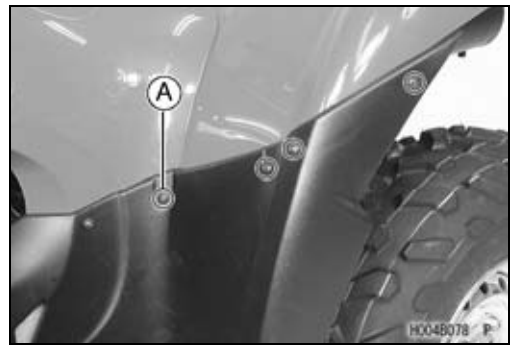
Rear Fender Removal



- Remove:
  - Seat (see Seat Removal)
- Disconnect:
  - Tail/Brake Light Lead Connector [A]
- Remove:
  - Bolts [B] and Collars



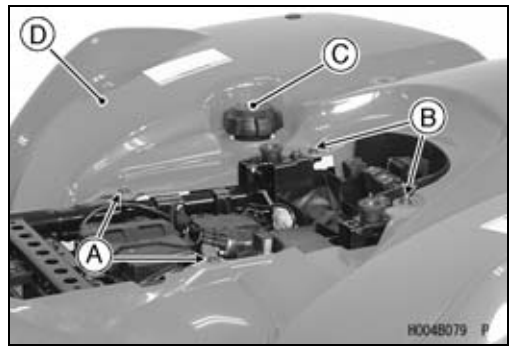
- Remove:
  - Seat (see Seat Removal)
  - Rear Carrier (see Rear Carrier Removal)
  - Screws [A] and Collars



- Remove:
  - Screws [A] and Collars

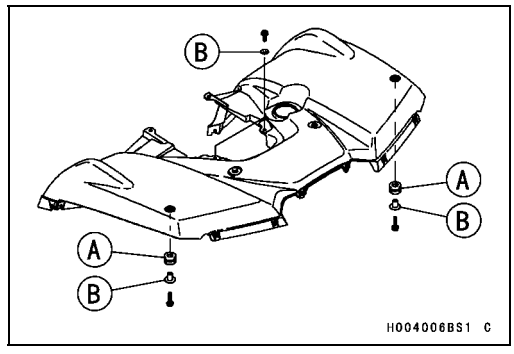
Fenders

- Remove:
  Screws [A] and Collars
  Bolts [B] and Collars
  Fuel Tank Cap [C]
  Rear Fender [D]
- Install the fuel tank cap after removing the rear fender.



Rear Fender Installation

- Connect:
  Tail/Brake Light Lead Connector
- Install:
  Rear Fender
  Dampers [A] and Collars [B]
  Rear Carrier (see Rear Carrier Installation)



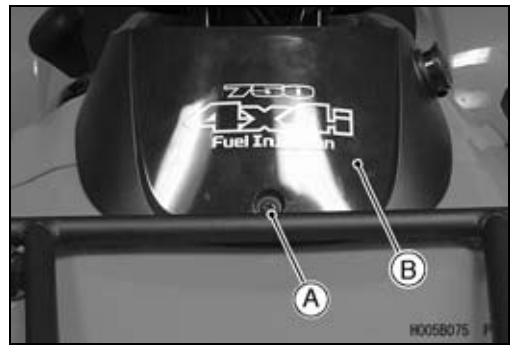
Covers

Middle Cover Removal

- Disconnect:
  Power Outlet Lead Connectors [A]

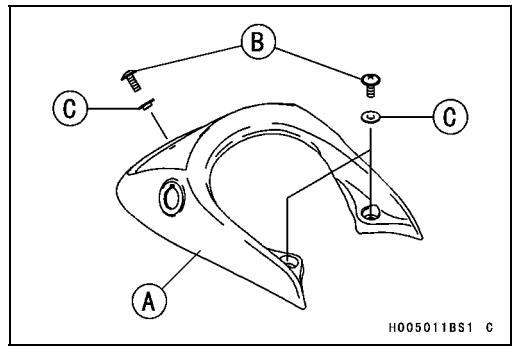
- Remove:
  Middle Cover Screws [A] and Collars

- Remove:
  Middle Cover Screw [A] and Collar
  Middle Cover [B]



Middle Cover Installation

- Connect:
  Power Outlet Lead Connectors
- Install:
  Middle Cover [A]
  Middle Cover Screws [B] and Collars [C]

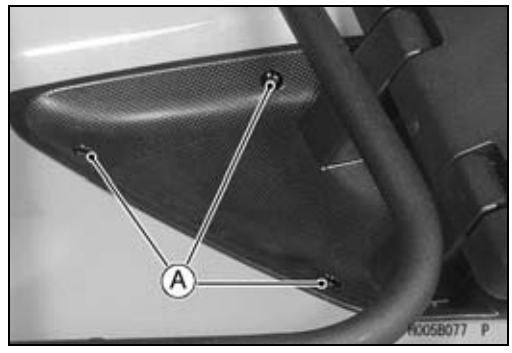


Storage Box Removal

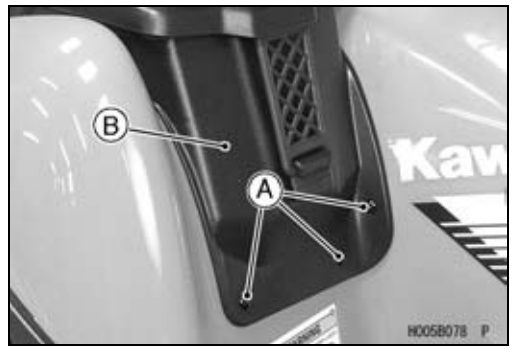
- Open the lid.
- Remove the screws [A].

Covers

● Remove:
Screws [A]

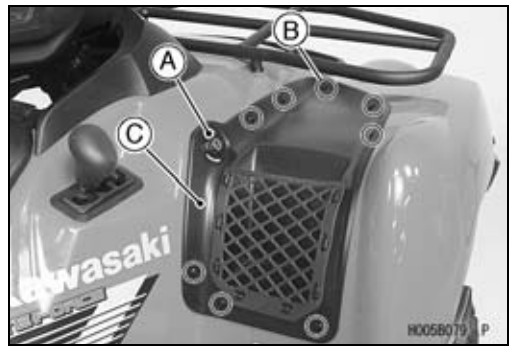


● Remove:
Screws [A]
Storage Box [B]



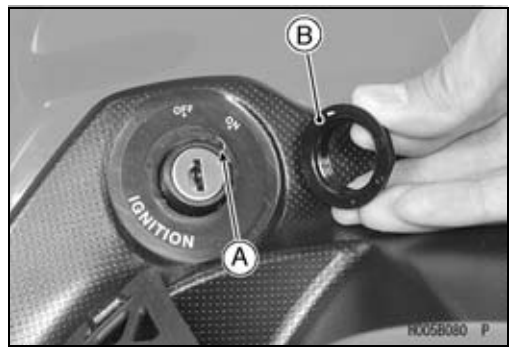
Storage Case Removal

● Remove:
Ignition Switch Nut [A]
Screws [B]
Storage Case [C]



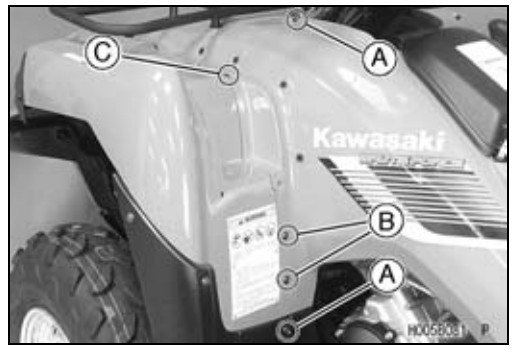
Storage Case Installation

● Install:
Storage Case
Screws
● Fit projection [A] on the ignition switch into the recess in the storage case.
● Tighten the nut [B] securely.



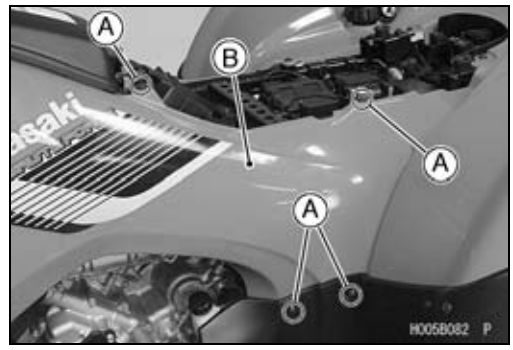
Left Side Cover Removal

● Remove:
Seat (see Seat Removal)
Middle Cover (see Middle Cover Removal)
Storage Box (see Storage Box Removal)
● Remove:
Screws [A] and Collars
Screws [B], Washers and Nuts
Screws [C]



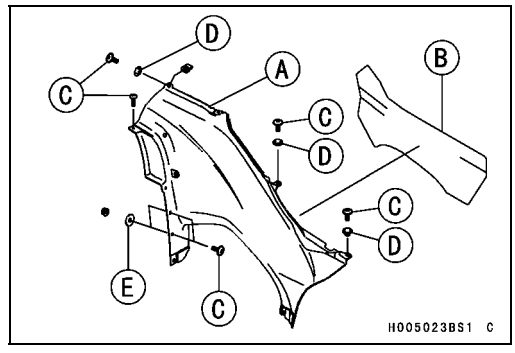
Covers

● Remove:
Screws [A] and Collars
Left Side Cover [B]



Left Side Cover Installation

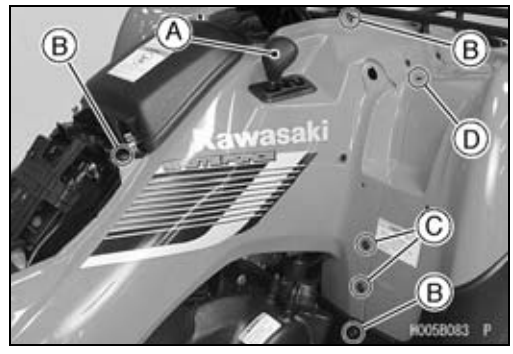
● Install:
Left Side Cover [A]
Insulator [B]
Screws [C] and Collars [D]
Washers [E]
Storage Case



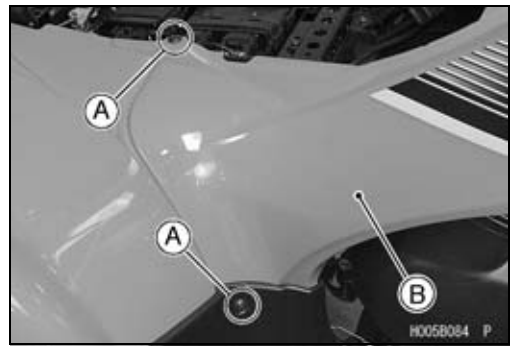
Right Side Cover Removal

● Remove:
Seat (see Seat Removal)
Middle Cover (see Middle Cover Removal)
Storage Case (see Storage Case Removal)

● Remove:
Shift Knob [A]
Screws [B] and Collars
Screws [C], Washers and Nuts
Screws [D]

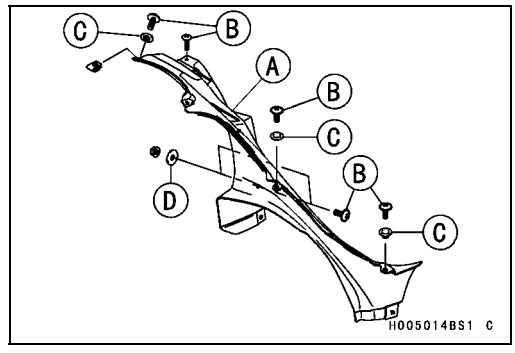


● Remove:
Screws [A] and Collars
Right Side Cover [B]



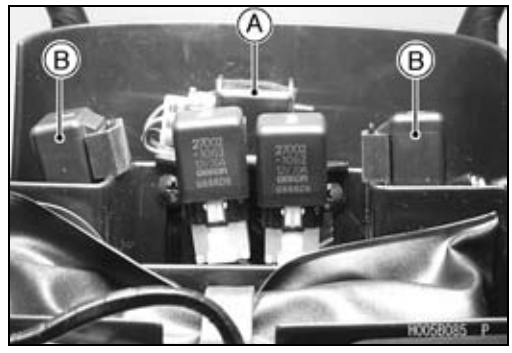
Right Side Cover Installation

● Install:
Right Side Cover [A]
Screws [B] and Collars [C]
Washer [D]

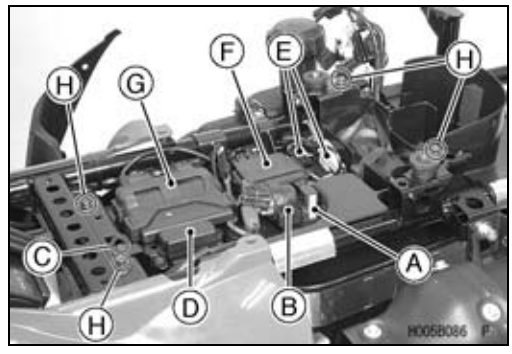


Covers

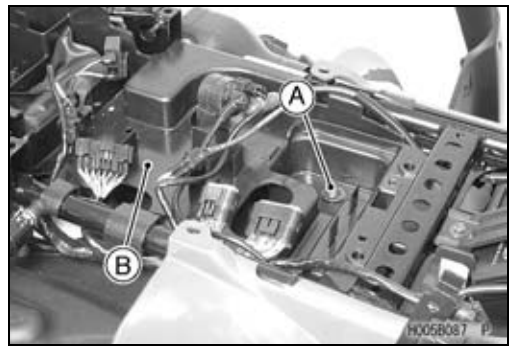
Electrical Parts Case Removal



- Remove:
  Seat (see Seat Removal)
  Rear Fender (see Rear Fender Removal)
  Vehicle-down Sensor [A] (see Vehicle-down Sensor Removal in the Fuel System (DFI) chapter)
  Stater Control Relays [B]



- Remove the following parts from the case.
  Radiator Fan Breaker [A]
  Starter Relay [B]
  Fuse Box Bracket Bolt [C]
  Fuse Box [D]
  Reset Connectors [E]
  Actuator Controller [F]
  ECU [G]
  Bolts [H]

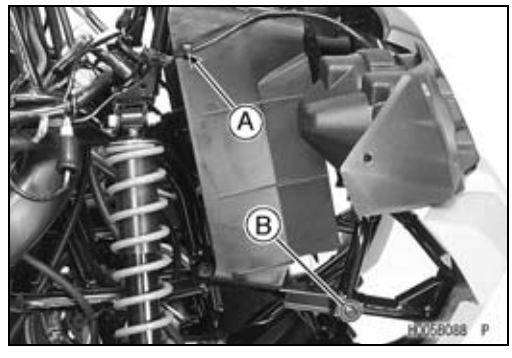


- Remove:
  Screw [A] and Collar
  Bolts [B]
  Electrical Parts Case [B]

Electrical Parts Case Installation

- Apply a non-parmanent agent to the fuse box bracket bolt.
- Install:
  Removed Parts
- Route the electrical parts leads according to the Appendix chapter.

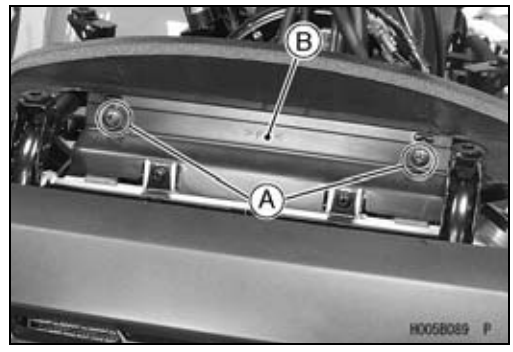
Radiator Cover Removal



- Remove:
  Front Fender (see Front Fender Removal)
  Clamps [A] (both sides)
  Radiator Cover Screws [B] and collars (both sides)

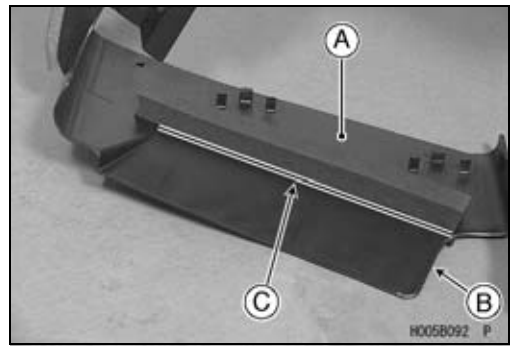
Covers

- Remove:
  Radiator Cover Screws [A] and Collars
  Radiator Cover [B]



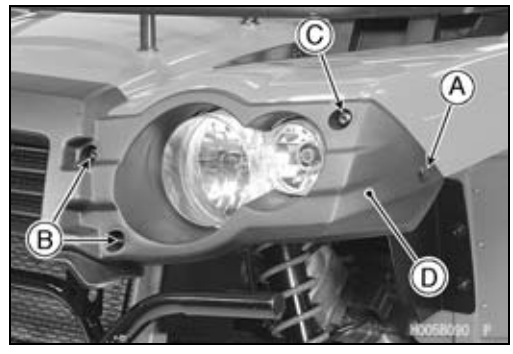
Radiator Cover Installation

- Install the seal [A] so that along it to the bottom [B] and corner line [C].
- Install:
  Radiator Cover Screws and Collars



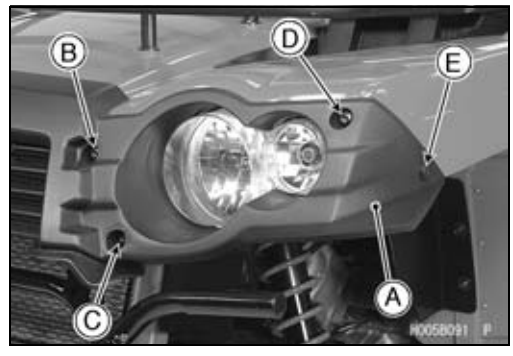
Headlight Cover Removal

- Remove:
  Front Guard Cover (see Front Guard Removal)
  Quick Rivets [A] (both sides)
  Bolts [B] and Collars (both sides)
  Bolts [C] (both side)
  Headlight Cover [D]



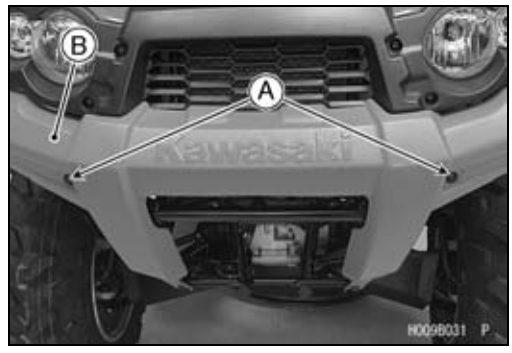
Headlight Cover Installation

- Install:
  Headlight Cover [A]
  Bolts and Collars [B] [L = 6 mm (0.24 in.)]
  Bolts and Collars [C] [L = 4 mm (0.16 in.)]
  Bolts [D]
  Quick Rivets [E]

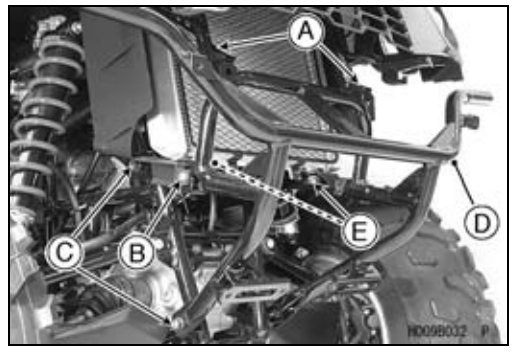


Guards

Front Guard Removal

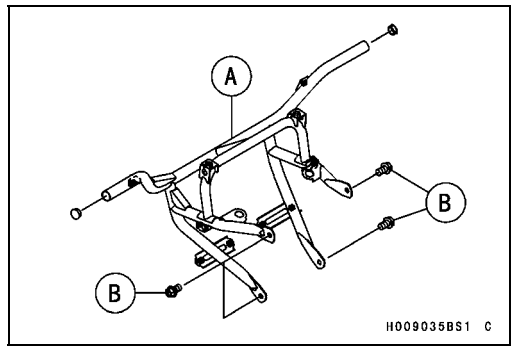


- Remove:
  Front Bottom Guard (see Front Bottom Guard Removal)
  Bolts [A] and Collars
  Front Guard Cover [B]



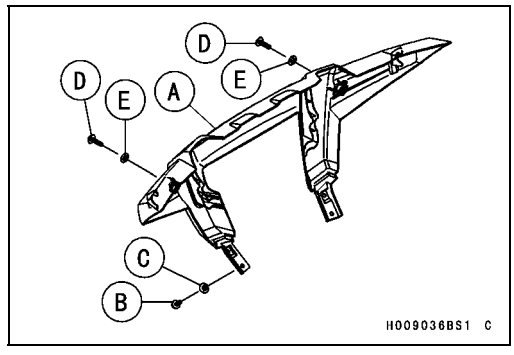
- Remove:
  Front Carrier Bracket Bolts [A]
  Radiator Cover Screws [B] and Collars (both sides)
  Front Guard Bolts [C] (both sides)
- Remove the front guard [D] from the radiator bottom stoppers [E].

Front Guard Installation



- Insert the radiator bottom stoppers in the grommet in the front guard.
- Install:
  Front Guard [A]
  Front Guard Bolts [B]
- Apply a non-parmanent locking agent to the front carrier bracket bolts.
- Tighten:

Torque - Front Guard Bolts: 46 N·m (4.7 kgf·m, 34 ft·lb)
Front Carrier Bracket Bolts: 32 N·m (3.3 kgf·m, 24 ft·lb)

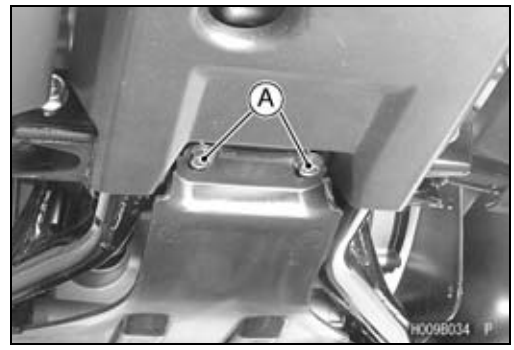


- Install:
  Radiator Cover Screws
  Front Guard Cover [A]
  Bolts [B] and Collars [C]
  Bolts [D] and Collars [E]

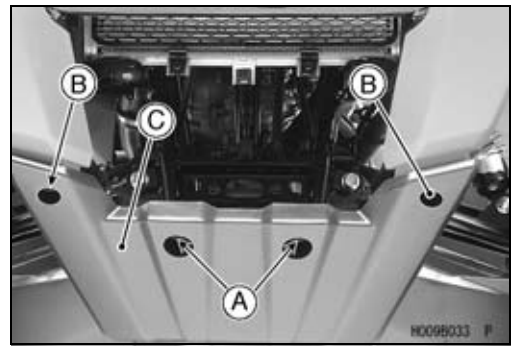
Guards

Front Bottom Guard Removal

- Remove:
  Bolts [A] and Collars

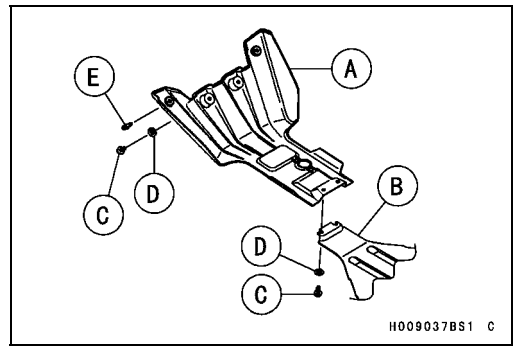


- Remove:
  Bolts [A] and Collars
  Quick Rivets [B]
  Front Bottom Guard [C]



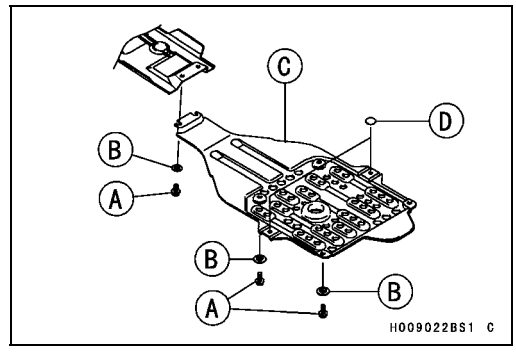
Front Bottom Guard Installation

- Install the front bottom guard [A] between the frame and engine bottom guard [B].
- Install:
  Bolts [C] and Collars [D]



Engine Bottom Guard Removal

- Remove:
  Bolts [A] and Collars [B]
  Engine Bottom Guard [C]

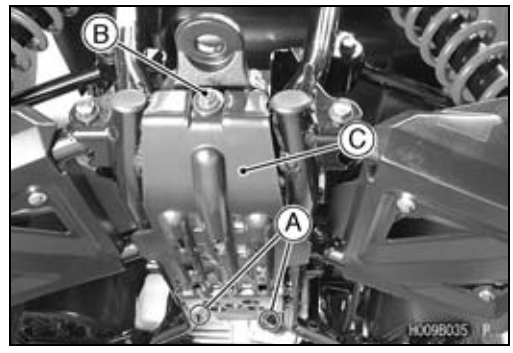


Engine Bottom Guard Installation

- Confirm:
  Damper [D]
- Install:
  Engine Bottom Guard
  Bolts and Collars

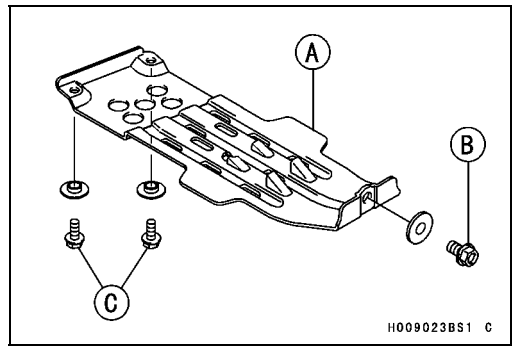
Guards

Rear Bottom Guard Removal



- Remove:
  Bolts (M6) [A] and Collars
  Bolt (M8) [B] and Collar
  Rear Bottom Guard [C]

Rear Bottom Guard Installation

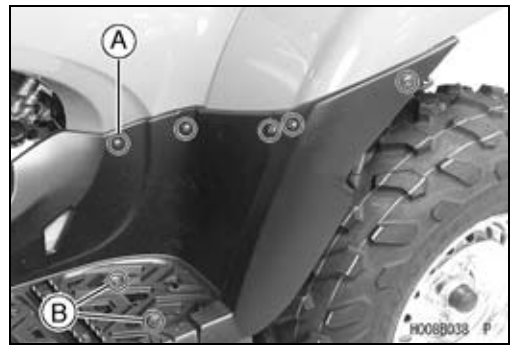


- Install:
  Rear Bottom Guard [A]
  Bolt (M8) [B] and Collar
  Bolts (M6) [C] and Collars

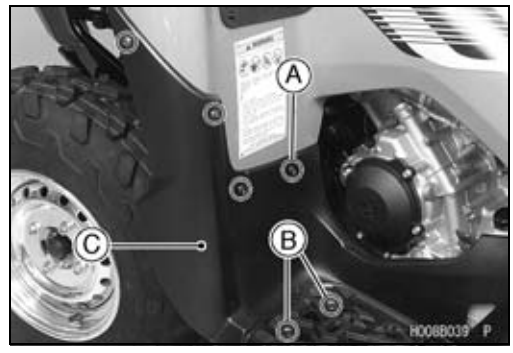
Flaps and Footboards

Left Footboard Removal

- Remove:
  Screws [A] and Collars
  Bolts [B] and Collars

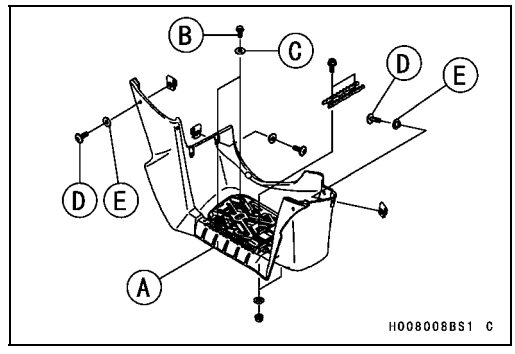


- Remove:
  Screws [A] and Collars
  Bolts [B] and Collars
  Left Footboard [C]



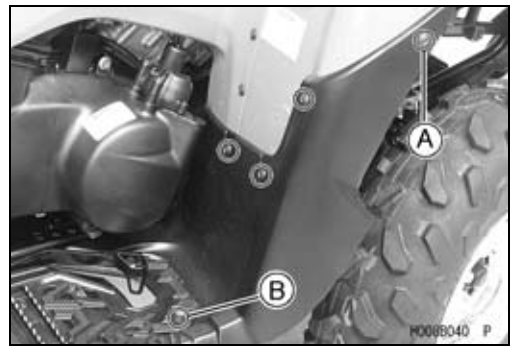
Left Footboard Installation

- Install:
  Left Footboard [A]
  Bolts [B] and Collars [C]
  Screws [D] and Collars [E]

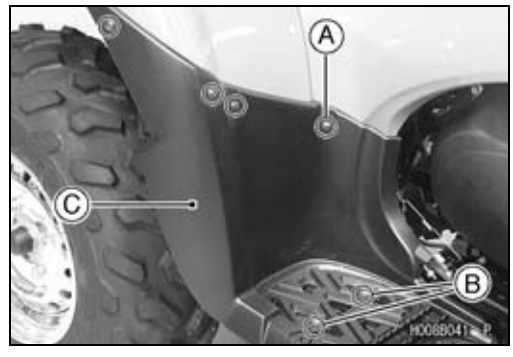


Right Footboard Removal

- Remove:
  Screws [A] and Collars
  Bolt [B] and Collar

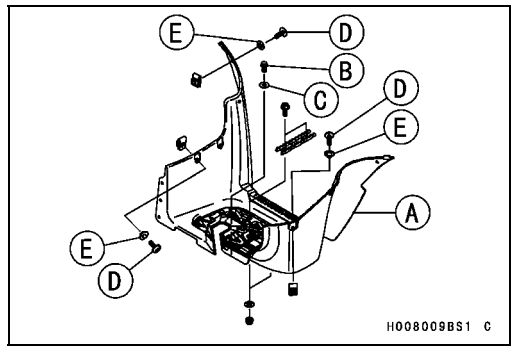


- Remove:
  Screws [A] and Collars
  Bolts [B] and Collars
  Right Footboard [C]



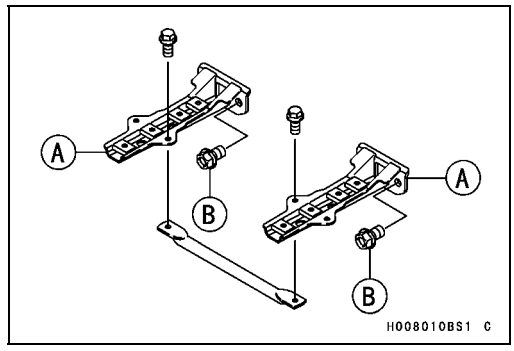
Flaps and Footboards

Right Footboard Installation



- Install:
  Right Footboard [A]
  Bolts [B] and Collars [C]
  Screws [D] and Collars [E]

Footboard Bracket installation

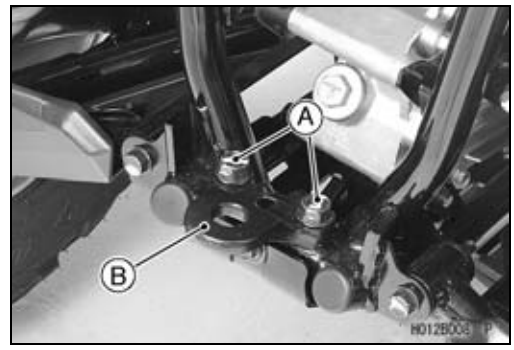


- Install:
  Footboard Bracket [A]
- Tighten:

Torque - Footboard Bracket Bolts [B]: 46 N·m (4.7 kgf·m, 34 ft·lb)

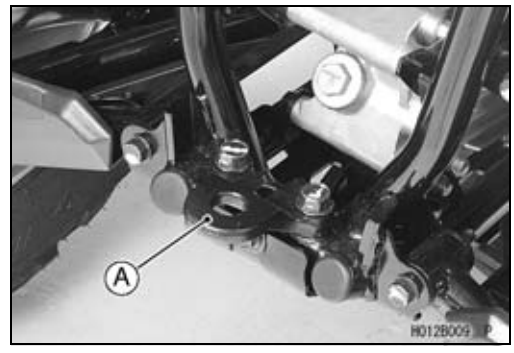
Trailer Hitch Bracket

Trailer Hitch Bracket Removal



- Remove:
  Trailer Hitch Bracket Bolts [A]
  Trailer Hitch Bracket [B]

Trailer Hitch Bracket Installation



- Install the trailer hitch bracket [A] as shown.
- Apply a non-parmanent locking agent to the trailer hitch bracket bolts.
- Tighten:

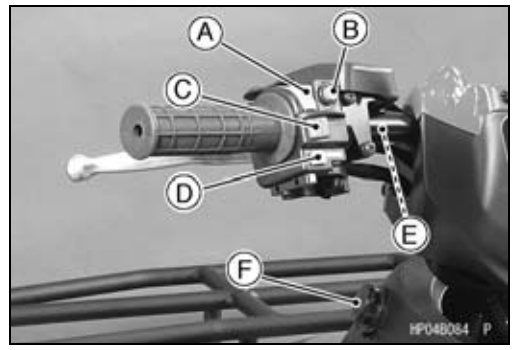
Torque - Trailer Hitch Bracket Bolts: 82 N·m (8.4 kgf·m, 60 ft·lb)

Electrical System

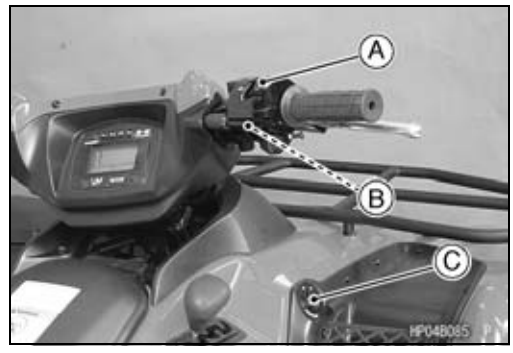
Table of Contents

Parts Location

Light/Dimmer Switch [A]
Starter Button [B]
Engine Stop Switch [C]
Reverse Power Assist Switch (Override) [D]
Rear Brake Light Switch [E]
Power Outlet Connector [F] (120 W)

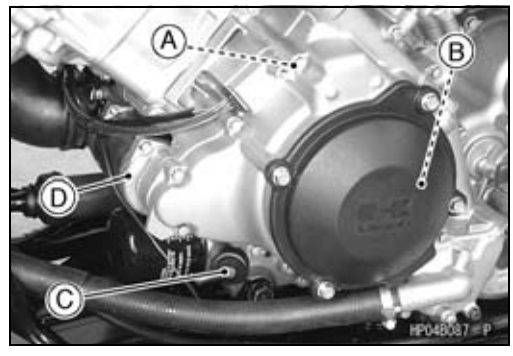


2WD/4WD Shift Switch [A]
Front Brake Light Switch [B]
Ignition Switch [C]

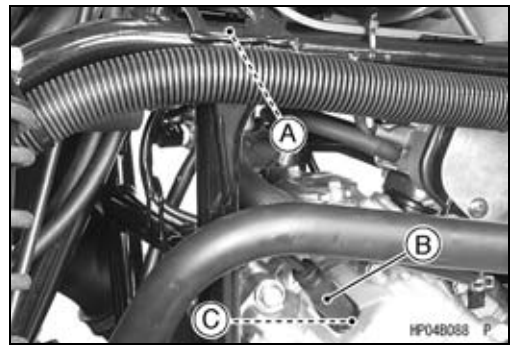


Radiator Fan [A]
Frame Ground [B]

Crankshaft Sensor [A]
Alternator [B]
Oil Pressure Warning Light Switch [C]
Starter Motor [D]

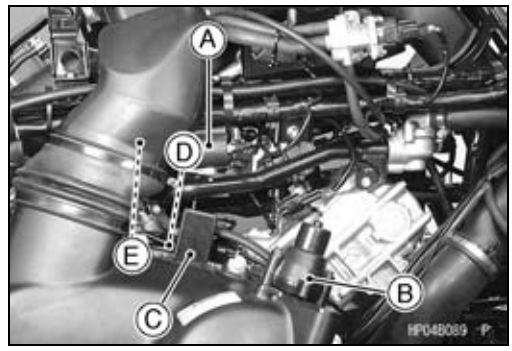


Ignition Coil (Front) [A]
Spark Plug Cap (Front) [B]
Spark Plug (Front) [C]

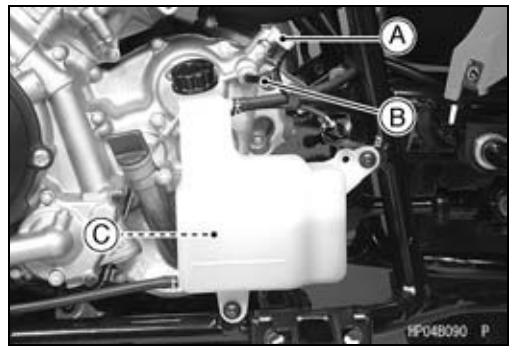


Parts Location

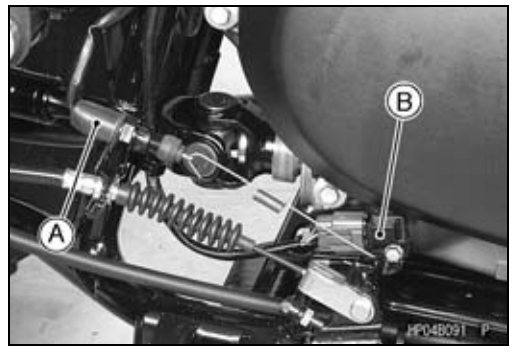
Ignition Coil (Rear) [A]
Engine Brake Actuator [B]
Drive Belt Failure Detection Switch [C]
Engine Ground [D]
Spark Plug Cap (Rear) [E]



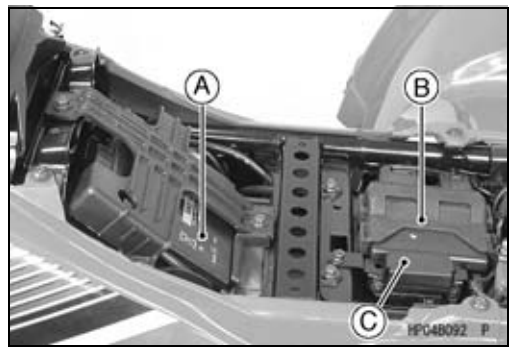
Neutral Position Switch [A]
Reverse Position Switch [B]
Forward/Reverse Detecting Sensor [C]



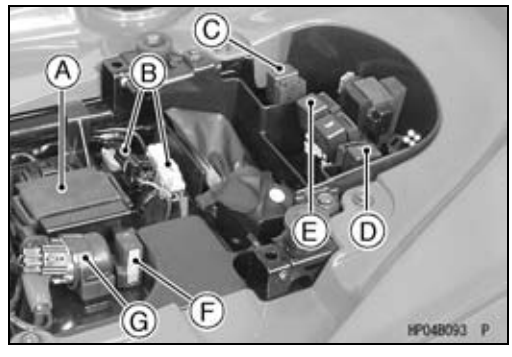
Rear Brake Light Switch [A]
Speed Sensor [B]



Battery 12 V 12 Ah [A]
ECU (Electronic Control Unit) [B]
Fuse Box [C]

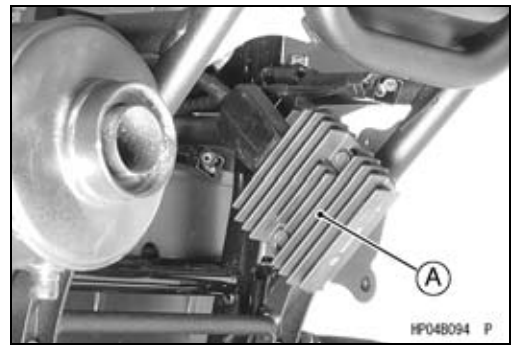


Actuator Controller [A]
Reset Connectors [B]
Starter Control Relay (Neutral) [C]
Starter Control Relay (Brake) [D]
Radiator Fan Relay [E]
Radiator Fan Breaker [F]
Starter Relay [G]

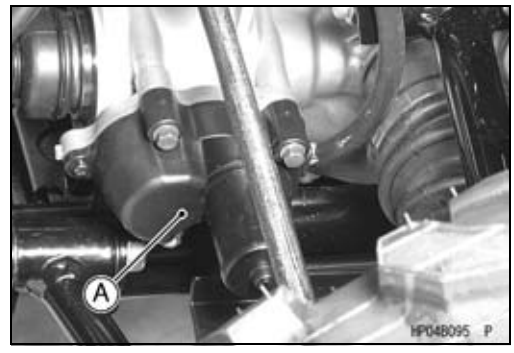


Parts Location

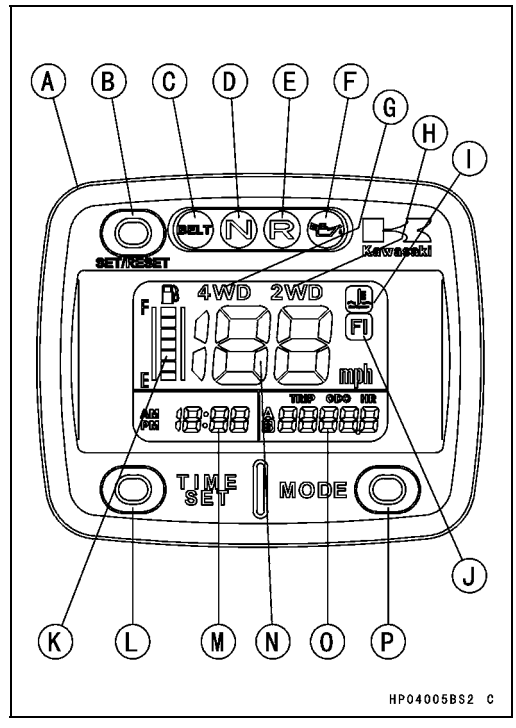
Regulator/Rectifier [A]



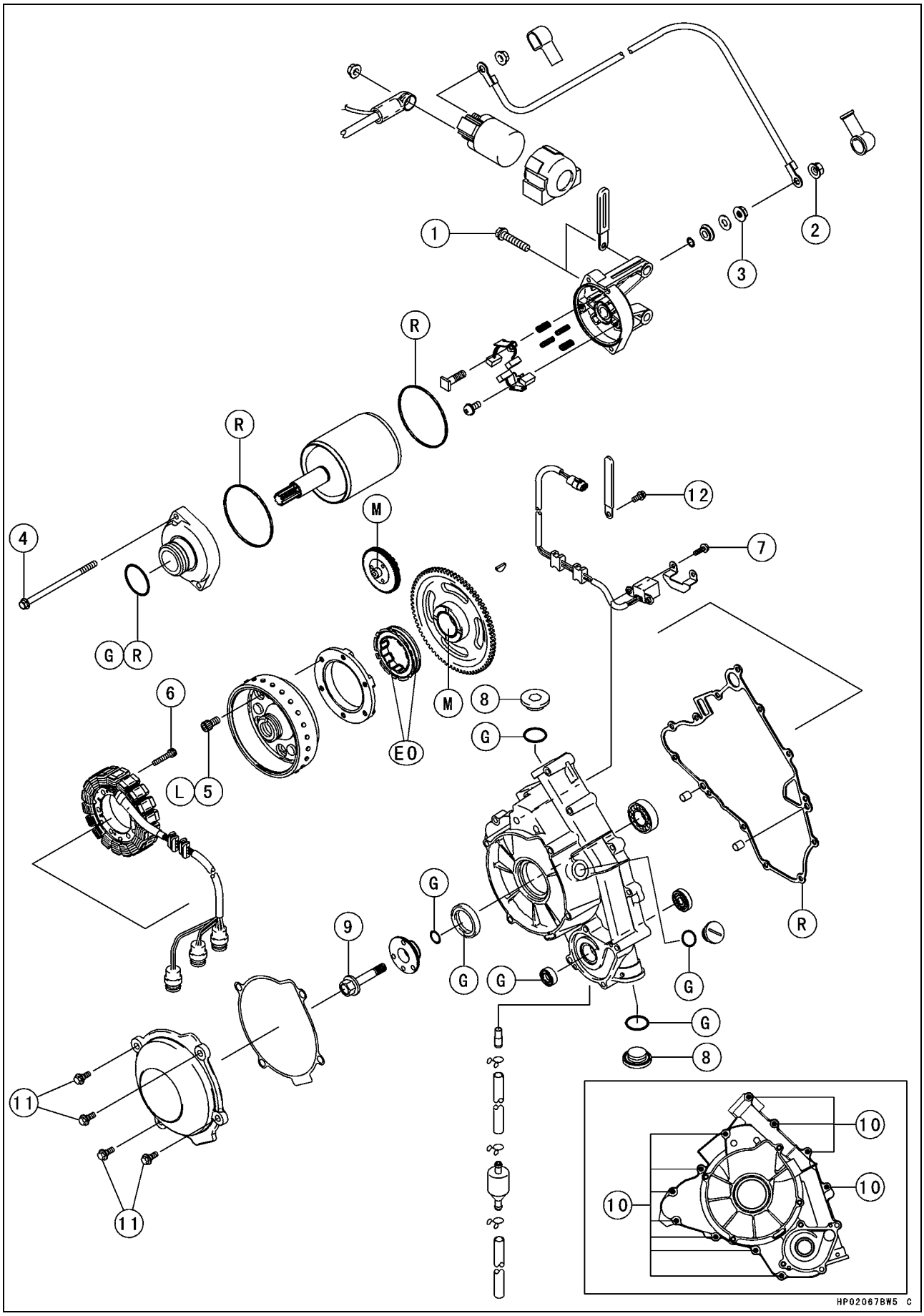
2WD/4WD Actuator [A]



Multifunction Meter [A]
“SET/RESET” Button [B]
Belt Check Indicator Light [C]
Neutral Indicator Light [D]
Reverse Indicator Light [E]
Oil Pressure Warning Indicator Light [F]
“4WD” Indicator Light [G]
“2WD” Indicator Light [H]
Water Temperature Warning Symbol [I]
FI Indicator Light [J]
Fuel Level Gauge [K]
“TIME SET” Button [L]
Clock [M]
Speedometer [N]
Trip Meter/Odometer/Hour Meter [O]
“MODE” Button [P]



Exploded View

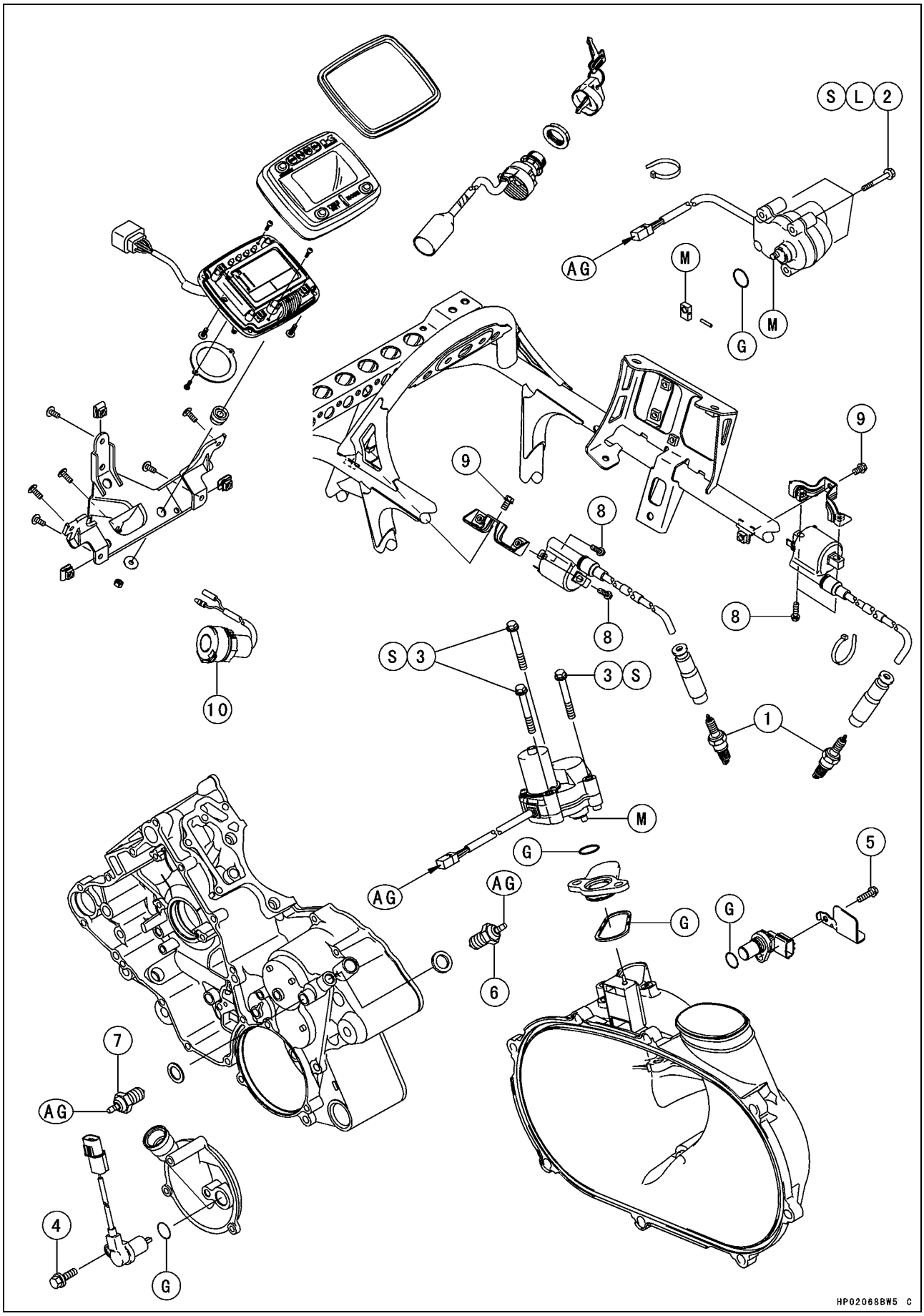


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	
2	Starter Motor Cable Mounting Nut	6.8	0.69	60 in·lb	
3	Starter Motor Terminal Locknut	11	1.1	97 in·lb	
4	Starter Motor Through Bolts	5.0	0.51	44 in·lb	
5	Starter Motor Clutch Bolts	34	3.5	25	L
6	Alternator Stator Bolts	13.5	1.4	119 in·lb	
7	Crankshaft Sensor Mounting Bolts	5.9	0.60	52 in·lb	
8	Alternator Cover Plugs	17.5	1.8	13	
9	Alternator Rotor Bolt	127	13	94	
10	Alternator Cover Bolts	8.8	0.90	78 in·lb	
11	Alternator Outer Cover Bolts	5.9	0.60	52 in·lb	L
12	Harness Clamp Bolt	8.8	0.90	78 in·lb	

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
R: Replacement Parts

Exploded View

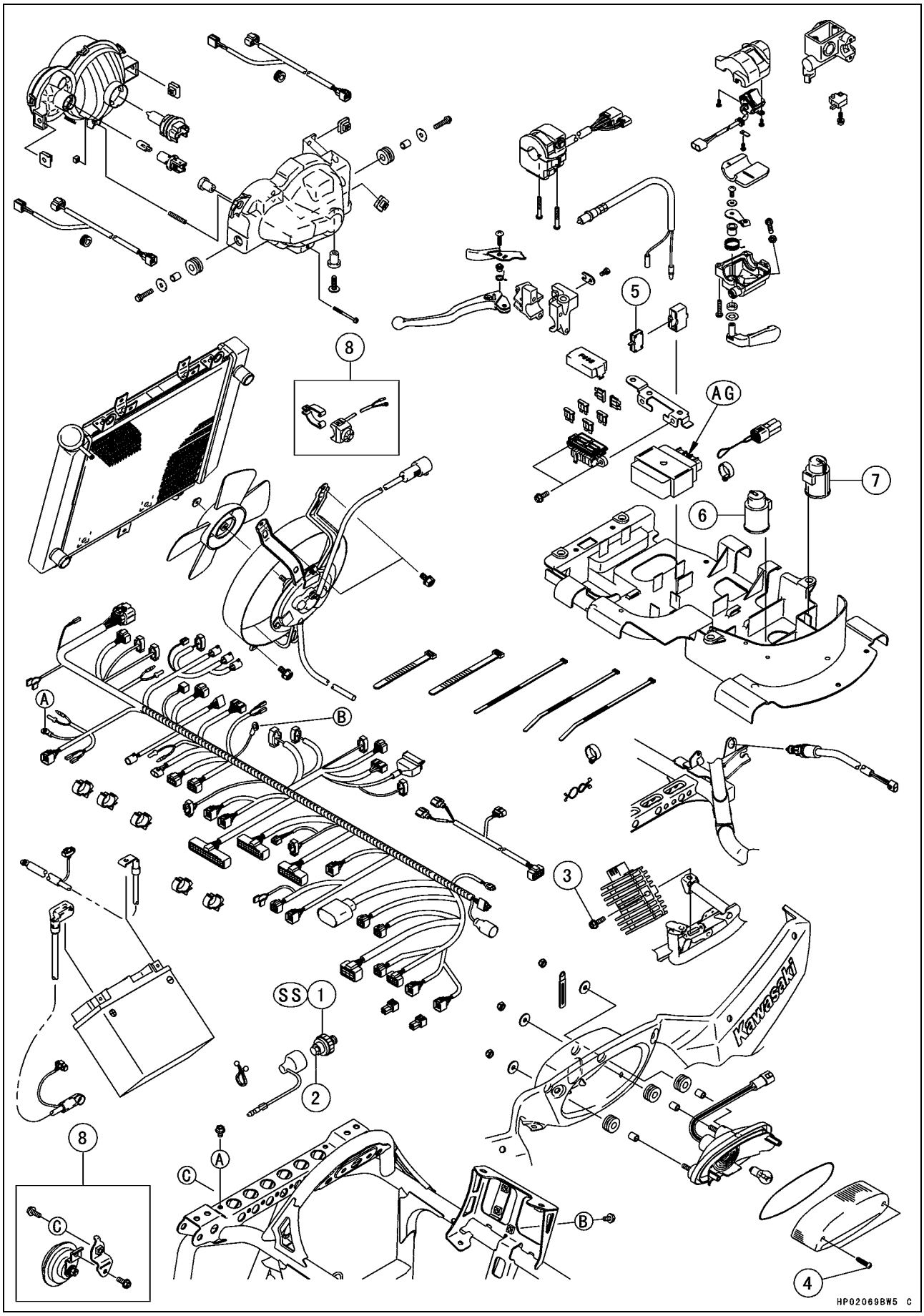


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Spark Plugs	13	1.3	115 in·lb	
2	2WD/4WD Actuator Mounting Bolts	9.8	1.0	87 in·lb	L, S
3	Engine Brake Actuator Mounting Bolts	8.8	0.90	78 in·lb	S
4	Forward/Reverse Detecting Sensor Mounting Bolt	14.9	1.5	11	
5	Speed Sensor Mounting Bolt	8.8	0.90	78 in·lb	
6	Neutral Position Switch	15	1.5	11	
7	Reverse Position Switch	15	1.5	11	
8	Ignition Coil Mounting Bolts	5.9	0.60	52 in·lb	
9	Ignition Coil Bracket Mounting Bolts	5.9	0.60	52 in·lb	

10. Power Outlet Connector (120 W)
AG: Apply grease (Chevron Black Pearl Green EP).
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
S: Follow the specific tightening sequence.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Pressure Switch	15	1.5	11	SS
2	Oil Pressure Switch Terminal Bolt	1.5	0.15	13 in·lb	
3	Regulator/Rectifier Mounting Bolts	8.8	0.90	78 in·lb	
4	Tail/Brake Light Lens Screws	1.0	0.10	8.8 in·lb	

5. Radiator Fan Breaker
6. Starter Control Relay (Brake)
7. Starter Control Relay (Neutral)
8. Other than US and CA Models

AG: Apply grease (Amoco rykon premium grease No.2 EP Green).
SS: Apply silicone sealant (Liquid Gasket, TB1211: 56019-120).

Specifications

Item	Standard	Service Limit
Battery		
Type	Sealed Battery	– – –
Model Name	KMX14-BS	– – –
Capacity	12 V 12 Ah	– – –
Voltage	12.8 V or more	– – –
Charging System		
Alternator Type	Three-phase AC	– – –
Charging Voltage	14 ~ 15 V	– – –
(Regulator/Rectifier Output Voltage)		
Alternator Output Voltage	54 ~ 80 V @4 000 r/min (rpm)	– – –
Stator Coil Resistance	0.25 ~ 0.37 Ω	– – –
Ignition System		
Spark Plug:		
Spark Plug Gap	0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)	– – –
Spark Plug Cap Resistance	3.75 ~ 6.25 kΩ	– – –
Ignition Coil:		
3 Needle Arcing Distance	7 mm (0.28 in.) or more	– – –
Primary Winding Resistance	2.1 ~ 2.5 Ω	– – –
Secondary Winding Resistance	10 ~ 16 kΩ	– – –
Primary Peak Voltage	130 V or more	– – –
Crankshaft Sensor Resistance	423 ~ 517 Ω	– – –
Crankshaft Sensor Peak Voltage	2 V or more	– – –
Electric Starter System		
Starter Motor:		
Brush Length	12 mm (0.47 in.)	6.5 mm (0.26 in.)
Fuel Level Sensor		
Fuel Level Sensor Resistance:		
Full Level Position	3 Ω	– – –
Empty Level Position	120 Ω	– – –
Actuator Control System		
Actuator Resistance	in the text	– – –
Forward/Reverse Detecting Sensor Resistance	1.2 ~ 1.6 kΩ	– – –
Switches		
Brake Light Switch Timing	ON after 10 mm (0.4 in.) of pedal travel	– – –
Water Temperature sensor Resistance	in the text	

Wiring Diagram

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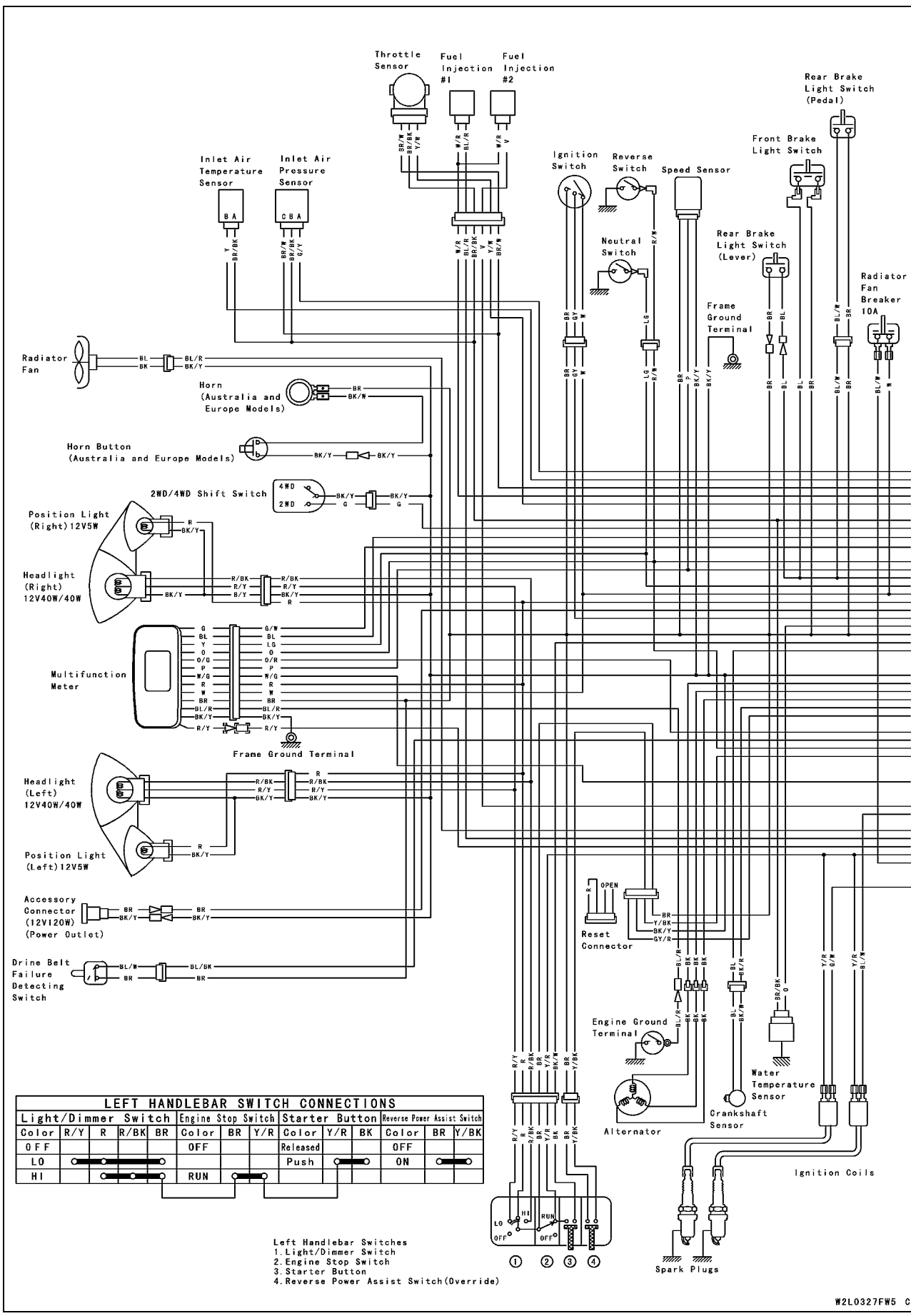
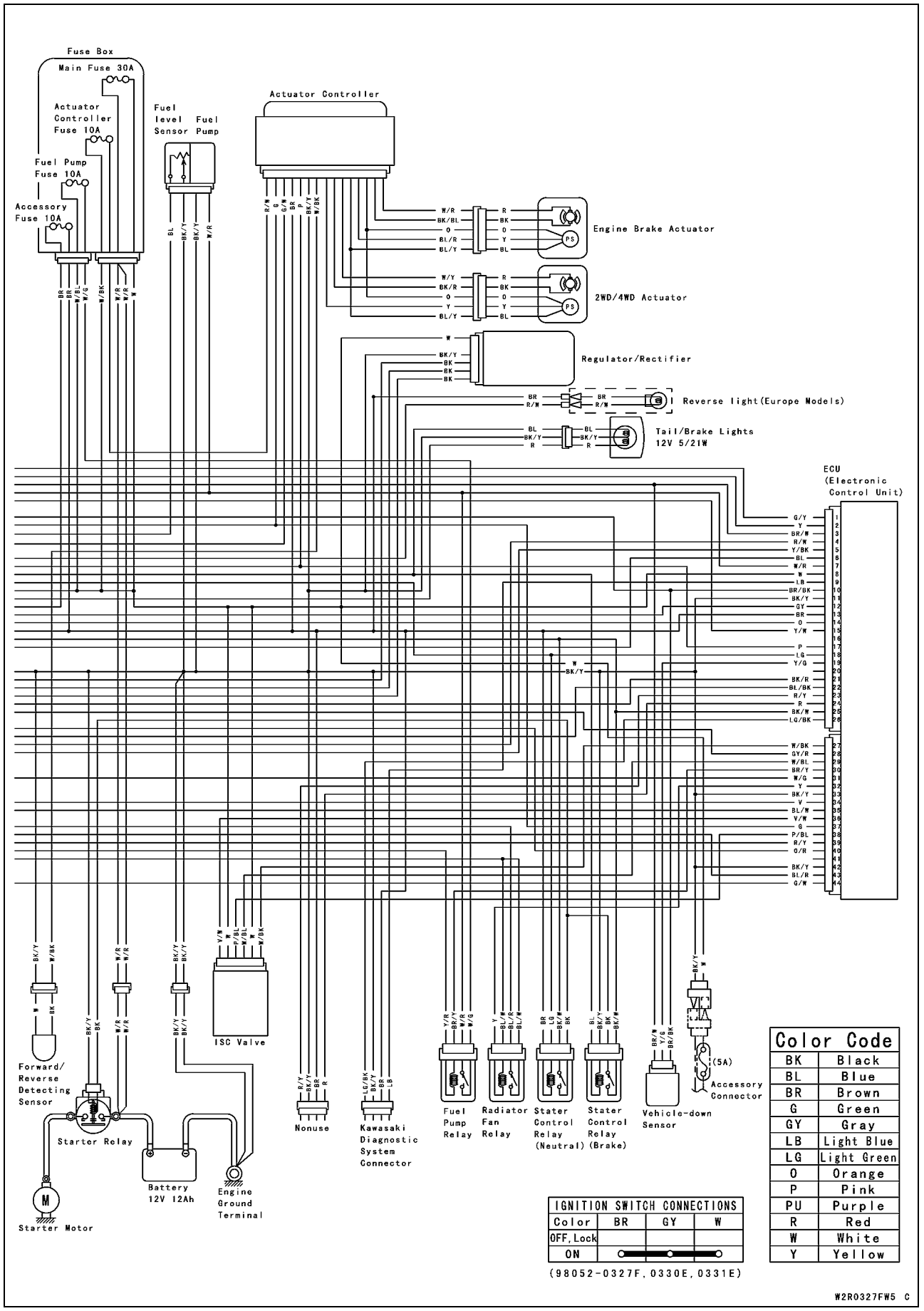
Wiring Diagram



LEFT HANDLEBAR SWITCH CONNECTIONS

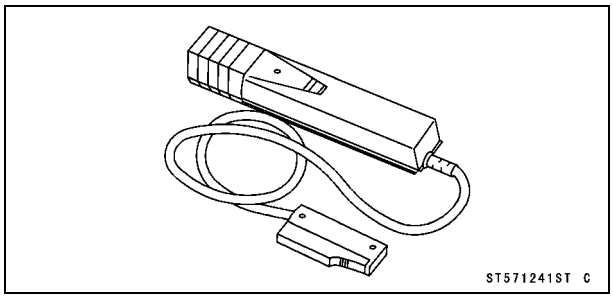
Light/Dimmer Switch					Engine Stop Switch			Starter Button			Reverse Power Assist Switch		
Color	R/Y	R	R/BK	BR	Color	BR	Y/R	Color	Y/R	BK	Color	BR	Y/BK
OFF					OFF			Released			OFF		
LO	●		●					Push	●	●	ON	●	●
HI		●	●		RUN	●	●						

Wiring Diagram

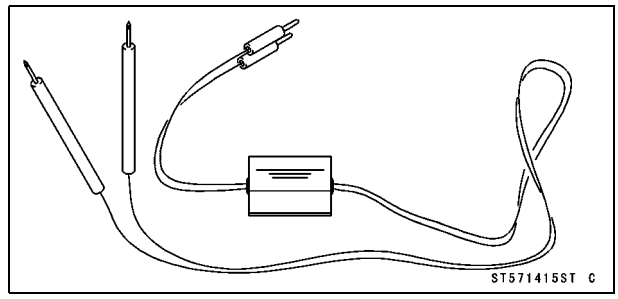


Special Tools

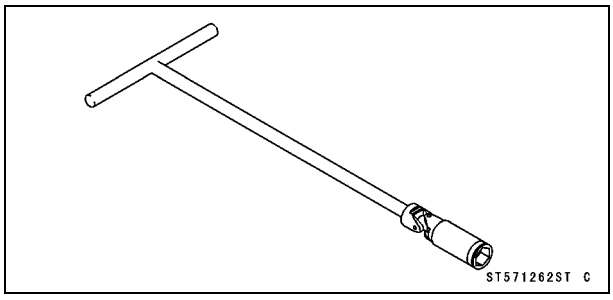
Timing Light:
57001-1241



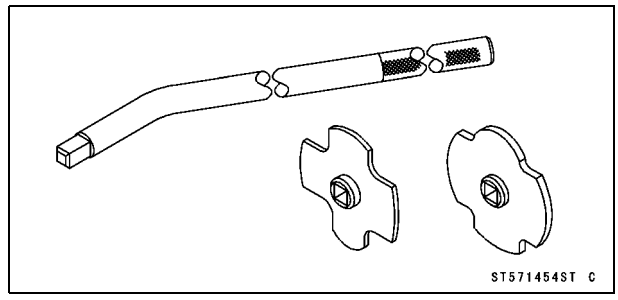
Peak Voltage Adapter:
57001-1415



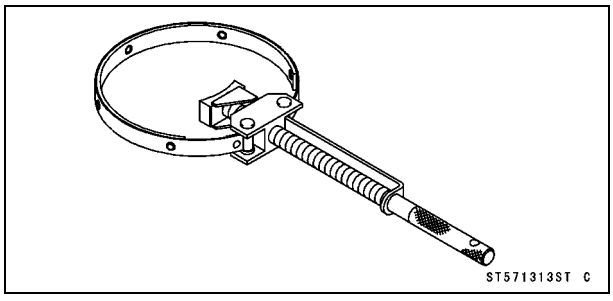
Spark Plug Wrench, Hex 16:
57001-1262



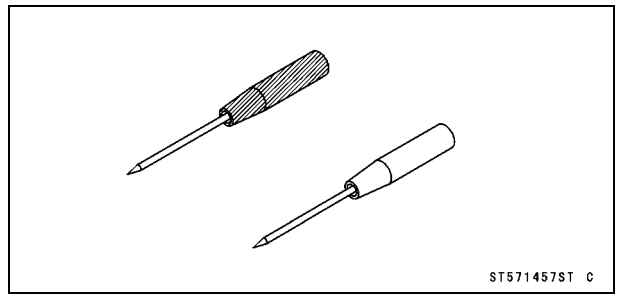
Filler Cap Driver:
57001-1454



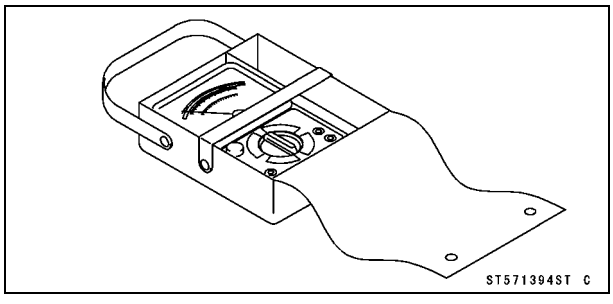
Flywheel Holder:
57001-1313



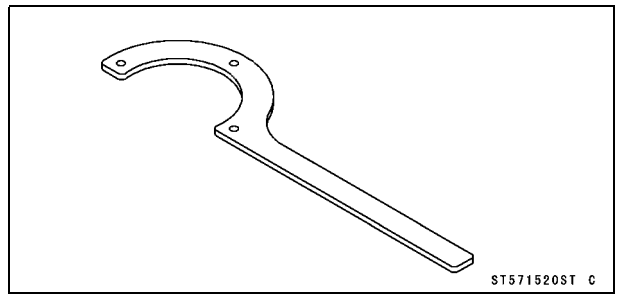
Needle Adapter Set:
57001-1457



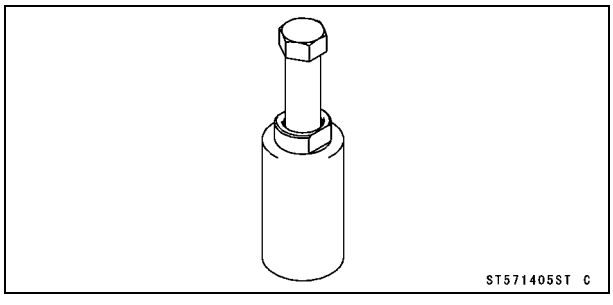
Hand Tester:
57001-1394



Drive Pulley Holder:
57001-1520



Flywheel Puller Assembly, M38 × 1.5/M35 × 1.5:
57001-1405



Precautions

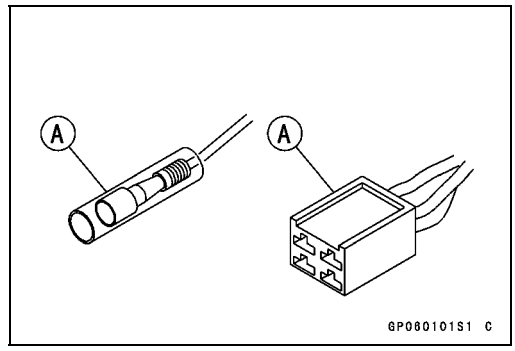
There are a number of important precautions that should be taken when servicing electrical systems. Learn and observe all the rules below.

- Do not reverse the battery lead connections. This will burn out the diodes in the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is required for conducting accurate electrical system tests.
- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- To prevent damaging electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the high current, never keep the starter button depressed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Only use an illumination bulb rated for the voltage or wattage specified in the wiring diagram, or the handle cover could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to chassis ground.
- Troubles may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they too must be repaired or replaced, or the new replacement will soon fail again.
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, etc. Defective wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).
- Color Codes:

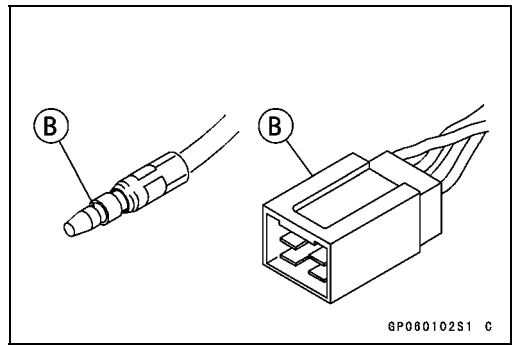
BK	Black	G	Green	P	Pink
BL	Blue	GY	Gray	PU	Purple
BR	Brown	LB	Light blue	R	Red
CH	Chocolate	LG	Light green	W	White
DG	Dark green	O	Orange	Y	Yellow

Precautions

○Electrical Connectors:
Connectors [A]

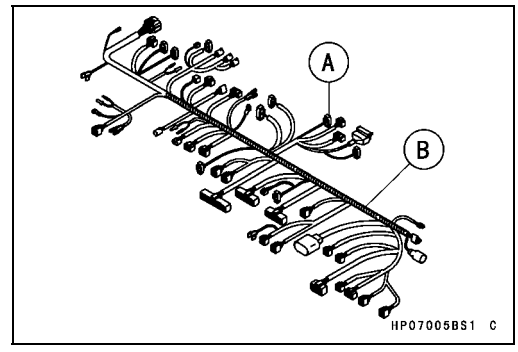


Connectors [B]



Electrical Wiring

Wiring Inspection



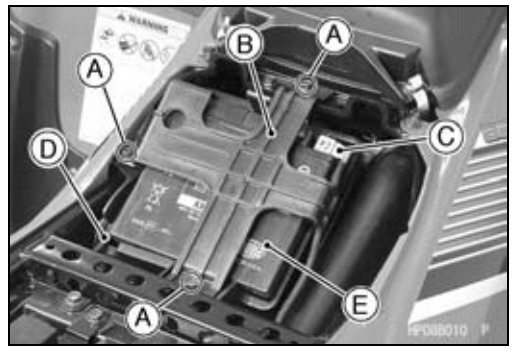
- ● Visually inspect the wiring for signs of burning, fraying, etc.
- ★If any wiring is defective, replace the damaged wiring.
- ● Pull each connector [A] apart and inspect for corrosion, dirt, and damage.
- ★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- ●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

Special Tool - Hand Tester: 57001-1394

- ○Set the tester to the ×1 Ω range.
- ★If the tester does not read 0 Ω, the lead is defective. Replace the lead or the wiring harness [B] if necessary.

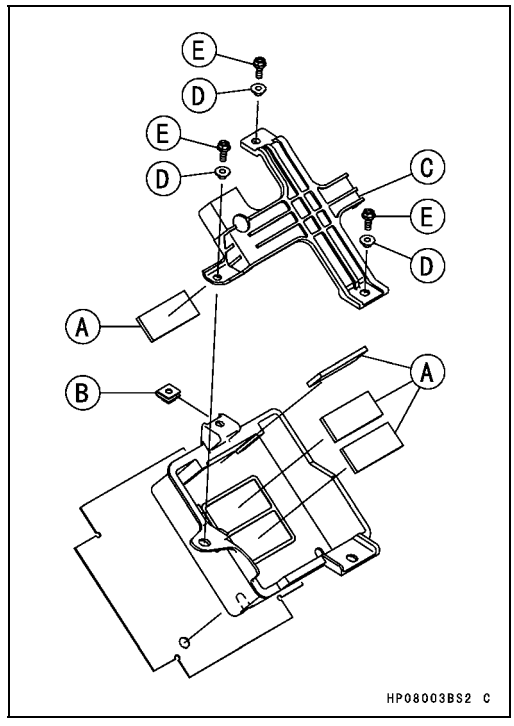
Battery

Battery Removal



- Turn off the ignition switch.
- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Battery Holder Bolts [A] and Collars
  Battery Holder [B]
- Disconnect the battery negative (–) cable [C] first, and then the positive (+) cable [D].
- Take out the battery [E].

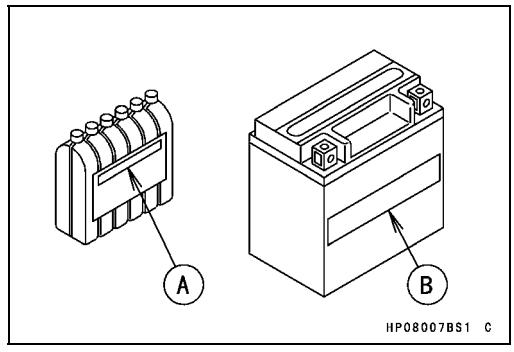
Battery Installation



- Turn off the ignition switch.
- Install:
  Rubber Dampers [A]
  Clamp Nut [B]
- Connect the positive cable first and then the negative.
- Put a light coat of grease on the terminals to prevent corrosion.
- Install:
  Battery Holder [C]
  Collars [D]
  Battery Holder Bolts [E]

Battery Activation

Electrolyte Filling



- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for KVF750D: KMX 14-BS

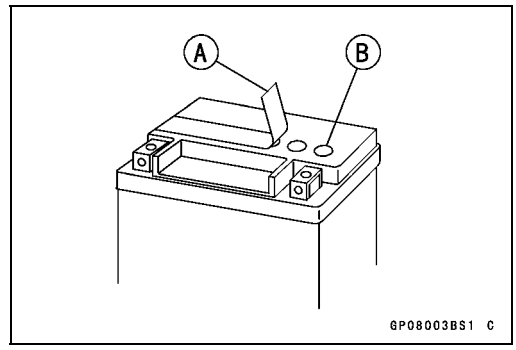
NOTICE

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.

Battery

NOTICE

Do not remove the aluminum sealing sheet [A] from the filler ports [B] until just prior to use. Be sure to use the dedicated electrolyte container for correct electrolyte volume.

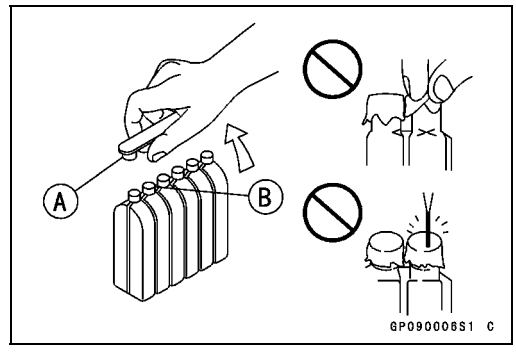


- Place the battery on a level surface.
- Check to see that the sealing sheet has no peeling, tears, or holes in it.
- Remove the sealing sheet.

NOTE

○*The battery is vacuum sealed. If the sealing sheet has leaked air into the battery, it may require a longer initial charge.*

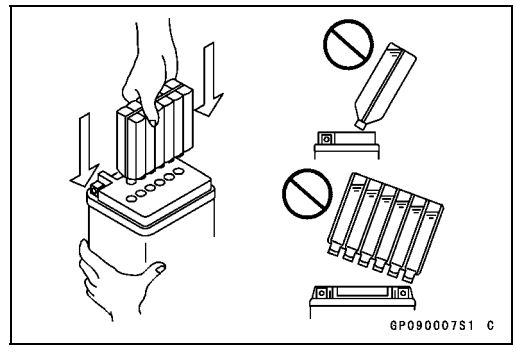
- Remove the electrolyte container from the vinyl bag.
- Detach the strip of caps [A] from the container and set aside, these will be used later to seal the battery.



NOTE

○*Do not pierce or otherwise open the sealed cells [B] of the electrolyte container. Do not attempt to separate individual cells.*

- Place the electrolyte container upside down with the six sealed cells into the filler ports of the battery. Hold the container level, push down to break the seals of all six cells. You will see air bubbles rising into each cell as the ports fill.



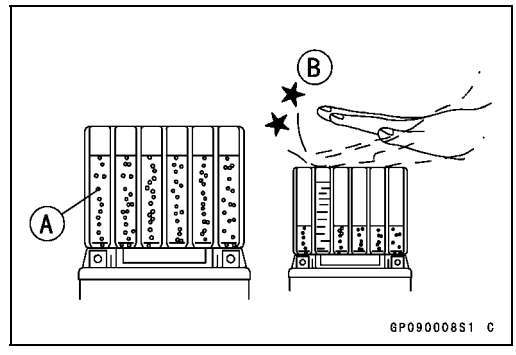
NOTE

○*Do not tilt the electrolyte container*

- Check the electrolyte flow.

★If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.

- Keep the container in place for **20** minutes or more. Don't remove the container from the battery until it's empty, the battery requires all the electrolyte from the container for proper operation.



NOTICE

Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the electrolyte container until it is completely empty and 20 minutes have elapsed.

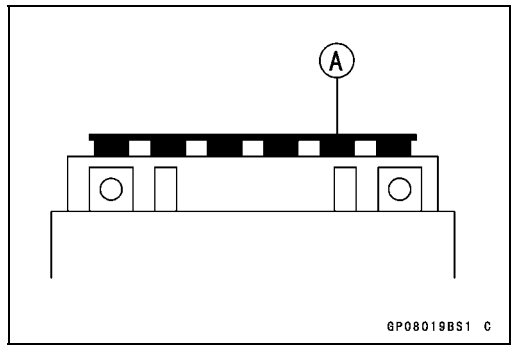
Battery

● Gently remove the container from the battery.
● Let the battery sit for **30** minutes prior to charging to allow the electrolyte to permeate into the plates for optimum performance.

NOTE

○*Charging the battery immediately after filling can shorten service life. Let the battery sit for at least **30** minutes after filling.*

Initial Charge



● Place the strip [A] of caps loosely over the filler ports.
● Newly activated sealed batteries require an initial charge.

Standard Charge 1.2 A × 5 ~ 10 hours

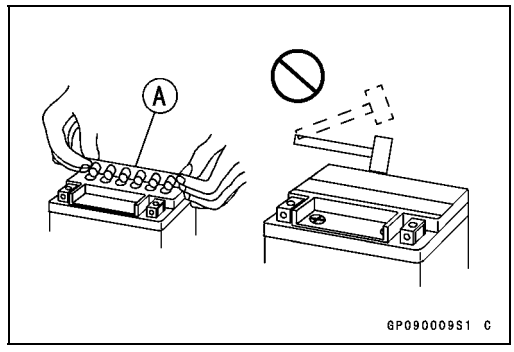
★If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

Kawasaki-recommended chargers:
Optimate III
Yuasa 1.5 Amp Automatic Charger
Battery Mate 150–9

★If the above chargers are not available, use equivalent one.

NOTE

○*Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. If it is not at least 12.8 volts, repeat charging cycle.*



● After charging is completed, press down firmly with both hands to seat the strip of caps [A] into the battery (don't pound or hammer). When properly installed, the strip of the caps will be level with the top of the battery.

NOTICE

Once the strip of the caps [A] is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.

NOTE

○*To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds.*
Re-check voltage and if less than 12.8 volts repeat the charging cycle and load test. If still below 12.8 volts the battery is defective.

Precautions

1) No need of topping-up
No topping-up is necessary in this battery until it ends its life under normal use. Forcibly prying off the sealing plug to add water is very dangerous. Never do that.
2) Refreshing charge

Battery

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 Refreshing Charge).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

NOTICE

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above.
Never remove the seal caps during refresh charge.
If by chance an excessive amount of gas is generated due to overcharging, the safety valve operates to keep the battery safe.

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 lead 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.)

⚠ DANGER

Batteries produce an explosive gas mixture of hydrogen and oxygen that can cause serious injury and burns if ignited. Keep the battery away from sparks and open flames during charging. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases. The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water and seek medial attention for more severe burns.

Interchange

A sealed battery can fully display its performance only when combined with a proper vehicle electrical system. Therefore, replace a sealed battery only on a vehicle which was originally equipped with a sealed battery.

Be careful, if a sealed battery is installed on a vehicle which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

Charging Condition Inspection

Battery charging condition can be checked by measuring battery terminal voltage.

● Remove the battery (see Battery Removal).

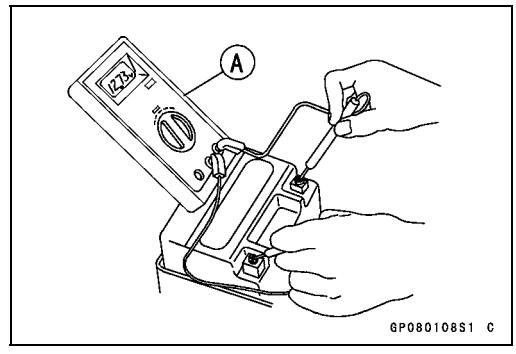
NOTICE

Be sure to disconnect the negative (−) cable first.

● Measure the battery terminal voltage.

NOTE

○*Measure with a digital voltmeter [A] which can be read to one decimal place voltage.*

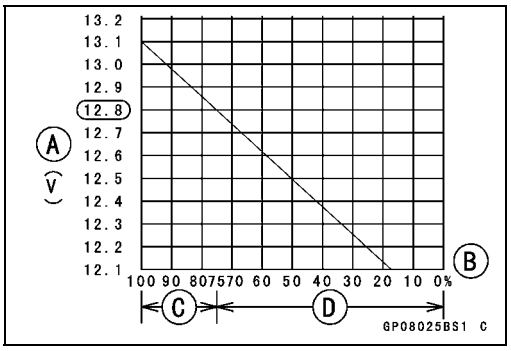


Battery

★If the reading is below the specified, refreshing charge is required.

Battery Terminal Voltage
Standard: 12.8 V or more

Terminal Voltage (V) [A]
Battery Charge Rate (%) [B]
Good [C]
Refresh charge is required [D]

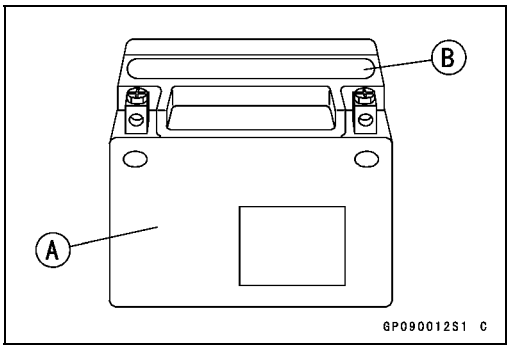


Refreshing Charge

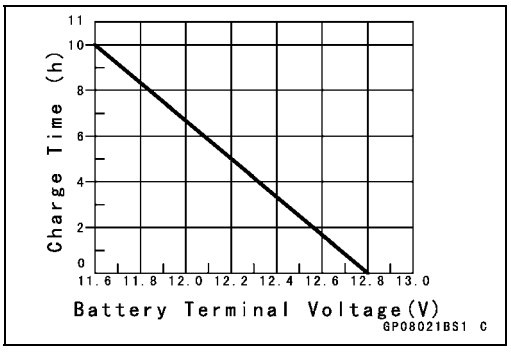
- Remove the battery [A] (see Battery Removal).
- Refresh-charge by following method according to the battery terminal voltage.

⚠ WARNING

This battery is sealed type. Never remove seal sheet [B] even at charging. Never add water. Charge with current and time as stated below.



Terminal Voltage: 11.5 ~ less than 12.8 V
Standard Charge
1.2 A × 5 ~ 10 h (see following chart)
Quick Charge
6.0 A × 1.0 h



NOTICE

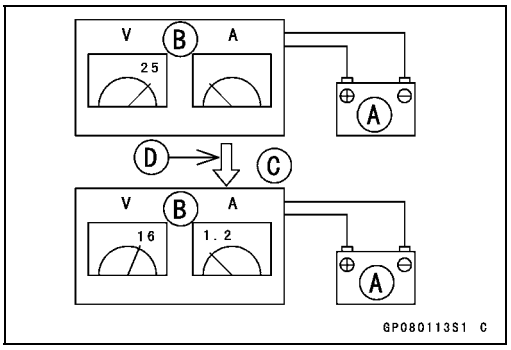
If possible, do not quick charge. If the quick charge is done due to unavoidable circumstances, do the standard charge later on.

Terminal Voltage: less than 11.5 V
Charging Method: 1.2 A × 20 h

NOTE

○*Increase the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than 5 minutes at the increased voltage then check if the battery is drawing current. If the battery will accept current [D], 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]



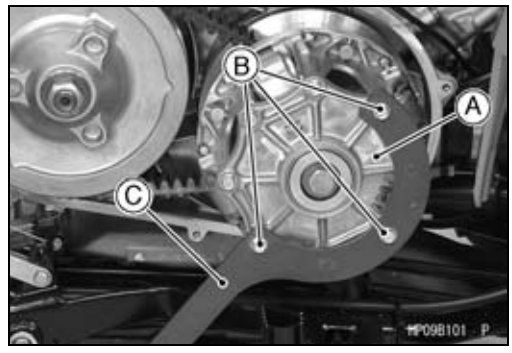
Battery

● Determine battery condition after refreshing charge.
○Determine the condition of the battery 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

Criteria	Judgement
12.8 V or higher	Good
12.0 ~ 12.8 V or lower	Charge insufficient → Recharge
12.0 V or lower	Unserviceable → Replace

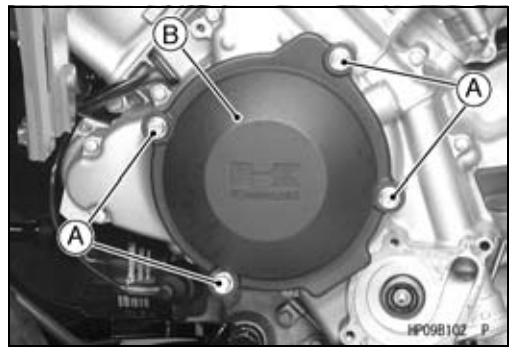
Charging System

Alternator Cover Removal

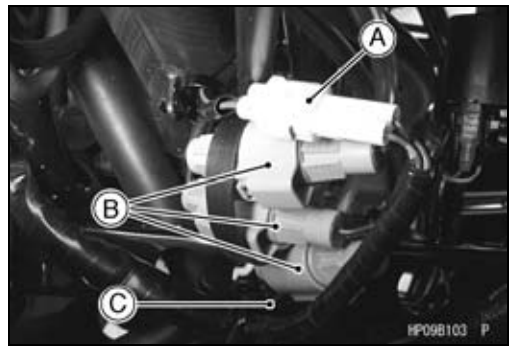


- Drain:
  Coolant (see Coolant Change in the Periodic Maintenance chapter)
  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
- Remove:
  Water Pump Impeller (see Water Pump Impeller Removal in the Cooling System chapter)
  Torque Converter Cover (see Torque Converter Cover Removal in the Converter System chapter)
  Middle Cover (see Middle Cover Removal in the Frame chapter)
- Remove the three bolts of the drive pulley cover [A].
- Install the drive pulley holder [C], tightening the removed three bolts [B].

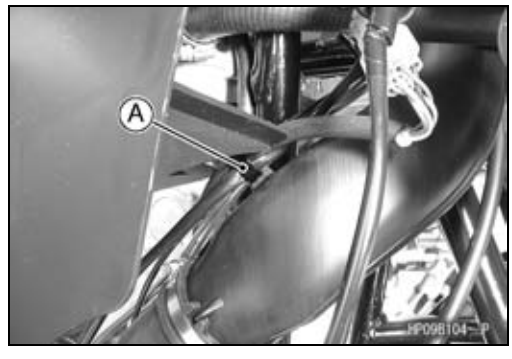
Special Tool - Drive Pulley Holder: 57001-1520



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



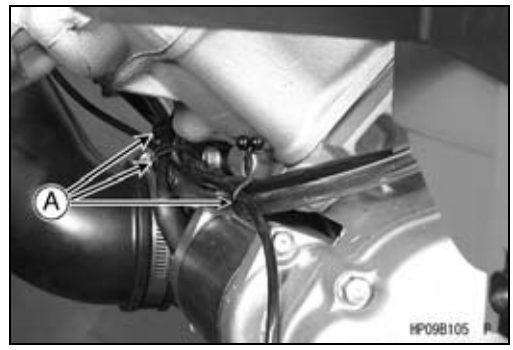
- Disconnect:
  Crankshaft Sensor Connector [A]
  Alternator Stator Connectors [B]
- Remove:
  Clamp [C]



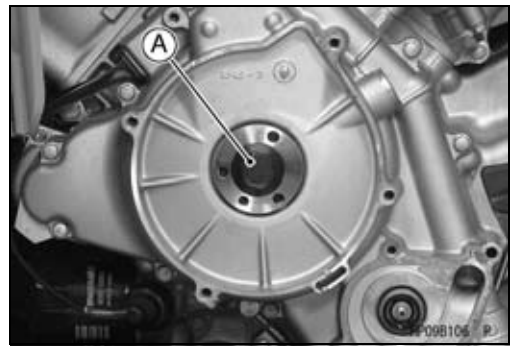
- Remove:
  Clamp [A]

Charging System

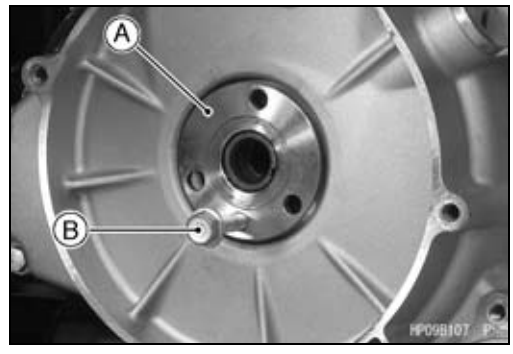
● Open the clamps [A].



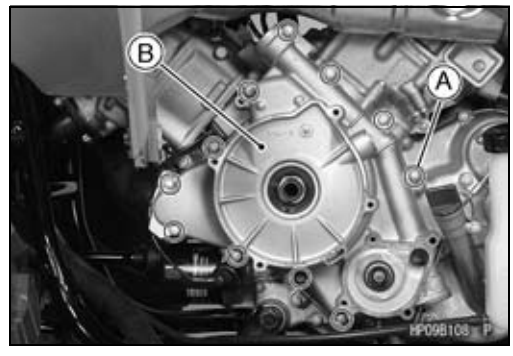
● Holding the drive pulley with the drive pulley holder, loosen the alternator rotor bolt [A].
● Remove:
Alternator Rotor Bolt



● Remove:
Collar [A]
○Install the M6 bolt [B] to the collar, and pull out it.

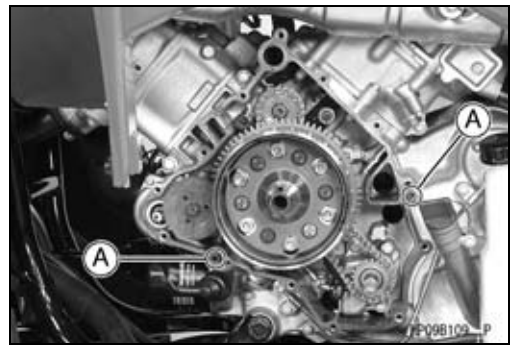


● Remove:
Alternator and Crankshaft Sensor Lead Connectors (disconnect)
Alternator Cover Bolts [A]
Alternator Cover [B]



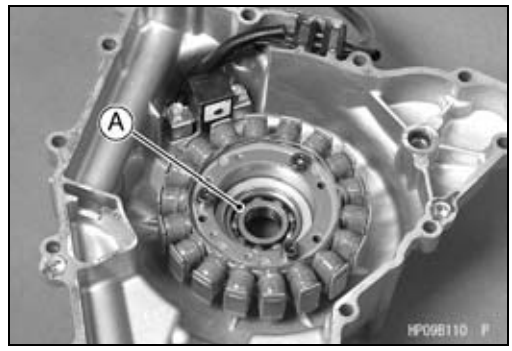
Alternator Cover Installation

● Be sure all of the old gasket has been removed from the alternator cover and the left crankcase sealing surfaces.
● Check that the dowel pins [A] are in place, and fit a new gasket on the crankcase.



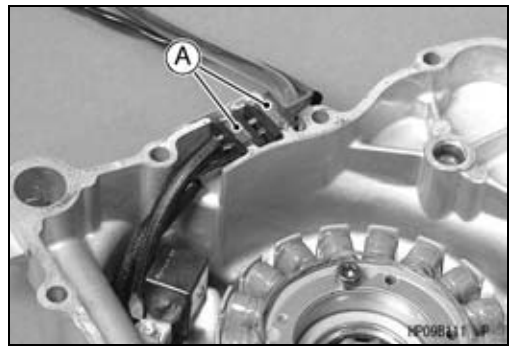
Charging System

● Check that the bearing [A] is in place.

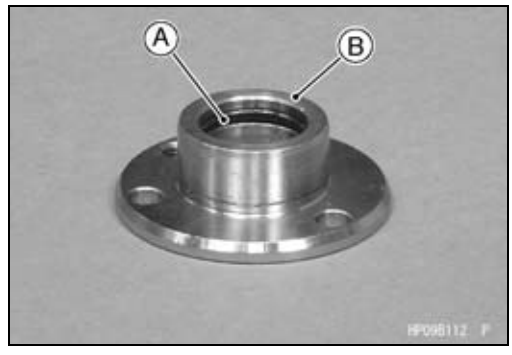


● Fit the grommets [A] into the notch in the cover.
● Grease the alternator cover oil seal.
● Tighten:

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

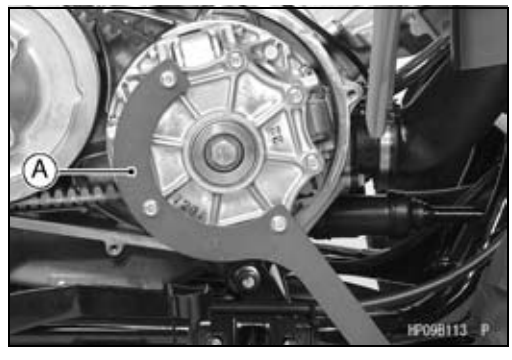


● Check that the O-ring [A] in the collar [B] is in good condition.
● Apply grease to the O-ring.
● Install the collar on the alternator cover.



● Hold the drive pulley with the drive pulley holder [A].

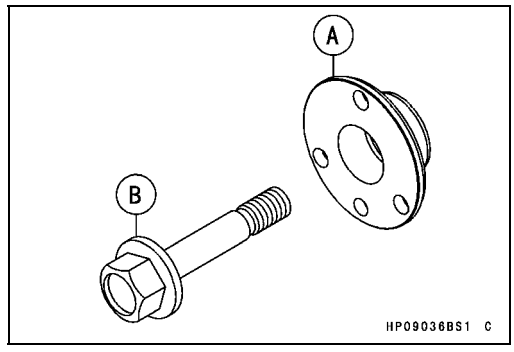
Special Tool - Drive Pulley Holder: 57001-1520



● Install the collar [A] to the crankshaft.
● Tighten:

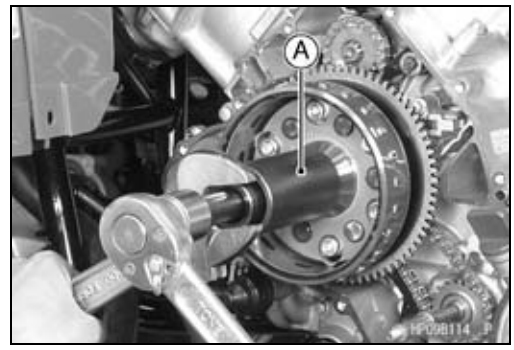
Torque - Alternator Rotor Bolt [B]: 127 N·m (13 kgf·m, 94 ft·lb)

● Install the removed parts (see appropriate chapter).
● Pour:
Coolant (see Coolant Change in the Periodic Maintenance chapter)
Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)



Charging System

Alternator Rotor Removal



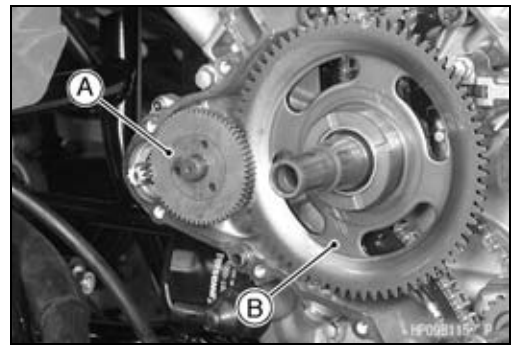
- Remove:
  Alternator Cover (see Alternator Cover Removal)
- Screw the flywheel puller [A] onto the alternator rotor.

Special Tool - Flywheel Puller Assembly, M38 × 1.5/M35 × 1.5: 57001-1405

- Holding the flywheel puller, turn the rotor puller bolt until the alternator rotor is forced off the end of the crankshaft.

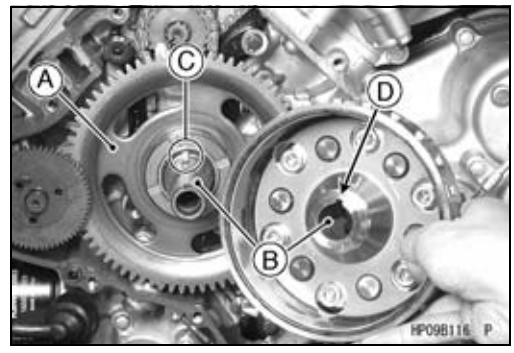
NOTICE

If the rotor is difficult to remove, turn the puller while tapping the end of the puller. Do not strike the alternator rotor. Striking the rotor can cause the magnets to lose magnetism.

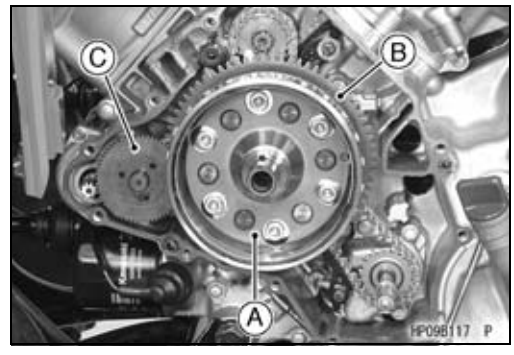


- Remove:
  Torque Limiter [A]
  Starter Clutch Gear [B]

Alternator Rotor Installation



- Install:
  Starter Clutch Gear [A]
- Clean [B] the inside of the rotor and the end of the crankshaft.
- Fit the rotor onto the crankshaft so that woodruff key [C] fits in the groove [D] in the hub of the rotor.

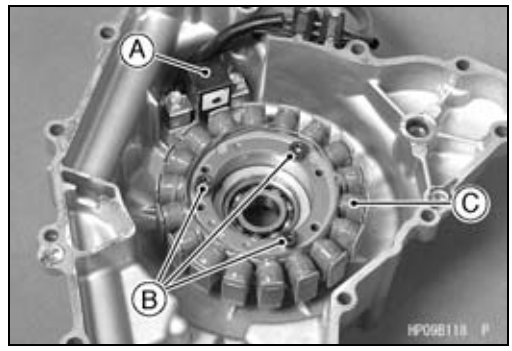


- Install the alternator rotor [A] while turning the starter clutch gear [B] counterclockwise.
- Apply molybdenum disulfide grease to the shaft of the torque limiter [C].
- Install the torque limiter.

○Pull out the alternator rotor a little, and install the torque limiter.

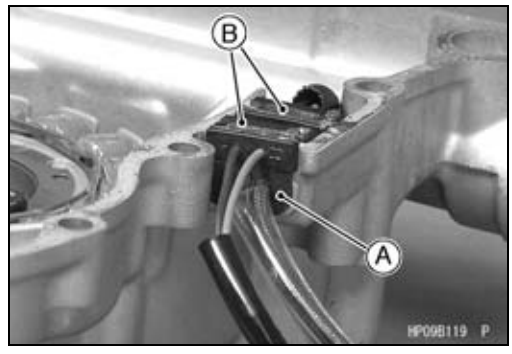
Charging System

Alternator Stator Removal



- Remove:
  Alternator Cover (see Alternator Cover Removal)
  Crankshaft Sensor [A] (see Crankshaft Sensor Removal)
  Bolts [B] and Alternator Stator [C]

Alternator Stator Installation



- Tighten:

  Torque - Alternator Stator Bolts: 13.5 N·m (1.4 kgf·m, 119 in·lb)

- Install:
  Crankshaft Sensor (see Crankshaft Sensor Installation)
- Fit the lead grommets into the notch on the alternator cover.
  Grommets [A] for Alternator Leads
  Grommets [B] for Crankshaft Sensor Leads

○Run the alternator starter leads under the crankshaft sensor leads.

○Fit the grommet for alternator leads first and then install the one of crankshaft sensor leads to the notch of the alternator cover.

Regulator/Rectifier Output Voltage Inspection

- Remove the seat (see Seat Removal in the Frame chapter).
- Check the battery condition (see Battery section).
- Warm up the engine to obtain actual alternator operating conditions.
- Check that the ignition switch is turned off, and connect a hand tester to the battery terminals.

  Special Tool - Hand Tester: 57001-1394

- Start the engine and note the voltage readings at various engine speeds with the headlight turned on and then off. The readings should show nearly battery voltage when the engine speed is low, and as the engine speed increases, the readings should also increase.

Regulator/Rectifier Output Voltage

Tester Range	Connections		Reading
	Tester (+) to	Tester (–) to	
25 V DC	Battery (+)	Battery (–)	14 ~ 15 V

- Turn off the ignition switch, and disconnect the hand tester.

★If the regulator/rectifier output voltage is between the values given in the table, the charging system is working normally.

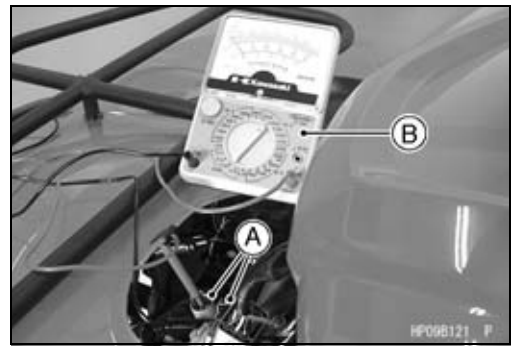
★If the output voltage is much higher than the values specified in the table, the regulator/rectifier is defective or the regulator/rectifier leads are loose or open.

Charging System

★If the battery voltage does not increase as the engine speed increases, then the regulator/rectifier is defective or the alternator output is insufficient for the loads. Check the alternator and regulator/rectifier to determine which part is defective.

Alternator Inspection

There are three types of alternator failures: short, open, or loss in rotor magnetism. A short or open in one of the coil wires will result in either a low output, or no output at all. A loss in rotor magnetism, which may be caused by dropping or hitting the alternator, by leaving it near an electromagnetic field, or just by aging, will result in low output.



● To check the alternator output voltage, perform the following procedures.

○Remove the middle cover (see Middle Cover Removal in the Frame chapter).

○Disconnect the alternator connectors [A].

○Connect a hand tester [B] as shown in the table.

○Start the engine.

○Run it at the rpm given in the table.

○Note the voltage readings (total 3 measurements).

Alternator Output Voltage

Tester Range	Connections		Reading
	Tester (+) to	Tester (–) to	@4 000 rpm
250 V AC	One black lead	Another black lead	54 ~ 80 V

★If the output voltage is within the values in the table, the alternator is operating correctly, and the regulator/rectifier is damaged. A much lower reading indicates that the alternator is defective.

Charging System

● Check the stator coil resistance as follows:
○Stop the engine.
○Disconnect the alternator connector.
○Connect a hand tester as shown in the table.
○Note the readings (total 3 measurement).

Stator Coil Resistance **@20°C (68°F)**

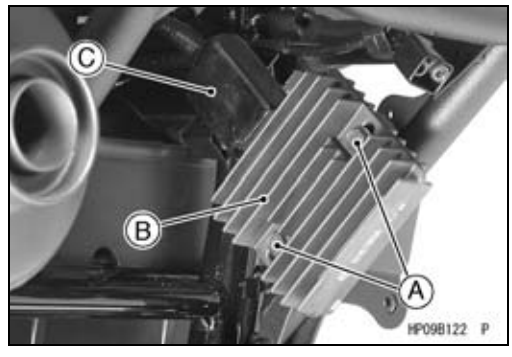
Tester Range	Connections		Reading
	Tester (+) to	Tester (–) to	
× 1 Ω	One black lead	Another black lead	0.25 ~ 0.37 Ω

★If there is more resistance than shown in the table, or no reading (infinity) for any two leads, the stator has an open and must be replaced. Much less resistance means the stator is shorted and must be replaced.
● Using the highest resistance range of the hand tester, measure the resistance between each of the black leads and chassis ground.
★Any reading less than infinity (∞) indicates a short, necessitating stator replacement.
★If the stator coils have normal resistance, but the voltage check shows the alternator to be defective; then the rotor magnetism has probably weakened, and the rotor must be replaced.

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

Regulator/Rectifier Removal

● Remove:
Bolts [A] and Regulator/Rectifier [B]
Connector [C] (disconnect)



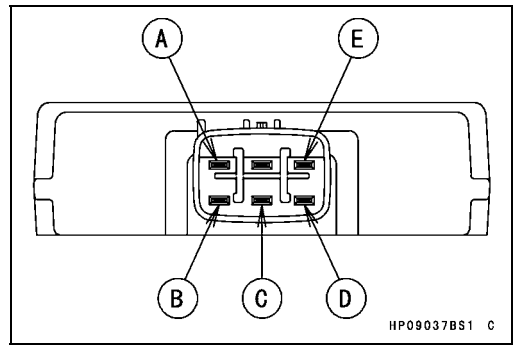
Regulator/Rectifier Installation

● Tighten:

Torque - Regulator/Rectifier Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Charging System

Regulator/Rectifier Inspection



- Remove:
  Regulator/Rectifier (see Regulator/Rectifier Removal)
- Set the hand tester to the × 1 kΩ range and make the measurements shown in the table.

Special Tool - Hand Tester: 57001-1394

- Connect the hand tester to the regulator rectifier.

★If the tester readings are not as specified, replace the regulator/rectifier.

NOTICE

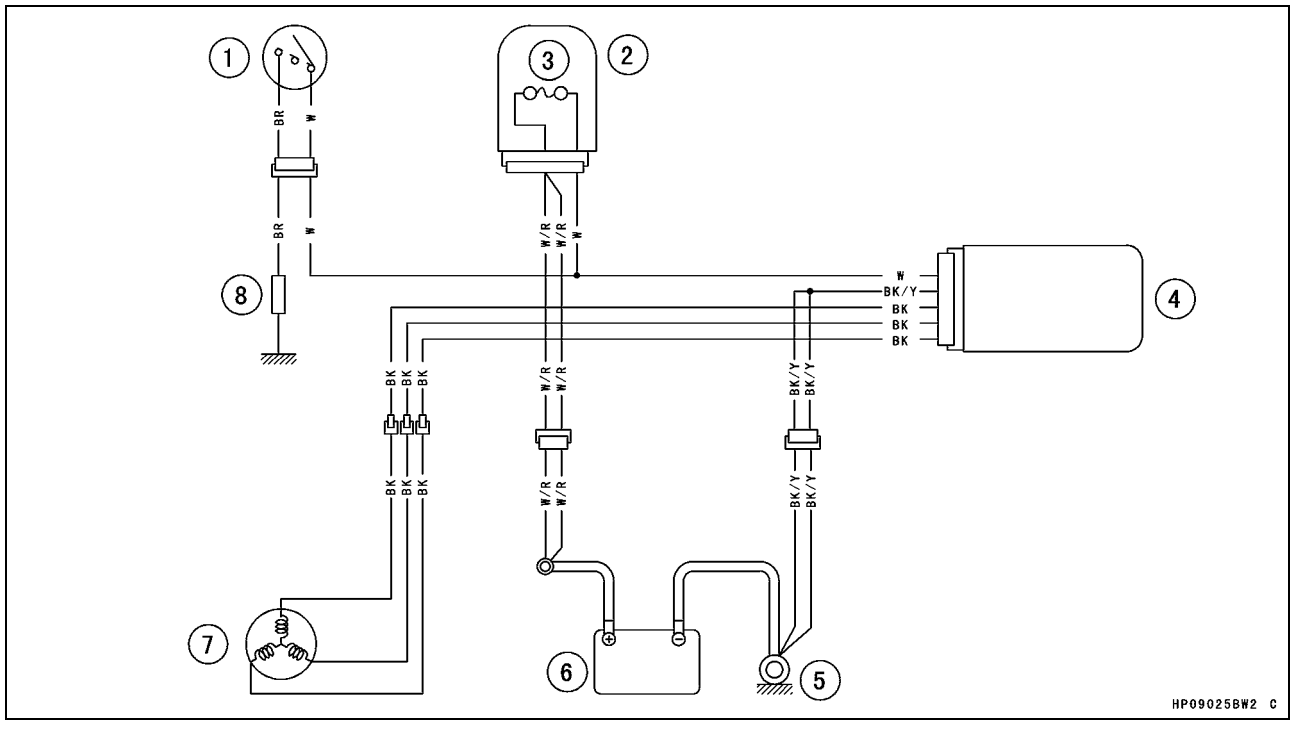
Use only Kawasaki Hand Tester 57001-1394 for this test. A tester other than the Kawasaki Hand Tester may show different readings.
If a megger or a meter with a large capacity battery is used, the regulator/rectifier will be damaged.

Regulator/Rectifier Resistance **(Unit: kΩ)**

		Tester (+) Lead Connection				
	Terminal	A	B	C	D	E
(–)*	A	–	∞	∞	∞	∞
	B	2 ~ 26	–	∞	∞	∞
	C	2 ~ 26	∞	–	∞	∞
	D	2 ~ 26	∞	∞	–	∞
	E	2 ~ 50	2 ~ 26	2 ~ 26	2 ~ 26	–

(−)*: Tester (−) Lead Connection

Charging System Circuit



1. Ignition Switch
2. Fuse Box
3. Main Fuse 30 A
4. Regulator/rectifier
5. Engine Ground Terminal
6. Battery 12 V 12 Ah
7. Alternator
8. Load

Ignition System

⚠ WARNING

The ignition system produces extremely high voltage. Do not touch the spark plug, ignition coil or spark plug lead while the engine is running, or you could receive a severe electrical shock.

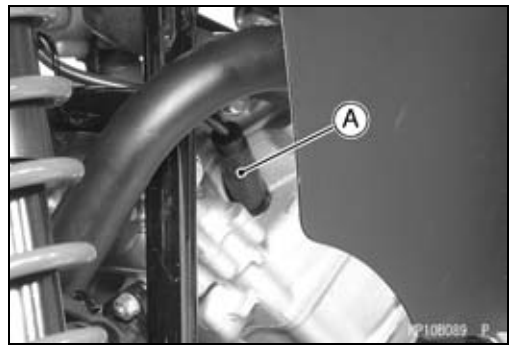
NOTICE

Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter damage.
Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and igniter.
Use the standard regulator/rectifier, or the igniter will be damaged.

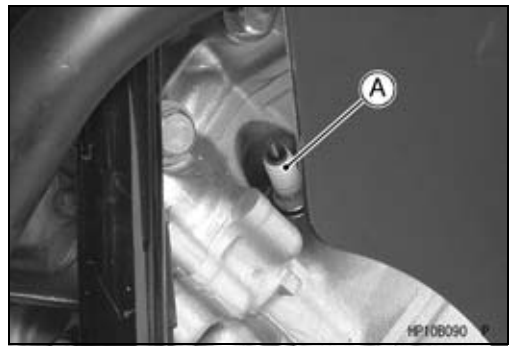
Spark Plug Removal

Front Side

● Remove:
Spark Plug Cap [A]

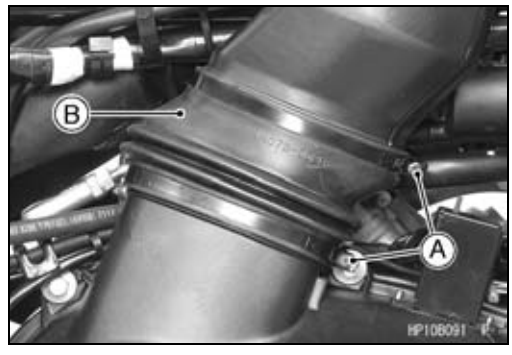


● Using a spark plug wrench, remove the spark plug [B].
Special Tool - Spark Plug Wrench, Hex 16: 57001-1262



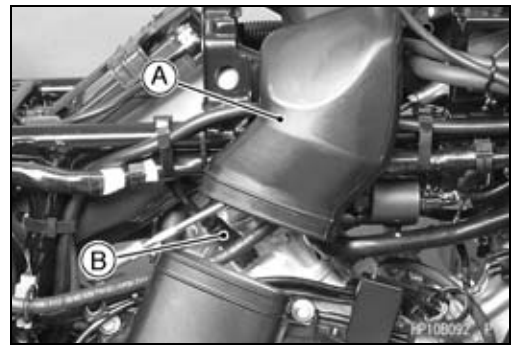
Rear Side

● Remove:
Right Side Cover (see Right Side Cover Removal in the Frame chapter)
Clamp Screws [A] and Clamps
Rubber Air Duct [B]



Ignition System

● While lifting up the air duct [A], remove the spark plug cap [B].



● Using a spark plug wrench, remove the spark plug [A].

Special Tool - Spark Plug Wrench, Hex 16: 57001-1262

Spark Plug Installation

● Tighten:

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 115 in·lb)

Special Tool - Spark Plug Wrench, Hex 16: 57001-1262

● Fit the spark plug caps securely.
● Pull up the spark pug caps lightly to make sure of the installation of the spark plug caps.

Spark Plug Cleaning/Inspection

● Refer to the Spark Plug Cleaning/Inspection in the Periodic Maintenance chapter.

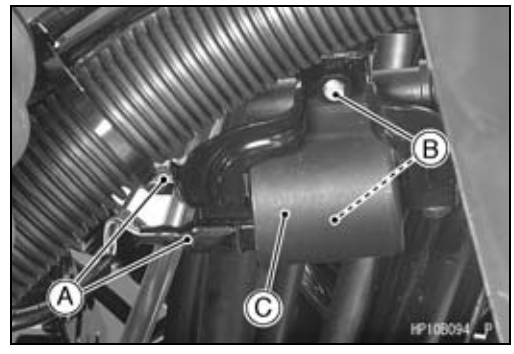
Spark Plug Gap Inspection

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

Ignition Coil Removal

Front Side

● Remove:
Spark Plug Cap (see Spark Plug Removal)
Primary Lead Connectors [A]
Bolts [B]
Ignition Coil [C]

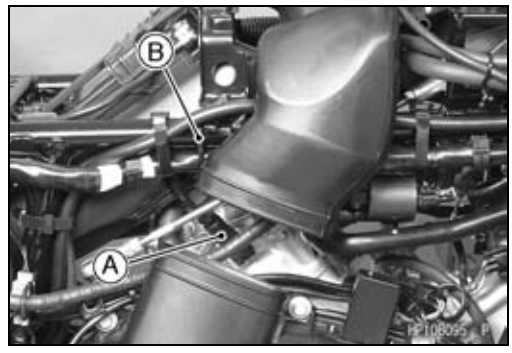


Ignition System

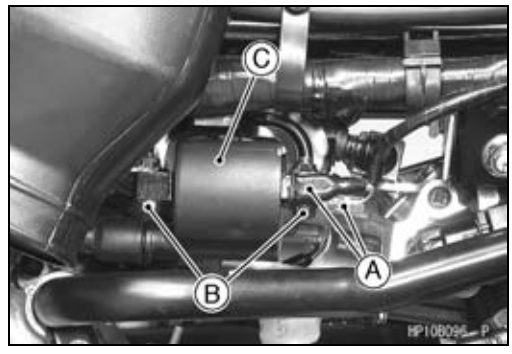
Rear Side

● Remove:
Right Side Cover (see Right Side Cover Removal in the Frame chapter)
Rubber Air Duct (see Spark Plug Removal)
Spark Plug Cap [A]

● Cut the band [B].



● Remove:
Primary Lead Connectors [A]
Bolts [B]
Ignition Coil [C]



Ignition Coil Installation

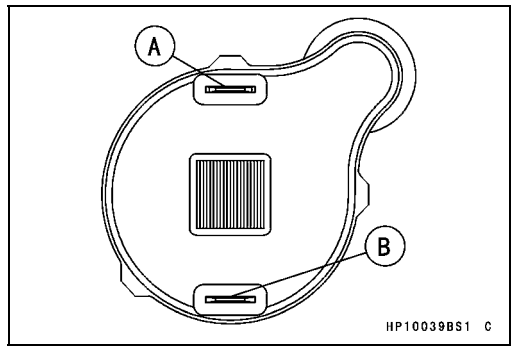
● Install:
Ignition Coil

Torque - Ignition Coil Mounting Bolts: 5.9 N·m (0.60 kgf·m, 52 in·lb)

● Connect the primary leads to the ignition coil terminals as shown.

Front Side

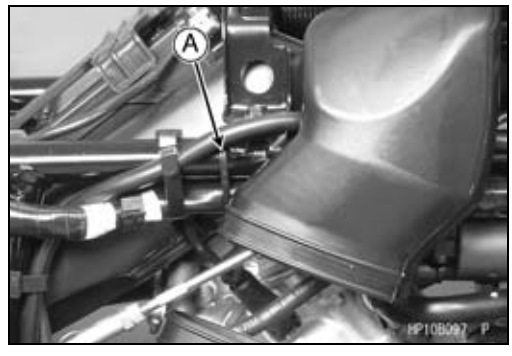
Y/R Lead → (+) Terminal [A]
G/W Lead → (–) Terminal [B]



Rear Side

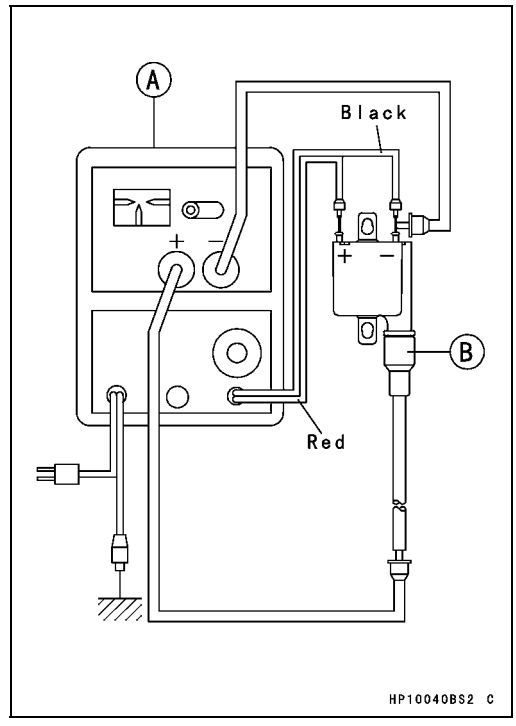
Y/R Lead → (+) Terminal [A]
BL/W Lead → (–) Terminal [B]

● For rear ignition coil, fix the ignition coil lead and main harness with a band [B].



Ignition System

Ignition Coil Inspection



- Remove the ignition coil.
- Measure the arcing distance with a coil tester [A] to check the condition of the ignition coil [B].
- Connect the ignition coil (with the spark plug cap left attached at the end of the spark plug lead) to the tester in the manner prescribed by the manufacturer and measure the arcing distance.

Ignition Coil Arcing Distance
7 mm (0.28 in.) or more

⚠ WARNING

To avoid extremely high voltage shocks, do not touch the coil body or leads.

★If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.

- To determine which part is defective, measure the arcing distance again with the spark plug cap removed from the ignition coil. Remove the cap by turning it counterclockwise.

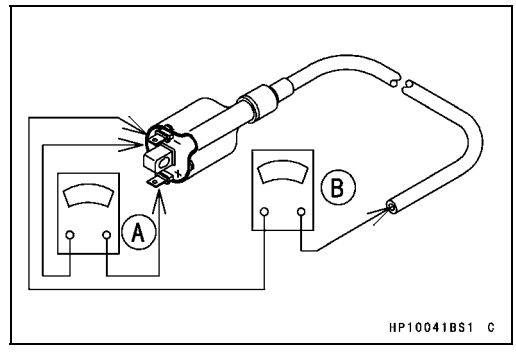
★If the arcing distance is as before, the trouble is with the ignition coil. If the arcing distance is normal, the trouble is with the spark plug cap.

★If a coil tester is not available, the coil can be checked for a broken or badly shorted winding with a hand tester.

Special Tool - Hand Tester: 57001-1394

NOTE

○*The hand tester cannot detect layer shorts and shorts resulting from insulation breakdown under high voltage.*



- Measure the primary winding resistance [A] as follows:

○Connect the tester between the coil terminals.
○Set the tester to the × 1 Ω range.

- Measure the secondary winding resistance [B] as follows:

○Remove the plug cap by turning it counterclockwise.
○Connect the tester between the spark plug lead and terminal.
○Set the tester to the × 1 kΩ range.

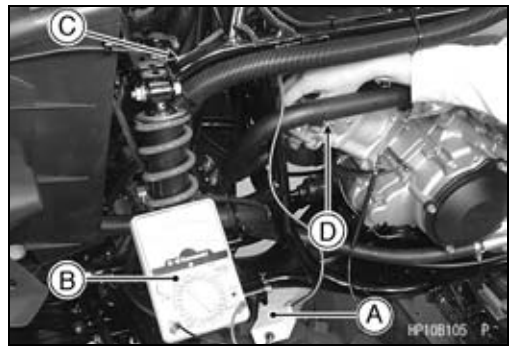
Ignition Coil Winding Resistance
Primary Windings: 2.1 ~ 2.5 Ω
Secondary Windings: 10 ~ 16 kΩ

★If the hand tester does not read as specified, replace the coil.

○To install the plug cap, turn it clockwise.

Ignition System

Ignition Coil Primary Peak Voltage Inspection



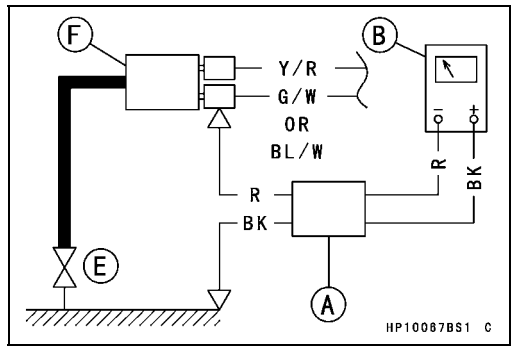
NOTE

○*Be sure the battery is fully charged.*

● Remove the spark plug cap (see Spark Plug Removal), but do not remove the spark plug.
● Measure the primary peak voltage as follows.
○Connect a commercially peak voltage adapter [A] to the hand tester [B] (250 V DC range).

Special Tools - Hand Tester: 57001-1394
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

○Insert the peak voltage adapter lead of the G/W (front) or BL/W (rear) primary lead [C].
○Install a new spark plug [D] into the spark plug cap, and ground it to the engine.
[E] Ignition Coil



⚠ WARNING

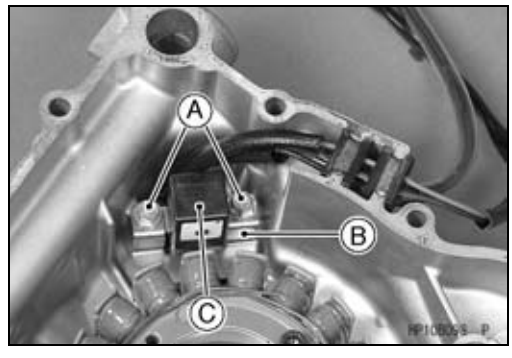
To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

● Turn the ignition switch ON, rotate the engine for 4 ~ 5 seconds with the transmission in neutral to measure the primary peak voltage.
● Repeat the measurements 5 times for one ignition coil.

Ignition Coil Primary Peak Voltage
Standard: 130 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 Sensor (see Crankshaft Sensor Inspection)
★If the ignition coils and crankshaft sensor are normal, see the Ignition System Troubleshooting chart on page 17-42.

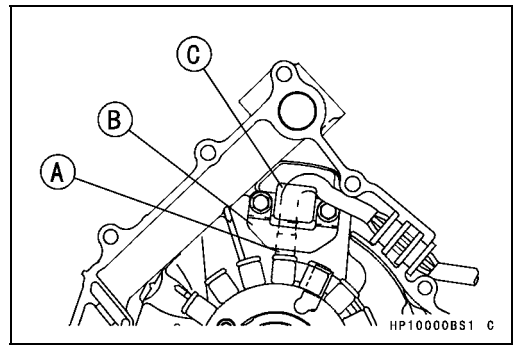
Crankshaft Sensor Removal



● Remove:
Alternator Cover (see Alternator Cover Removal)
Crankshaft Sensor Mounting Bolts [A]
Plate [B]
Crankshaft Sensor [C]

Ignition System

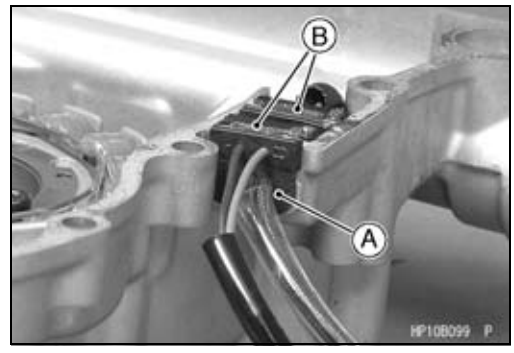
Crankshaft Sensor Installation



- Install:
  Stator Coil Leads [A]
  Plate [B]
  Crankshaft Sensor [C]
- Tighten:

Torque - Crankshaft Sensor Mounting Bolts: 5.9 N·m (0.60 kgf·m, 52 in·lb)

- Fit the lead grommets into the notch on the alternator cover.
  Grommets [A] for Alternator Leads
  Grommets [B] for Crankshaft Sensor Leads



Crankshaft Sensor Inspection

- Remove the middle cover (see Middle Cover Removal in the Frame chapter).
- Disconnect the crankshaft sensor lead connector [A].
- Measure the crankshaft sensor resistance.

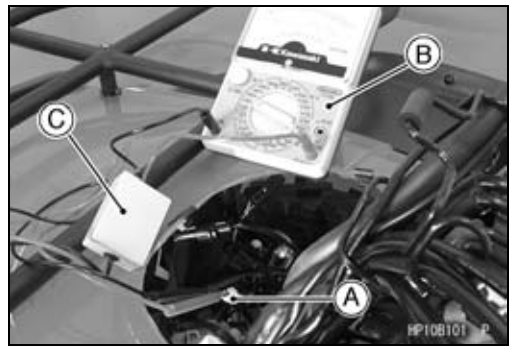
○Connect a hand tester between the BK/W lead and the BL lead.

○Set the tester to the × 100 Ω range.

Crankshaft Sensor Resistance
423 ~ 517 Ω

★If the tester does not read as specified, replace the crankshaft sensor.

Crankshaft Sensor Peak Voltage Inspection



NOTE

○*Be sure the battery is fully charged.*

- Removal the middle cover (see Middle Cover Removal in the Frame chapter).
- Remove the spark plug caps, but do not remove the spark plugs.
- Disconnect:
  Crankshaft Sensor Lead Connector [A]
- Set the hand tester [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the hand tester and crankshaft sensor leads in the connector.

Special Tools - Hand Tester: 57001-1394
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B
Needle Adapter Set: 57001-1457

Connections:

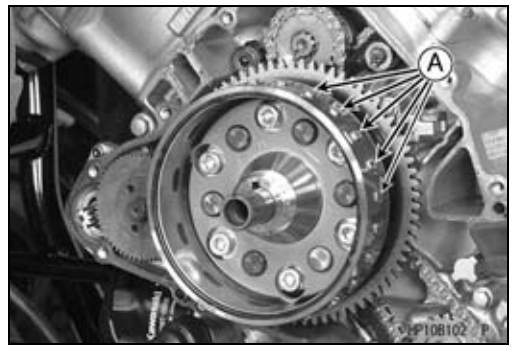
Crankshaft Sensor Lead		Adapter		Hand Tester
Black/White	←	Red	→	(+)
Blue	←	Black	→	(–)

- Turn the ignition switch on, and rotate the engine for 4 ~ 5 seconds with the transmission gear in neutral to measure the crankshaft sensor peak voltage.
- Repeat the measurement 5 or more times.

Crankshaft Sensor Peak Voltage
Standard: 2 V or more

★If the peak voltage is lower than the standard, inspect the crankshaft sensor.

Alternator Rotor Inspection



- Check the timing projections [A] for damage such as chipping or grooving.

★If the timing projection on the rotor is visibly damaged, replace the alternator rotor.

Ignition Timing Test

- Remove the ignition timing inspection plug [A].

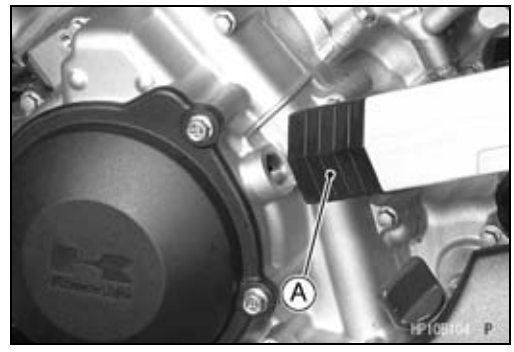
Special Tool - Filler Cap Driver: 57001-1454

Ignition System

- Attach a timing light [A] and a tachometer in the manner prescribed by the manufacturer.

  Special Tool - Timing Light: 57001-1241

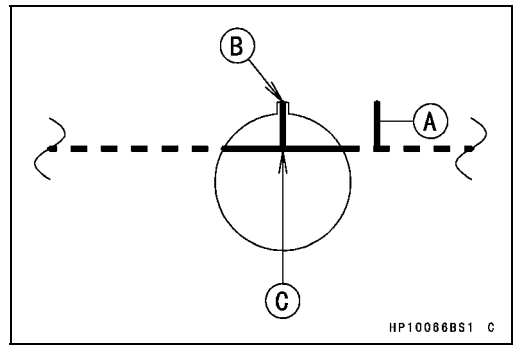
- Start the engine and aim the timing light at the timing mark on the alternator rotor.
- Run the engine at the speeds specified and note the alignment of the timing marks.



[A] F or R mark

Ignition Timing

Slot [B] aligned with:
Advanced mark [C] on alternator rotor



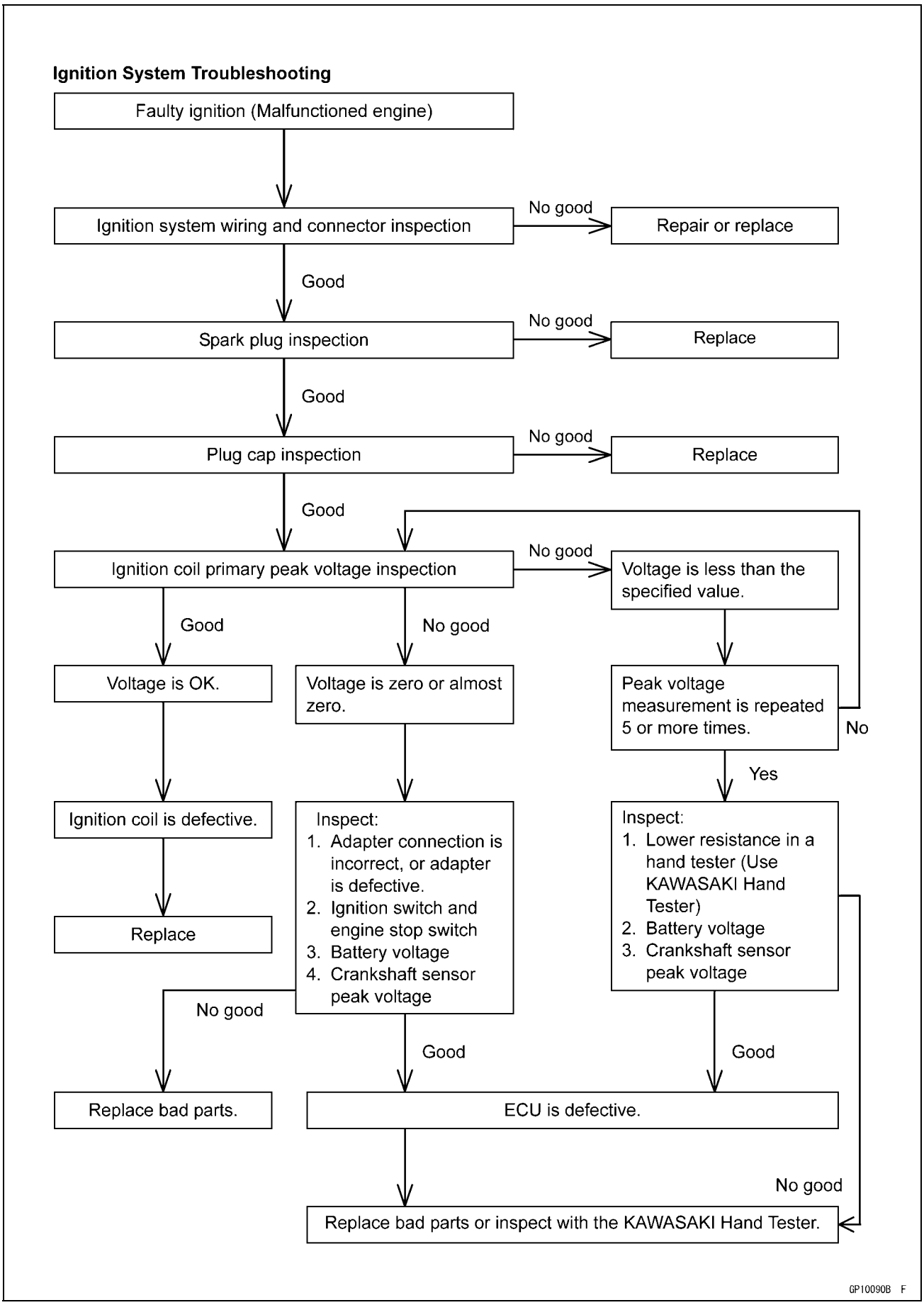
NOTE

○*Do not mix up the timing marks with mark [A].*

★If the ignition timing is incorrect, replace the ECU and the crankshaft sensor.

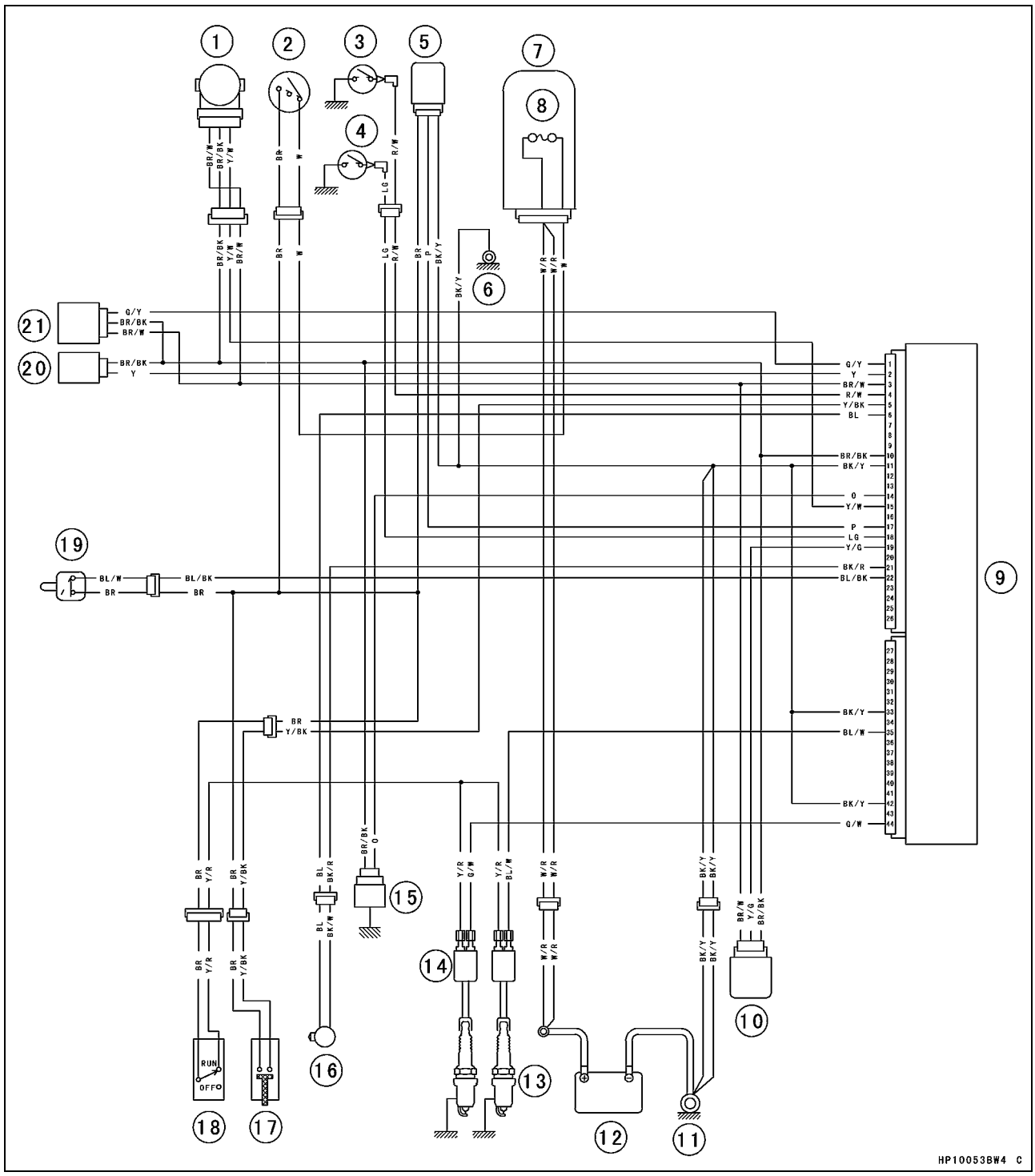
Ignition System

Ignition System Troubleshooting



Ignition System

Ignition System Circuit

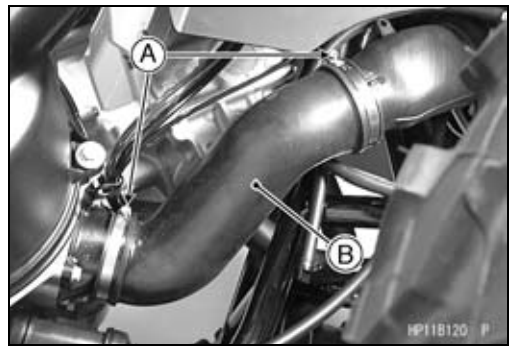


1. Throttle Sensor
2. Ignition Switch
3. Reverse Switch
4. Neutral Switch
5. Speed Sensor
6. Frame Ground Terminal
7. Fuse Box
8. Main Fuse 30 A
9. ECU (Electronic Control Unit)
10. Vehicle-down Sensor
11. Engine Ground Terminal
12. Battery 12 V 12 Ah
13. Spark Plugs
14. Ignition Coils
15. Water Temperature Sensor
16. Crankshaft Sensor
17. Reverse Power Assist Switch (Override)
18. Engine Stop Switch
19. Drive Belt Failure Detecting Switch
20. Inlet Air Temperature Sensor
21. Inlet Air Pressure Sensor

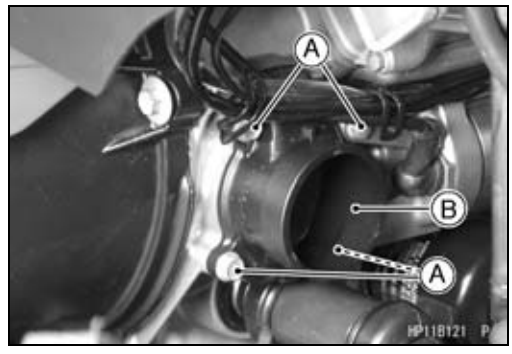
Electric Starter System

Starter Motor Removal

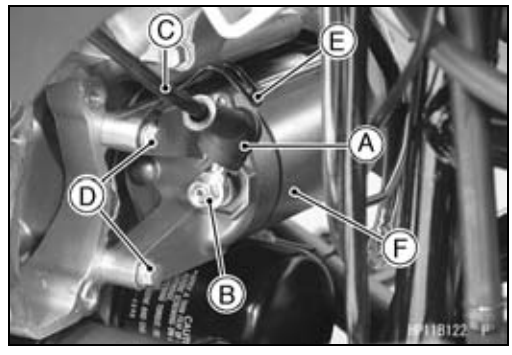
- Loosen:
  Clamp Bolts [A]
- Remove:
  Air Intake Rubber Duct [B]



- Remove:
  Bolts [A]
  Joint Duct [B] and Collars



- Slide the rubber boots [A].
- Remove:
  Starter Motor Cable
  Mounting Nut [B]
  Starter Motor Cable [C]
  Starter Motor Mounting Bolts [D]
  Clamp [E]
  Starter Motor [F]

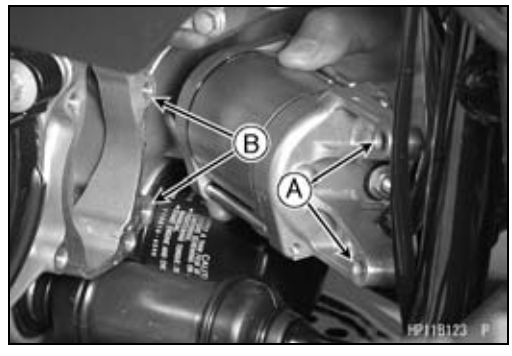


NOTICE

Do not tap the end of the starter motor shaft or the motor may be damaged.

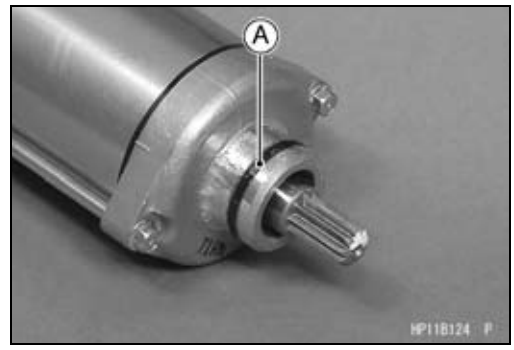
Starter Motor Installation

- When installing the starter motor, clean the starter motor lugs [A] and crankcase [B] where the starter motor is grounded.



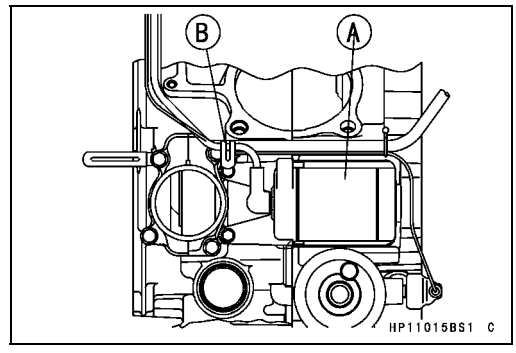
Electric Starter System

★If the O-ring [A] shows wear or damage, or if it is hardened, replace it with a new one.
● Apply a small amount of engine oil to the O-ring.



● Install:
Starter Motor [A]
Clamp [B] (as shown)
● Tighten:

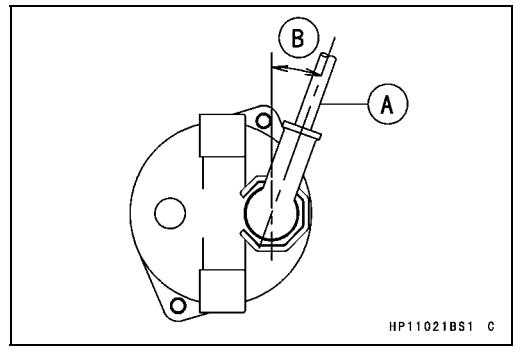
Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)



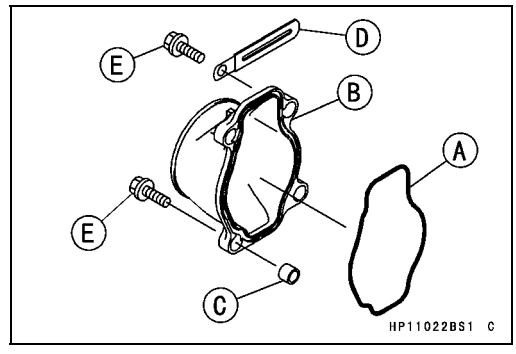
● Position the starter motor cable [A] as shown.
About 20° [B]
● Tighten:

Torque - Starter Motor Cable Mounting Nut: 6.8 N·m (0.69 kgf·m, 60 in·lb)

● Slide back the rubber cap to the original position.

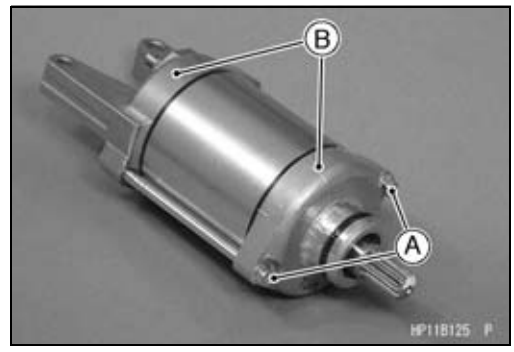


● Apply grease to the O-ring [A] in the joint duct [B].
● Install:
Joint Duct and Collars [C]
Clamp [D] (as shown)
● Tighten the joint duct bolts [E].



Starter Motor Disassembly

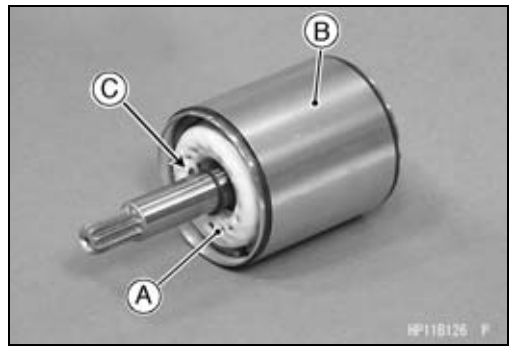
● Remove the starter motor (see Starter Motor Removal).
● Take off the starter motor through bolts [A] and remove the both end covers [B].



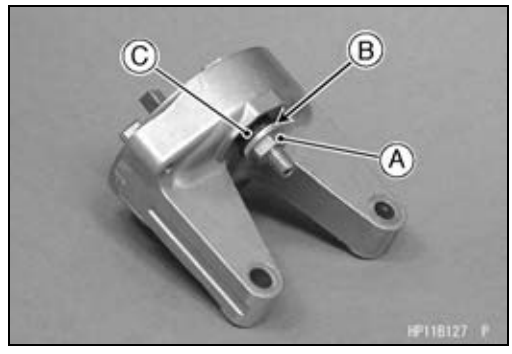
● Pull out the armature [A] out of the yoke [B].

NOTE

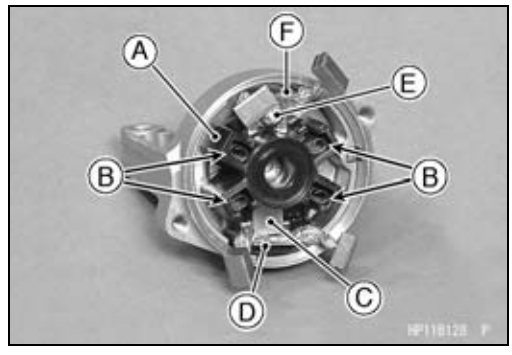
○*Do not remove the circlip [C] from the shaft.*



● Remove:
Starter Motor Terminal Locknut [A]
Washer [B]
Collar [C]

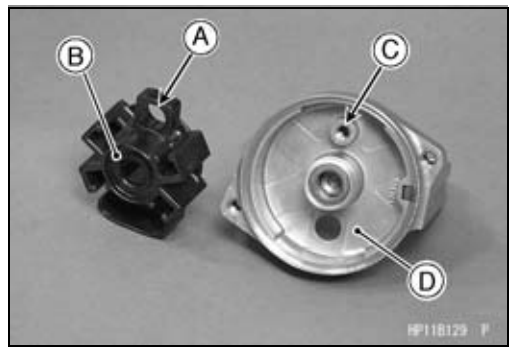


● Pull out the brushes from the brush holder [A].
● Remove:
Brush Springs [B]
Starter Motor Terminal [C]
Positive Brush Assy [D] and O-ring
Screw [E]
Negative Brush Assy [F]
Brush Holder

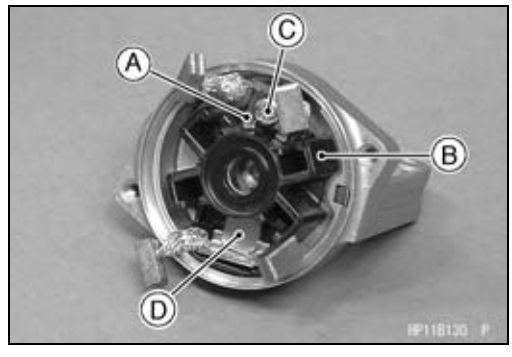


Starter Motor Assembly

● Align the hole [A] of the brush holder [B] to the boss [C] of the end cover [D].



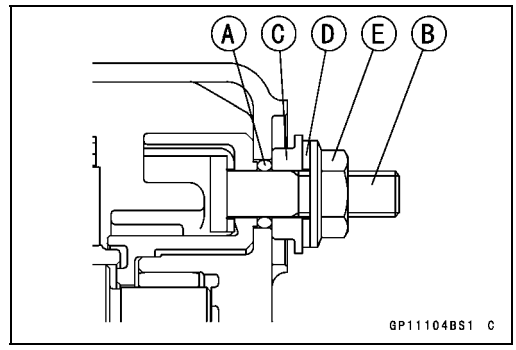
● Install the negative brush assy [A] to the brush holder [B].
● Tighten the screw [C] securely.
● Install the positive brush assy [D] to the brush holder.
● Install the starter motor terminal.



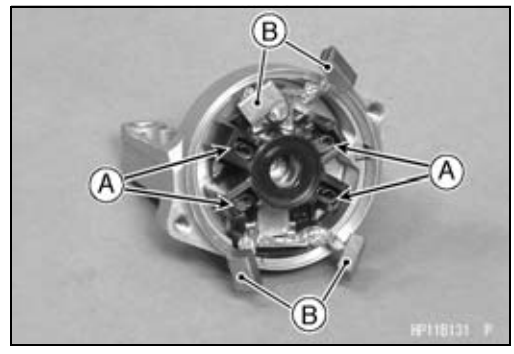
Electric Starter System

● Replace the O-ring [A] with a new one.
● Install the following parts to the starter motor terminal [B].
O-ring
Collar [C]
Washer [D]
Starter Motor Terminal Locknut [E]
○Install the collar so that stepped side faces outward.
● Tighten:

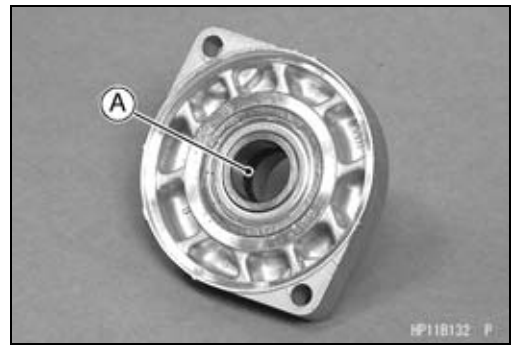
Torque - Starter Motor Terminal Locknut: 11 N·m (1.1 kgf·m, 97 in·lb)



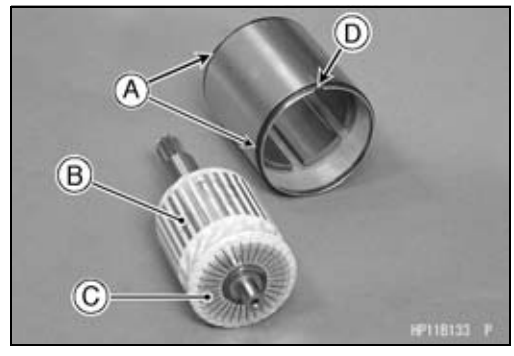
● Install the brush springs [A].
● Insert the brushes [B] to the brush holder.



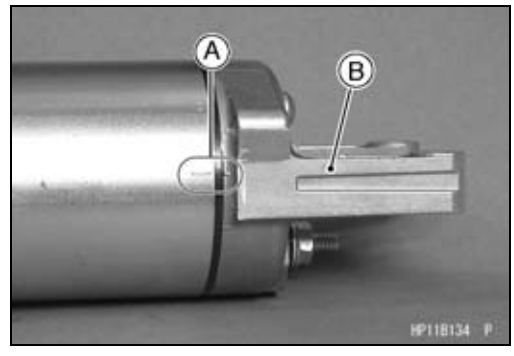
● Apply thin coat of grease to the oil seal [A].



● Replace the O-rings [A] with new ones.
● Insert the armature [B] so that commutator side [C] faces hollow side [D] of the yoke [E].



● Align the marks [A] to assembly the yoke and the end cover [B] as shown.



Electric Starter System

● Tighten:

Torque - Starter Motor Through Bolts [A]: 5.0 N·m (0.51 kgf·m, 44 in·lb)

Brush Inspection

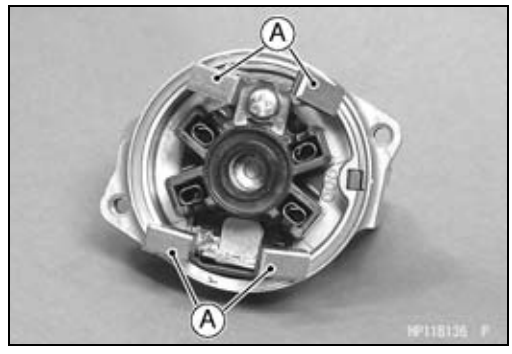
● Measure the length of each brush [A].

★If any is worn down to the service limit, replace the brush assy.

Starter Motor Brush Length

Standard: 12 mm (0.47 in.)

Service Limit: 6.5 mm (0.26 in.)



Commutator Cleaning and Inspection

● Clean the metallic debris off the between commutator segments [A].

NOTE

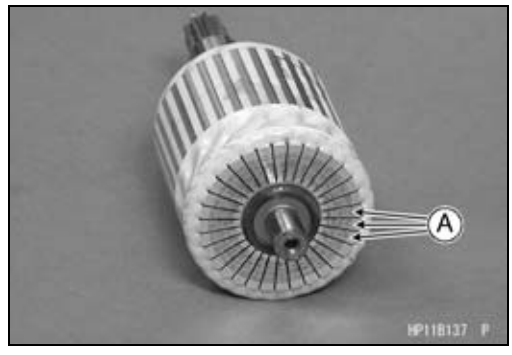
○*Do not use emery or sand paper on the commutator.*

● Check the commutator for damage or abnormal wear.

★Replace the starter motor with a new one if there is any damage or wear.

● Visually inspect the commutator segments for discoloration.

★Replace the starter motor with a new one if discoloration is noticed.



Armature Inspection

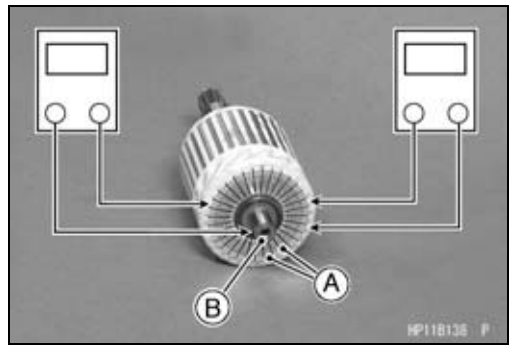
● Using the × 1 Ω hand tester range, measure the resistance between any two commutator segments [A].

Special Tool - Hand Tester: 57001-1394

★If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.

● Using the highest hand tester range, measure the resistance between the segments and the shaft [B].

★If there is any reading at all, the armature has a short and the starter motor must be replaced.

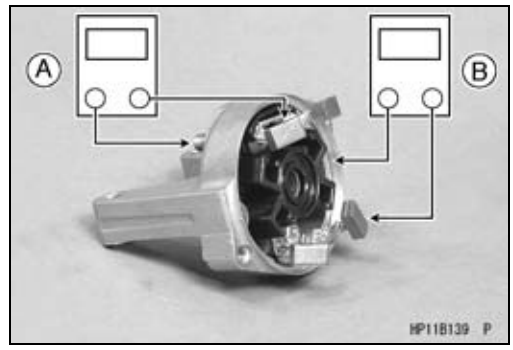


NOTE

○*Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.*

Electric Starter System

Brush Lead Inspection

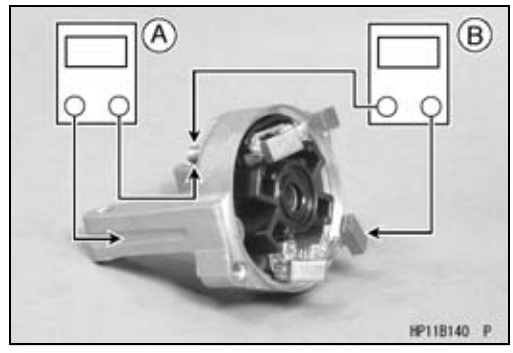


- Using the × 1 Ω hand tester range, measure the resistance as shown.
  Terminal Bolt and Positive Brushes [A]
  Right-hand End Cover and Negative Brushes [B]

  Special Tool - Hand Tester: 57001-1394

★If there is not close to zero ohms, the brush lead has an open. Replace the brush plate assy.

Right-hand End Cover Inspection

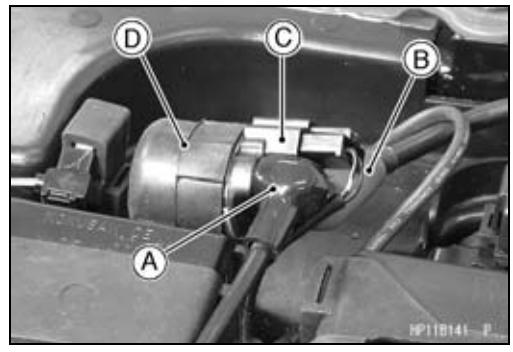


- Using the highest hand tester range, measure the resistance as shown.
  Terminal Bolt and Right-hand End Cover [A]
  Terminal Bolt and Negative Brushes [B]

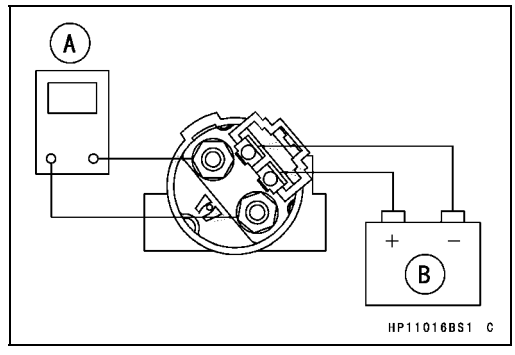
  Special Tool - Hand Tester: 57001-1394

★If there is any reading, the brush assy and/or terminal bolt assy have a short. Replace the starter motor.

Starter Relay Inspection



- Remove:
  Seat (see Seat Removal in the Frame chapter)
- Disconnect:
  Starter Motor Cable [A]
  Battery Positive Cable [B]
  Connector [C]
- Remove:
  Starter Relay [D]



- Connect the hand tester [A] and a 12 V battery [B] to the starter relay as shown.

★If the relay does not work as specified, the relay is defective. Replace the relay.

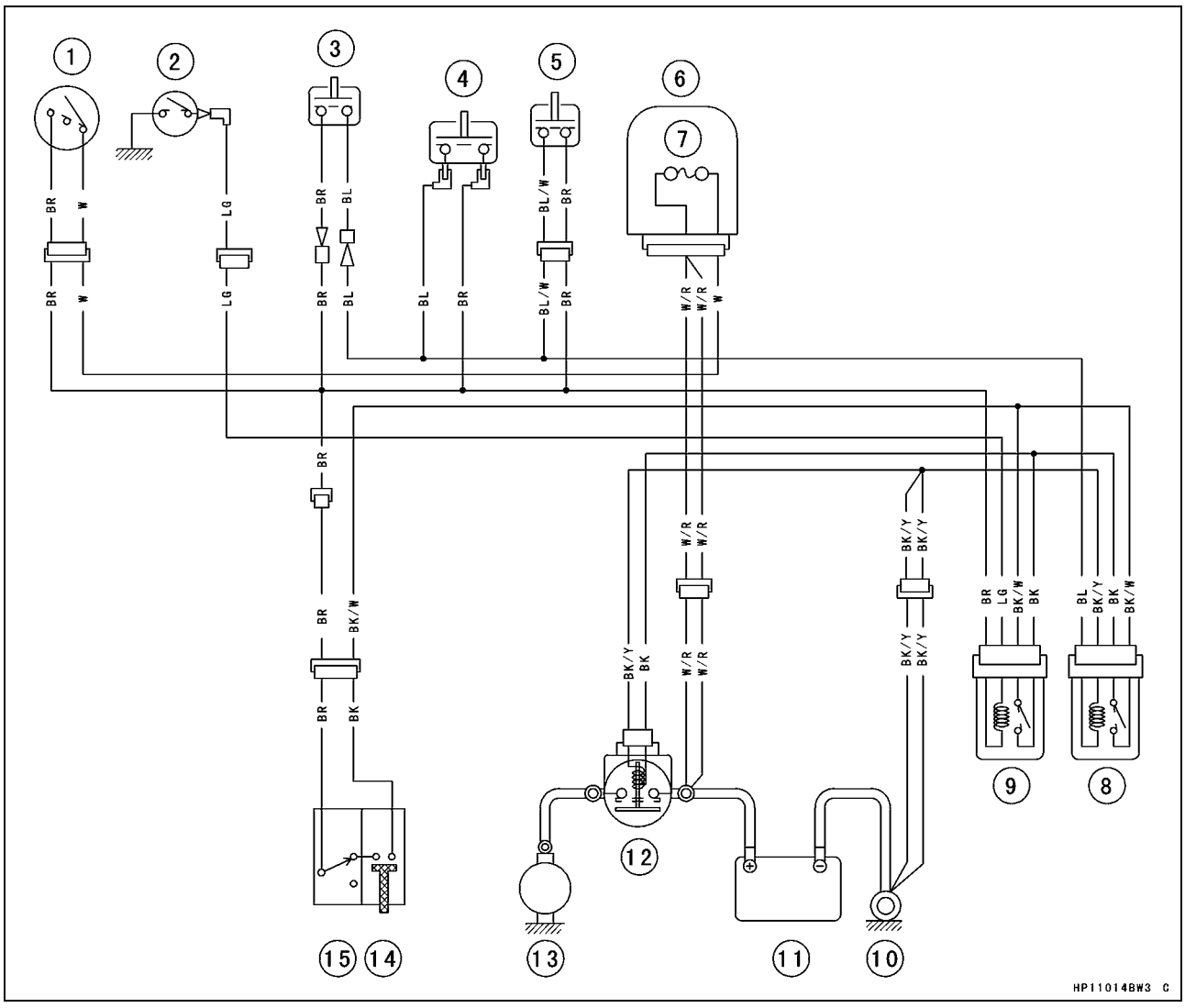
Testing Relay
Hand Tester Range: × 1Ω range
Criteria: When battery is connected ⇒ 0 Ω
When battery is disconnected ⇒ ∞Ω

Starter Control Relay Inspection

- Refer to the Relay Inspection.

Electric Starter System

Electric Starter Circuit



1. Ignition Switch
2. Neutral Switch
3. Rear Brake Light Switch (Lever)
4. Front Brake Light Switch
5. Rear Brake Light Switch (Pedal)
6. Fuse Box
7. Main Fuse 30 A
8. Stater Control Relay (Brake)
9. Stater Control Relay (Neutral)
10. Engine Ground Terminal
11. Battery 12 V 12 Ah
12. Starter Relay
13. Starter Motor
14. Starter Button
15. Engine Stop Switch

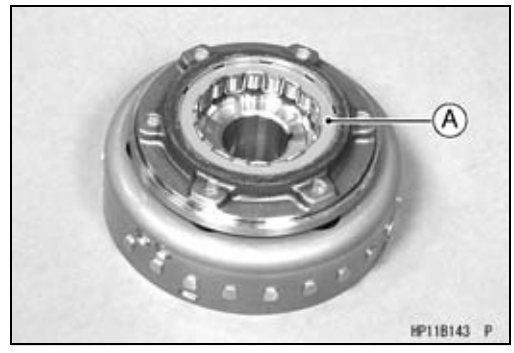
Electric Starter System

Starter Motor Clutch Removal

- Remove the alternator rotor (see Alternator Rotor Removal).
- Hold the rotor with the flywheel holder and take out the starter motor clutch bolts [A].

Special Tool - Flywheel Holder: 57001-1313

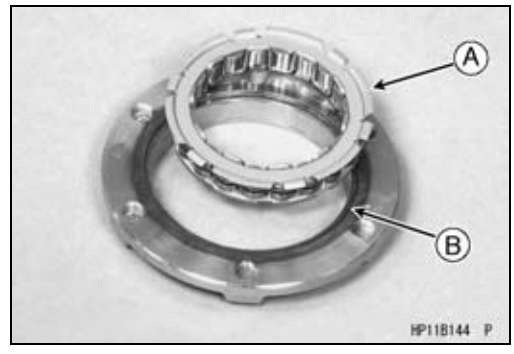
- Take out the one-way clutch [A].



Starter Motor Clutch Installation

- Install the one-way clutch so that the flange [A] fits on the recess [B] of the race.
- Apply a non-permanent locking agent to the starter motor clutch bolts.
- Tighten:

Torque - Starter Motor Clutch Bolts: 34 N·m (3.5 kgf·m, 25 ft·lb)

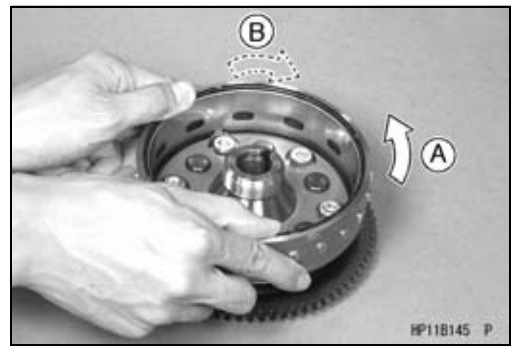


Starter Motor Clutch Inspection

- Remove:
  Alternator Rotor (see Alternator Rotor Removal)
- Fit the starter clutch gear into the starter motor clutch.

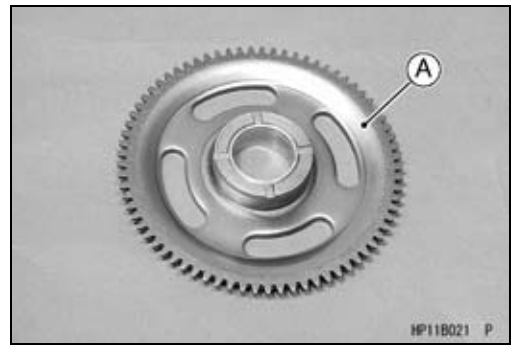
★If the alternator rotor turns counterclockwise [A] freely from the starter clutch gear, but not clockwise [B], the clutch is operating correctly.

★If the clutch does not operate correctly, or if it makes noise, disassemble it and examine each part visually. Replace any worn or damaged parts.



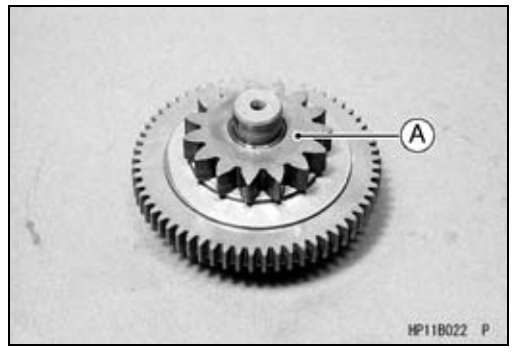
NOTE

○*Examine the starter clutch gear [A]. Replace it if it is worn or damaged.*



Electric Starter System

Torque Limiter Inspection

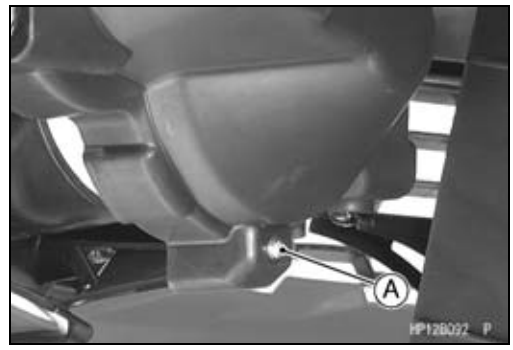


- Remove:
  Alternator Rotor (see Alternator Rotor Removal)
- Remove the torque limiter [A] and visually inspect it.

★If the limiter has wear, discoloration, or other damage, replace it as a unit.

Lighting System

Headlight Beam Vertical Adjustment



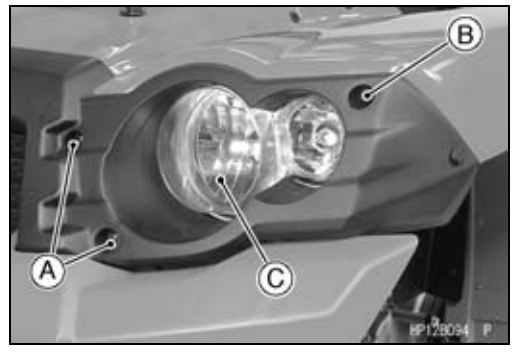
● Turn the adjusting screw [A] on each headlight rim in or out to adjust the headlight vertically.

NOTE

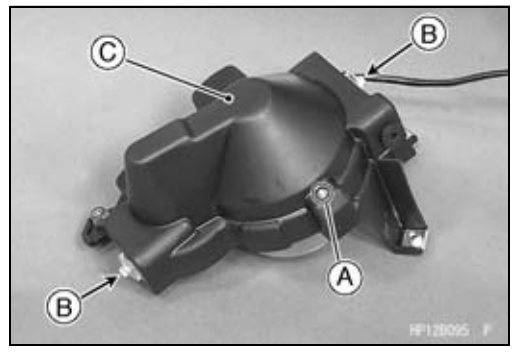
○*On high beam, the brightest point should be slightly below horizontal with the vehicle on its wheels and the rider seated. Adjust both headlights to the same angle.*

Headlight Bulb Replacement

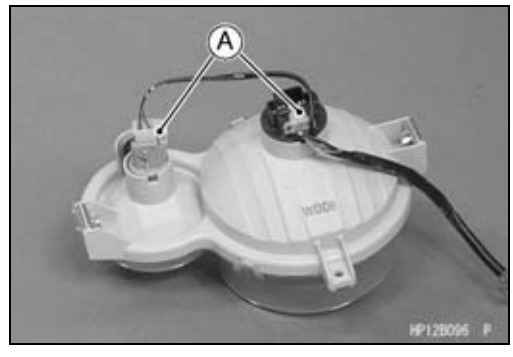
● Remove:
Connector [A]
Clamp [B]
Screw [C]



● Remove:
Headlight Bolts [A] and Collars
Headlight Bolt [B]
Headlight Body [C]



● Remove:
Vertical Adjustment Screw [A], Spring and Nut
Bolts [B]
Headlight Cover [C]

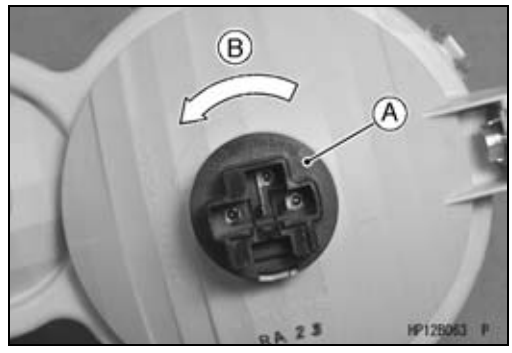


● Disconnect:
Connectors [A]

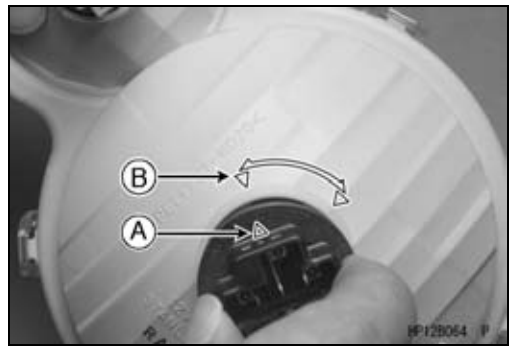
Lighting System

- Turn the bulb socket [A] counterclockwise [B], and remove the bulb.

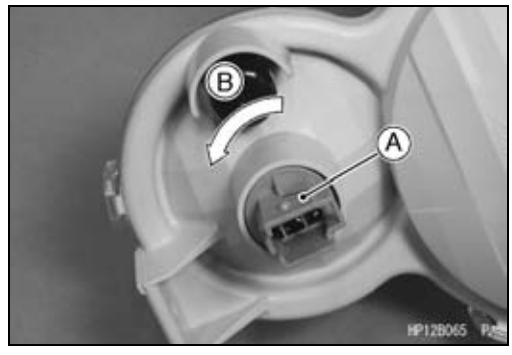
○The headlight bulb can not be removed from the socket.



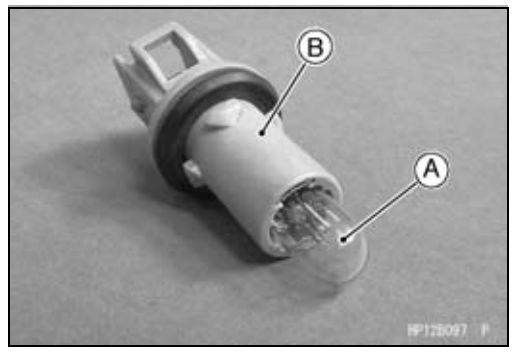
- Align the mark [A] of a new bulb socket with the mark [B] of the headlight body.
- Turn the bulb socket clockwise until it is stopped.



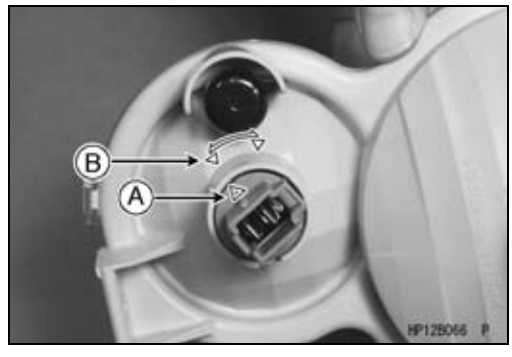
- Turn the bulb socket [A] counterclockwise [B], and remove it.



- Pull the bulb [A] from the socket [B].
- Install the new bulb to the socket.

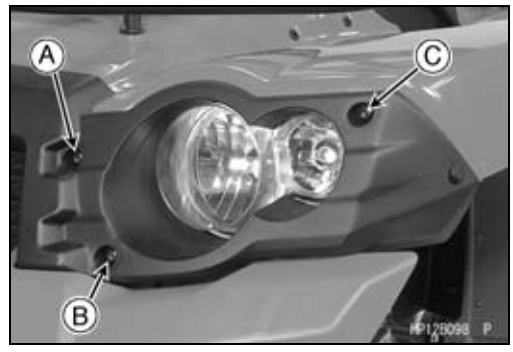


- Align the mark [A] of a new bulb socket with the mark [B] of the headlight body.
- Turn the bulb socket clockwise until it is stopped.



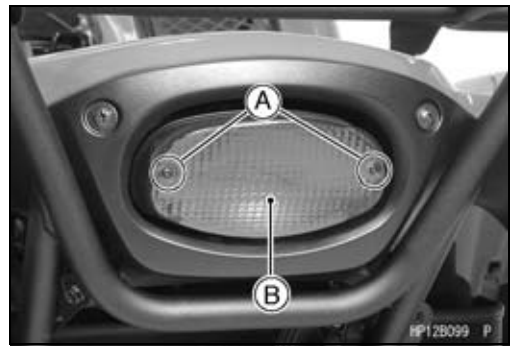
Lighting System

● Install the removed parts.
[A] Bolt and Collar [L = 6 mm (0.24 in.)]
[B] Bolt and Collar [L = 4 mm (0.16 in.)]
[C] Bolt (only)



Tail/Brake Light Bulb Replacement

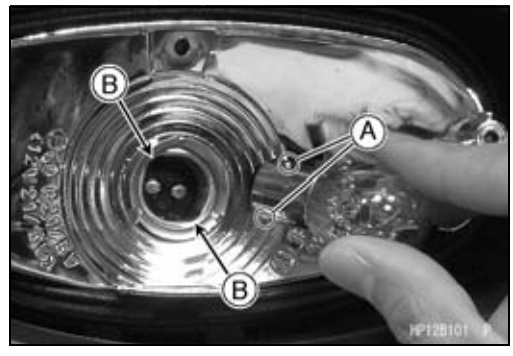
● Remove:
Tail/Brake Light Lens Mounting Screws [A]
Tail/Brake Light Lens [B]



● Push the bulb [A] in, turn it counterclockwise, and pull it out.
● Be sure the socket is clean.

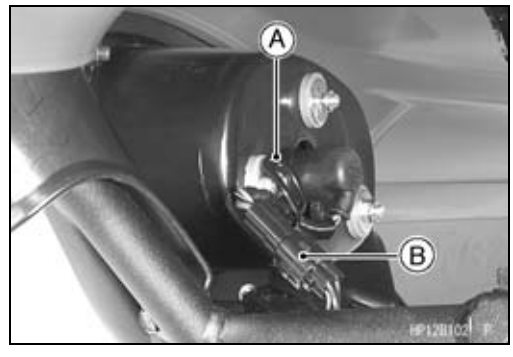
● Insert the new bulb by aligning the pins [A] with the grooves in the walls of the socket.
● Push the bulb in, turn it clockwise, and release it. It should lock in position.
● Tighten:

Torque - Tail/Brake Light Lens Screws: 1.0 N·m (0.10 kgf·m, 8.8 in·lb)



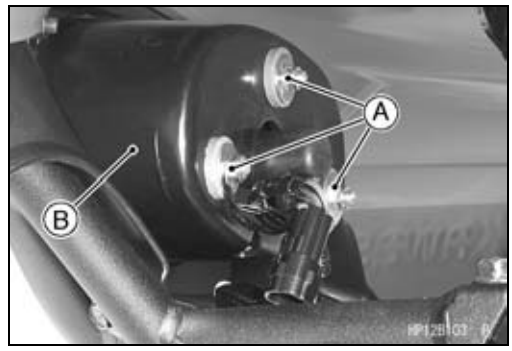
Tail/Brake Light Removal

● Open the clamp [A].
● Disconnect:
Taillight Connector [B]

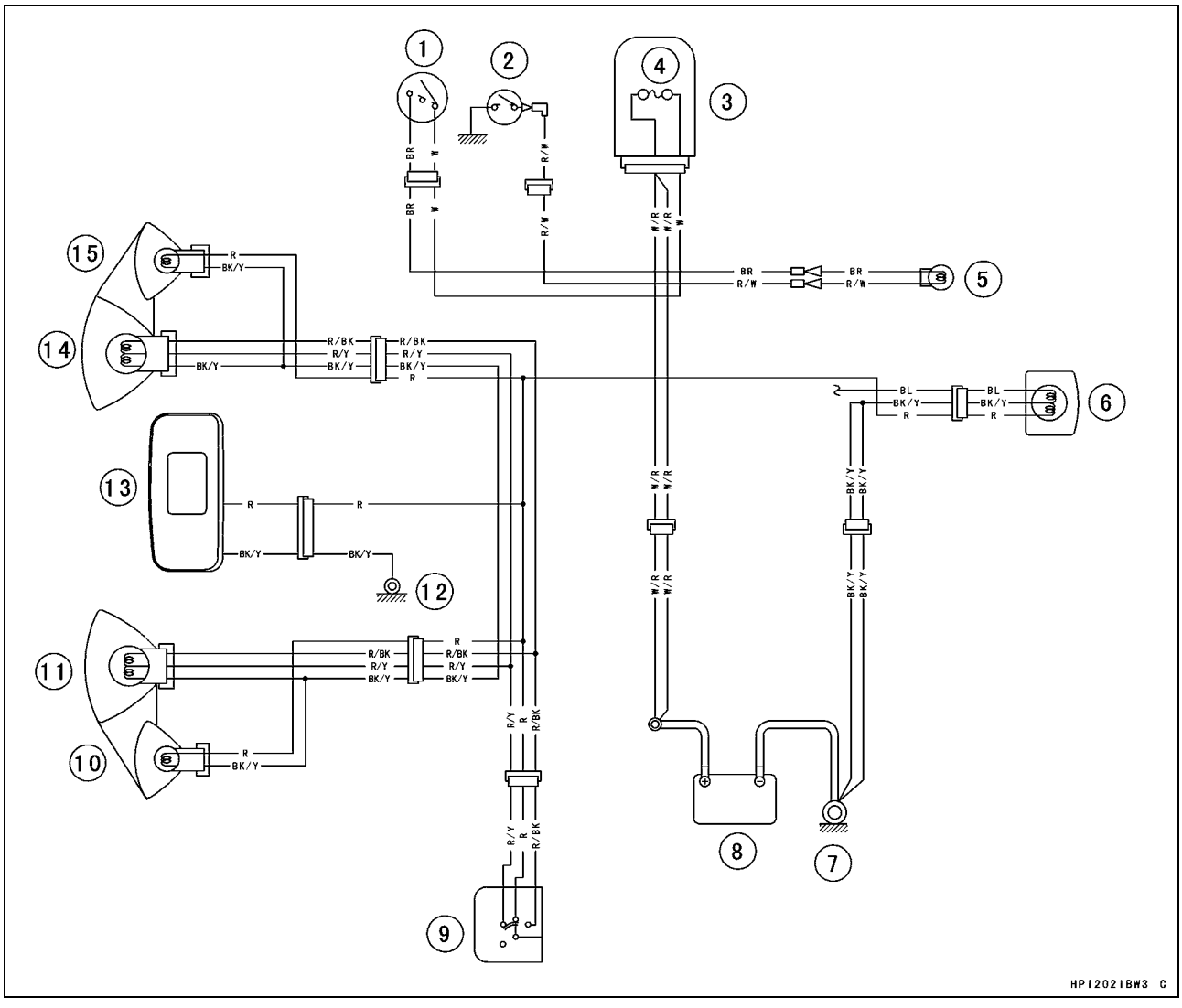


Lighting System

● Remove:
Tail/Brake Light Mounting Nuts [A]
Tail/Brake Light [B]



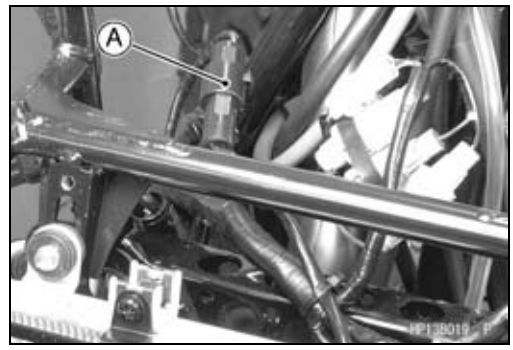
Lighting System Circuit



1. Ignition Switch
2. Reverse Switch
3. Fuse Box
4. Main Fuse 30 A
5. Reverse Light (Europe Models)
6. Tail/Brake Lights 12 V 5/21 W
7. Engine Ground Terminal
8. Battery 12 V 12 Ah
9. Light/Dimmer Switch
10. Position Light (Left) 12 V 5 W
11. Headlight (Left) 12 V 40/40 W
12. Frame Ground
13. Multifunction Meter
14. Headlight (Right) 12 V 40/40 W
15. Position Light (Right) 12 V 5 W

Radiator Fan System

Radiator Fan Motor Inspection

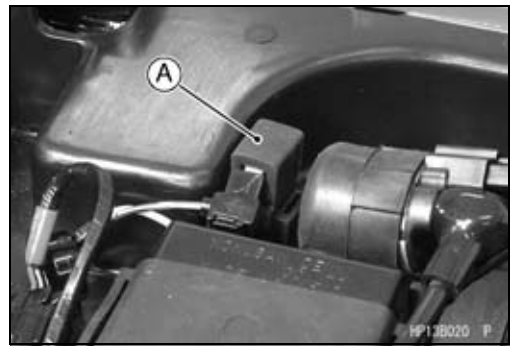


- Disconnect the connector [A] in the fan lead.
- Using two auxiliary wires, supply battery voltage to the fan motor.

★If the fan does not rotate, the fan motor is defective and must be replaced.

Radiator Fan Motor Lead Connections:
BL → Battery (+)
BK → Battery (–)

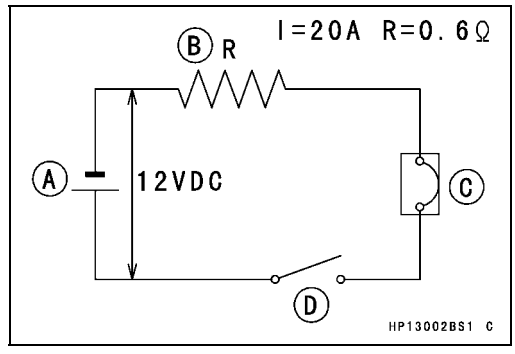
Radiator Fan Breaker Inspection



- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Radiator Fan Breaker [A]

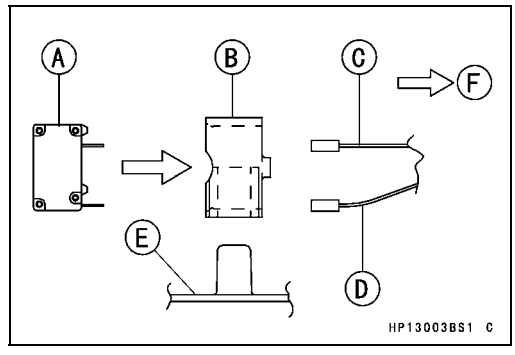
- Inspect the breaker for operation.
- Connect:
  12 V Battery [A]
  0.6 Ω Resistance [B]
  Radiator Fan Breaker [C]
  Switch [D]

★If the circuit in the breaker will not open within 60 seconds, replace the breaker.



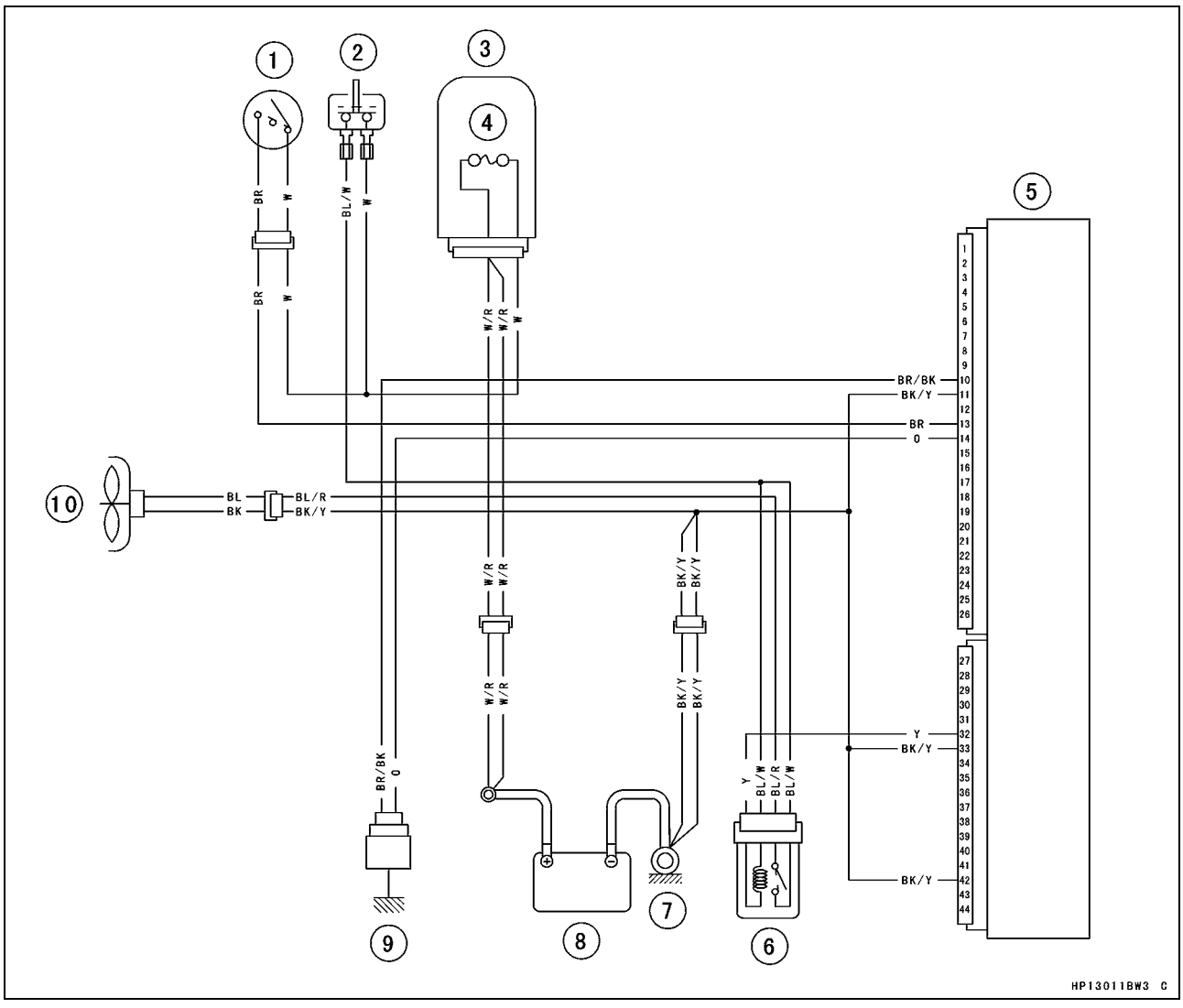
Radiator Fan Breaker Installation

- Install:
  Radiator Fan Breaker [A]
  Holder [B]
- Connect:
  White Lead [C]
  Blue/White Lead [D]
  [E] Electrical Parts Case
  [F] Right Side



Radiator Fan System

Radiator Fan Circuit



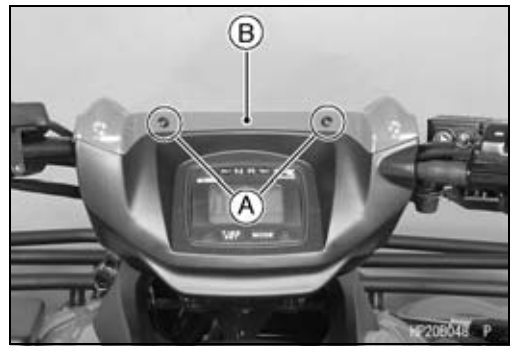
1. Ignition Switch
2. Radiator Fan Breaker 10 A
3. Fuse Box
4. Main Fuse 30 A
5. ECU (Electronic Control Unit)
6. Radiator Fan Relay
7. Engine Ground Terminal
8. Battery 12 V 12 Ah
9. Water Temperature Sensor
10. Radiator Fan

Meter

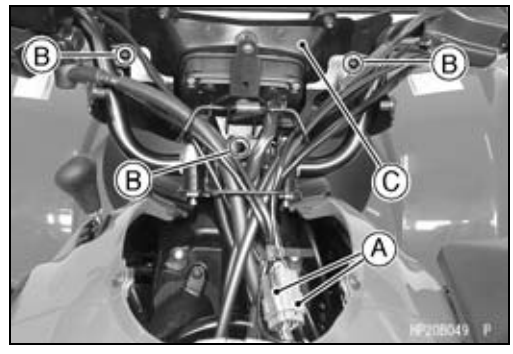
Multifunction Meter Unit Removal

- Remove:
  Handlebar Cover Screws [A]

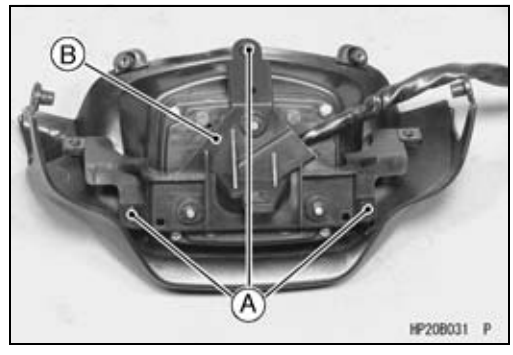
- Remove:
  Handlebar Cover Screws [A]
  Handlebar Cover Front [B]



- Remove:
  Meter Unit Lead Connectors [A]
  Handlebar Cover Screws [B]
  Handlebar Cover Rear [C] with Meter Unit



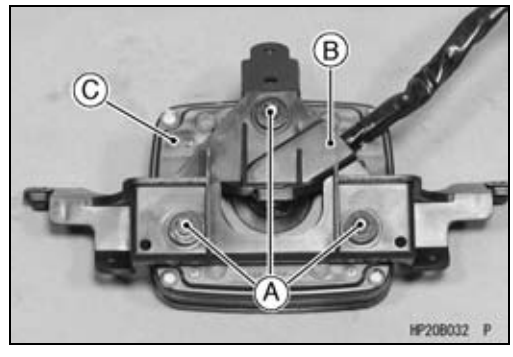
- Remove:
  Bracket Mounting Screws [A]
  Meter and Bracket [B]
  Upper Damper



- Remove:
  Multifunction Meter Mounting Nuts [A] and Washers
  Bracket [B]
  Multifunction Meter Unit [C]

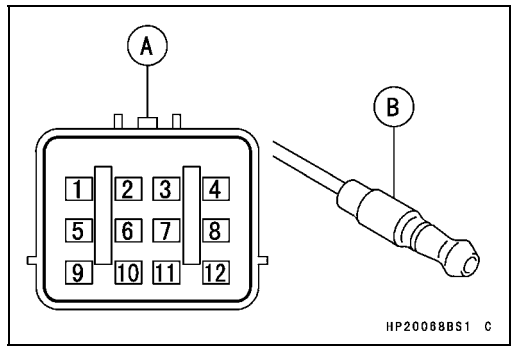
NOTICE

Do not drop the meter unit.



Meter

Multifunction Meter Unit Inspection



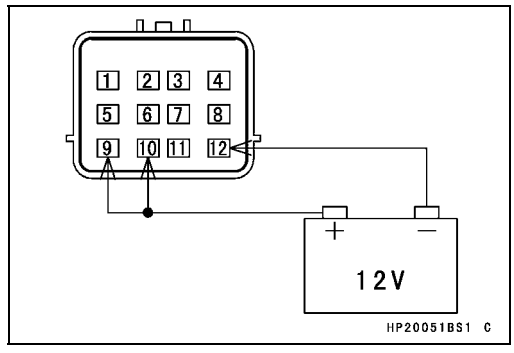
● Remove:
Multifunction Meter Unit (see Multifunction Meter Unit Removal)

NOTICE

Do not drop the meter unit.

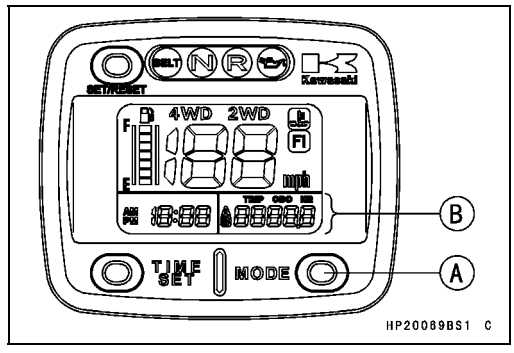
[A] Meter Unit Lead Connector
[B] FI Indicator (LCD) Connector
[1] Speed Sensor Pulse
[2] Belt Indicator Light (LED) (–)
[3] Water Temperature Sensor (–)
[4] 2WD/4WD LCD Indicator (–)
[5] Fuel Gauge (Fuel Indicator LCD Segments)
[6] Meter Illumination (+)
[7] Reverse Indicator Light (LED) (–)
[8] Neutral Indicator Light (LED) (–)
[9] Ignition (+)
[10] Battery (+)
[11] Oil Pressure Warning Indicator Light (LED)
[12] Battery (–)
LED: Light Emitting Diode
LCD: Liquid Crystal Display

Check 1: LCD Segments Check



● Using auxiliary wires, connect a 12 V battery to the meter unit connector as follows.
● Connect the battery positive (+) terminal to terminal [10].
● Connect the battery negative (–) terminal to terminal [12].
● Connect terminal [9] to the battery (+) terminal.
○When the terminal [9] is connected, all the LCD segments appear for one second.
○When the terminal [9] is disconnected, all the LCD segments disappear.
★If this display function does not work, replace the meter unit.

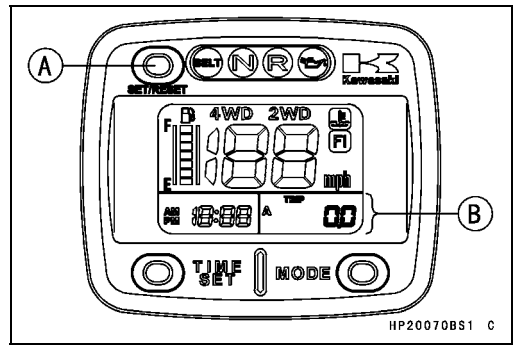
Check 2: MODE and TIME SET Buttons Operation Check



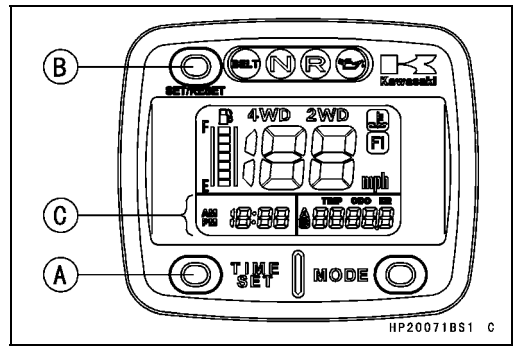
● Connect the wires in the same manner as Check 1.
● Check that when the MODE button [A] is pushed and held continuously, the display [B] cycles through the four modes.
ODO → TRIP A → TRIP B → Hour → ODO
★If this display function does not work, replace the meter unit.

Meter

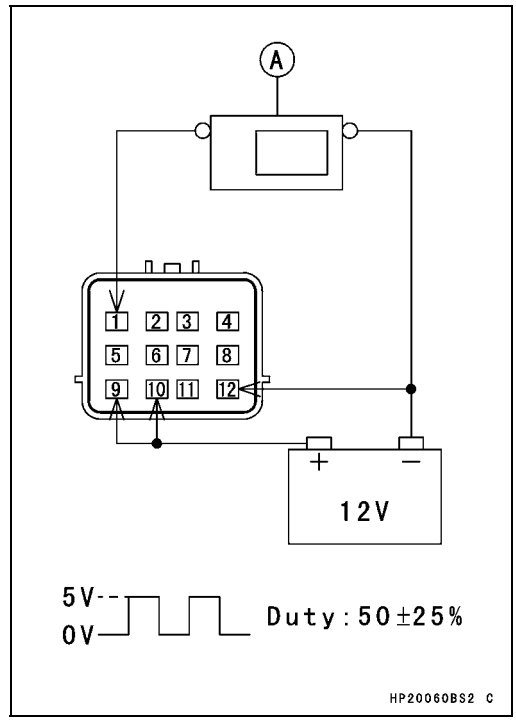
● Cycle the meter to TRIP A or TRIP B mode.
● Check that when the SET/RESET button [A] is pushed, the display turns to 0.0.
★If this display function does not indicate 0.0 [B], replace the meter unit.



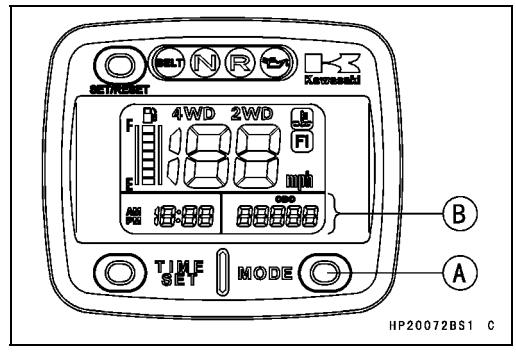
● Check that when the TIME SET [A] and SET/RESET [B] buttons are pushed, the time [C] will reset.
★If the meter function does not work, replace the meter unit.



Check 3: Speedometer Check
● Connect the wires in the same manner as Check 1.
● The speed equivalent to the input frequency is indicated in the oscillator [A], if the square wave is input into terminal [1].
○Indicates approximately 40 mph if the input frequency is approximately 789 Hz.
○Indicates approximately 40 km/h if the input frequency is approximately 526 Hz.
★If the meter function does not work, replace the meter unit.



Check 4: Odometer Check
● Connect the wires in the same manner as Check 3.
● Pushing the MODE button [A], cycles the odometer [B].
● Raise the input frequency of the oscillator to see the result of this inspection.
★If the value indicated by the odometer does not work, replace the meter unit.

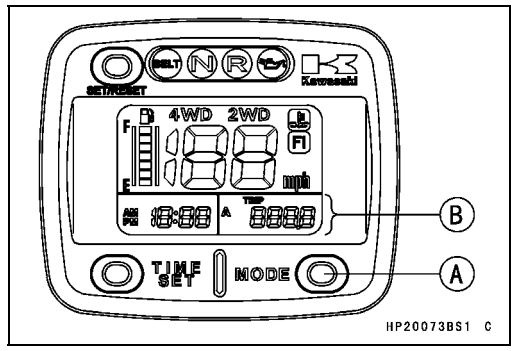


Meter

Check 5: Trip Meter A/B Check

- Connect the wires in the same manner as Check 3.
- Pushing the MODE button [A], cycles the trip meter A or B [B].
- Raise the input frequency of the oscillator to see the result of this inspection.

★If the value indicated by the trip meter A or B does not increase, replace the meter unit.

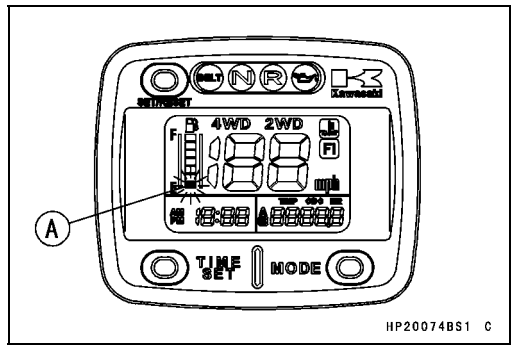


Check 6: Fuel Meter Check

- Connect the wires in the same manner as Check 1.

○The first segment (LCD) [A] should flash.

★It the segment (LCD) does not flash, replace the meter unit.

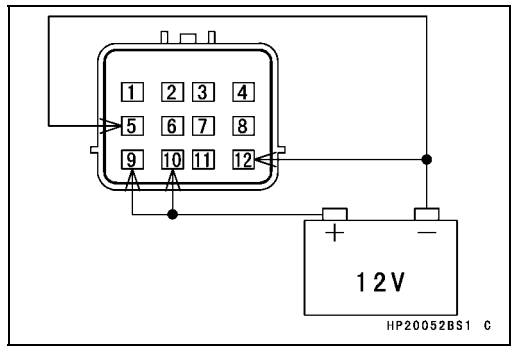


- Connect terminal [5] to the battery (–) terminal.

○When terminal [5] is connected, one segment in the fuel gauge should appear every 15 seconds.

NOTICE
When all segments appeared, disconnect the terminal [5].

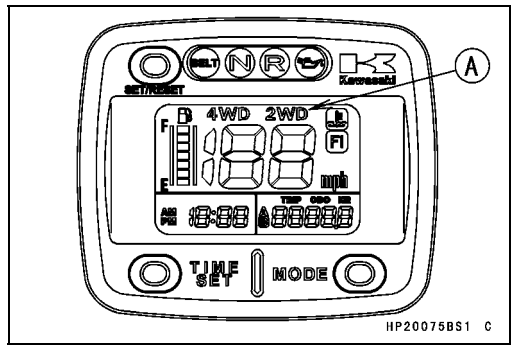
★If this display function does not work, replace the meter unit.



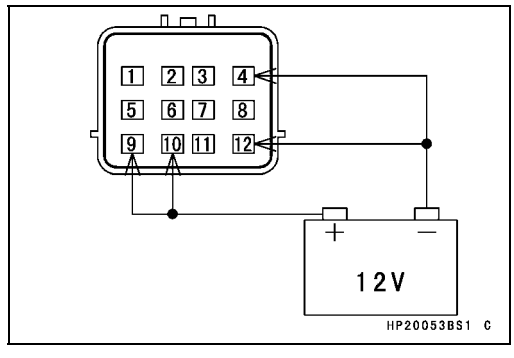
Check 7: 2WD/4WD Indicator Lights Check

- Connect the wires in the same manner as Check 1.

○The 2WD indicator light (LCD) [A] should appear.

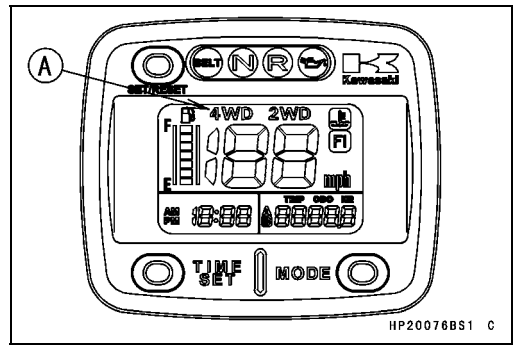


- Connect terminal [4] to the battery (–) terminal.

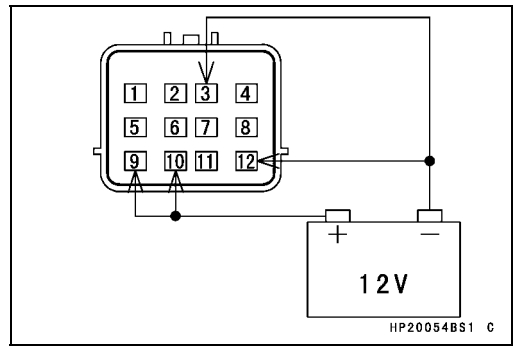


Meter

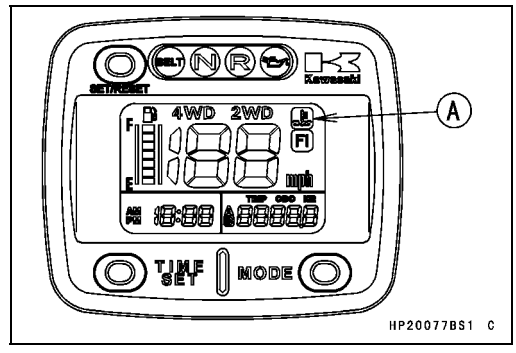
○The 4WD indicator light (LCD) [A] should appear.
★If this display function does not work, replace the meter unit.



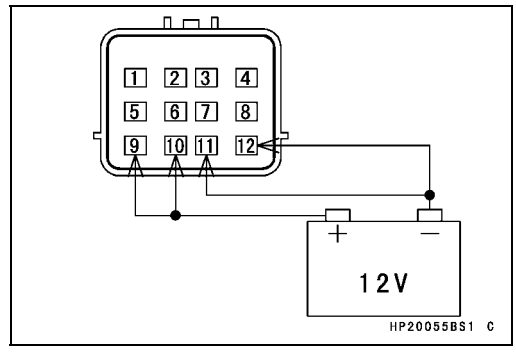
Check 8: Water Temperature Warning Symbol Check
● Connect the wires in the same manner as Check 1.
● Connect terminal [3] to the battery (–) terminal.



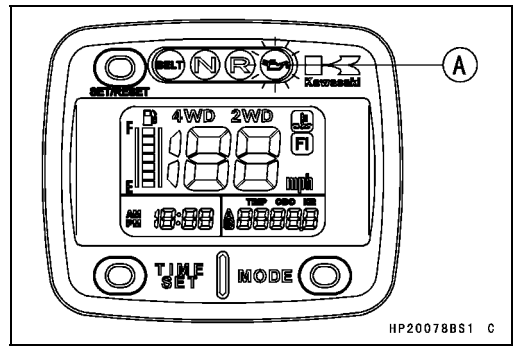
○The water temperature warning symbol (LCD) [A] should appear.
★If this display function does not work, replace the meter unit.



Check 9: Oil Pressure Warning Light Check
● Connect the wires in the same manner as Check 1.
● Connect terminal [11] to the battery (–) terminal.

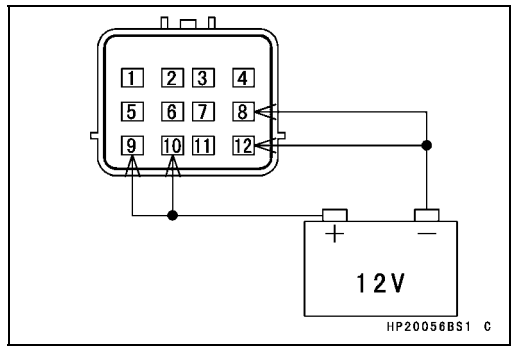


○The oil pressure warning light (LED) [A] should flash.
★If the LED light does not flash, replace the meter unit.

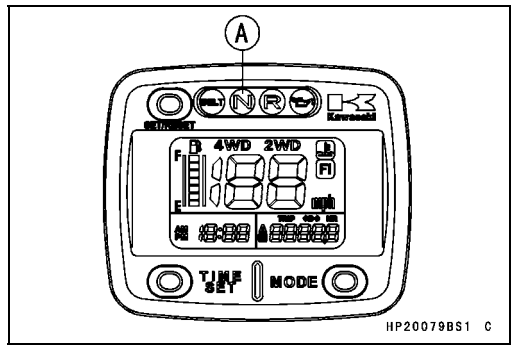


Meter

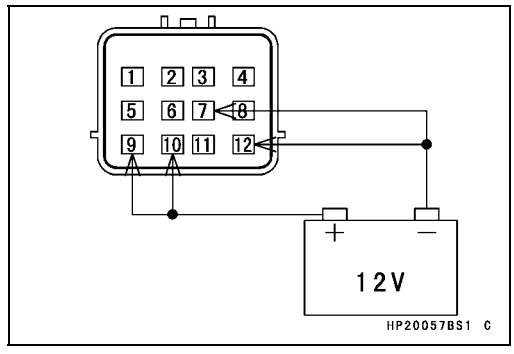
Check 10: Neutral Indicator Light Check
- Connect the wires in the same manner as Check 1.
- Connect terminal [8] to the battery (–) terminal.



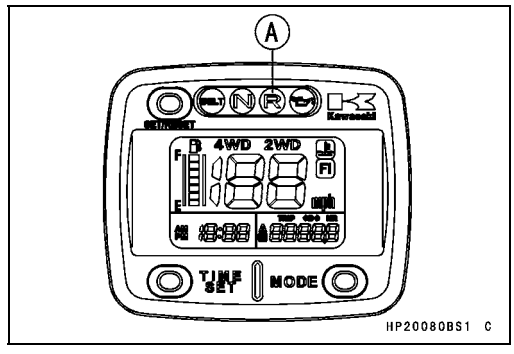
○The neutral indicator light (LED) [A] should go on.
★If the LED light does not go on, replace the meter unit.



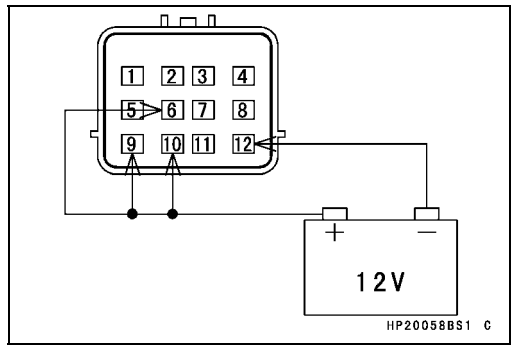
Check 11: Reverse Indicator Light Check
- Connect the wires in the same manner as Check 1.
- Connect terminal [7] to the battery (–) terminal.



○The reverse indicator light (LED) [A] should go on.
★If the LED light does not go on, replace the meter unit.

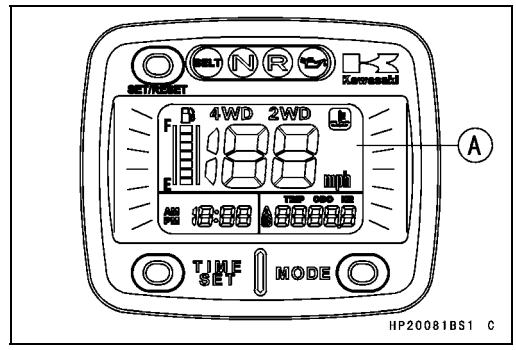


Check 12: Meter Illumination Check
- Connect the wires in the same manner as Check 1.
- Connect terminal [6] to battery (+) terminal.

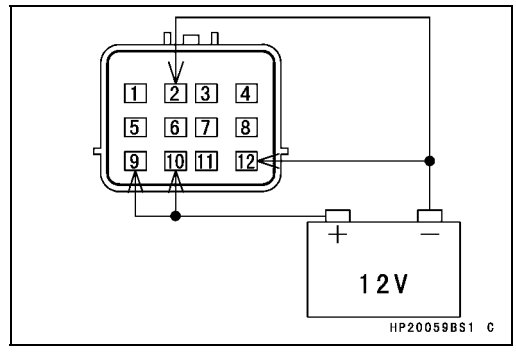


Meter

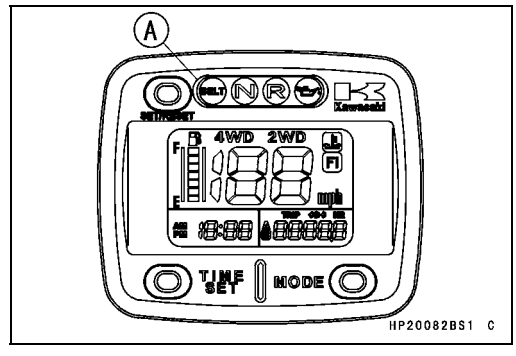
○The meter illumination [A] should go on.
★If the illumination does not go on, replace the meter unit.



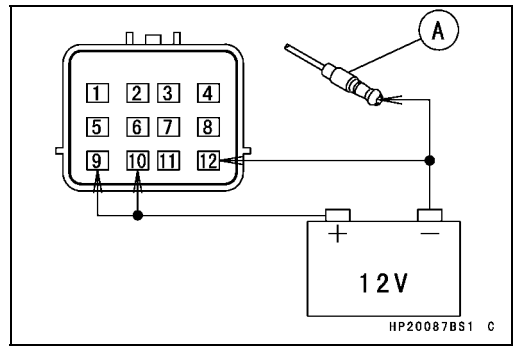
Check 13: Belt Check Indicator Light check
● Connect the wires in the same manner as Check 1.
● Connect terminal [2] to the battery (–) terminal.



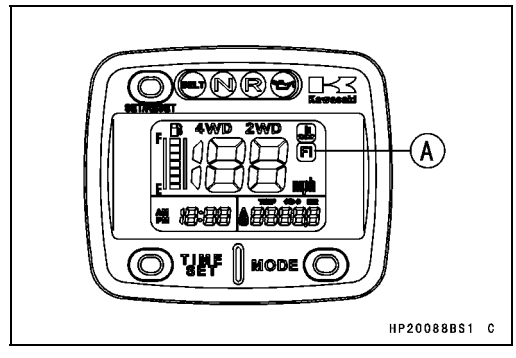
○The belt check indicator light (LED) [A] should go on.
★It the LED does not go on, replace the meter unit.



Check 14:FI Indicator Light check
● Connect the wires in the same manner as Check 1.
● Connect FI indicator connector [A] to the battery (–) terminal.



○The FI indicator light (LCD) [A] should flash (Frame No.: ~ JKAVFDD1 8B507293, ~ JKAVFDE1 8B502729, ~ JKAVFDF1 8B502422, ~ JKAVF750DDB601280).
○The FI indicator light (LCD) [A] should go on for 3 seconds, and flash after that (Frame No.: JKAVFDD1 8B507294 ~, JKAVFDE1 8B502730 ~, JKAVFDF1 8B502423 ~, JKAVF750DDB601281 ~) .
★It the LCD does not flash, replace the meter unit.



Meter

Drive Belt Failure Mode Memory Clearing Procedure

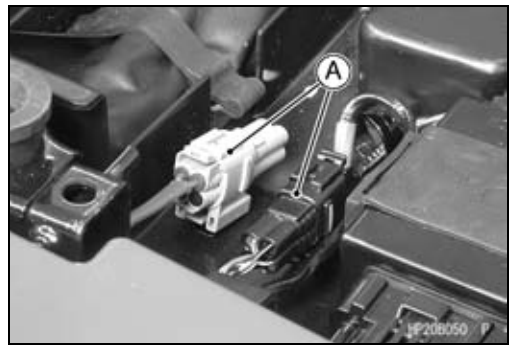
A flashing BELT check indicator LED (Light Emitting Diode) light means that the drive belt failure detection system has activated. The belt check indicator light will illuminate and stay on when activated by the 100 hour belt check system.

NOTE

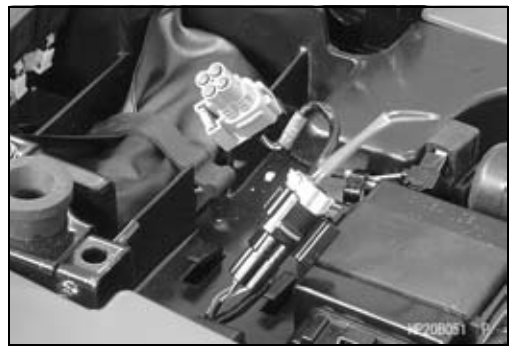
○*Follow the instruction on page 2-25 of this Service Manual to complete the necessary inspections.*

○*After completing the inspections, follow these instructions to clear the system memory and turn off the light.*

● Turn off the ignition switch.
● Remove the seat (see Seat Removal in the Frame chapter).
● Disconnect both sets of 4 pin connectors [A] in the electrical parts case.



● Reconnect these 4 pin connectors to their opposite gray to black and black to gray as shown.



● Turn on the ignition switch.
● Observe the belt check indicator light [A].
○It should be flashing quickly.

● Disconnect the belt switch at the 2 pin connectors [A] above the torque converter cover.
● Observe the belt check indicator light.
○It should be flashing slowly.
○Let it flash for at least five seconds.

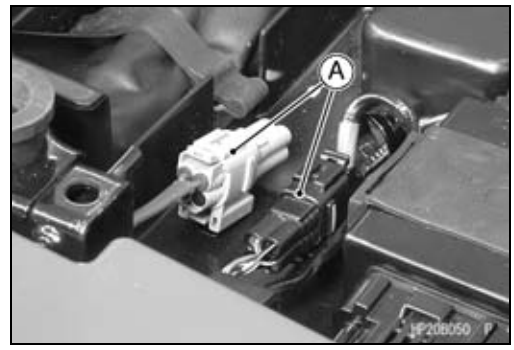
NOTE

○*More than five seconds is OK.*

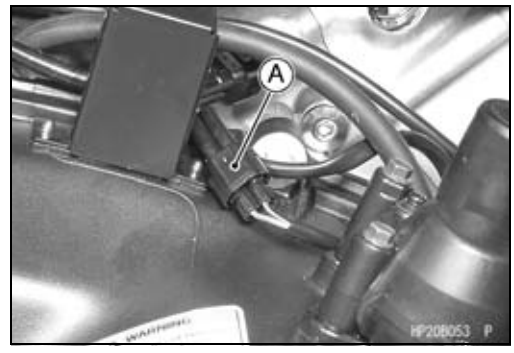
● While observing the belt check indicator light, turn off the ignition switch.

Meter

- Disconnect the mismatched 4 pin connector sets and reconnect them normally. (Black to black, gray to gray) [A]

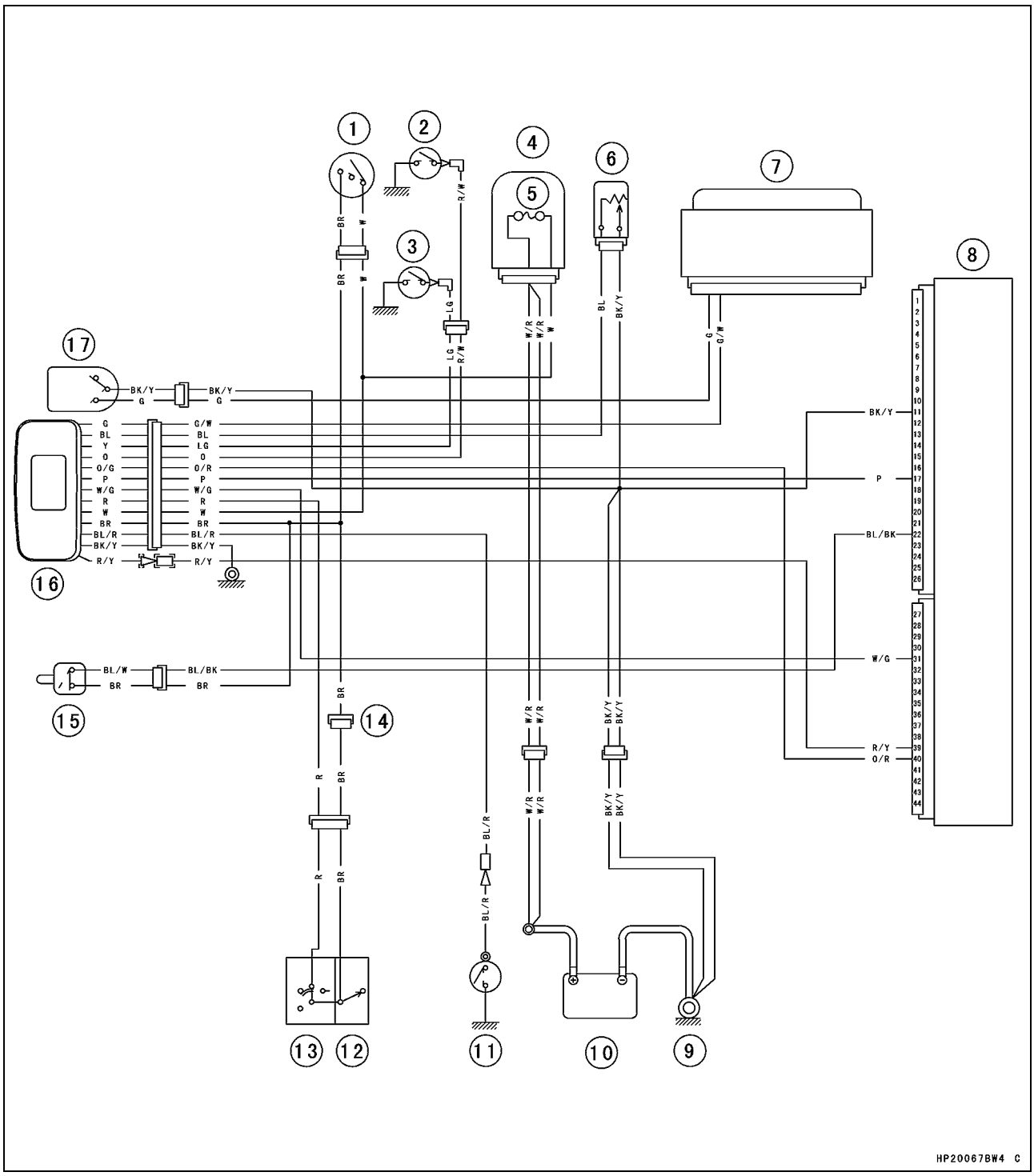


- Connect the belt switch 2 pin connector [A].
- Turn on the ignition switch.
- Confirm that no belt check indicator light is flashing.
- Put the connectors back and bend the clamps.



Meter

Meter Circuit

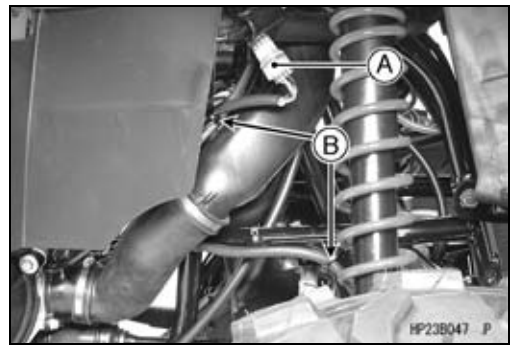


1. Ignition Switch
2. Reverse Switch
3. Neutral Switch
4. Fuse Box
5. Main Fuse 30 A
6. Fuel Level Sensor
7. Actuator Controller
8. ECU (Electronic Control Unit)
9. Engine Ground Terminal
10. Battery 12 V 12 Ah
11. Oil Pressure Switch
12. Engine Stop Switch
13. Light/Dimmer Switch
14. Reset Connector
15. Drive Belt Failure Detecting Switch
16. Multifunction Meter
17. 2WD/4WD Shift Switch

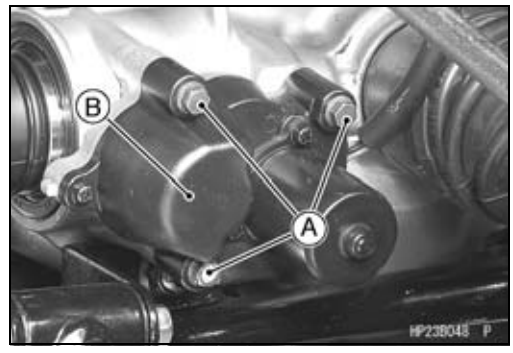
Actuator Control System

2WD/4WD Actuator Removal

- Drain the front final gear case oil (see Front Final Gear Case Oil Change in the Periodic Maintenance chapter).
- Remove:
  Actuator Lead Connector [A]
  Clamps [B]

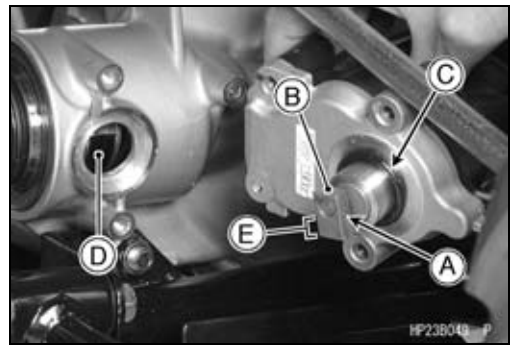


- Remove:
  Actuator Mounting Bolts [A]
  Actuator [B]



2WD/4WD Actuator Installation

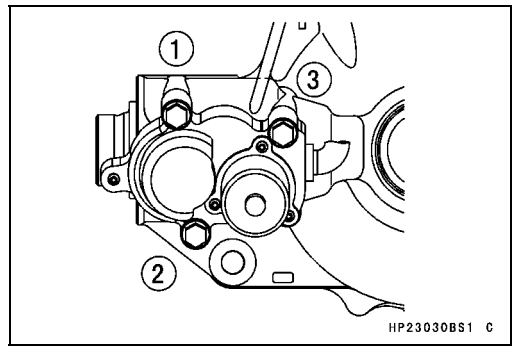
- When installing the pin [A], apply engine oil to the rod of the actuator and install the collar [B] on the actuator and then press the pin.
- Apply grease to the O-ring [C].
- Apply molybdenum disulfide grease to the collar.
- Insert the collar into the groove [D] of the shifter so that the long side [E] faces downward.



- Apply a non-permanent locking agent to the actuator mounting bolts, and tighten them following the tightening sequence [1 ~ 3].

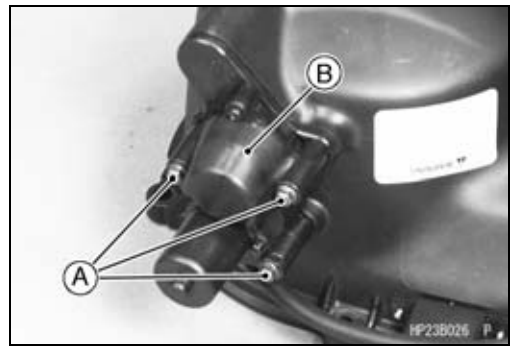
  Torque - 2WD/4WD Actuator Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Apply grease (Amoco Rykon Premium grease No.2 EP Green) to the actuator connector, and connect it.



Engine Brake Actuator Removal

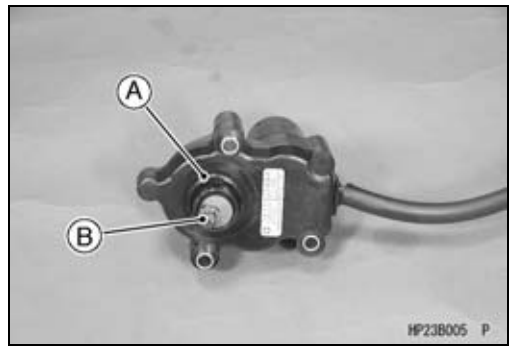
- Confirm that the ignition switch is in OFF position.
- Remove:
  Torque Converter Cover (see Torque Converter Cover Removal in the Converter System chapter)
  Actuator Mounting Bolts [A]
  Actuator [B]



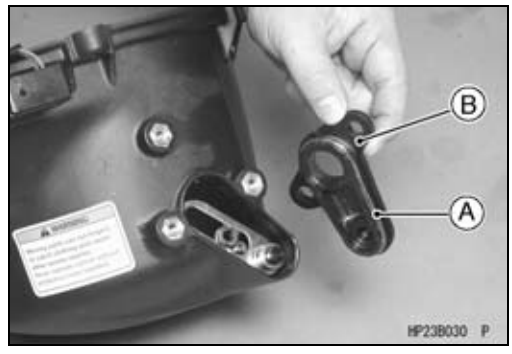
Actuator Control System

Engine Brake Actuator Installation

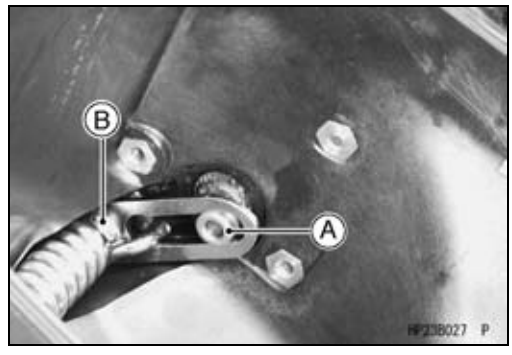
- Apply grease and Install:
  O-ring [A]
- Apply molybdenum disulfide grease to the pin [B].



- Apply grease to the trim seal [A] and install the cover [B].



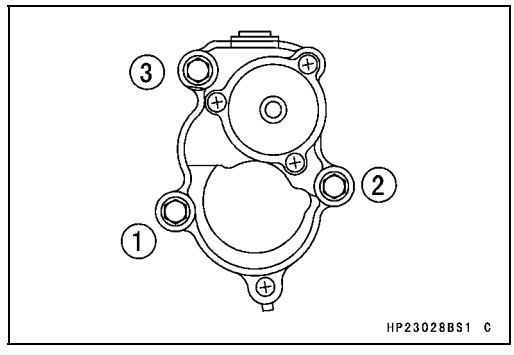
- Insert the pin into the collar [A] of the engine brake lever assembly [B].
- Wipe off any protruding grease.



- Tighten the actuator mounting bolts following the tightening sequence [1 ~ 3].

  Torque - Engine Brake Actuator Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Apply grease (Amoco Rykon Premium grease No.2 EP Green) to the actuator connector, and connect it.

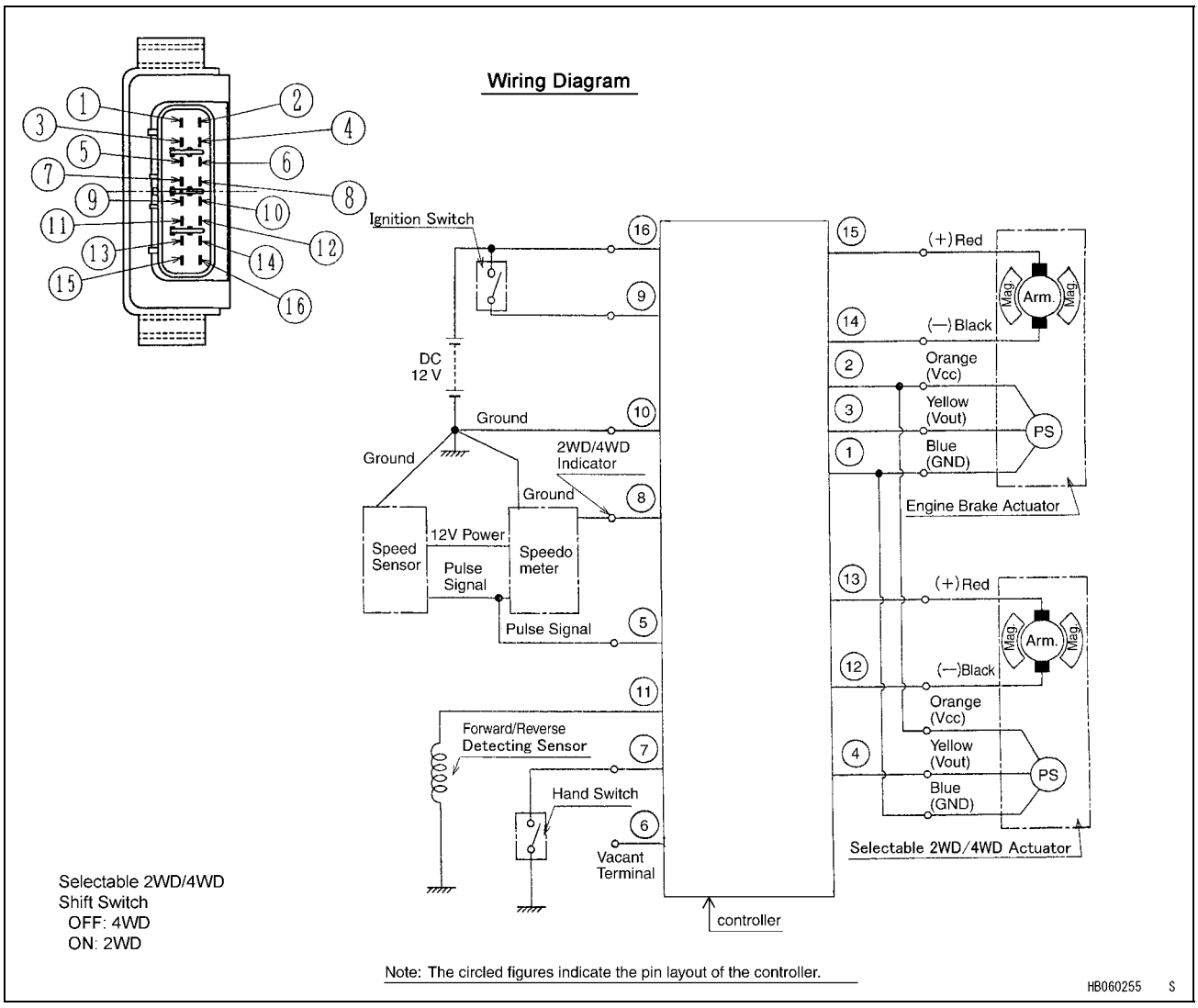


Actuator Control System Outline

The actuator controller has a microprocessor that detects vehicle speed, state of the selectable 2WD/4WD shift switch, ignition switch, and the forward/reverse movement of the vehicle in order to control the engine brake actuator and selectable 2WD/4WD actuator.

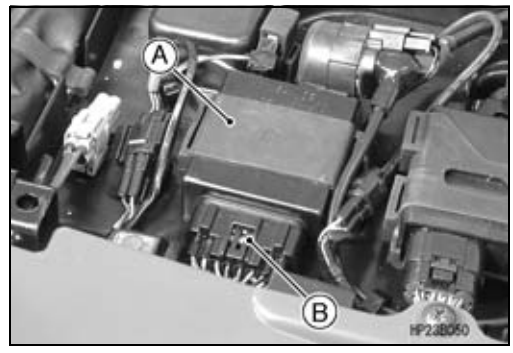
Actuator Control System

Actuator Control System



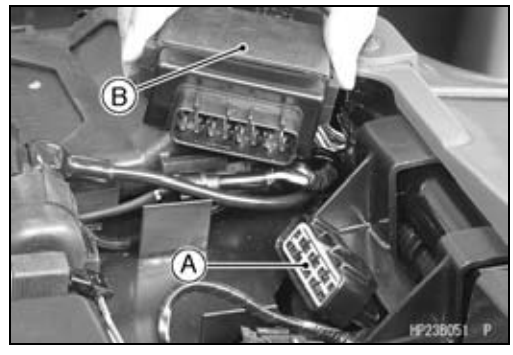
Actuator Controller Removal

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Actuator Controller [A]
- Disconnect the connector [B].



Actuator Controller Installation

- Apply grease (Amoco Rykon Premium grease No.2 EP Green) to the connector [A], and connect it to the actuator controller [B].



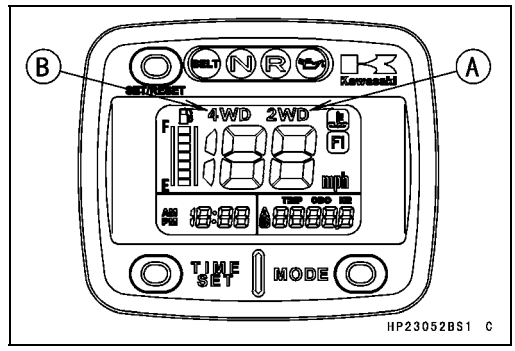
Actuator Control System

Actuator Control System Troubleshooting

When the actuator fails, the controller enters failure mode and the indicator light illuminates 2WD and 4WD alternately.

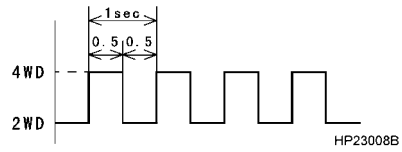
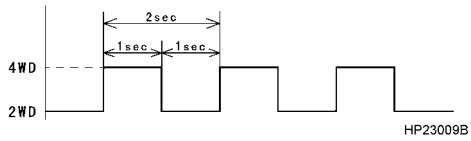
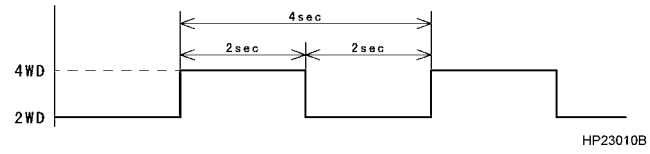
[A] 2WD Indicator Light (LCD)

[B] 4WD Indicator Light (LCD)

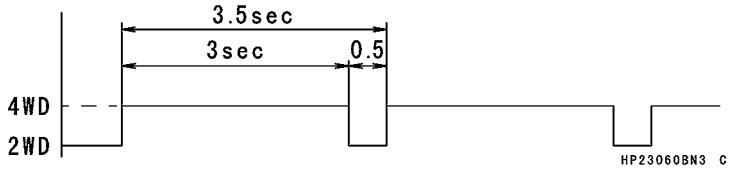
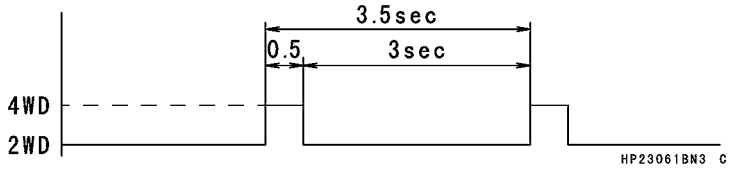
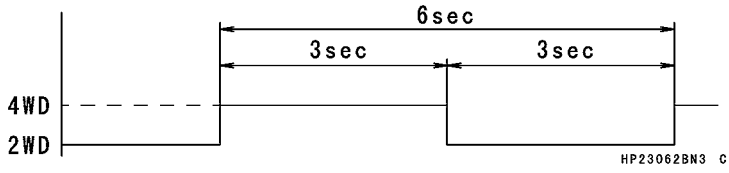


Actuator Control System

Failure Indication Pattern and Failure Part (KVF750D8F/E8F/E8FA/F8F Models)

No.	Failure Indication Pattern	Failure Part
1		Selectable 2WD/4WD actuator
2		Engine brake actuator
3		Both the selectable 2WD/4WD actuator and the engine brake actuator

Failure Indication Pattern and Failure Part (KVF750D9F ~/E9F ~/E9FA/FAF ~ Models)

No.	Failure Indication Pattern	Failure Part
1		Selectable 2WD/4WD actuator
2		Engine brake actuator
3		Both the selectable 2WD/4WD actuator and the engine brake actuator

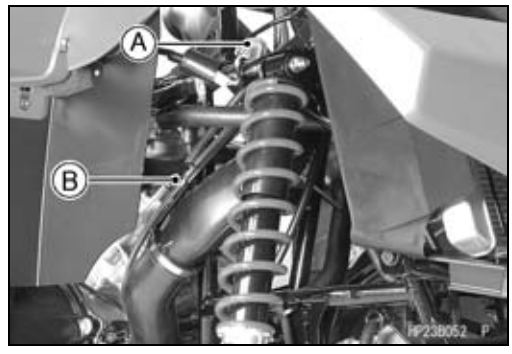
Actuator Control System

Malfunction Mode

No.	Malfunction Mode	Probable Faulty Part/Location	Check Number
1	The 2WD/4WD actuator does not operate correctly.	2WD/4WD actuator	1
		Controller power supply	3
		Speed sensor	4
		2WD/4WD shift switch	5
		Controller	6
2	The engine brake actuator does not operate correctly.	Engine brake actuator	2
		Controller power supply	3
		Speed sensor	4
		F/R detecting sensor	7
		Controller	6
3	The 2WD/4WD indicator light does not switch.	Indicator light (LCD)	8
		Controller	6

Check 1. 2WD/4WD Actuator Inspection

● Remove:
Actuator Lead Connector [A]
Clamp [B]



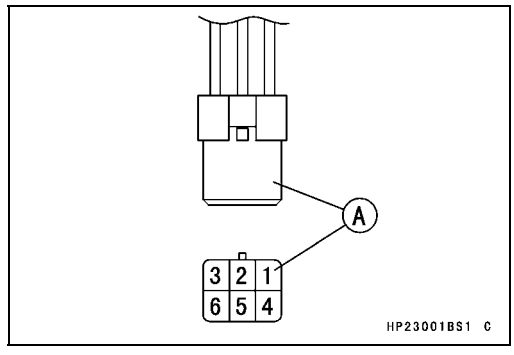
● Measure the resistance between the following terminals in the actuator lead connector [A].

Special Tool - Hand Tester: 57001-1394

Actuator Internal Resistance

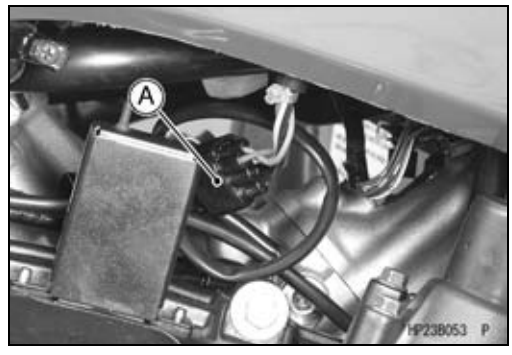
4 (Red) - 6 (Black):	**3 ~ 15 Ω**
1 (Orange) - 3 (Blue):	**3.5 ~ 6.5 kΩ**
2 (Yellow) - 3 (Blue):	**630 ~ 3,720 Ω**

★If any reading is not within the specified range, replace the 2WD/4WD actuator.



Check 2. Engine Brake Actuator Inspection

● Remove:
Actuator Lead Connector [A]



Actuator Control System

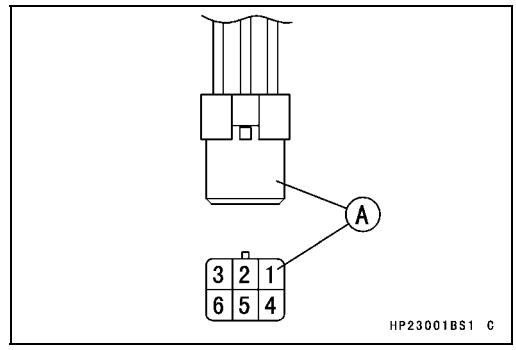
● Measure the resistance between the following terminals in the actuator lead connector [A].

Special Tool - Hand Tester: 57001-1394

Actuator Internal Resistance

4 (Red) - 6 (Black):	**3 ~ 15 Ω**
1 (Orange) - 3 (Blue):	**3.5 ~ 6.5 kΩ**
2 (Yellow) - 3 (Blue):	**630 ~ 5,330 Ω**

★If any reading is not within the specified range, replace the engine brake actuator.



Check 3. Controller Power Supply Inspection

NOTE

○*Be sure the battery is fully charged.*

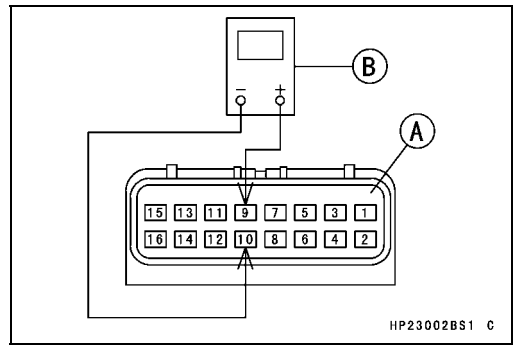
● Remove:
Seat (see Seat Removal in the Frame chapter)
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 25 V)
Tester (+) → Connector (BR) Terminal [9]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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

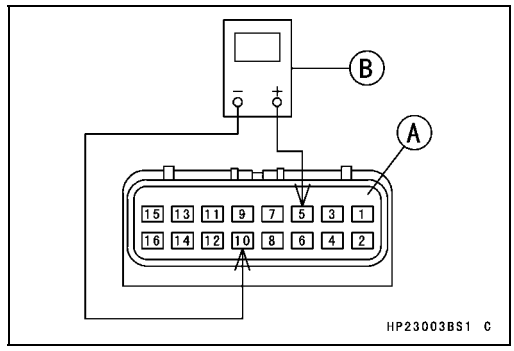
● Turn ON the ignition switch.

Controller Power Supply Voltage
Standard: near Battery Voltage

★If the reading is not battery voltage, check the wiring harness, 30 A fuse, or ignition switch.



Check 4. Speed Sensor Inspection



NOTE

○*Be sure the battery is fully charged.*

- Support the vehicle on a stand or a jack so that the wheels are off the ground.
- Remove:
  Seat (see Seat Removal in the Frame chapter)
- Connect:
  Controller Connector [A]
  Hand Tester [B] (range: DC 25 V)
  Tester (+) → Connector (P) Terminal [5]
  Tester (–) → Connector (BK/Y) Terminal [10]

○Install the needle adapters on the tester leads.

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

- Turn ON the ignition switch.
- Spin a rear wheel, measure the voltage.

Speed Sensor Output Voltage
Standard: repeat from 0 to 5 V

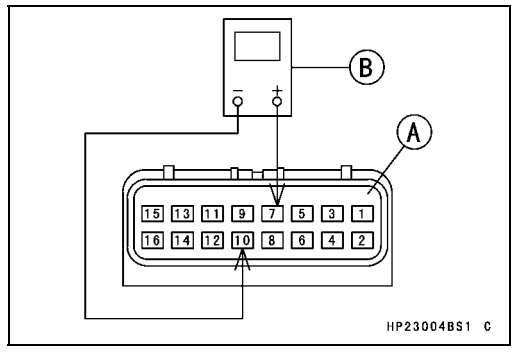
★If the reading is not standard, replace the speed sensor.

○When installing a new O-ring on the speed sensor, apply grease all around the O-ring. Insert the speed sensor to the fully seated position before tightening the mounting bolt for the sensor.

NOTE

○*If the sensor is not fully seated before tightening the bolt, the O-ring can be damaged and oil may leak.*

Check 5. 2WD/4WD Shift Switch Inspection



NOTE

○*Be sure the battery is fully charged.*

- Remove:
  Seat (see Seat Removal in the Frame chapter)
- Connect:
  Controller Connector [A]
  Hand Tester [B] (range: DC 10 V)
  Tester (+) → Connector (G) Terminal [7]
  Tester (–) → Connector (BK/Y) Terminal [10]

○Install the needle adapters on the tester leads.

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

- Turn ON the ignition switch.
- Push the switch to the 4WD position.

Controller Output Voltage (at 2WD/4WD Shift Switch OFF, 4WD)
Standard: about 5 V

★If the reading is not standard, check the 2WD/4WD shift switch or actuator controller unit.

Actuator Control System

● Push the switch to the 2WD position.

Controller Output Voltage (at 2WD/4WD Shift Switch ON, 2WD)
Standard: 0 V

★If the reading is not standard, check the 2WD/4WD shift switch or actuator controller unit.

Check 6. Controller Unit Inspection

NOTE

○*Be sure the battery is fully charged.*

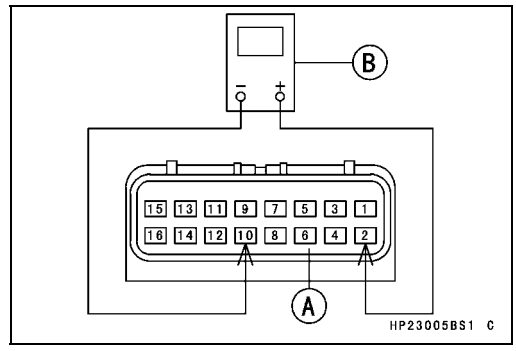
● Remove:
Seat (see Seat Removal in the Frame chapter)
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 10 V)
Tester (+) → Connector (O) Terminal [2]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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

● Turn ON the ignition switch.
● Measure the controller output voltage for the actuators.

Controller Output Voltage (to Actuators)
Standard: 4.8 ±0.2 V

★If the reading is not standard, replace the actuator controller unit.



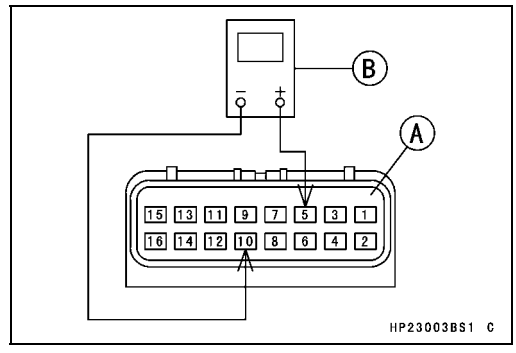
● Disconnect the speed sensor lead connector.
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 10 V)
Tester (+) → Connector (P) Terminal [5]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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

● Turn ON the ignition switch.
● Measure the controller output voltage for the speed sensor.

Controller Output Voltage (to speed sensor)
Standard: 5 ±0.25 V

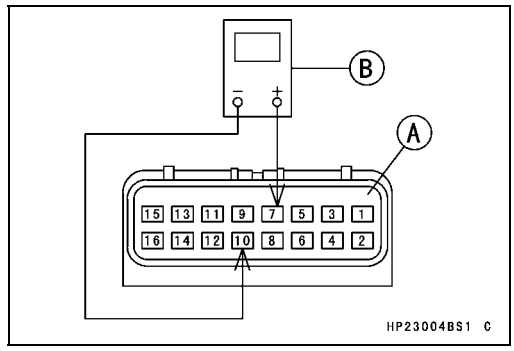
★If the reading is not standard, replace the actuator controller unit.



Actuator Control System

● Disconnect the 2WD/4WD shift switch lead connector.
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 10 V)
Tester (+) → Connector (G) Terminal [7]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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



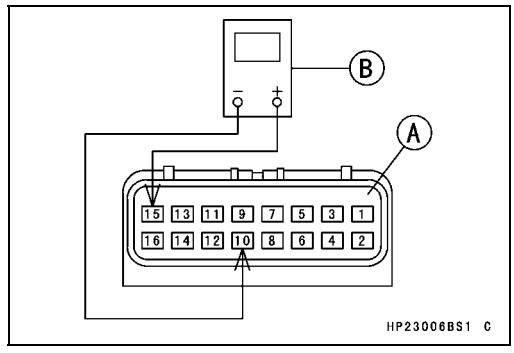
● Turn ON the ignition switch.
● Measure the controller output voltage for the 2WD/4WD shift switch.

Controller Output Voltage (to 2WD/4WD shift switch)
Standard: 5 ±0.25 V

★If the reading is not standard, replace the actuator controller unit.

● Support the vehicle on a stand or a jack so that the wheels are off the ground.
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 25 V)
Tester (+) → Connector (W/R) Terminal [15]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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



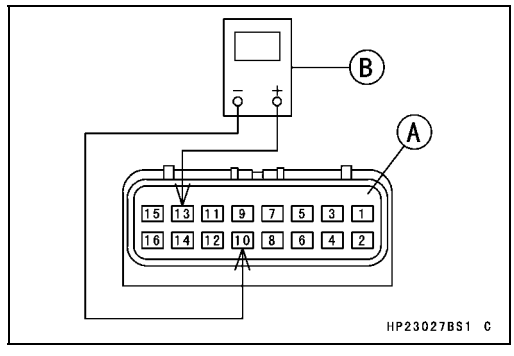
● Turn ON the ignition switch.
● Spin a rear wheel as forward rotation.
● After the wheels stop and one second elapses, turn OFF the ignition switch.
● After two seconds elapses, measure the controller output voltage for the engine brake actuator until the actuator stops.

Controller Output Voltage (to engine brake actuator)
Standard: 5 ~ 12 V

★If the reading is not standard, check the forward/reverse detecting sensor.
★If the forward/reverse detecting sensor is normal, replace the actuator controller unit.

● Support the vehicle on a stand or a jack so that the wheels are off the ground.
● Run the engine and shift to the 4WD position.
● Stop the engine and turn OFF the ignition switch.
● Connect:
Controller Connector [A]
Hand Tester [B] (range: DC 25 V)
Tester (+) → Connector (W/Y) Terminal [13]
Tester (–) → Connector (BK/Y) Terminal [10]
○Install the needle adapters on the tester leads.

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



Actuator Control System

- Turn ON the ignition switch.
- Shift to the 2WD position.
- Measure the controller output voltage for the 2WD/4WD actuator until the actuator stops.

Controller Output Voltage (to 2WD/4WD actuator)
Standard: 5 ~ 12 V

★If the reading is not standard, check the 2WD/4WD shift switch.
★If the 2WD/4WD shift switch is normal, replace the actuator controller unit.

Check 7. Forward/Reverse Detecting Sensor Inspection

- Remove the left footboard (see Left Footboard Removal in the Frame chapter).
- Disconnect forward/reverse detecting sensor lead connector [A].
- Measure the forward/reverse detecting sensor resistance.

○Connect the hand tester between the BK lead and the W lead.
○Set the tester to the × kΩ range.

Special Tool - Hand Tester: 57001-1394

Forward/Reverse Detecting Sensor Resistance
Standard: 1.2 ~ 1.6 kΩ

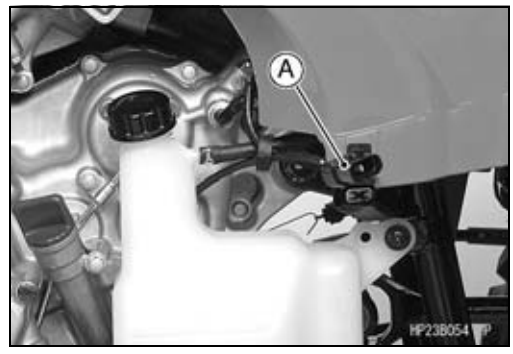
★If the reading is not within the specified range, replace the forward/reverse detecting sensor.

- Using the highest resistance, measure the resistance between forward/reverse detecting sensor leads and chassis ground.

★If the tester reading is less than infinity (∞) indicates a short, replace the forward/reverse detecting sensor.

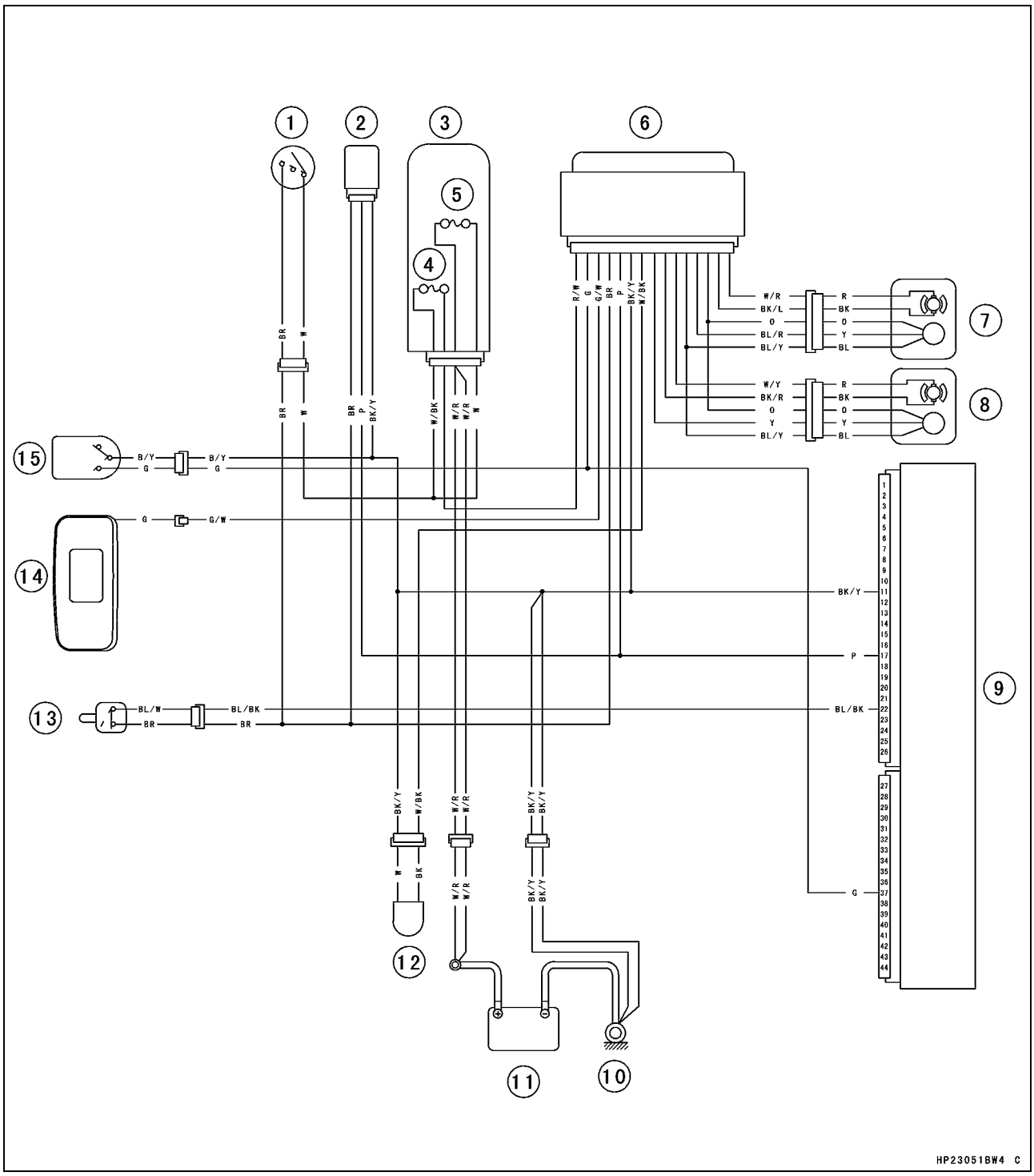
Check 8. Indicator Light (LCD) Inspection

- Refer to Check 7: 2WD/4WD Indicator Lights Check in Multifunction Meter Unit Inspection.



Actuator Control System

Actuator Control System Circuit



1. Ignition Switch
2. Speed Sensor
3. Fuse Box
4. Actuator Controller Fuse 10 A
5. Main Fuse 30 A
6. Actuator Controller
7. Engine Brake Actuator
8. 2WD/4WD Actuator
9. ECU (Electronic Control Unit)
10. Engine Ground Terminal
11. Battery 12 V 12 Ah
12. Forward/Reverse Detecting Sensor
13. Drive Belt Failure Detecting Switch
14. Multifunction Meter
15. 2WD/4WD Shift Switch

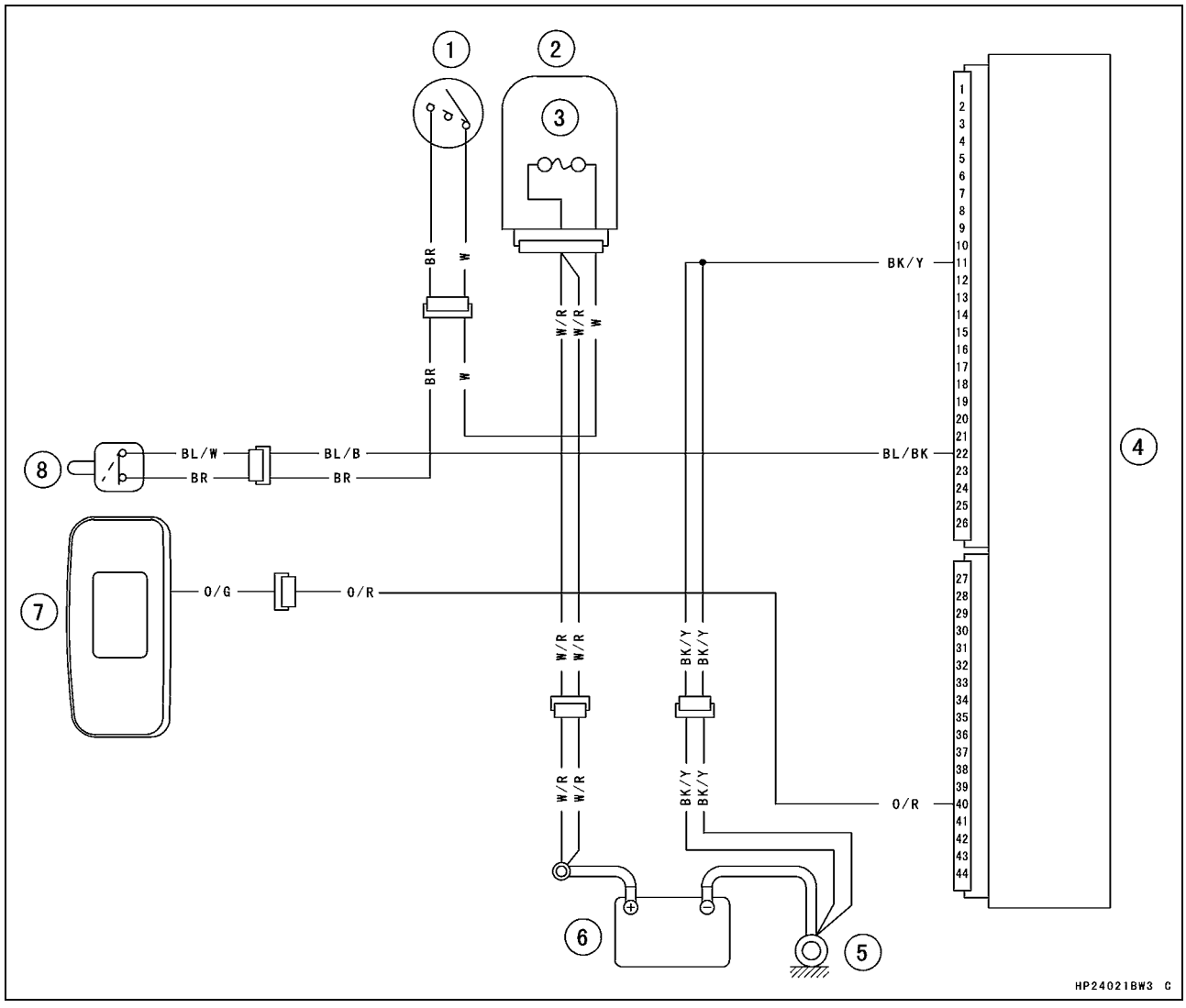
Drive Belt Failure Detection System

If the drive belt failure detection system activated by abnormal belt, the drive belt failure detection switch is damaged. Make sure replace the torque converter cover (see Torque Converter Cover Removal/Installation in the Converter System chapter).

Drive Belt Failure Detection System Inspection

- Refer to the Drive Belt Failure Detection System Inspection in the Periodic Maintenance chapter.

Drive Belt Failure Detection System Circuit



1. Ignition Switch
2. Fuse Box
3. Main Fuse 30 A
4. ECU (Electronic Control Unit)
5. Engine Ground Terminal
6. Battery 12 V 12 Ah
7. Multifunction Meter
8. Drive Belt Failure Detecting Switch

Switches and Sensor

Fuel Level Sensor Inspection

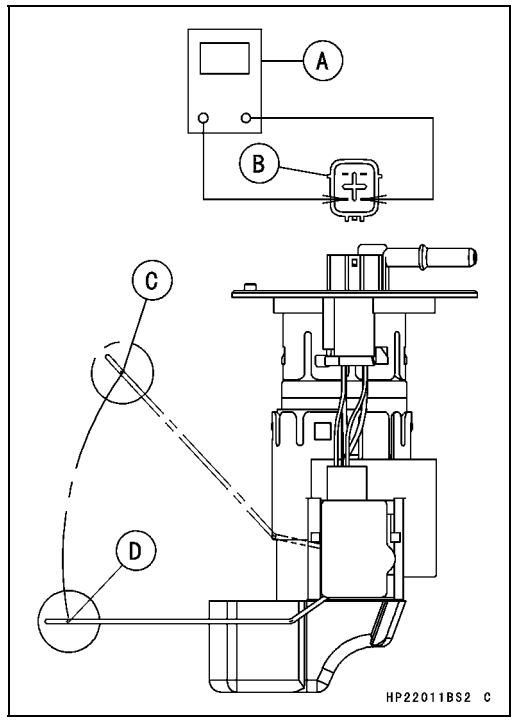
● Remove:
Fuel Pump (see Fuel Pump Removal in the Fuel System (DFI) chapter)

● 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 fuel pump assembly.

● Using a hand tester [A], measure the resistance across the terminals in the fuel pump lead connector [B].

Special Tool - Hand Tester: 57001-1394



NOTE

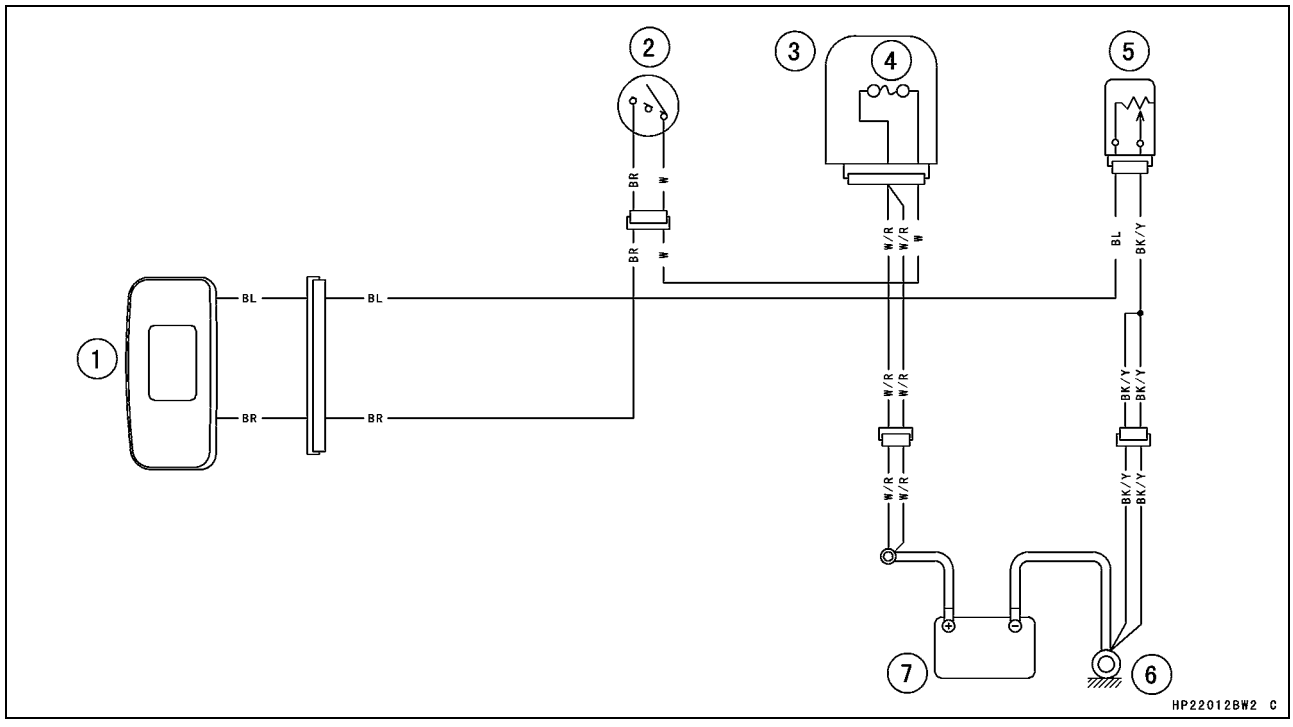
○*In contrast to the normal measuring method, the current that flows through the gauge when measuring it with a tester is very low, thus making the measurement easily affected by the oxidized film of the resistance plate, and resulting in excessive resistance. Therefore, make sure to wipe the resistance plate with alcohol before taking a measurement.*

★If the readings are not as specified, replace the fuel pump assembly.

Fuel Level Sensor Resistance
Standard: Full Level Position [C]: 3 Ω
Empty Level Position [D]: 120 Ω

Switches and Sensor

Fuel Level Sensor Circuit



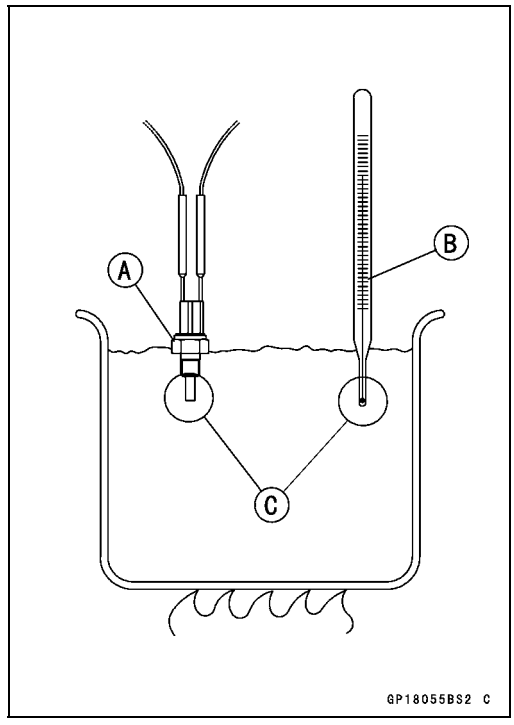
1. Multifunction Meter
2. Ignition Switch
3. Fuse Box
4. Main Fuse 30 A
5. Fuel Level Sensor
6. Engine Ground Terminal
7. Battery 12 V 12 Ah

Brake Light Switch Adjustment

- Refer to the Brake Light Switch Inspection and Adjustment in the Periodic Maintenance chapter.

Switches and Sensor

Water Temperature Sensor Inspection



- Remove the water temperature sensor (see Water Temperature Sensor Removal/Installation in the Fuel System (DFI) chapter).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

NOTE

○*The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester, measure the internal resistance of the sensor across the terminal and the body at the temperatures shown in the table.

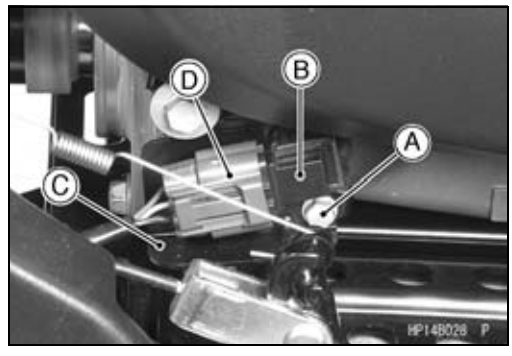
★If the measurement is out of the range, replace the sensor.

Water Temperature Sensor Resistance

Temperature	Resistance (kΩ)
−20°C (−4°F)	*18.80 ±2.37
0°C (32°F)	*(about 6.544)
40°C (104°F)	1.136 ±0.095
100°C (212°F)	0.1553 ±0.0070

*: Reference Information

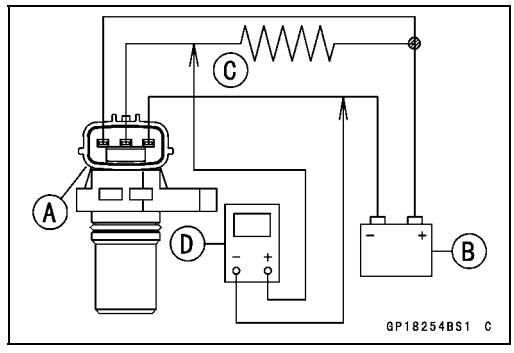
Speed Sensor Removal/Installation



- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance Chapter).
- Remove:
  Bolts [A]
  Speed Sensor [B]
  Guard [C]
- Disconnect the speed sensor Connector [D].
- Replace the O-ring with a new one.
- Apply grease to the O-ring
- Tighten:

Torque - Speed Sensor Mounting Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Speed Sensor Inspection

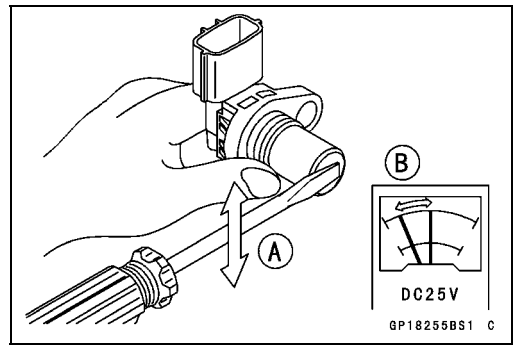


- Remove the speed sensor (see Speed Sensor Removal).
- Connect the speed sensor connector [A] with the battery [B], 10 kΩ resistor [C] and hand tester [D] as shown.
- Set the tester to the DC 25 V range.

Special Tool - Hand Tester: 57001-1394

Switches and Sensor

● Trace [A] each side of 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.



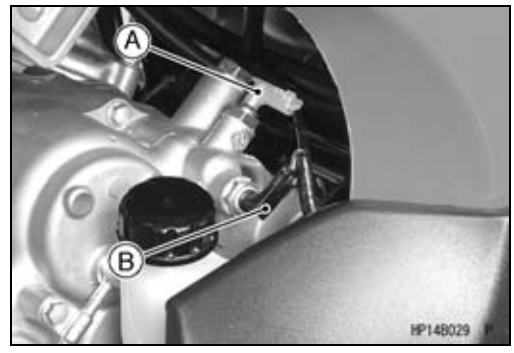
Switch Inspection

● Using the hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
○For the handlebar switches, ignition switch, refer to tables in the Wiring Diagram.
★If the switch has an open or short, repair or replace it with a new one.

Neutral Switch Connection

	SW.Terminal	⏚
When transmission is in neutral	○	○
When transmission is not in neutral		

[A] Neutral Switch



Reverse Switch Connections

	SW.Terminal	⏚
When transmission is in reverse	○	○
When transmission is not in reverse		

[B] Reverse Switch

2WD/4WD Shift Switch

	G	BK/Y
2WD Position	○	○
4WD Position		

Oil Pressure Switch Connections*

	SW. Terminal	⏚
When engine is stopped	○	○
When engine is running		

*: Engine lubrication system is in good condition

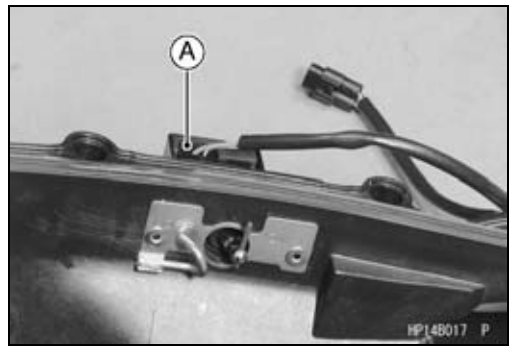
Switches and Sensor

Drive Belt Failure Detection Switch Inspection

If the drive belt failure detection system is activated by abnormal belt, the drive belt failure detection switch is damaged. Make sure to replace the torque converter cover (see Torque Converter Cover Removal/Installation in the Converter System chapter).

● Remove:

Torque Converter Cover (see Torque Converter Cover Removal in the Converter System chapter)



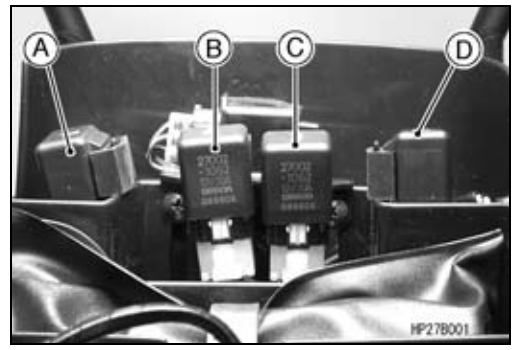
	BR	BL/W
When drive belt failure detection switch is in ON position	○——	——○
When drive belt failure detection switch is in OFF position		

[A] Drive Belt Failure Detection Switch

★If the switch has an open or short, repair or replace it with a new one.

Relay

Relay Inspection

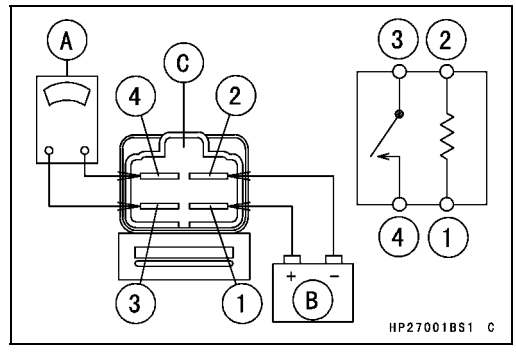


● Remove:
Seat (see Seat Removal in the Frame chapter)
Starter Control Relay (Neutral) [A]
Radiator Fan Relay [B]
Fuel Pump Relay [C]
Starter Control Relay (Brake) [D]

○The relays are identical.

● Connect the hand tester [A] and a 12 V battery [B] to the starter circuit relay [C] as shown.

★If the relay does not work as specified, the relay is defective. Replace the relay.



Testing Relay

Hand Tester Range: × 1 Ω

Criteria: When battery is connected ⇒ 0 Ω

When battery is disconnected ⇒ ∞Ω

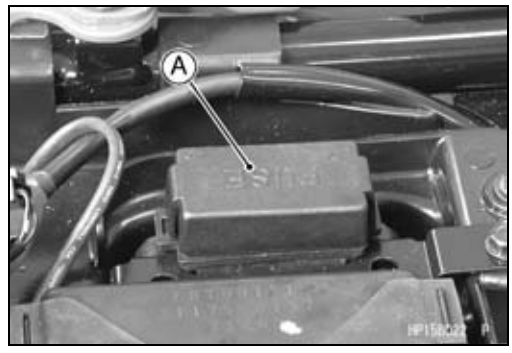
Relay Coil Terminals [1] and [2]

Relay Switch Terminals [3] and [4]

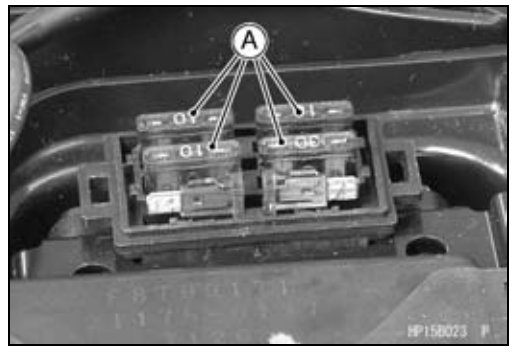
Fuses

Fuse Removal

● Remove:
Seat (see Seat Removal in the Frame chapter)
Fuse Box Lid [A]



● Pull the fuses [A] straight out of the fuse box with needle nose pliers.



Fuse Installation

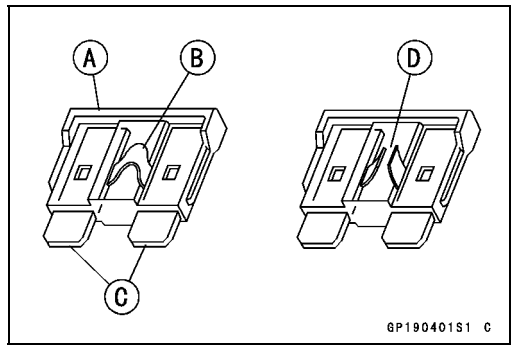
★If a fuse fails during operation, inspect the electrical system to determine the cause, and then replace it with a new fuse of proper amperage.

● Install the fuses on the original position as specified on the fuse box lid [A].

Fuse Inspection

● Inspect the fuse element.

★If it is blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
Housing [A]
Fuse Element [B]
Terminals [C]
Blown Element [D]



NOTICE

When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.

Appendix

Table of Contents

Troubleshooting Guide

NOTE

○*Refer to the Fuel System chapter for most of DFI trouble shooting guide.*

○*This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

Engine Doesn't Start, Starting Difficulty:

Starter motor not rotating:
- Neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Relays not contacting or operating
- Starter button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

Starter motor rotating but engine doesn't turn over:
- Starter motor clutch trouble

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

No fuel flow:
- Fuel tank air vent obstructed
- Fuel line clogged
- Fuel pump damaged or circuit open/short

Engine flooded:
- Fuel level too high
- Float valve worn or stuck open
- Starting technique faulty
- (When flooded, crank the engine with the throttle fully opened to allow more air to reach the engine.)

Fuel/air mixture incorrect:
- Pilot screw and/or idle adjusting screw maladjusted
- Air cleaner clogged, poorly sealed, or missing

No spark; spark weak:
- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap not in good contact
- Spark plug incorrect
- Crankshaft sensor trouble
- Ignition coil trouble
- Battery voltage low
- Ignition or engine stop switch shorted
- Wiring shorted or open
- Fuse blown

Compression Low:
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)
- Compression release (KACR) cam sticks open (Engine stalls when moving off)

Poor Running at Low Speed:

Spark weak:
- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap shorted or not in good contact
- Spark plug incorrect
- Crankshaft sensor trouble
- Ignition coil trouble
- Battery voltage low

Fuel/air mixture incorrect:
- Pilot screw and/or idle adjusting screw maladjusted
- Air cleaner clogged, poorly sealed, or missing
- Fuel level too high or too low
- Fuel tank air vent obstructed
- Throttle body holder loose
- Air cleaner duct loose

Compression low:
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)
- Compression release (KACR) cam sticks open (Engine stalls when moving off)

Other:
- Engine oil viscosity too high

Troubleshooting Guide

Brake dragging
Front or rear final gear case oil viscosity too high

Poor Running or No Power at High Speed:
Firing incorrect:
Spark plug dirty, broken, or maladjusted
Spark plug cap or spark plug lead trouble
Spark plug cap shorted or not in good contact
Spark plug incorrect
Crankshaft sensor trouble
Ignition coil trouble
Drive belt failure detection switch activated
Fuel/air mixture incorrect:
Air cleaner clogged, poorly sealed, or missing
Water or foreign matter in fuel
Throttle body holder loose
Air cleaner duct loose
Fuel tank air vent obstructed
Fuel line clogged
Compression low:
Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston rings bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head gasket damaged
Cylinder head warped
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)
Compression release cam (K.A.C.R.) sticks open (Engine stalls when moving off)
Knocking:
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
Miscellaneous:
Throttle valve won't fully open
Brake dragging
Overheating
Engine oil level too high
Engine oil viscosity too high
Front or rear final gear case oil viscosity too high

Overheating:
Firing incorrect:
Spark plug dirty, broken, or maladjusted
Spark plug incorrect
Fuel/air mixture incorrect:
Throttle body holder loose
Air cleaner poorly sealed, or missing
Air cleaner duct loose
Air cleaner clogged
Compression high:
Carbon built up in combustion chamber
Engine load faulty:
Engine oil level too high
Engine oil viscosity too high
Drive train trouble
Brake dragging
Lubrication inadequate:
Engine oil level too low
Engine oil poor quality or incorrect
Front or rear final gear case overheating:
Insufficient oil
Bevel gears maladjusted
LSD clutches in front final gear case maladjustment
Coolant incorrect:
Coolant level too low
Coolant deteriorated
Thick coolant
Cooling system component incorrect:
Radiator clogged
Thermostat trouble
Radiator cap trouble
Fan motor broken
Fan blade damaged
Water pump not turning
Water pump impeller damaged

Over Cooling:
Cooling system component incorrect:
Thermostat trouble

Converter Operation Faulty:
Belt slipping:
Belt dirty, worn, or wetted
Drive or driven pulley sheave dirty or worn
Drive pulley spring broken or weak
Converter engagement speed too low:
Drive pulley spring broken or weak
Converter engagement speed too high:
Belt dirty or worn
Drive or driven pulley sheave dirty or worn
Drive pulley weight doesn't move smoothly
Drive pulley movable sheave doesn't move smoothly
Drive or driven pulley movable sheave bush worn
Drive pulley weight or roller worn
Shifting too quickly:
Drive pulley spring weak
Driven pulley spring weak or incorrectly installed (too loose)
Shifting too slowly:
Belt dirty or worn
Drive or driven pulley sheave dirty or worn
Drive pulley weight doesn't move smoothly

Troubleshooting Guide

Drive pulley movable sheave doesn't move smoothly
Drive pulley spring incorrect installed (too tight)
Driven pulley movable sheave doesn't move smoothly

Gear Shifting Faulty:

Doesn't go into gear:
Shift arm bent or seized
Gear stuck on the shaft
Shift tie-rod maladjusted
Shift tie-rod damaged

Jumps out of gear:
Shifter groove worn
Gear dogs worn
Shift block worn
Shift arm positioning bolt spring weak or broken
Shift tie-rod maladjusted
Drive shaft, output shaft, and/or gear splines worn

Overshifts:
Shift arm positioning bolt spring weak or broken
Shift tie-rod maladjusted

Abnormal Engine Noise:

Knocking:
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
Overheating

Piston Slap:
Cylinder/piston clearance excessive
Cylinder, piston worn
Connecting rod bent
Piston pin, piston holes worn

Valve noise:
Valve clearance incorrect
Valve spring broken or weak
Camshaft bearing worn
Rocker arm worn

Other noise:
Connecting rod small end clearance excessive
Connecting rod big end clearance excessive
Piston ring worn, broken, or stuck
Piston seizure, damage
Cylinder head gasket leaking
Exhaust pipe leaking at cylinder head connection
Crankshaft runout excessive
Engine mounts loose
Crankshaft bearing worn
Camshaft chain tensioner trouble
Camshaft chain, sprocket, guides worn
Loose alternator rotor

Abnormal Drive Train Noise:

Converter noise:
Belt worn
Drive or driven pulley sheave worn
Drive or driven pulley movable sheave bush worn
Drive or driven pulley mount loose
Driven pulley shoe worn
Drive pulley weight or roller side washer worn
Drive pulley weight or roller worn
Wear guides worn

Transmission noise:
Bearing worn
Transmission gears worn or chipped
Metal chips jammed in gear teeth
Engine oil insufficient or too thin

Front or rear final gear case noise:
Insufficient lubricant
Incorrect oil (Front final gear case)
Bevel gear bearings worn
Bevel gears worn or chipped
Bevel gears maladjusted
Worn LSD clutch friction plate (Front final gear case)
Thrust plug maladjusted (Rear final gear case)
Damaged side gears or pinions (Front final gear case)

Abnormal Frame Noise:

Shock absorber noise:
Shock absorber damaged

Disc brake noise:
Pad installed incorrectly
Pad surface glazed
Disc warped
Caliper trouble

Rear brake noise:
Foreign matter in hub
Brake not properly adjusted

Other noise:
Bracket, nut bolt, etc. not properly mounted or tightened

Exhaust Smokes Excessively:

White smoke:
Piston oil ring worn
Cylinder worn
Valve oil seal damaged
Valve guide worn
Cylinder head gasket damaged
Engine oil level too high

Black Smoke:
Air cleaner clogged

Brown smoke:
Air cleaner duct loose
Air cleaner poorly sealed or missing

Troubleshooting Guide

Handling and/or Stability Unsatisfactory
- **Handlebar hard to turn:**
  - Tire air pressure too low
  - Steering stem bearing damaged
  - Steering stem bearing lubrication inadequate
  - Steering stem bent
  - Damaged steering knuckle joint
  - Damage tie-rod end
  - LSD clutch maladjusted (front final gear case)
- **Noise when turning:**
  - Damaged side gear or pinion (front final gear case)
  - Worn LSD clutch friction plates (Front final gear case)
- **Handlebar shakes or excessively vibrates:**
  - Tire worn
  - Wheel rim warped
  - Rear axle runout excessive
  - Wheel bearing worn
  - Handlebar clamp loose
  - Steering stem clamp bolt loose
- **Handlebar pulls to one side:**
  - Frame bent
  - Wheel maladjustment
  - Suspension arm bent or twisted
  - Steering stem bent
  - Front or rear tire air pressure unbalanced
  - Front shock absorber unbalanced
- **Shock absorption unsatisfactory:**
  - **Too hard:**
  - Tire air pressure too high
  - Shock absorber maladjusted
  - **Too soft:**
  - Shock absorber oil leaking
  - Shock absorber spring weak
  - Tire air pressure too low
  - Shock absorber maladjusted

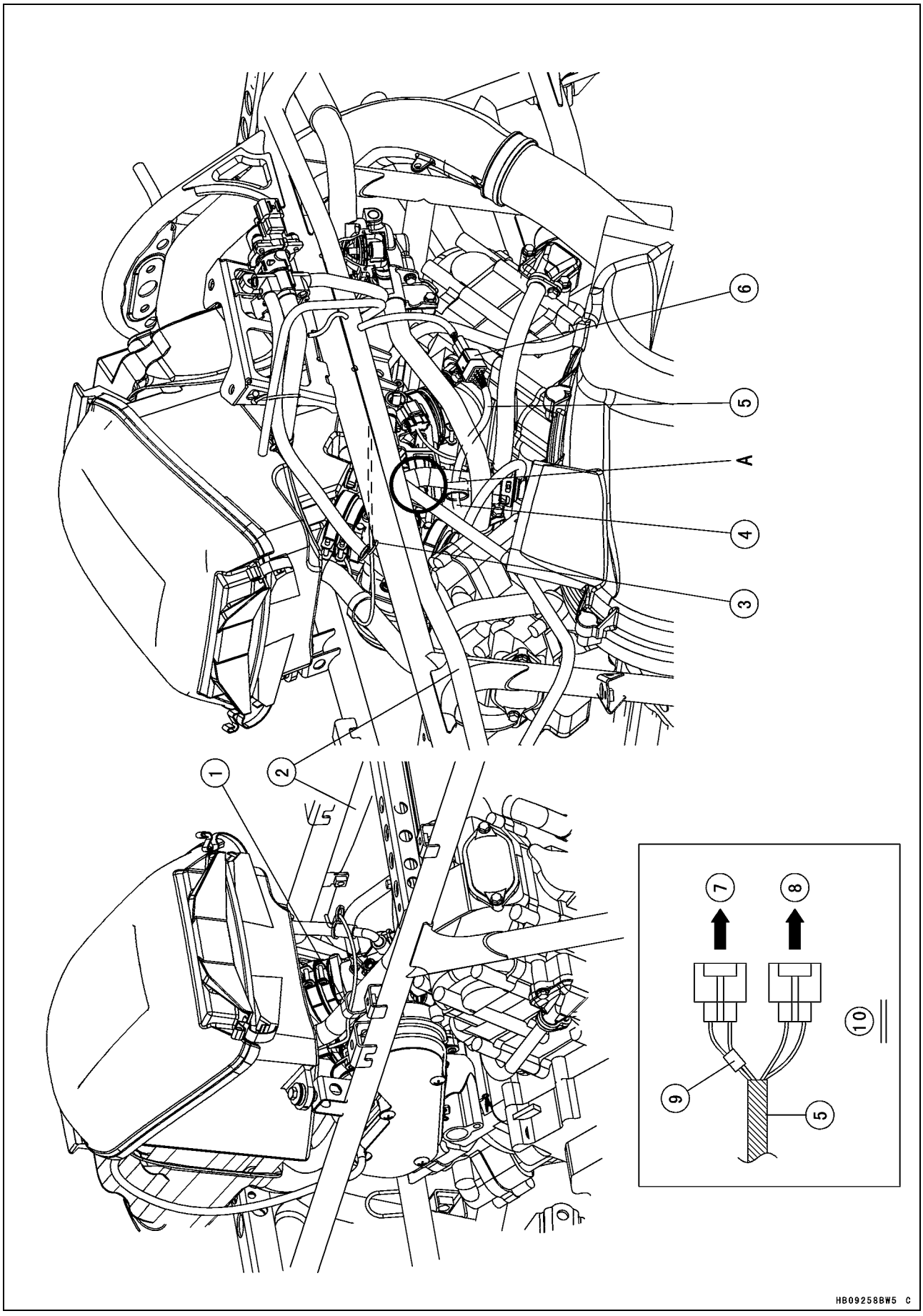
Brake Doesn't Hold
- **Front brake:**
  - Air in the brake line
  - Brake fluid leakage
  - Brake fluid deteriorated
  - Primary or secondary cup trouble
  - Master cylinder scratched inside
  - Pad overworn or worn unevenly
  - Oil, grease on pads and disc
  - Disc worn or warped
  - Brake overheated
- **Rear Brake:**
  - Brake not properly adjusted
  - Plates worn
  - Brake parts worn or damaged

Kawasaki Engine Brake Control and Selectable 2WD/4WD System Malfunction:
- Actuators failed
- Speed sensor short or open
- Forward/Reverse detecting sensor short or open
- Actuator controller failed
- Controller 10A fuse blown
- Battery disconnected

Battery Discharged:
- Battery faulty (e.g., plates sulphated, shorted through sedimentation, electrolyte level too low)
- Battery leads making poor contact
- Load excessive (e.g., bulb of excessive wattage)
- Ignition switch trouble
- Regulator/rectifier trouble
- Alternator trouble
- Wiring faulty

Battery Overcharged:
- Regulator/rectifier trouble
- Battery trouble

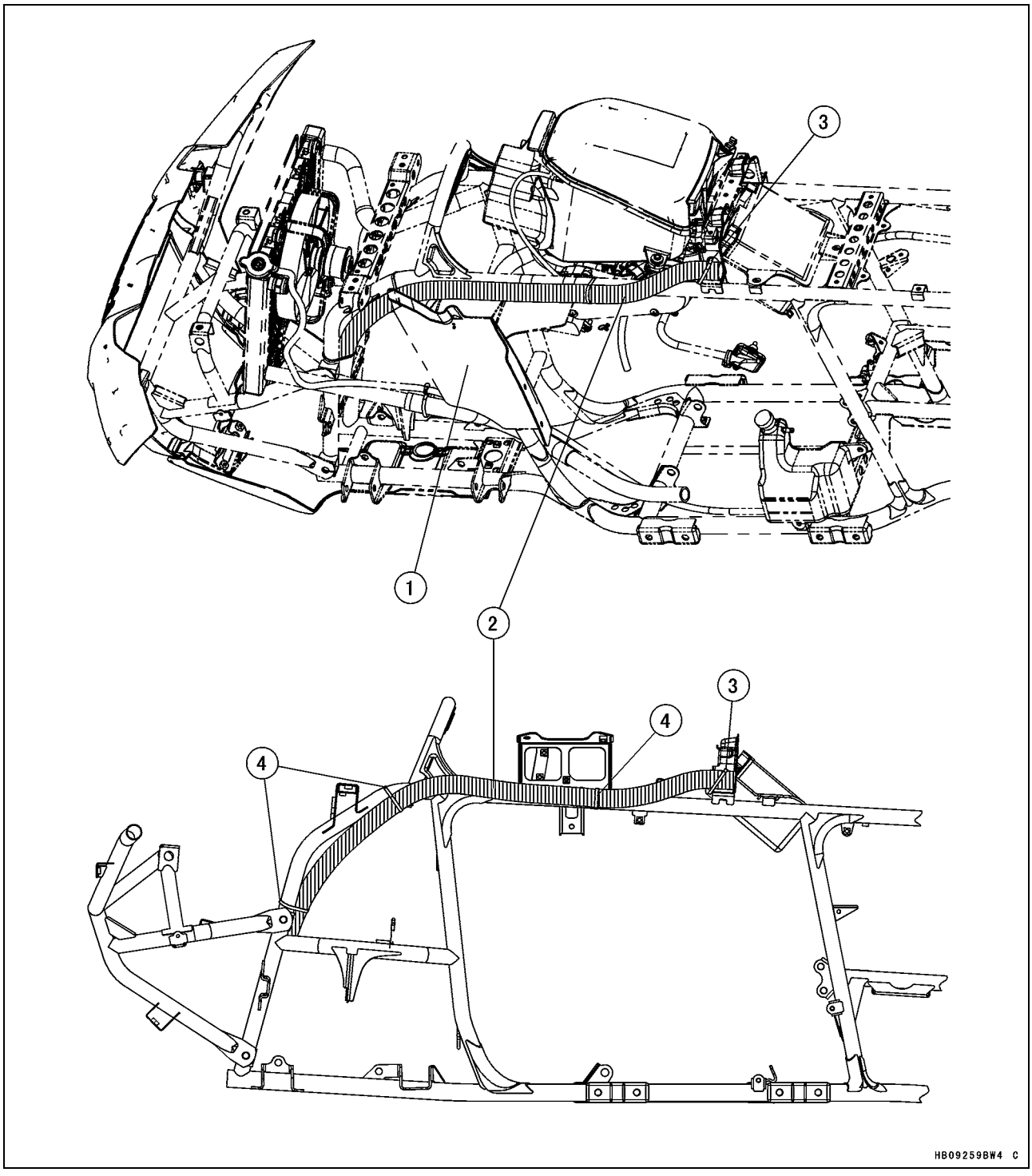
Cable, Wire, and Hose Routing



Cable, Wire, and Hose Routing

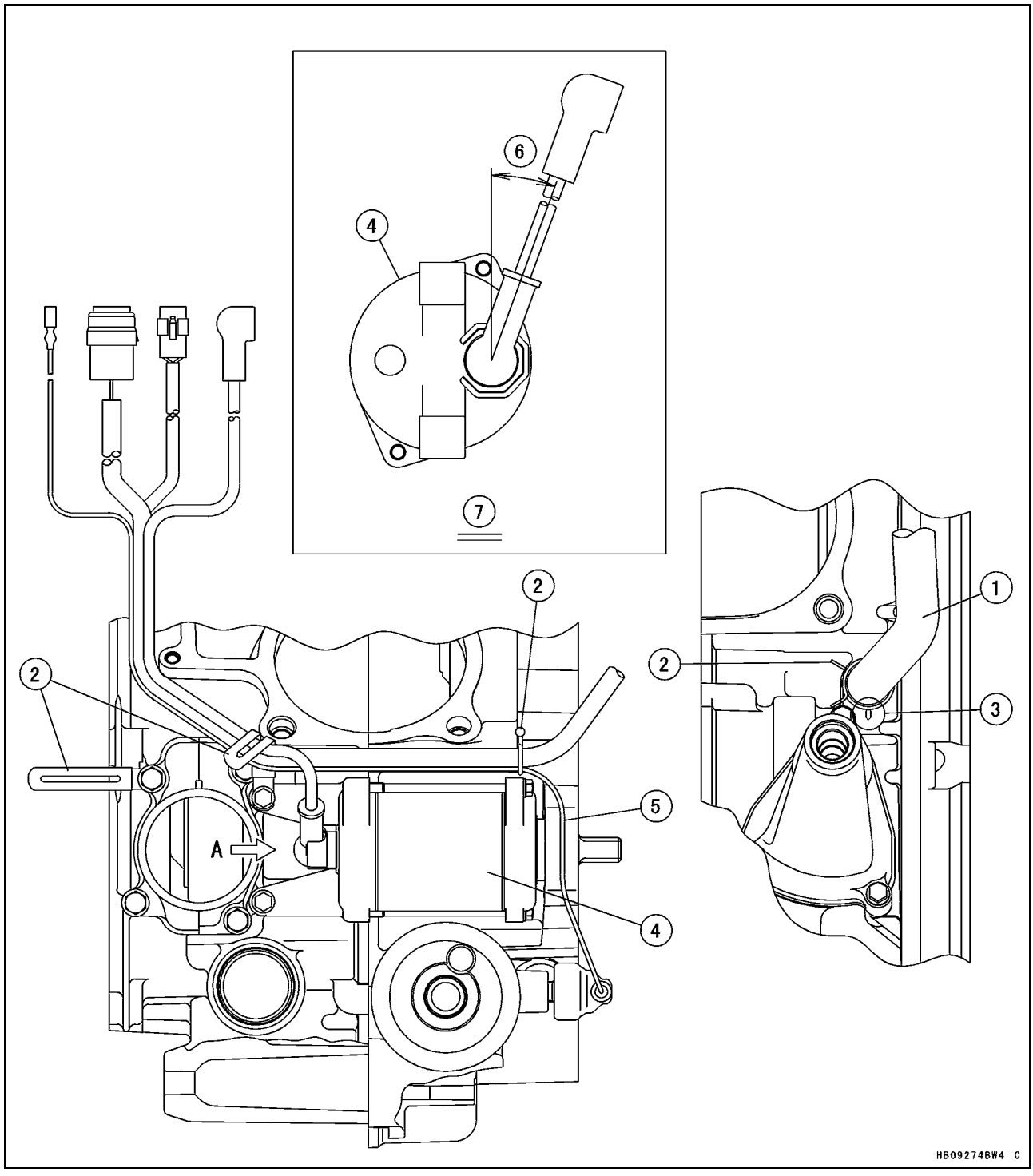
1. Band
2. Main Harness
3. Clamp
4. To Fuel Injectors and Throttle Sensor
5. Fuel Injector Throttle Sensor Subharness
6. Fuel Injector Throttle Sensor Subharness Connector (Clamp the connector to the bracket of the cylinder head.)
7. To Fuel Injector #1
8. To Fuel Injector #2
9. White Tape
10. Detail A

Cable, Wire, and Hose Routing



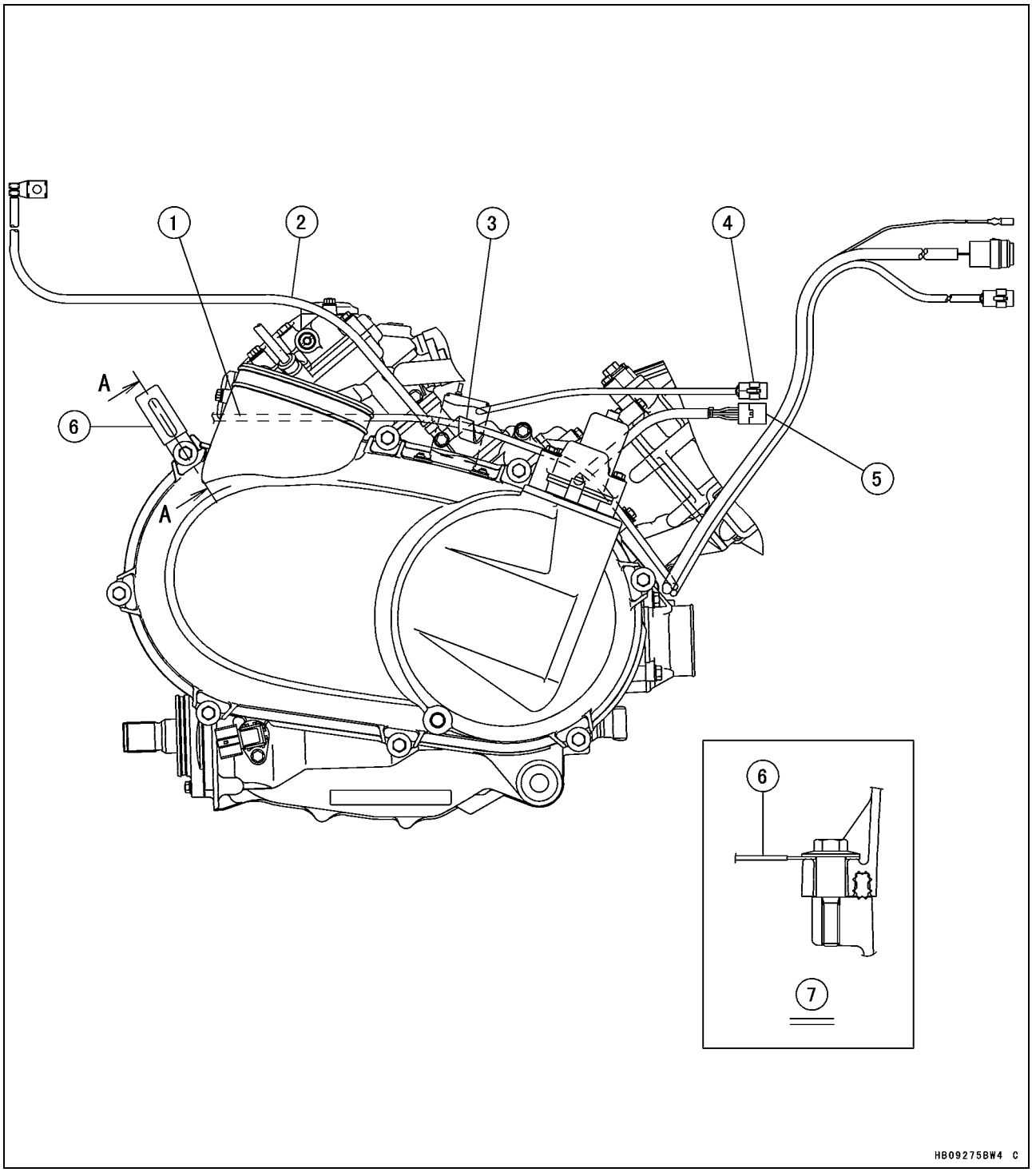
1. Front Fender Inner Cover
2. Tube (for Winch Harness)
3. Band (Pass the band through the hole of the frame bracket.)
4. Bands

Cable, Wire, and Hose Routing



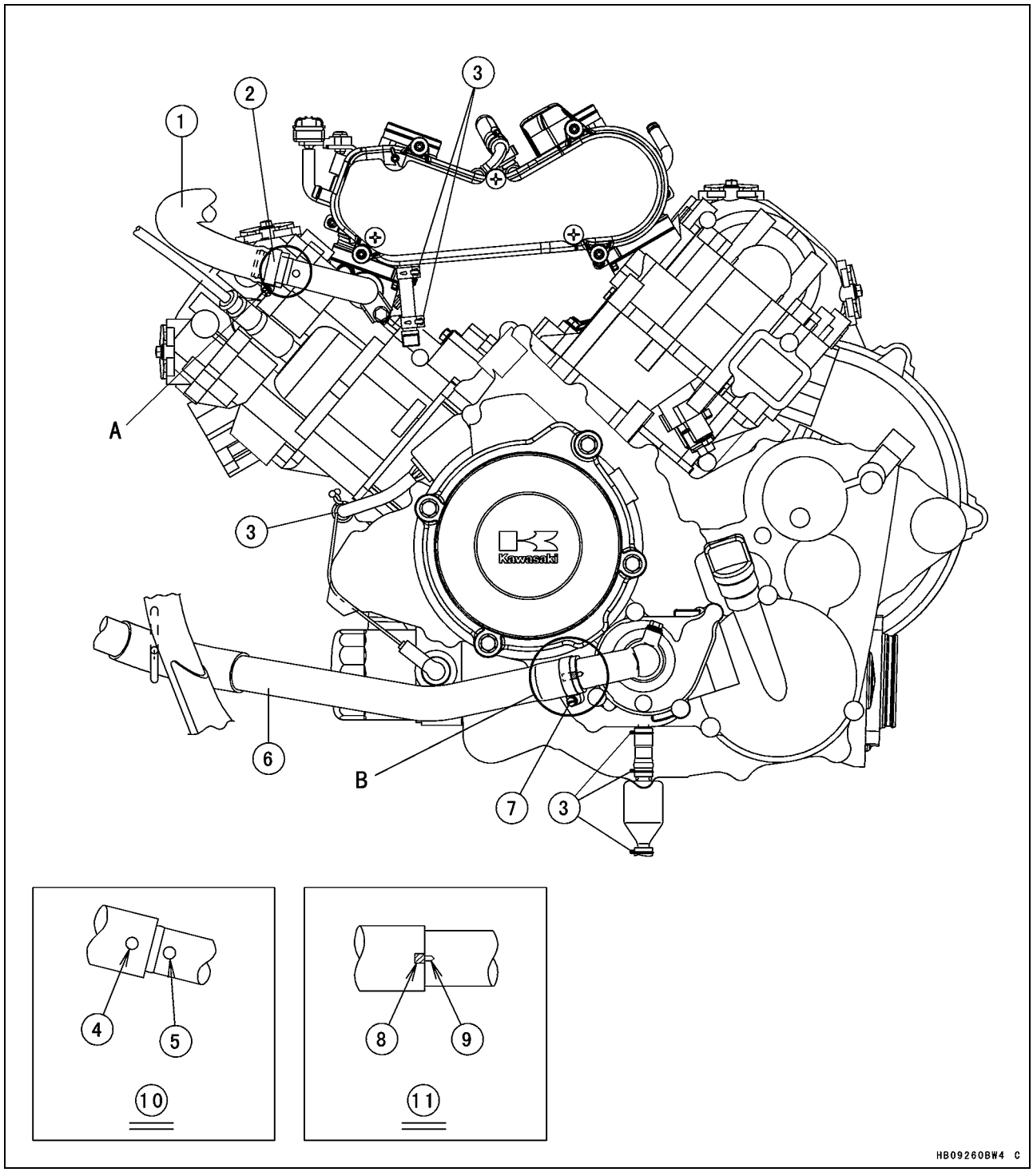
1. Engine Breather Hose
2. Clamps (Install the clamps direction as shown.)
3. Align the white paint of the breather hose with the projection of the crankcase.
4. Starter Motor
5. Run the oil pressure switch lead so that it does not touch the starter motor.
6. About 20°
7. View A

Cable, Wire, and Hose Routing



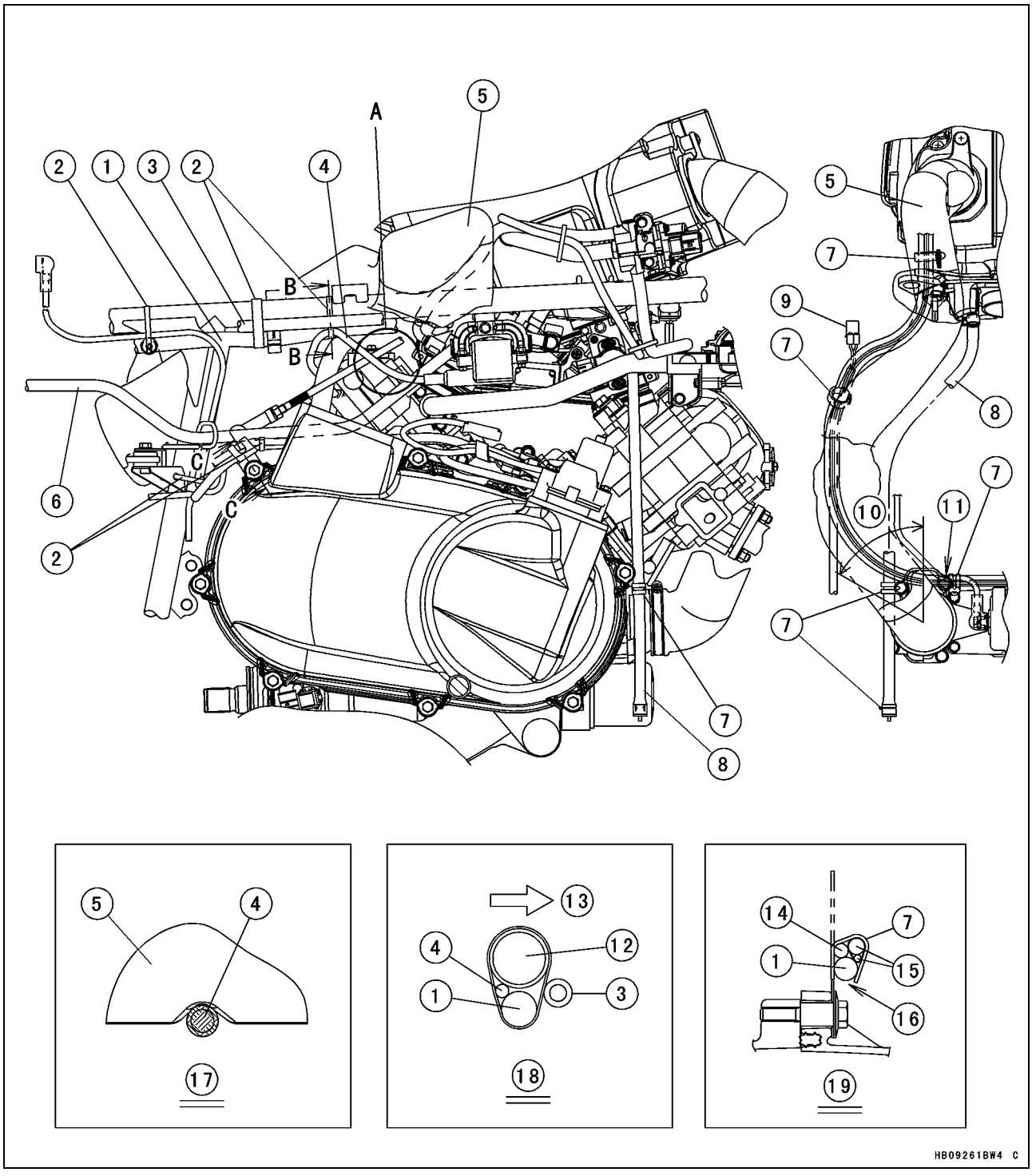
1. Starter Motor Cable
2. Engine Ground Lead (Install the lead so that the flat side of the lower terminal faces toward the engine.)
3. Install the clamp on the engine ground lead terminal.
4. Drive Belt Failure Detecting Switch Lead Connector
5. Engine Brake Actuator Lead Connector
6. Clamp
7. Section A-A

Cable, Wire, and Hose Routing



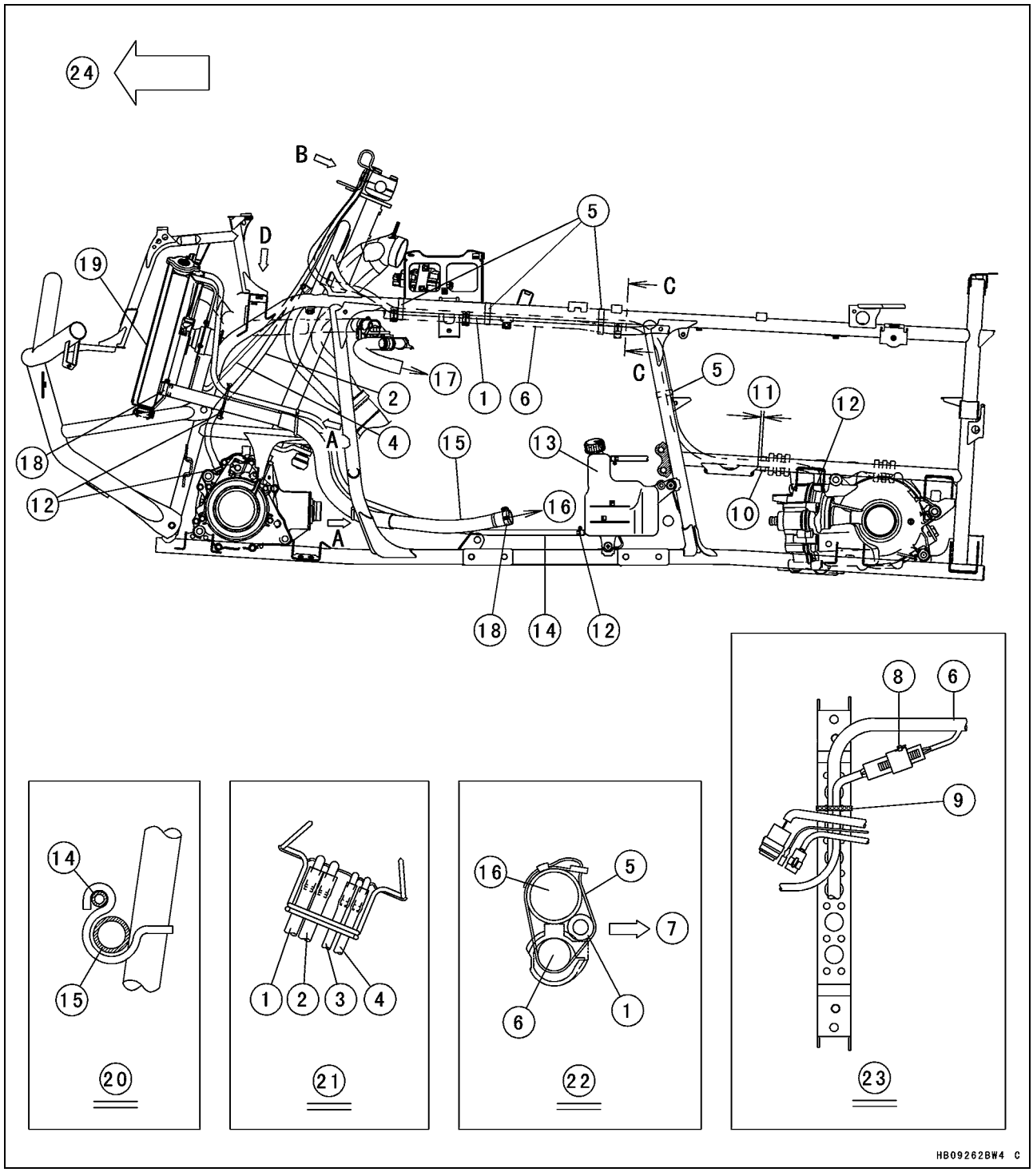
1. Water Hose (Thermostat Housing ~ Front Cylinder Head)
2. Water Hose Clamp
3. Clamps
4. White Paint of Water Hose
5. White Paint of Water Pipe
6. Radiator Hose (Radiator ~ Water Pump)
7. Radiator Hose Clamp
8. White Paint of Radiator Hose
9. Projection of Water Pump Cover
10. Detail A
11. Detail B

Cable, Wire, and Hose Routing



1. Main Harness
2. Bands
3. Rear Final Gear Case Vent Hose
4. Spark Plug Lead of Rear Ignition Coil (Run the spark plug lead along the concave of the exhaust duct.)
5. Torque Converter Exhaust Duct
6. Fuel Hose
7. Clamp
8. Drain Hose
9. 2WD/4WD Actuator Connector
10. 60°
11. Install the clamp so that it do not touch the harness. Set the position of the clamp within 60°.
12. Frame Pipe
13. Outside of Vehicle
14. Starter Motor Cable
15. Engine Ground Lead
16. Bend the clamp so that this position do not touch.
17. Detail A
18. Section B-B
19. Section C-C

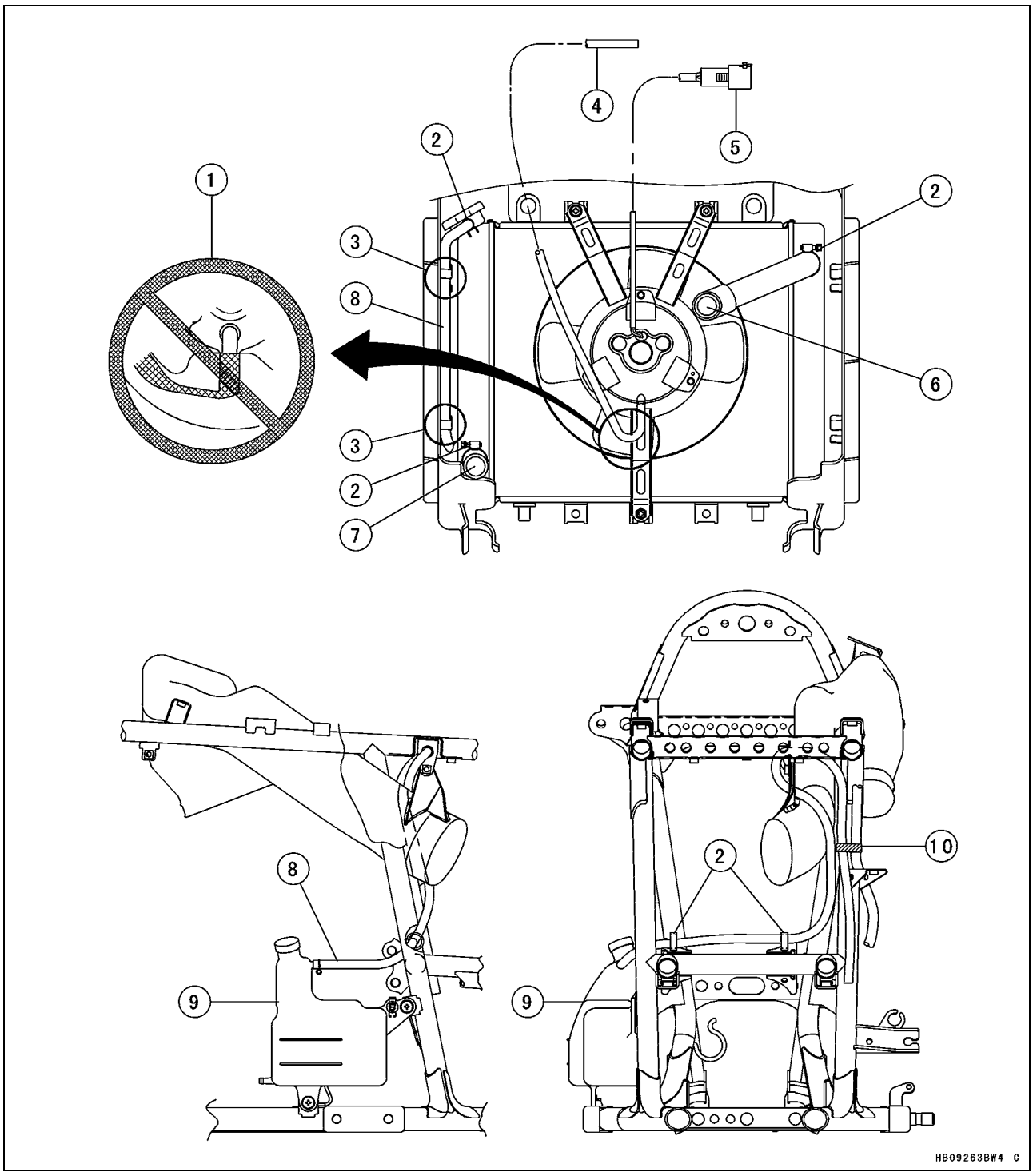
Cable, Wire, and Hose Routing



1. Rear Final Gear Case Vent Hose
2. Front Final Gear Case Vent Hose
3. Vacuum Hose
4. Radiator Fan Motor Vent Hose
5. Bands
6. Main Harness
7. Outside of Vehicle
8. Radiator Fan Motor Connector
9. Band (Clamp the main harness and radiator fan motor lead.)
10. Band (Clamp the rear final gear case vent hose to the right side of the frame.)
11. About 5 mm (0.20 in.)
12. Clamps
13. Reserve Tank
14. Reserve Tank Hose
15. Radiator Hose
16. To Water Pump
17. To Front Cylinder Head
18. Radiator Hose Clamps
19. Radiator
20. View A
21. View B
22. Section C-C
23. View D
24. Front

Cable, Wire, and Hose Routing

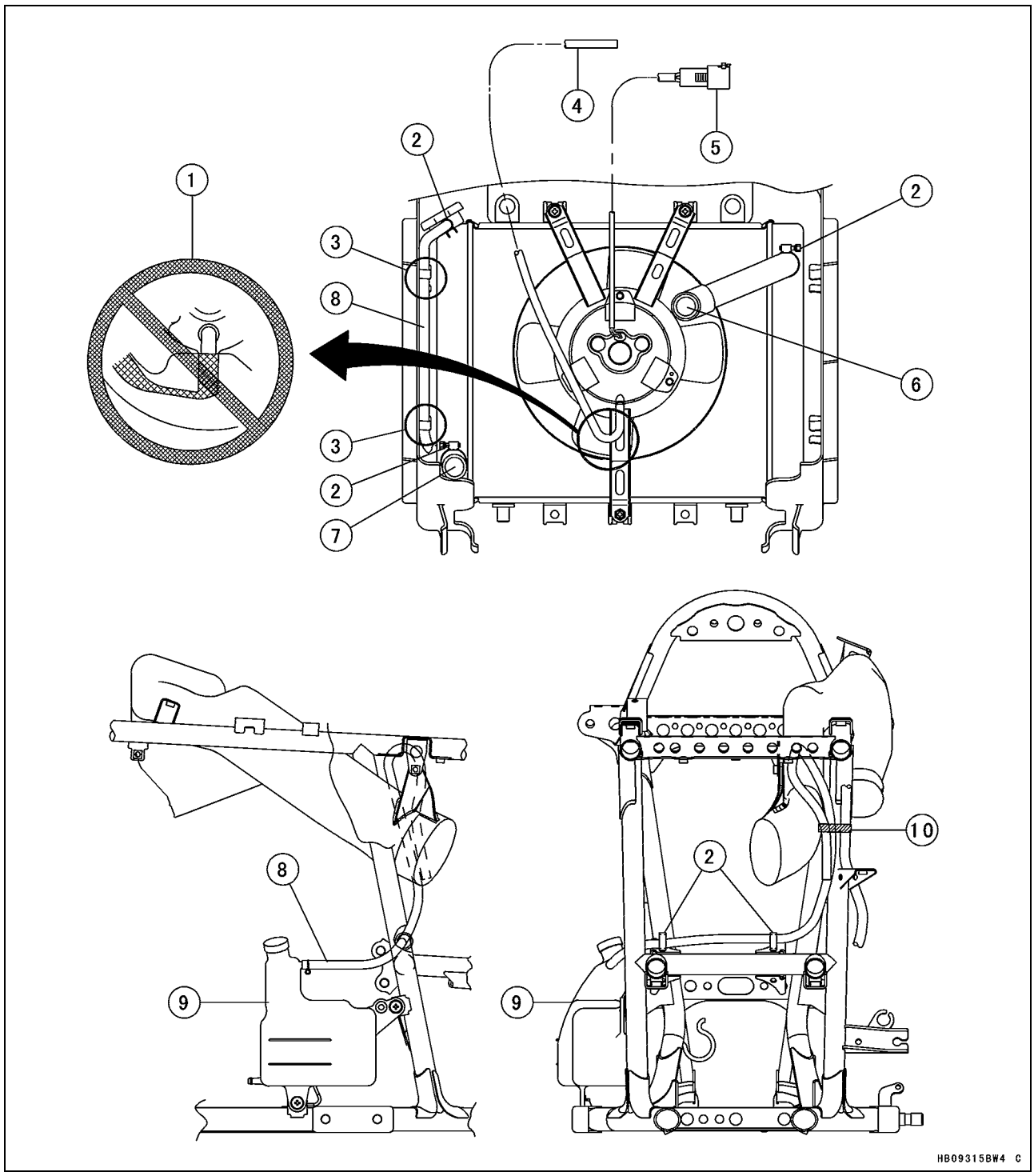
KVF750D8F ~ D9F/E8F ~ E9F/F8F



1. Do not crush the radiator fan motor vent hose to pull it.
2. Clamps
3. Clamp the reserve tank hose to the radiator cover.
4. Radiator Fan Motor Vent Hose
5. Radiator Fan Motor Connector
6. To Thermostat Housing
7. To Water Pump
8. Reserve Tank Hose
9. Reserve Tank
10. Band (Clamp the reserve tank hose and the rear final gear case vent hose.)

Cable, Wire, and Hose Routing

KVF750DAF/EAF/FAF ~



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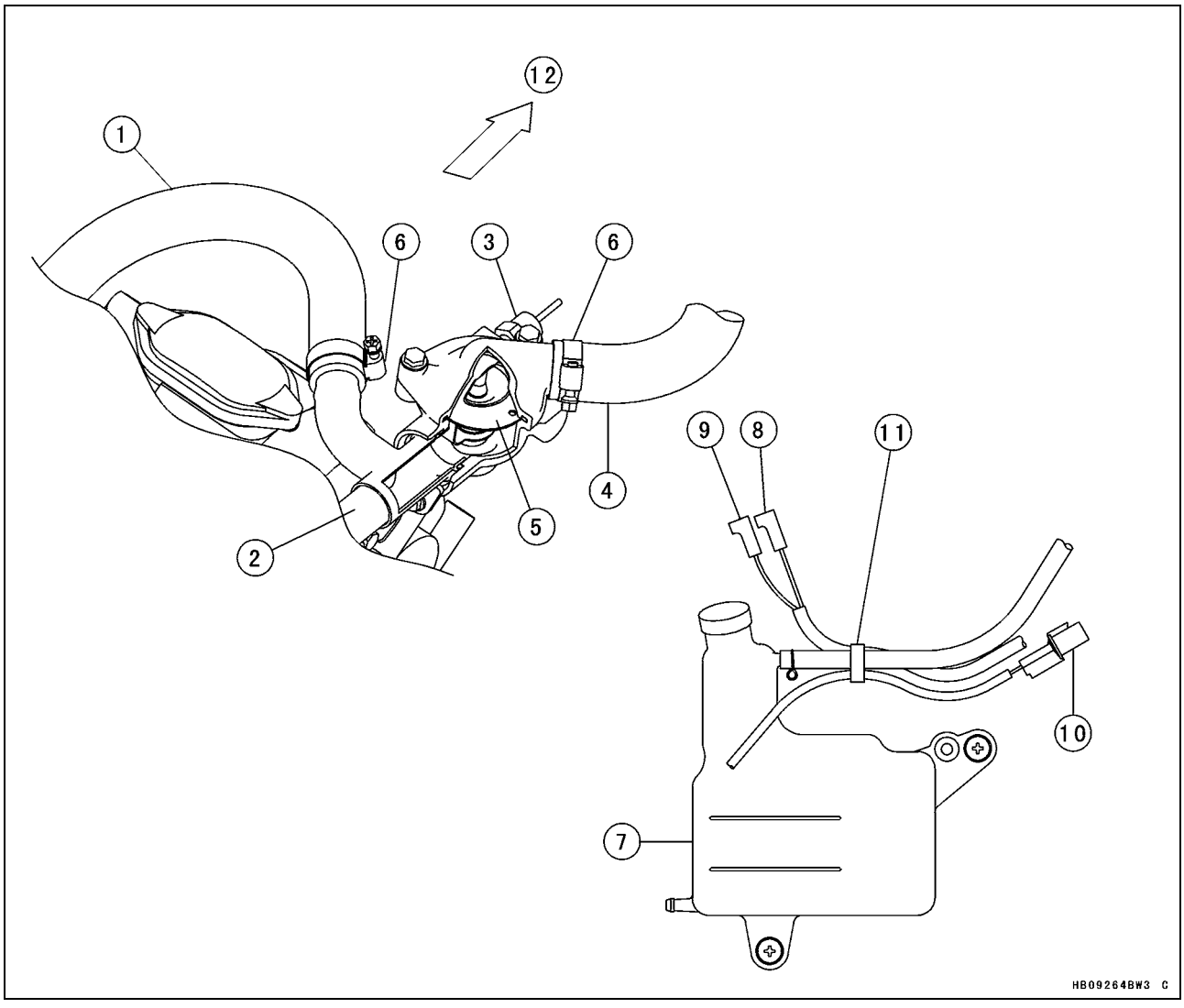
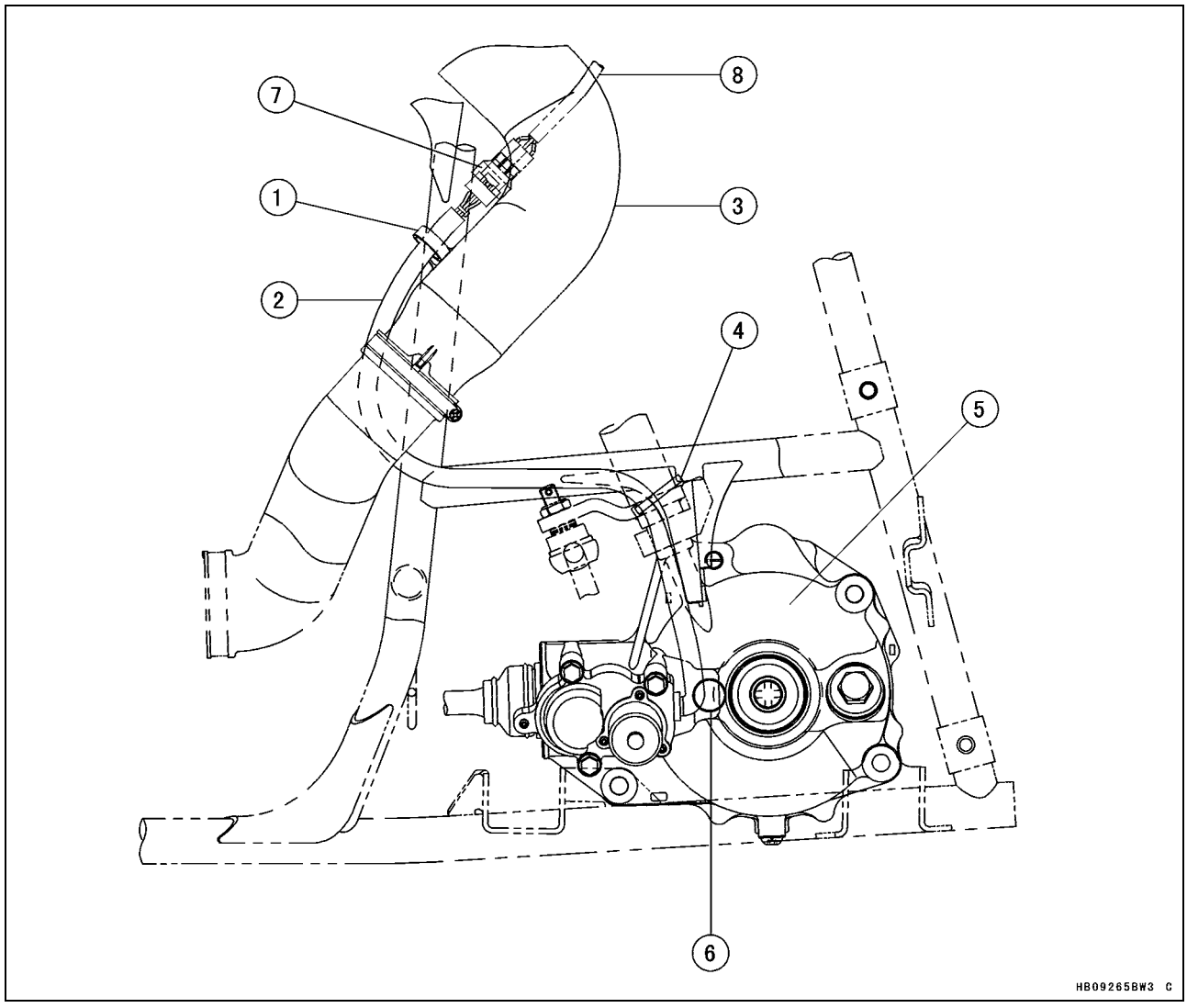
Cable, Wire, and Hose Routing



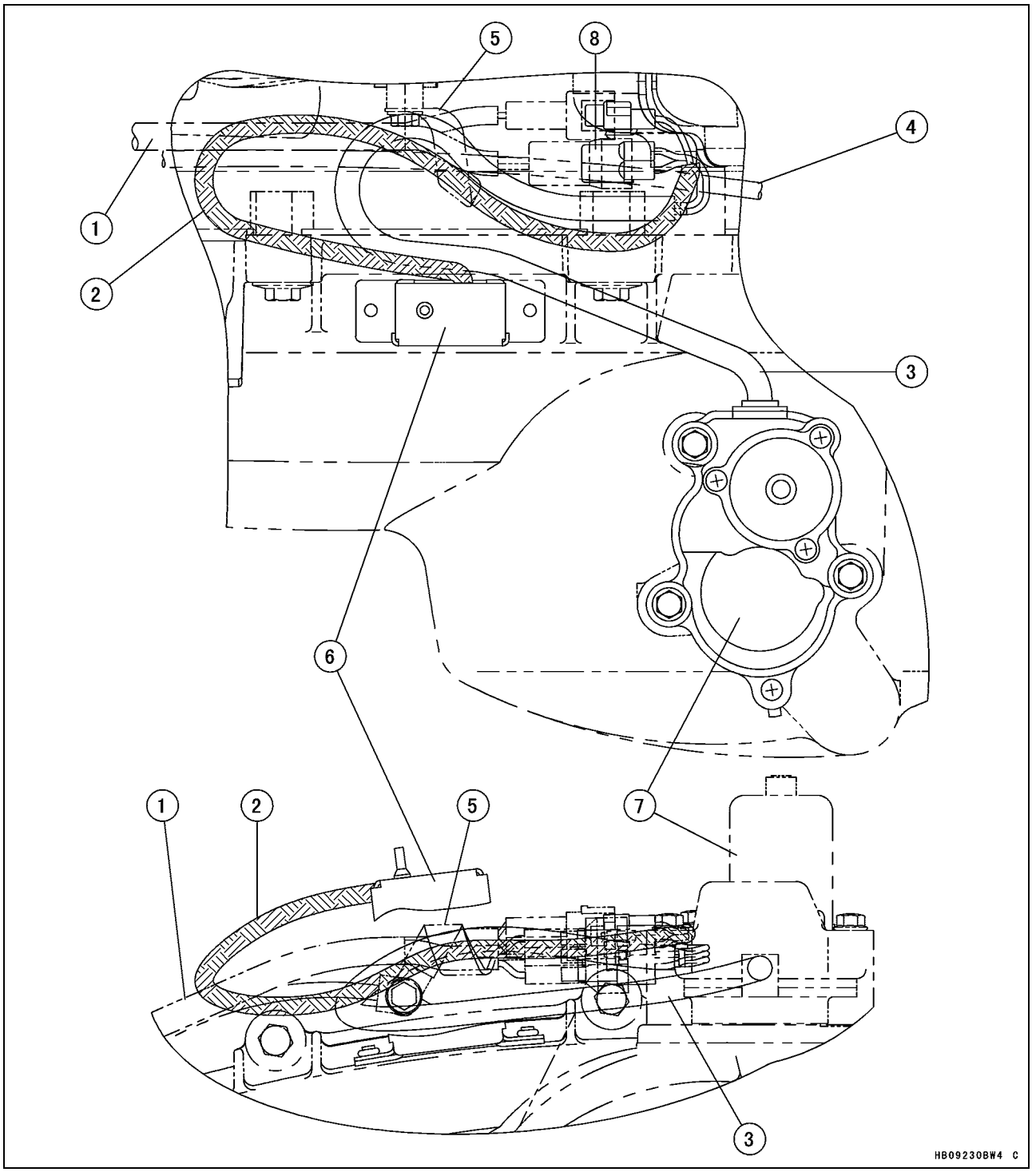
1. Water Hose (Thermostat Housing ~ Front Cylinder Head)
2. Water Pipe (Thermostat Housing ~ Rear Cylinder Head)
3. Water Temperature Sensor
4. Radiator Hose (Thermostat Housing ~ Radiator)
5. Thermostat
6. Clamps
7. Reserve Tank
8. Reverse Switch Lead Connector (R/W Lead)
9. Neutral Switch Lead Connector (LG Lead)
10. Forward/Reverse Detecting Sensor Lead Connector
11. Band
12. Front

Cable, Wire, and Hose Routing



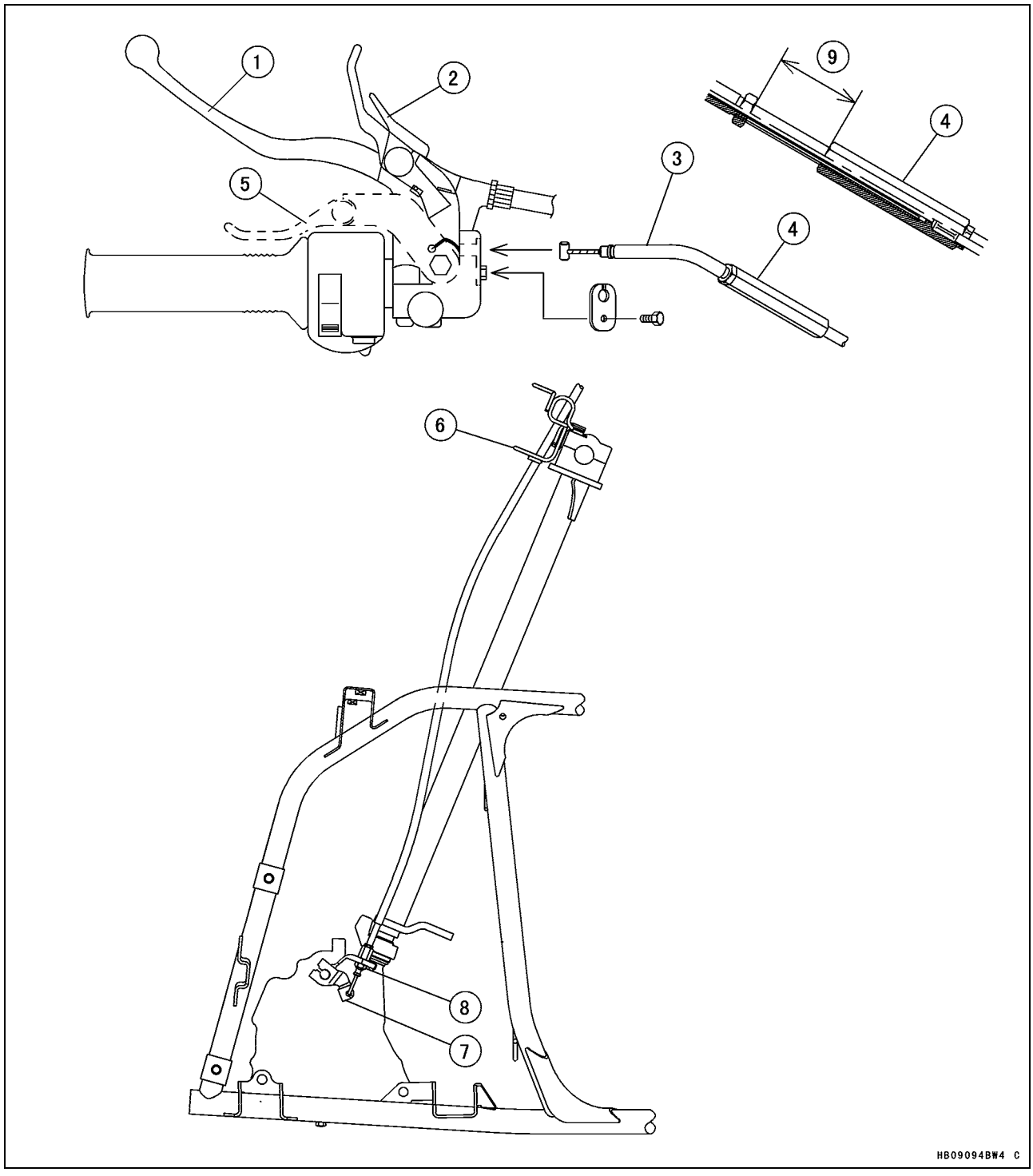
1. Clamp
2. 2WD/4WD Actuator Lead
3. Air Intake Duct
4. Band
5. Front Final Gear Case
6. Run the 2WD/4WD actuator lead so that it do not touch the front final gear case.
7. 2WD/4WD Actuator Lead Connector (Apply grease all around on the top surface of connector to be waterproof.)
8. Main Harness

Cable, Wire, and Hose Routing



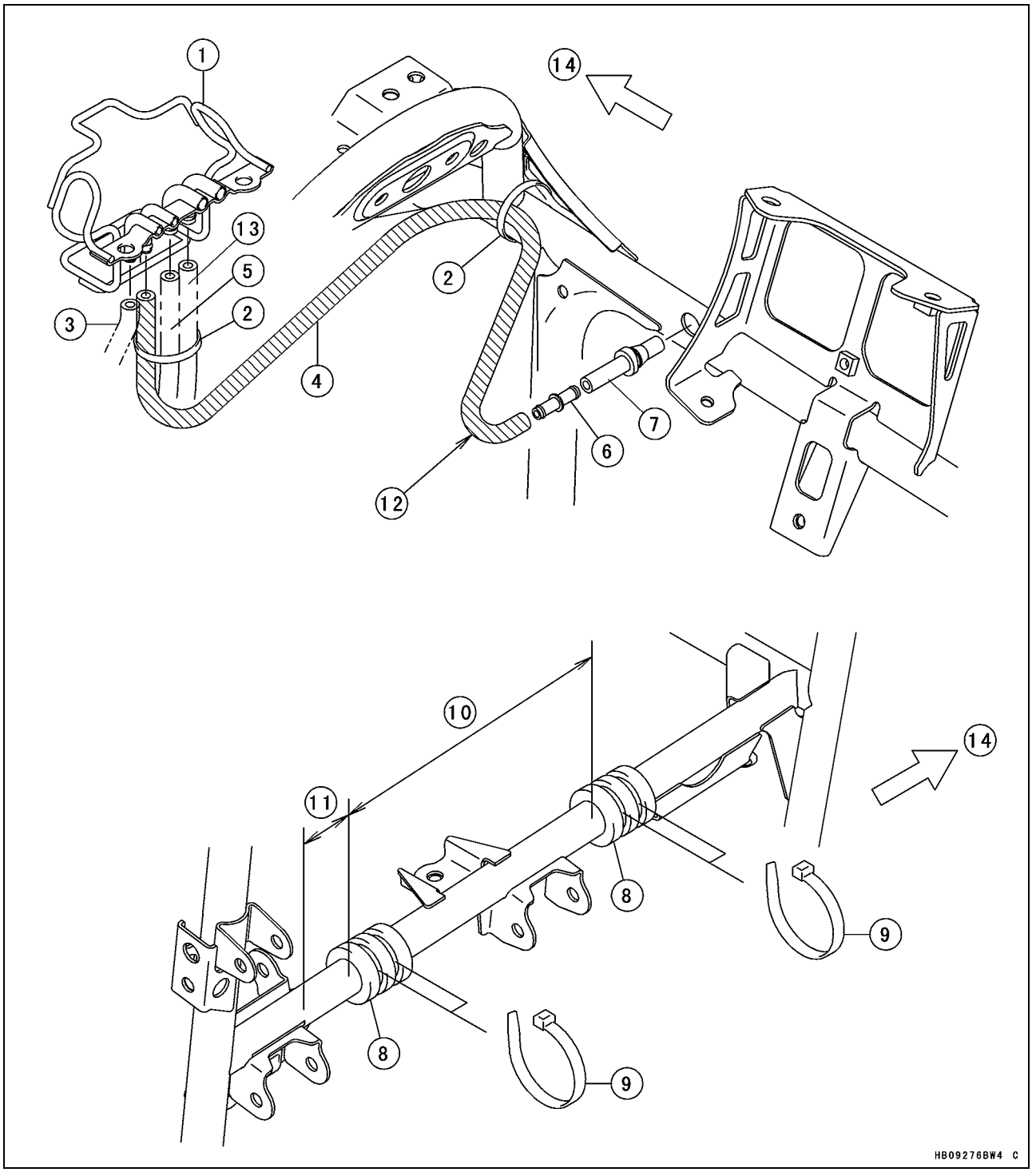
1. Main Harness
2. Drive Belt Failure Detecting Switch Lead
3. Engine Brake Actuator Lead
4. Starter Motor Cable
5. Clamp
6. Drive Belt Failure Detecting Switch
7. Engine Brake Actuator
8. Engine Brake Actuator Lead Connector (Apply grease all around on the top surface of connector to be waterproof.)

Cable, Wire, and Hose Routing



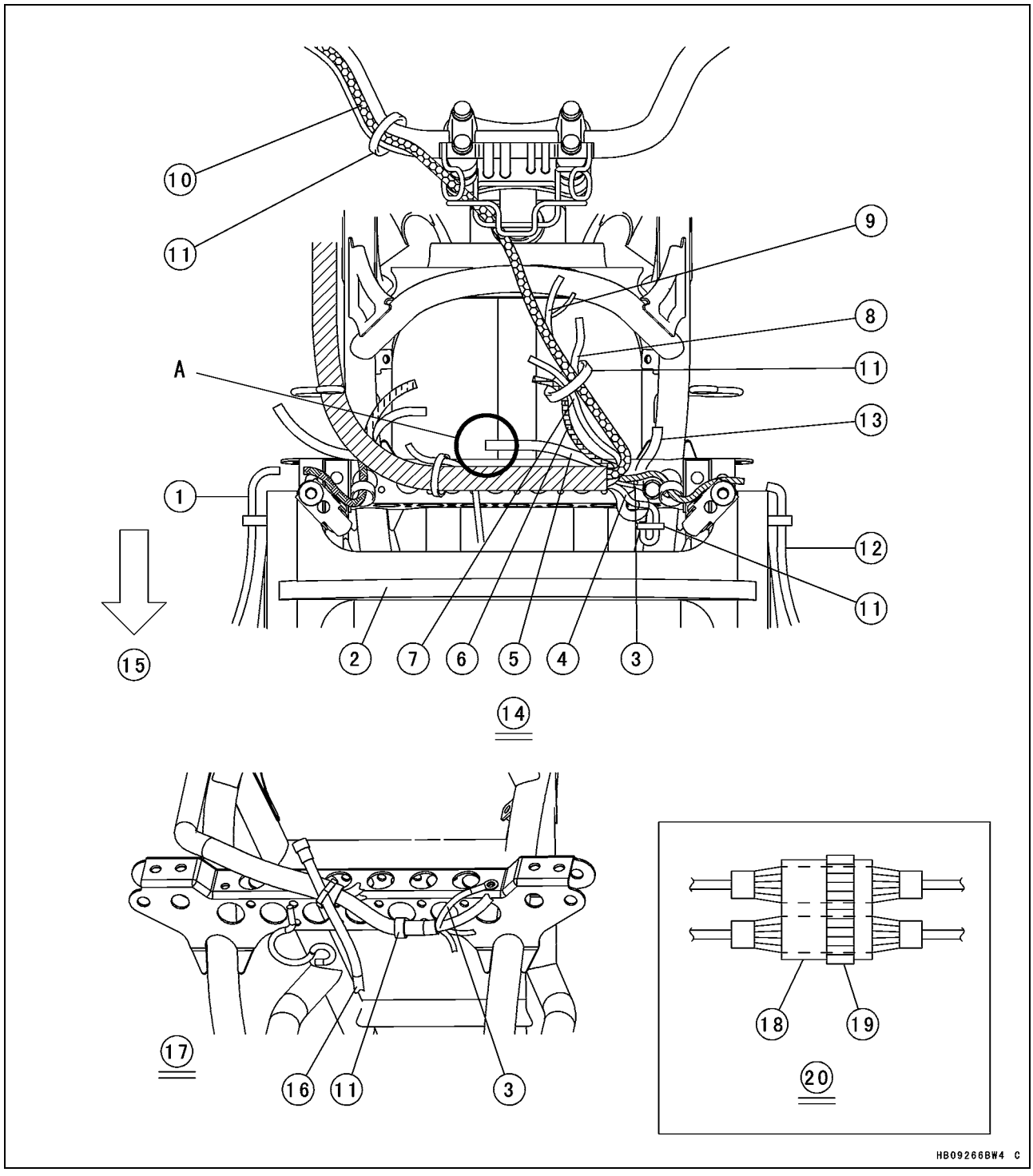
1. Rear Brake Lever
2. Parking Brake Lock Lever
3. Variable Differential Control Cable
4. Cable Adjuster
5. Variable Differential Control Lever
6. Handle Holder Clamp
7. Variable Differential Operating Lever
8. Fit the dust cap.
9. 27 ~ 35 mm (1.1 ~ 1.4 in.)

Cable, Wire, and Hose Routing



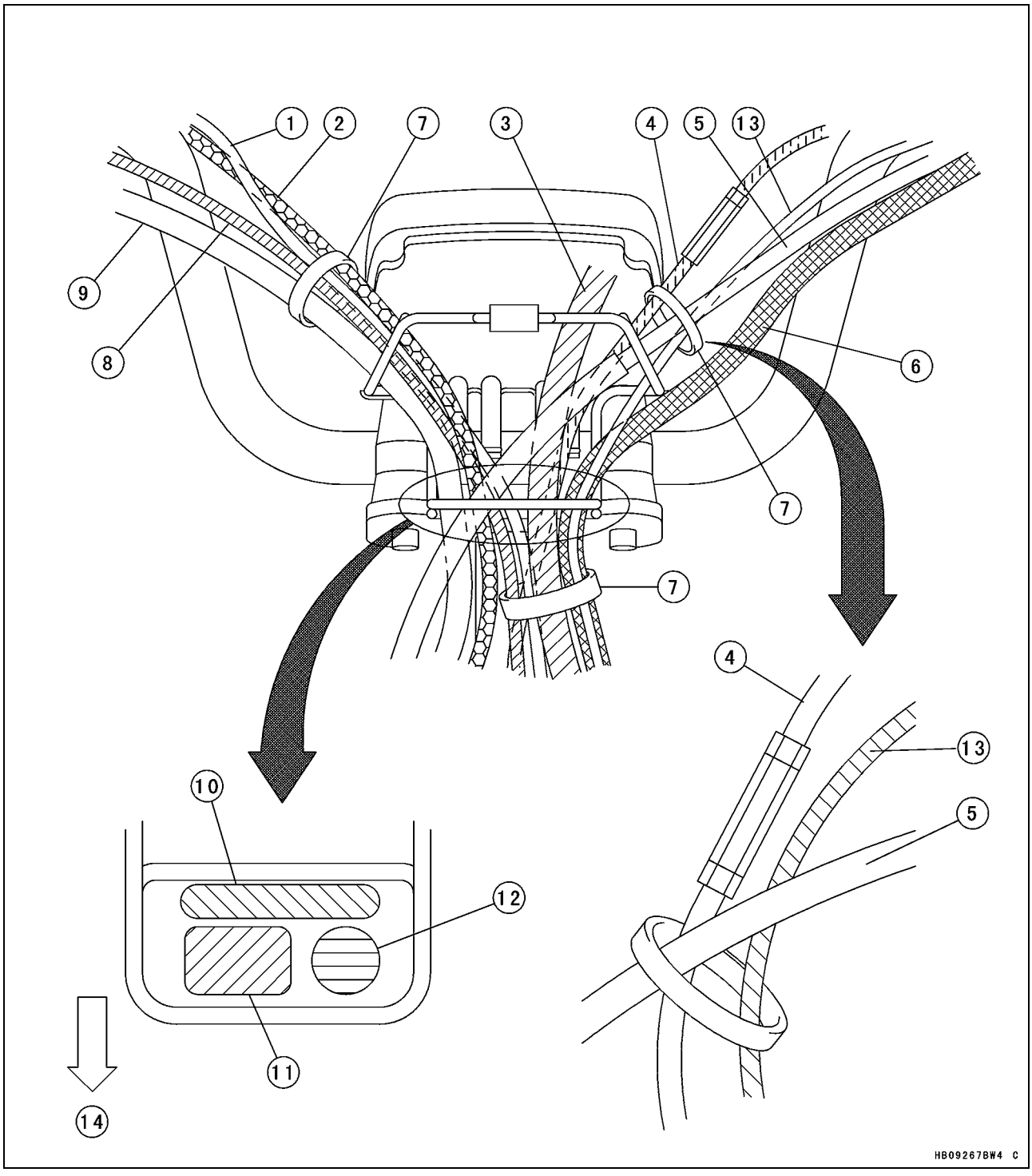
1. Clamp
2. Bands
3. Radiator Fan Motor Vent Hose
4. Vacuum Hose
5. Front Final Gear Case Vent Hose
6. Fitting
7. Tube
8. Dampers
9. Bands
10. 220 mm (8.66 in.)
11. 60 mm (2.36 in.)
12. “L” Formed Side
13. Rear Final Gear Case Vent Hose
14. Front

Cable, Wire, and Hose Routing



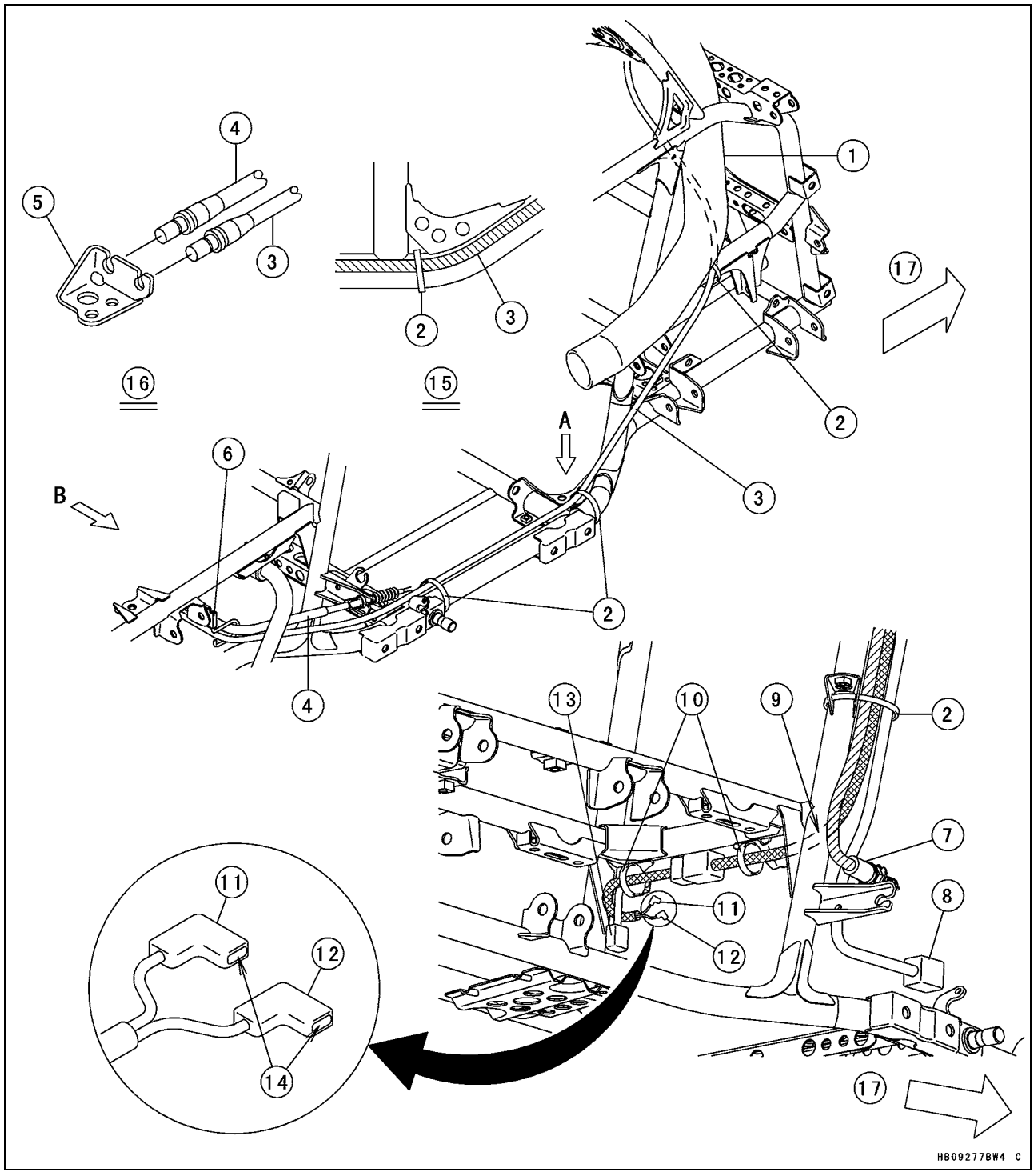
1. Right Headlight Lead
2. Radiator Cover
3. Frame Ground Lead
4. Horn Switch Lead (Australia and Europe Models)
5. Alternator Lead
6. Rear Brake Light Switch Lead
7. 2WD/4WD Shift Switch Lead
8. Left Handlebar Switch Lead
9. Meter Unit Lead
10. Front Brake Light Switch Lead
11. Bands
12. Left Headlight Lead
13. Front Ignition Coil Primary Lead (Run the primary lead under the frame.)
14. Top View
15. Front
16. Radiator Fan Motor Lead
17. Front View
18. Alternator Lead Connector
19. Band
20. Detail A

Cable, Wire, and Hose Routing



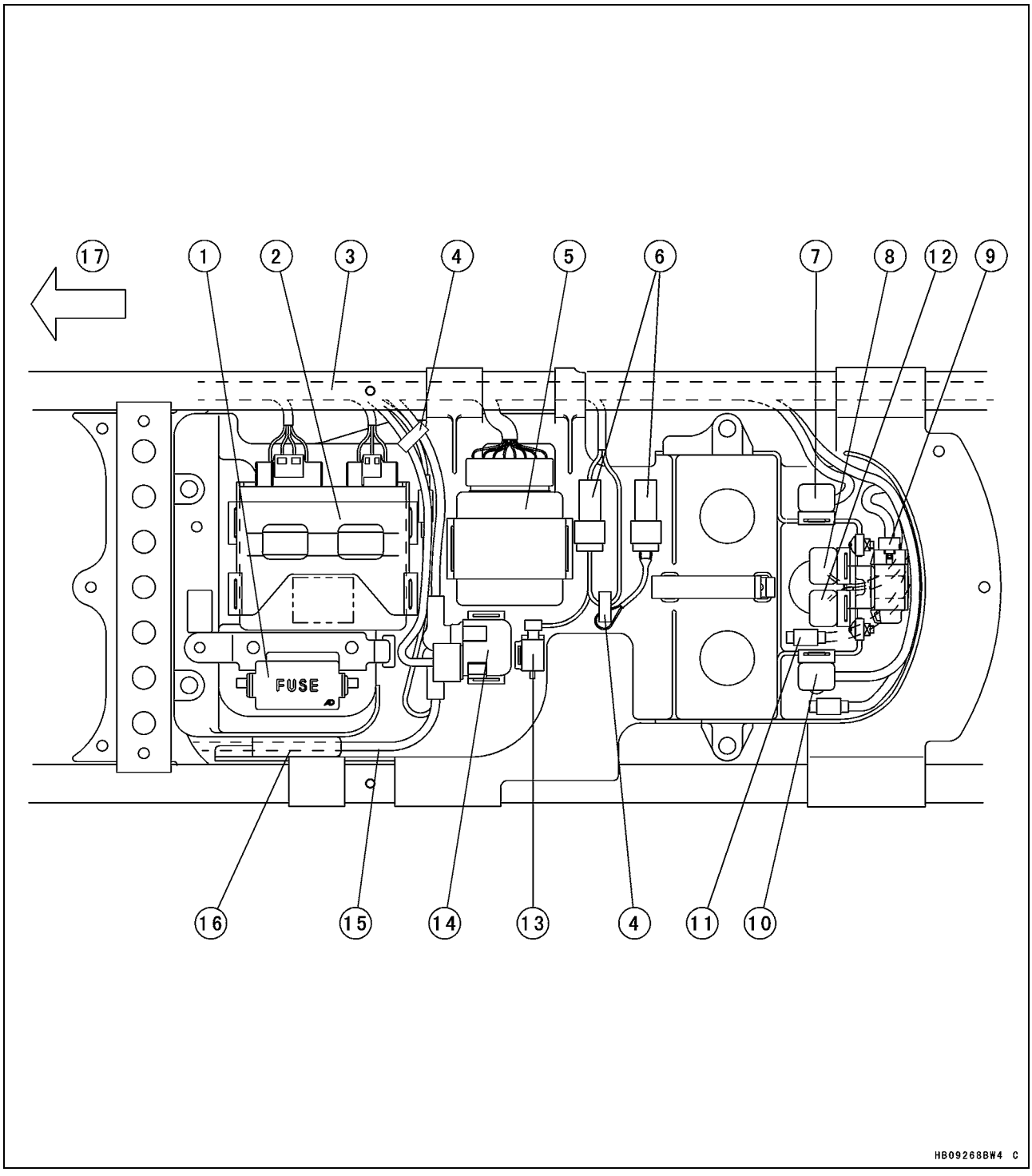
1. Right Handlebar Switch Lead
2. Throttle Cable
3. Meter Unit Lead
4. Variable Differential Control Cable
5. Parking Brake Cable
6. Left Handlebar Switch Lead
7. Bands
8. Front Brake Light Switch Lead
9. Brake Hose
10. Hoses
11. Cables and Brake Hose
12. Leads
13. Rear Brake Light Switch Lead
14. Front

Cable, Wire, and Hose Routing



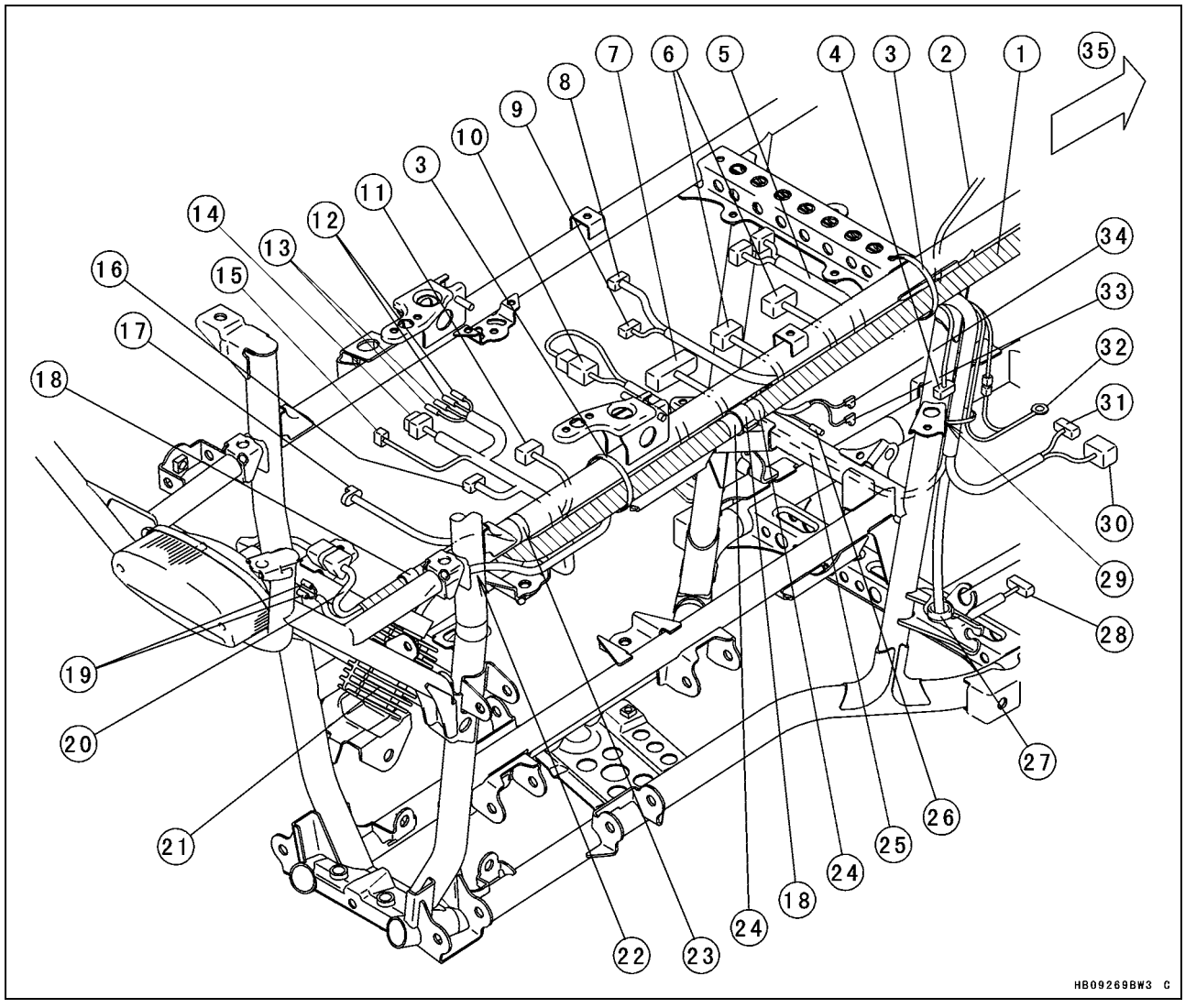
1. Air Intake Duct
2. Bands
3. Parking Brake Cable
4. Rear Brake Cable
5. Bracket
6. Clamp
7. Rear Brake Light Switch
8. Speed Sensor Lead Connector
9. Run the lead front side of frame pipe.
10. Clamps
11. Reverse Switch Lead Connector (BK Lead)
12. Neutral Switch Lead Connector (W Lead)
13. Forward/Reverse Detecting Sensor Lead Connector
14. Apply grease (Chevron Black Pearl Grease EP)
15. View A
16. View B
17. Front

Cable, Wire, and Hose Routing



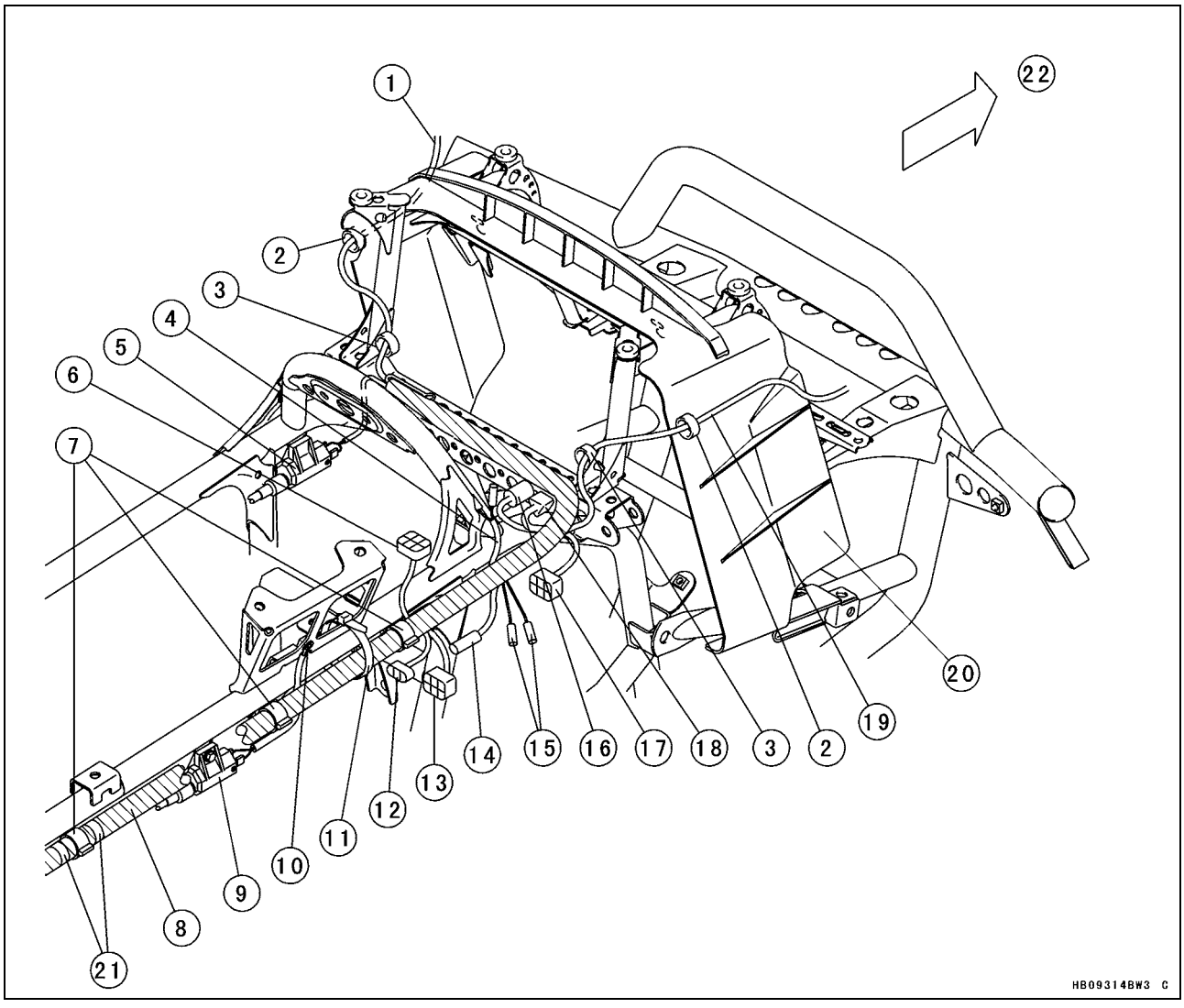
1. Fuse Box
2. ECU
3. Main Harness (Run the main harness under the frame pipe.)
4. Clamps
5. Actuator Controller
6. Reset Connectors (Clamp the connector to the electrical parts case.)
7. Starter Control Relay (Neutral)
8. Radiator Fan Relay
9. Vehicle-down Sensor
10. Starter Control Relay (Brake)
11. Kawasaki Diagnostic System Connector (Connector of Gray)
12. Fuel Pump Relay
13. Radiator Fan Breaker
14. Starter Relay
15. Battery (+) Cable
16. Run the battery (+) cable under the electrical parts case.
17. Front

Cable, Wire, and Hose Routing



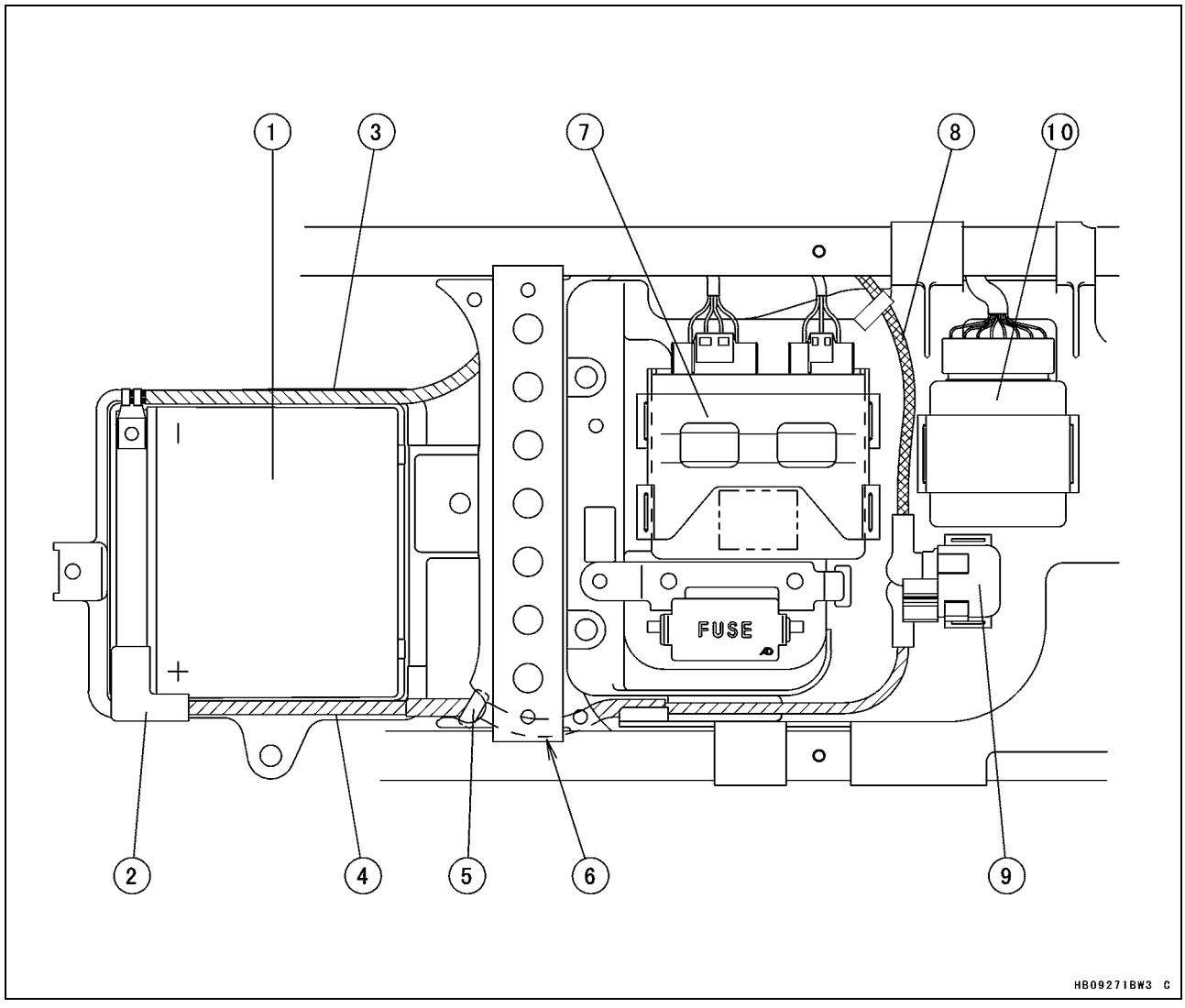
1. Main Harness (Run the main harness under the frame pipe.)
2. Battery (–) Cable
3. Bands
4. To Rear Brake Light Switch
5. To Fuse Box
6. To ECU
7. To Actuator Controller
8. To Starter Circuit Relay
9. To Battery (–) Cable
10. Reset Connector
11. Fuel Pump Lead Connector
12. To Radiator Fan Relay and Fuel Pump Relay
13. Kawasaki Diagnostic System Connector
14. To Starter Control Relay (Brake)
15. To Vehicle-down Sensor
16. To Starter Control Relay (Neutral)
17. Accessory Connector
18. Clamps
19. To Reverse Light (Europe Model)
20. Tail/Brake Light Lead
21. Regulator/Rectifier
22. Run the regulator/rectifier lead to the inside of the frame pipe.
23. Band (Clamp the accessory lead.)
24. White Tapes (KVF750D8F/E8F/F8F ~ DAF/EAF/FAF)
25. Run the lead under the frame pipe.
26. Forward/Reverse Detecting Sensor Lead Connector
27. Clamp (Insert the clamp into the hole of the frame.)
28. To Speed Sensor
29. Band (Pass the band through the hole of the frame bracket.)
30. To Engine Brake Actuator
31. To Drive Belt Failure Detecting Switch
32. Engine Ground Terminal
33. Neutral Switch Lead Connector (LG Lead)
34. Reverse Switch Lead Connector (R/W Lead)
35. Front

Cable, Wire, and Hose Routing



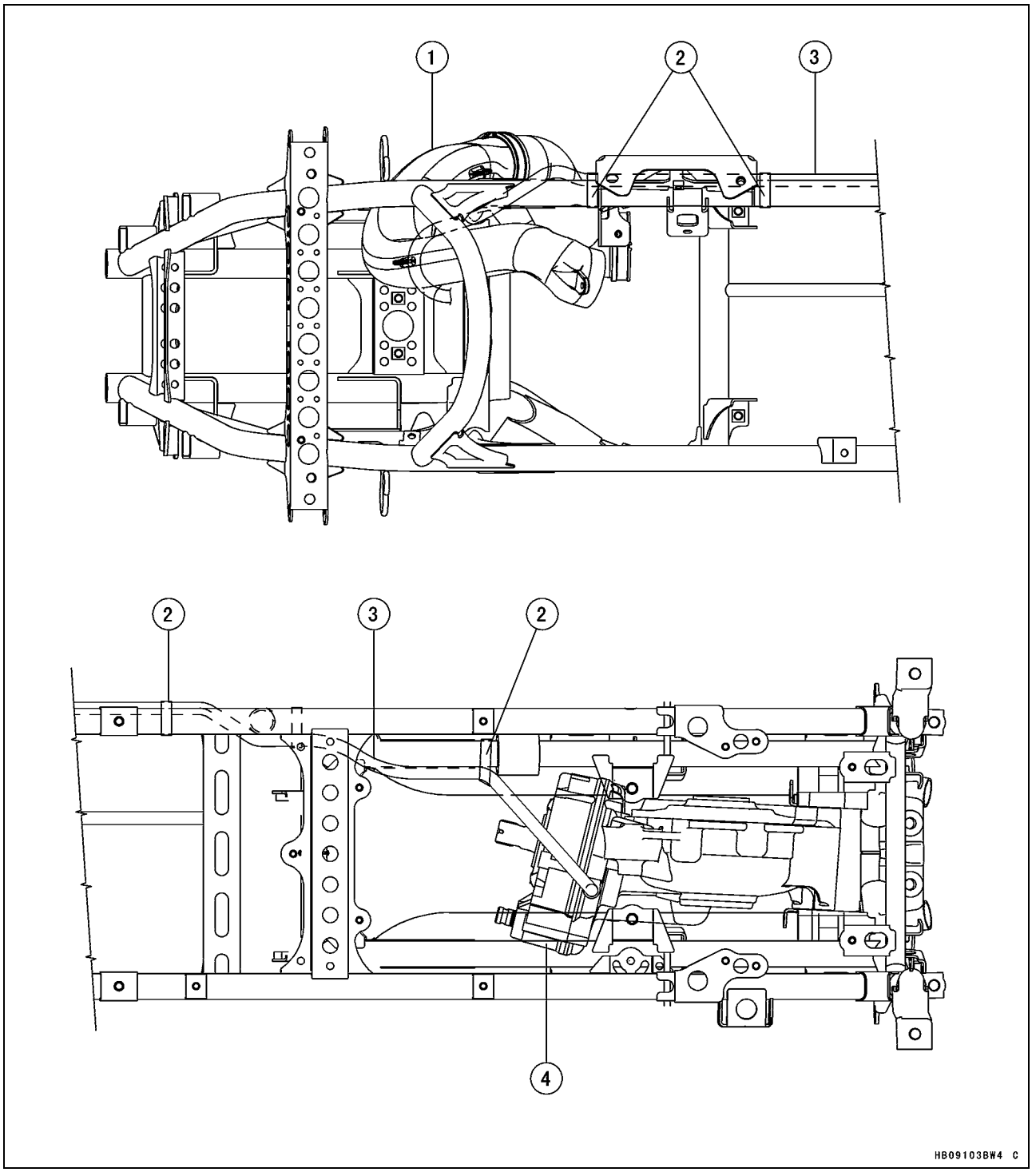
1. To Left Headlight Lead
2. Clamps (Insert the clamp into the hole of the radiator cover.)
3. Clamps
4. To Power Outlet Connector
5. Front Ignition Coil
6. To ISC Valve
7. Clamps
8. Main Harness (Run the main harness under the frame pipe.)
9. Rear Ignition Coil
10. Frame Ground Terminal
11. Band
12. To Intake Air Pressure Sensor
13. To Fuel Injector Throttle Sensor Subharness Connector
14. To Water Temperature Sensor (Run the water temperature sensor inside of the frame pipe.)
15. Accessory Connector
16. To Radiator Fan Motor
17. To 2WD/4WD Actuator
18. To Ignition Switch
19. To Right Headlight Lead
20. Radiator Cover
21. White Tapes (KVF750DBF/EBF/FBF)
22. Front

Cable, Wire, and Hose Routing



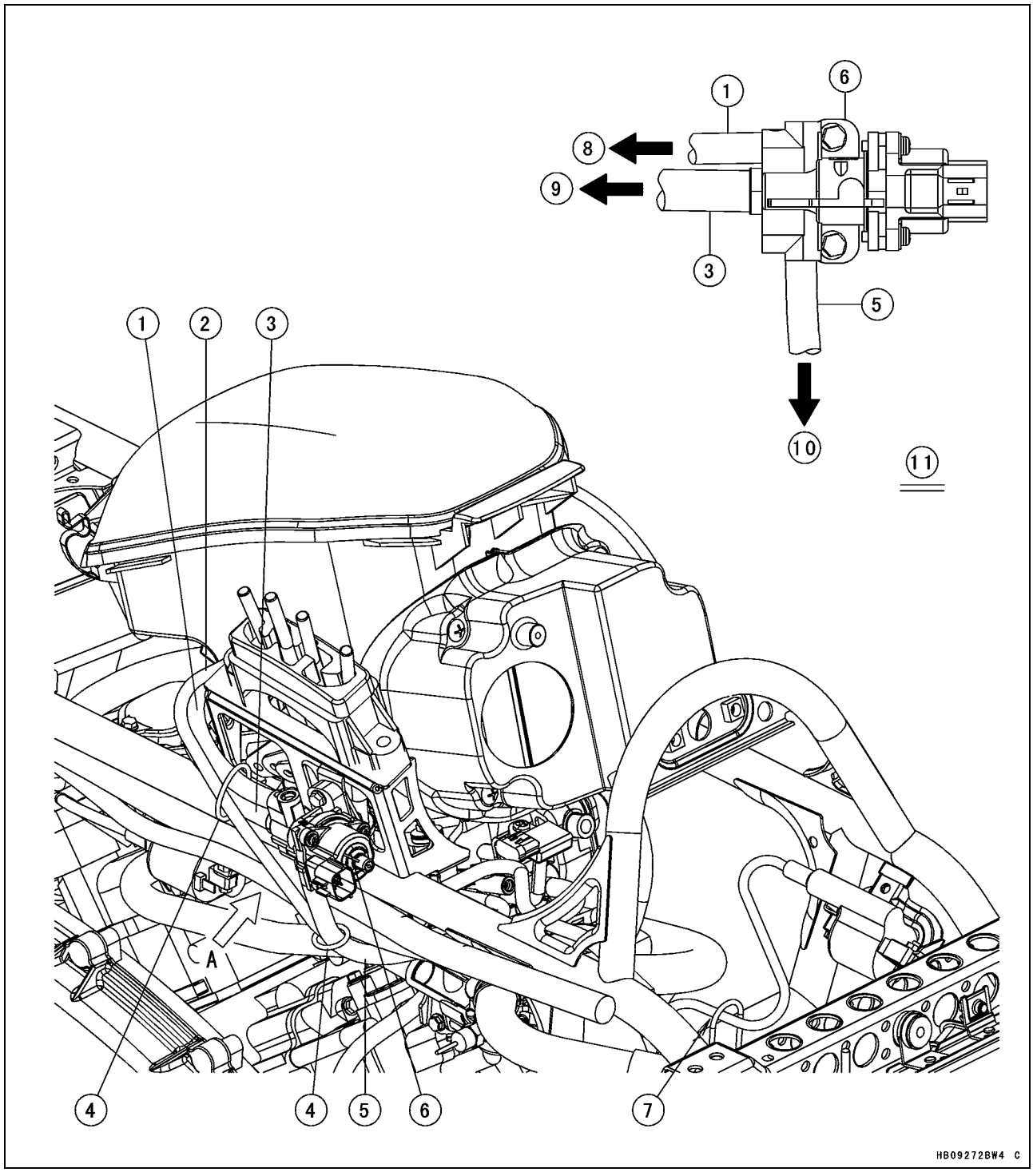
1. Battery
2. Red Cap
3. Battery (–) Cable
4. Battery (+) Cable
5. Clamp (Insert the clamp into the hole of the frame from inside.)
6. Run the battery (+) cable under the frame.
7. ECU
8. Starter Motor Cable
9. Starter Relay
10. Actuator Controller

Cable, Wire, and Hose Routing



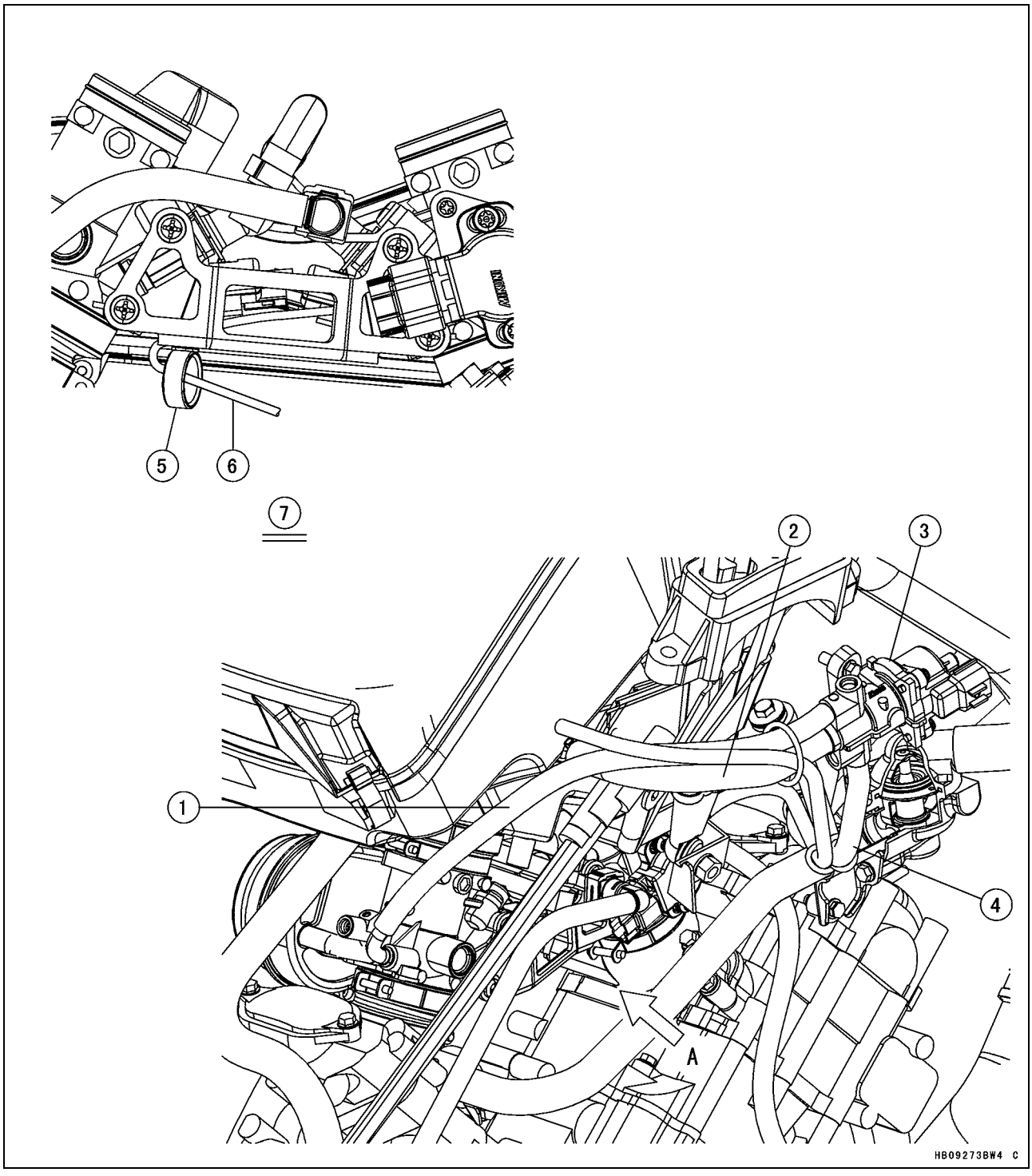
1. Air Intake Duct
2. Bands
3. Rear Final Gear Case Vent Hose
4. Rear Final Gear Case

Cable, Wire, and Hose Routing



1. ISC Valve Tube (Rear)
2. Tube
3. ISC Valve Tube (Primary)
4. Clamps
5. ISC Valve Tube (Front)
6. ISC Valve
7. Run the spark plug lead of the front ignition coil to the guide of the frame.
8. To Throttle Body #2
9. To Air Cleaner Housing
10. To Throttle Body #1
11. View A

Cable, Wire, and Hose Routing



1. ISC Valve Tube (Rear)
2. ISC Valve Tube (Primary)
3. ISC Valve
4. ISC Valve Tube (Front)
5. Clamp
6. Fuel Injector/Throttle Sensor Subharness
7. View A

MODEL APPLICATION

Year	Model	Beginning Frame No.
2008	KVF750D8F	JKAVFDD1□8B500001 or JKAVF750DDB600001
2008	KVF750E8F	JKAVFDE1□8B500001
2008	KVF750E8FA	JKAVFDE1□8B500001
2008	KVF750F8F	JKAVFDF1□8B500001
2009	KVF750D9F	JKAVFDD1□9B510501 or JKAVF750DDB601701
2009	KVF750E9F	JKAVFDE1□9B503601
2009	KVF750E9FA	JKAVFDE1□9B503601
2010	KVF750DAF	JKAVFDD1□AB518401 or JKAVF750DDB603001
2010	KVF750EAF	JKAVFDE1□AB506801
2010	KVF750FAF	JKAVFDF1□AB521601
2011	KVF750DBF	JKAVFDD1□BB522501 or JKAVF750DDB603301
2011	KVF750EBF	JKAVFDE1□BB507701
2011	KVF750FBF	JKAVFDF1□BB574601

□:This digit in the frame number changes from one machine to another.

Kawasaki
KAWASAKI HEAVY INDUSTRIES, LTD.
Motorcycle & Engine Company

Part No.99924-1394-04

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