



PRAIRIE 650
KVF 650
PRAIRIE 650 4X4
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All Terrain Vehicle Service Manual



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

LIST OF ABBREVIATIONS

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

Read OWNER'S MANUAL before operating.

EMISSION CONTROL INFORMATION

To protect the environment in which we all live, Kawasaki has incorporated crankcase emission (1) and exhaust emission (2) control systems in compliance with applicable regulations of the California Air Resources Board.

1. Crankcase Emission Control System

A sealed-type crankcase emission control system is used to eliminate blow-by gases. The blow-by gases are led to the breather chamber through the crankcase. Then, it is led to the air cleaner.

Oil is separated from the gases while passing through the inside of the breather chamber from the crankcase, and then returned back to the bottom of crankcase.

2. Exhaust Emission Control System

The exhaust emission control system applied to this engine family is engine modifications that consist of a modified carburetor and an ignition system having optimum ignition timing characteristics.

The carburetor has been calibrated to provide lean air/fuel mixture characteristics and optimum fuel economy with a suitable air cleaner and exhaust system.

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

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

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

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

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

NOTE

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

1. Tampering does not include the temporary removal or rendering inoperative of devices or elements of design in order to perform maintenance.

2. Tampering could include:

a. Maladjustment of vehicle components such that the emission standards are exceeded.

b. Use of replacement parts or accessories which adversely affect the performance or durability of the 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)**

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

Foreword

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

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

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

To get the longest life out of your vehicle:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki Vehicle parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki vehicles are introduced by the Special Tool Catalog or Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use This Manual

In preparing this manual, we divided the product into its major systems. These systems became the manual's chapters. All information for a particular system from adjustment through disassembly and inspection is located in a single chapter.

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

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

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

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

⚠ WARNING

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

⚠ CAUTION

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

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

NOTE

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

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

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

General Information

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1-2 GENERAL INFORMATION

Before Servicing

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

- (1) **Dirt**
Before removal and disassembly, clean the vehicle. Any dirt entering the engine will shorten the life of the vehicle. For the same reason, before installing a new part, clean off any dust or metal filings.
- (2) **Battery Ground**
Disconnect the ground (–) wire from the battery before performing any disassembly operations on the vehicle. This prevents the engine from accidentally turning over while work is being carried out, sparks from being generated while disconnecting the wires from electrical parts, as well as damage to the electrical parts themselves. For reinstallation, first connect the positive wire to the positive (+) terminal of the battery
- (3) **Installation, Assembly**
Generally, installation or assembly is the reverse of removal or disassembly. However, if installation or assembly sequence is given in this Service Manual, follow it. Note parts locations and cable, wire, and hose routing during removal or disassembly so they can be installed or assembled in the same way. It is preferable to mark and record the locations and routing whenever possible.
- (4) **Tightening Sequence**
When installing bolts, nuts, or screws for which a tightening sequence is given in this Service Manual, make sure to follow the sequence. When installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit, thus ensuring that the part has been installed in its proper location. Then, tighten them to the specified torque in the tightening sequence and method indicated. If tightening sequence instructions are not given, tighten them evenly in a cross pattern. Conversely, to remove a part, first loosen all the bolts, nuts, or screws that are retaining the part a 1/4–turn before removing them.
- (5) **Torque**
When torque values are given in this Service Manual, use them. Either too little or too much torque may lead to serious damage. Use a good quality, reliable torque wrench.
- (6) **Force**
Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic-faced mallet. Use an impact driver for screws (particularly for the removing screws held by non-permanent locking agent) in order to avoid damaging the screw heads.
- (7) **Edges**
Watch for sharp edges, as they could cause injury through careless handling, especially during major engine disassembly and assembly. Use a clean piece of thick cloth when lifting the engine or turning it over.
- (8) **High-Flash Point Solvent**
A high-flash point solvent is recommended to reduce fire danger. A commercial solvent commonly available in North America is standard solvent (generic name). Always follow manufacturer and container directions regarding the use of any solvent.
- (9) **Gasket, O-Ring**
Replace a gasket or an O-ring with a new part when disassembling. Remove any foreign matter from the mating surface of the gasket or O-ring to ensure a perfectly smooth surface to prevent oil or compression leaks.
- (10) **Liquid Gasket, Locking Agent**
Clean and prepare surfaces where liquid gasket or non-permanent locking agent will be used. Apply them sparingly. Excessive amount may block engine oil passages and cause serious damage.
- (11) **Press**
When using a press or driver to install a part such as a wheel bearing, apply a small amount of oil to the area where the two parts come in contact to ensure a smooth fit.
- (12) **Ball Bearing and Needle Bearing**
Do not remove a ball bearing or a needle bearing unless it is absolutely necessary. Replace any ball or needle bearings that were removed with new ones. Install bearings with the manufacturer and size marks facing out, applying pressure evenly with a suitable driver. Apply force only to the end of the race that contacts the press fit portion, and press it evenly over the base component.
- (13) **Oil Seal and Grease Seal**
Replace any oil or grease seals that were removed with new ones, as removal generally damages seals. Oil or grease seals should be pressed into place using a suitable driver, applying a force uniformly to the end of seal until the face of the seal is even with the end of the hole, unless instructed otherwise. When pressing in an oil or grease seal which has manufacturer's marks, press it in with the marks facing out.

Before Servicing

(14) Circlip, Retaining Ring, and Cotter Pin

When installing circlips and retaining rings, take care to compress or expand them only enough to install them and no more. Install the circlip with its chamfered side facing load side as well.

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

(15) Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the sliding surfaces have an adequate lubricative film. During assembly, make sure to apply oil to any sliding surface or bearing that has been cleaned. Old grease or dirty oil could have lost its lubricative quality and may contain foreign particles that act as abrasives; therefore, make sure to wipe it off and apply fresh grease or oil. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended.

(16) Direction of Engine Rotation

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

(17) Replacement Parts

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

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

(18) Electrical Wires

All the electrical wires are either one-color or two-color. A two-color wire is identified first by the primary color and then the stripe color. For example, a yellow wire with thin red stripes is referred to as a "yellow/red" wire; it would be a "red/yellow" wire if the colors were reversed. Unless instructed otherwise, electrical wires must be connected to wires of the same color.

Two-Color Electrical

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

GB020801W1 C

(19) Inspection

When parts have been disassembled, visually inspect these parts for the following conditions or other damage. If there is any doubt as to the condition of them, replace them with new ones.

Abrasion	Crack	Hardening	Warp
Bent	Dent	Scratch	Wear
Color change	Deterioration	Seizure	

(20) Specifications

Specification terms are defined as follows:

"Standards" show dimensions or performances which brand-new parts or systems have.

"Service Limits" indicate the usable limits. If the measurement shows excessive wear or deteriorated performance, replace the damaged parts.

(21) 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.

1-4 GENERAL INFORMATION

Model Identification

KVF650-A1



Model Identification

KVF650-A2



HB03B014 S



HB03B015 S

1-6 GENERAL INFORMATION

Model Identification

KVF650-B1, B2



GENERAL INFORMATION 1-7

General Specifications

Items	KVF650-A1, B1	KVF650-A2, B2
Dimensions:		
Overall length	2 155 mm (84.84 in.)	←
Overall width	1 170 mm (46.06 in.)	←
Overall height	1 150 mm (45.28 in.)	←
Wheelbase	1 295 mm (50.98 in.)	←
Ground clearance:		
Rear final gear case	193 mm (7.60 in.)	←
Center of frame	240 mm (9.45 in.)	←
Seat height	855 mm (33.66 in.)	←
Dry mass	274 kg (604 lb)	←
Curb mass:		
Front	155 kg (342 lb)	←
Rear	138 kg (304 lb)	←
Fuel tank capacity	17 L (4.5 US gal)	←
Performance:		
Minimum turning radius	3.1 m (10.17 ft)	←
Engine:		
Type	4-stroke, SOHC, V2-cylinders	←
Cooling system	Liquid-cooled	←
Bore and stroke	80.0 x 63.0 mm (3.15 x 2.48 in.)	←
Displacement	633 mL (38.6 cu in.)	←
Compression ratio	9.9:1	←
Maximum horsepower	30.9 kW (42 PS) @6 500 r/min (rpm), (US) -	←
Maximum torque	52.1 N·m (5.3 kgf·m, 38.33 ft·lb) @4 000 r/min (rpm)	←
Carburetion system	Carburetor, Keihin CVKR-D32	←
Starting system	Electric Starter & Recoil Starter	←
Ignition system	Digital DC-CDI	←
Timing advance	Electronically advanced	←
Ignition timing	From 5° BTDC @1 100 r/min (rpm) to 28° BTDC @5 000 r/min (rpm)	←
Spark plug	NGK CR7E, DENSO U22ESR-N	←
Cylinder numbering method	Front to rear, 1-2	←
Firing order	1-2	←
Valve timing:		
Inlet	Open	30° BTDC
	Close	34° ABDC
	Duration	244°
Exhaust:	Open	54° BBDC
	Close	10° ATDC
	Duration	244°
Lubrication system	Forced lubrication (wet sump)	←
Engine oil:	Grade	API SF or SG class
		API SH or SJ with JASO MA class
	Viscosity	SAE10W-40
	Capacity	2.05 L (2.17 US qt)
Drive Train:		
Primary reduction system:		
Type	Belt converter	←
Reduction ratio	3.122 ~ 0.635	←

1-8 GENERAL INFORMATION

General Specifications

Items	KVF650-A1, B1	KVF650-A2, B2
Transmission:		
Type	2-speed plus reverse	←
Gear ratios:		
Forward: High	3.098 (30/26 x 29/18 x 20/12)	←
Low	4.833 (36/20 x 29/18 x 20/12)	←
Reverse:	4.028 (16/12 x 18/16 x 29/18 x 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:	Grade	←
	API SF or SG class	←
	API SH or SJ with JASO MA class	←
	Viscosity	←
	SAE10W-40	←
	Capacity	←
	0.43 L (0.45 US qt)	←
Rear final gear case oil:	Type	←
	MOBIL Fluid 424	←
		MOBIL Fluid 424 or CITGO TRANSGARD TRACTOR HYDRAULIC FLUID
	Capacity	←
	0.9 L (0.95 US qt)	←
Frame:		
Type	Double tubular	←
Caster (rake angle)	3.5°	←
Camber	0° @1 G	←
King pin angle	15.5°	←
Trail	15 mm (0.59 in.)	←
Tread		
Front	914 mm (35.98 in.)	←
Rear	910 mm (35.83 in.)	←
Front tire:	Type	←
	Tubeless	←
	Size	←
	AT25 x 8 – 12	←
Rear tire:	Type	←
	Tubeless	←
	Size	←
	AT25 x 10 – 12	←
Suspension:	Type	←
Front	MacPherson strut	←
	Wheel travel	←
	170 mm (6.69 in.)	←
Rear	Type	←
	Swingarm	←
	Wheel travel	←
	184 mm (7.24 in.)	←
Brake:		
Front	Disc (Hydraulic) x 2	←
Rear	Enclosed Wet Multi-Plate	←
Electrical Equipment:		
Battery	12 V 12 Ah	←
Headlight:	Type	←
	Semi-sealed beam	←
	Bulb	←
	12 V 45/45 W x 2	←
Tail/brake light	Bulb	←
	12 V 8/27 W	←
Alternator:	Type	←
	Three - phase AC	←
	Rated output	←
	25 A, 14 V @6 000 r/min (rpm)	←

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

US: U.S.A. Model

GENERAL INFORMATION 1-9

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.**

KVF650-A1, B1

	FREQUENCY	First Ser- vice	Regular Service			
		After 10 hrs. or 100 km (60 mi.) of use	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days or 1700 km (1100 mi.) of use	Every year of use
OPERATION						
ENGINE						
	Converter drive belt wear – check *				•	
	Converter drive belt deflection - check *				•	
	Drive belt failure detection system function – check*				•	
	Engine brake control (K-EBC) lever – check*				•	
	Air cleaner – service*	•	•			
	Throttle lever play – check*	•	•			
	Valve clearance – check*					•
	Fuel system cleanliness – check*	•			•	
	Engine oil – change *	•			•	
	Oil filter – replace*	•			•	
	Spark plug – clean and gap	•			•	
	Spark arrester – clean					•
	Radiator – clean*	•	•			
	Radiator hoses, and connections – check*					•
	Coolant – change*	2 years				
	Coolant filter of carburetor – clean					•
	Fuel hoses, connections – check				•	
	Fuel hose – replace	4 years				
CHASSIS						
	Joint boots – check*	•	•			
	Rear brake pedal and lever adjustment – check*	•	•			
	Rear brake plates – change*	every 10 000 km (6 000 mi.)				
	Cable adjustment*	•	•			
	Bolts and nuts – tighten	•	•			
	Front brake pad wear – check*	•		•		
	Brake light switch – check*	•		•		
	Steering – check	•			•	
	Differential control lever play– check	•	•			
	Tire wear – check*			•		
	Front and rear finial gear case oil – change	•				•
	General lubrication*			•		
	Front brake fluid level – check	•		•		
	Front brake fluid – change					•
	Brake master cylinder piston assembly and dust seal – replace	2 years				
	Caliper piston seal and dust seal – replace	2 years				
	Brake hoses, connections– check				•	
	Brake hose – replace	4 years				

1-10 GENERAL INFORMATION

Periodic Maintenance Chart

KVF650-A2, B2

	FREQUENCY	Regular Service			
		First Service	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days of vehicle use, 1700 km (1100 mi.) or when belt indicator light comes on (100 hours) whichever comes first
OPERATION					
ENGINE					
Converter drive belt wear – check *				●	
Converter drive belt deflection - check *				●	
Drive belt failure detection system function – check*				● (Note)	
Engine brake control (K-EBC) lever – check*				●	
Air cleaner – service*	●	●			
Throttle lever play – check*	●	●			
Valve clearance – check*					●
Fuel system cleanliness – check*	●			●	
Engine oil – change *	●			●	
Oil filter – replace*	●			●	
Spark plug – clean and gap	●			●	
Spark arrester – clean					●
Radiator – clean*	●	●			
Radiator hoses, and connections – check*					●
Coolant – change*			2 years		
Coolant filter of carburetor – clean					●
Fuel hoses, connections – check				●	
Fuel hose – replace			4 years		
CHASSIS					
Joint boots – check*	●	●			
Rear brake pedal and lever adjustment – check*	●	●			
Rear brake plates – change*			every 10 000 km (6 000 mi.)		
Cable adjustment*	●	●			
Bolts and nuts – tighten	●	●			
Front brake pad wear – check*	●		●		
Brake light switch – check*	●		●		
Steering – check	●			●	
Differential control lever play– check	●	●			
Tire wear – check*			●		
Front and rear finial gear case oil – change	●				●
General lubrication*			●		
Front brake fluid level – check	●		●		
Front brake fluid – change					●
Brake master cylinder piston assembly and dust seal – replace			2 years		
Caliper piston seal and dust seal – replace			2 years		
Brake hoses, connections– check				●	
Brake hose – replace			4 years		

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

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

NOTE

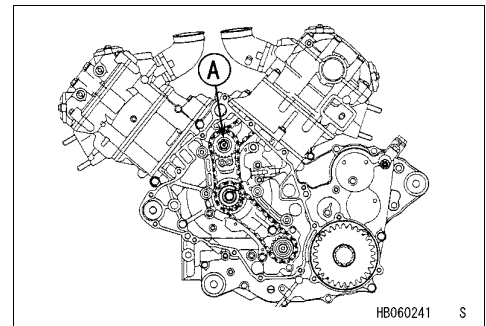
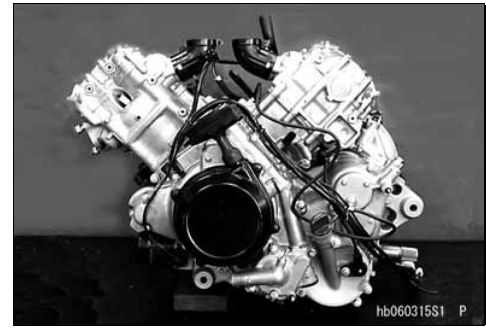
- When the drive belt failure detection system is activated, return the vehicle immediately to an authorized Kawasaki dealer for drive belt inspection and adjustment or replacement.

Technical Information — Engine

Engine Main Specification

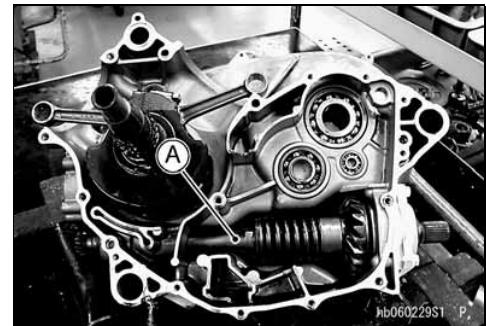
1. Newly designed, liquid-cooled, 633 cm³ SOHC, 4-valve V-twin engine produces 30.9 kW (42 PS)/6,500 rpm.
2. Over square bore and stroke of 80.0 mm x 63.0 mm contributes to a high torque output of 52.1 N·m (5.3 kgf·m)/4,000 rpm and a flat, user-friendly torque curve.
3. Off-setting the cylinders by 90-degree results in perfect primary balance, for low vibration levels and comfortable riding.
4. Concave piston crown improves combustion efficiency.
5. Large, 30 mm intake and 26 mm exhaust valves are set at a narrow 19-degree intake and 21-degree exhaust for a compact, high-efficiency combustion chamber.
6. Dual, CVKR-D32 downdraft carburetors deliver smooth throttle response and efficient fuel consumption.
7. An intermediate sprocket is used between the crank and cams for more compact engine design.

[A] Intermediate Shaft

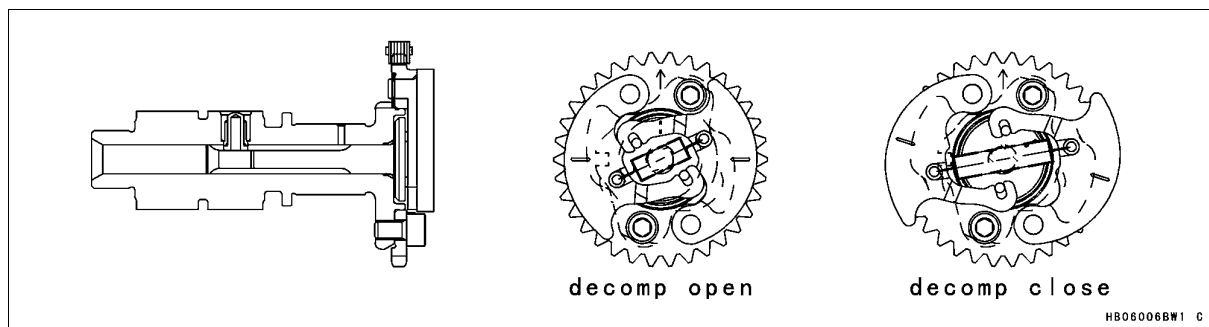


8. The propeller shaft is built into the crankcase for a compact, low mass drive train. The capacity of cam-damper is increased.

[A] Propeller Shaft



9. The KVF650A,B comes equipped with both an electric starter and a recoil starter. Together with KACR (Kawasaki Automatic Compression Release), starting is quick and easy. The deviation of operating degree and lift is improved.



HB0606BW1 C

1-12 GENERAL INFORMATION

Technical Information — K-EBC System

1. Outline

This vehicle is equipped with the K-EBC (Kawasaki Engine Brake Control) system. It can assist the operator when descending hills by supplementing the wheel brake systems with additional braking force that is produced by the engine.

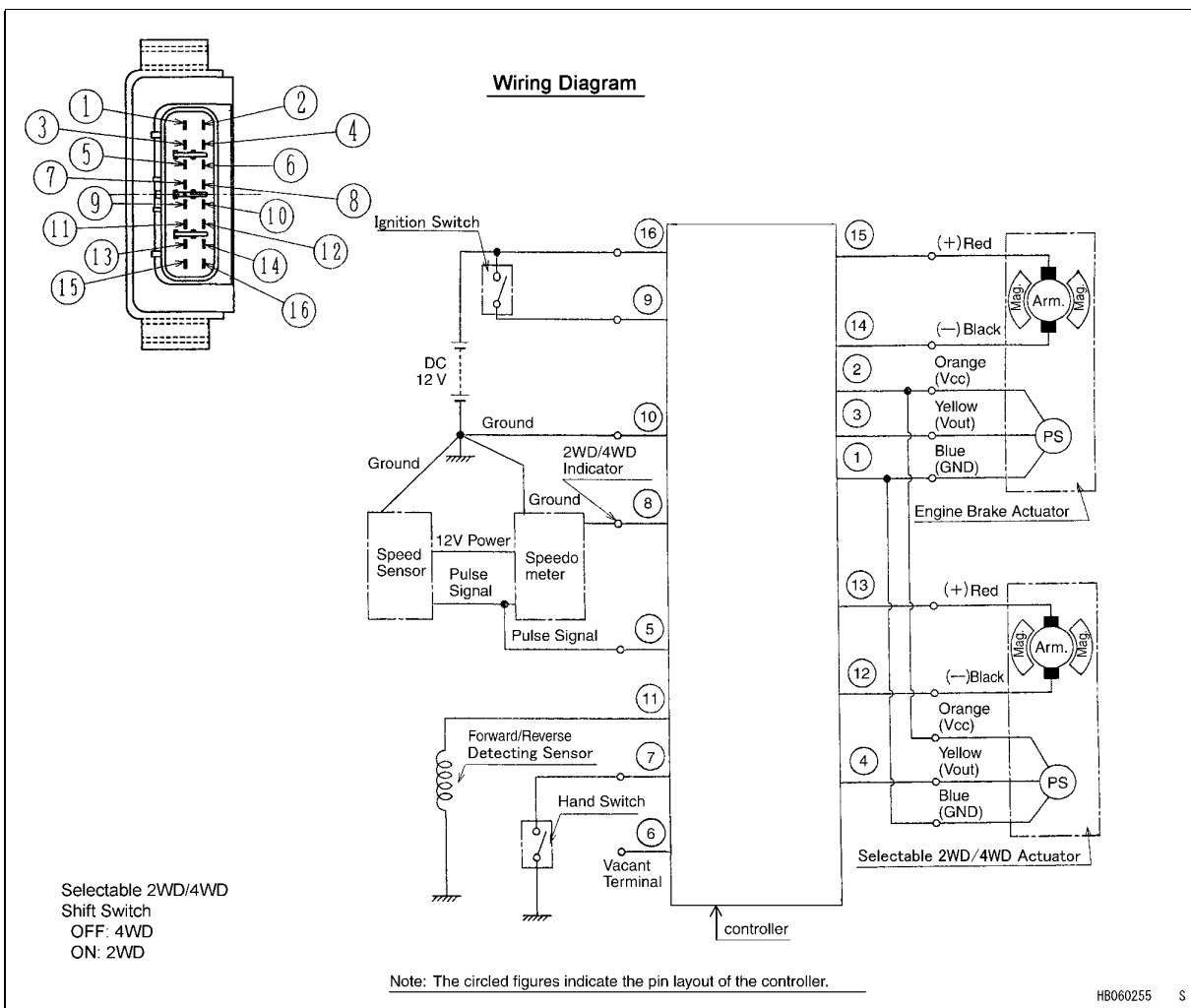
When descending hills, the K-EBC system alone may not supply enough braking force. The operator should apply the brakes to keep the speed safe for the type of terrain, visibility, operating conditions, and operator's experience. The K-EBC system is applied automatically under certain conditions when the throttle is released.

This system detects the ATV's speed and running direction electrically, and when the conditions are met, a electric actuator presses the torque converter drive pulley resulting in connecting the drive pulley with the driven pulley through the belt and then generating braking force by the engine.

The K-EBC is a supplemental braking system when the speed is comparatively low (about 3 km/h — 20 km/h) and does not function in reverse.

2. Wiring Diagram

The entire system is shown in the wiring diagram. The system is powered by a 12 Volt battery. Always keep the battery connected even when the battery is discharged and operator needs to start engine. The engine can be started with the recoil starter with the battery disconnected. However, the controller will not operate correctly.



Technical Information — K-EBC System

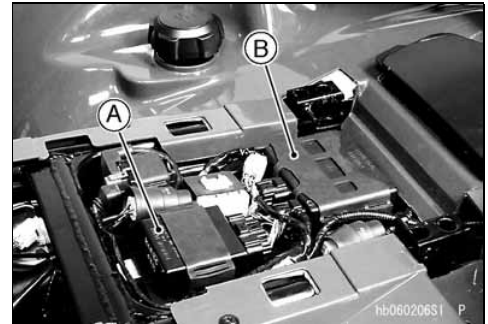
3. Component Parts

This system consists of a controller, actuator, lever assembly, forward/reverse detecting sensor, and a speed sensor.

1) Controller

The controller is located under the seat and controls the engine brake and selectable 2WD/4WD actuators.

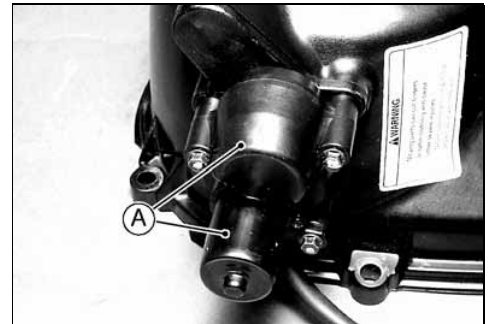
- [A] Controller
- [B] Igniter



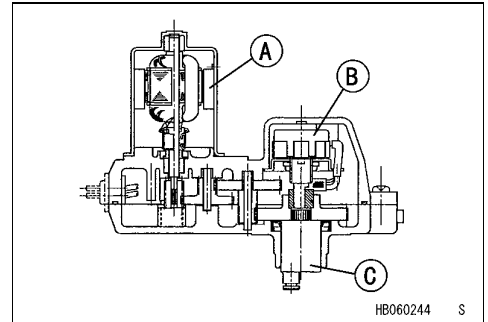
2) Engine Brake Actuator

The engine brake actuator is installed on the converter cover. It consists of a DC motor, reduction gears, and potentiometer.

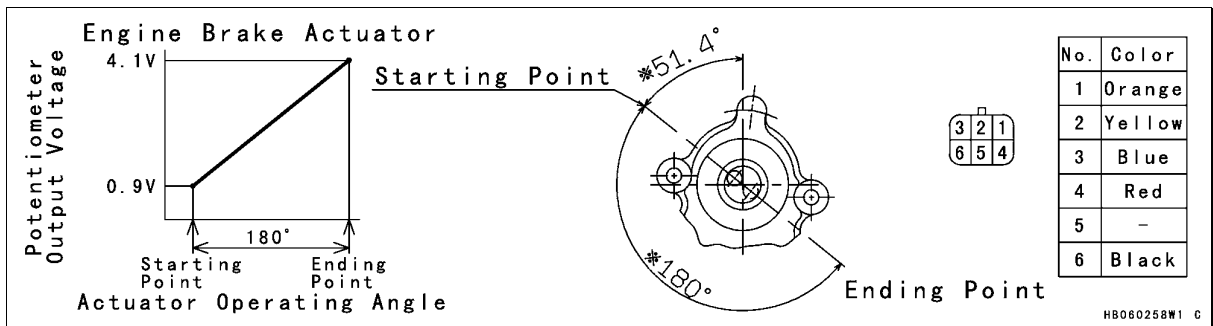
- [A] Engine Brake Actuator



- [A] DC Motor
- [B] Potentiometer
- [C] Output Shaft



Engine Brake Actuator



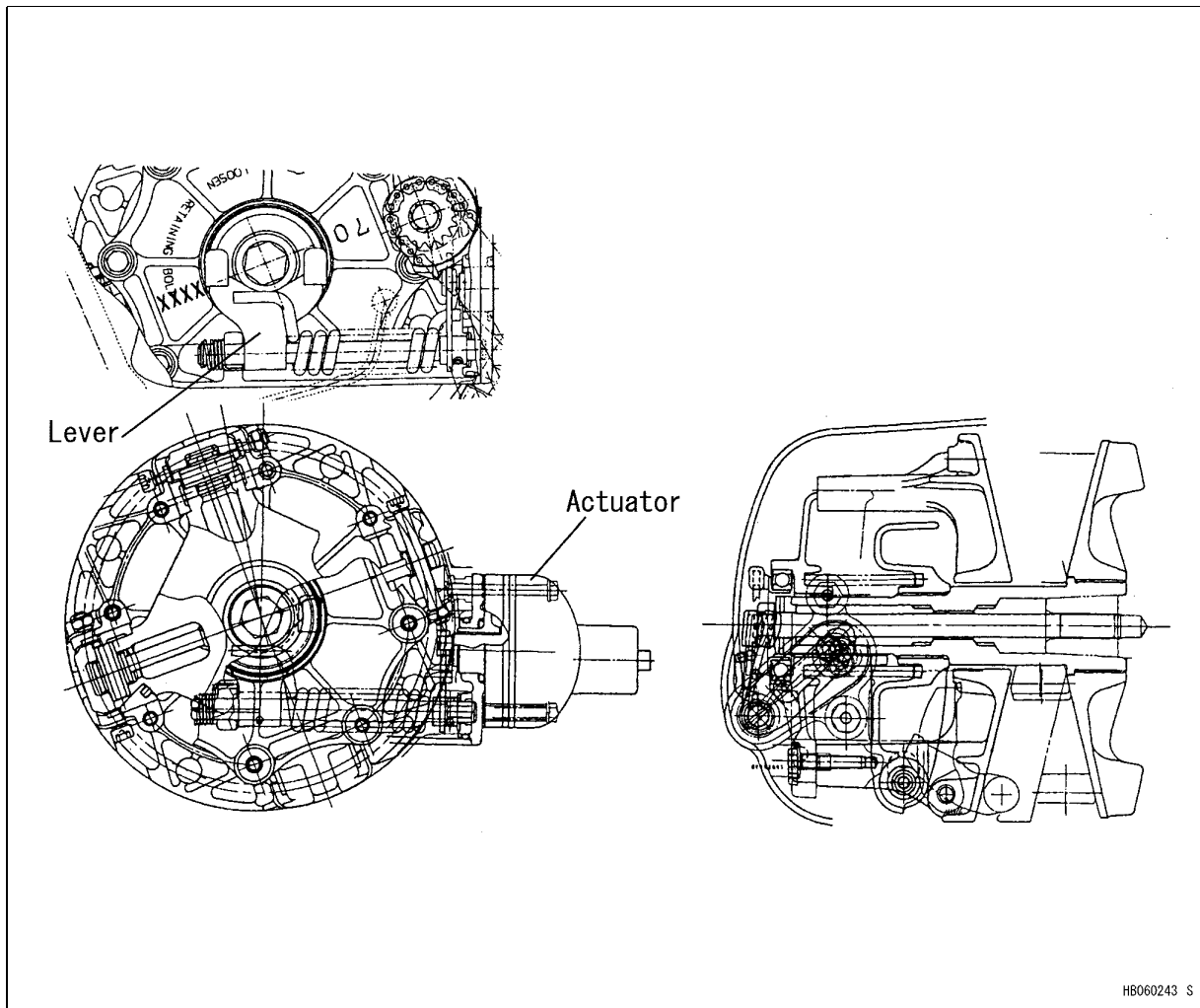
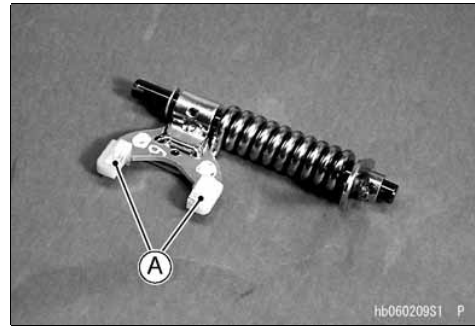
1-14 GENERAL INFORMATION

Technical Information — K-EBC System

3) Lever Assembly

The lever assembly is installed in the converter cover. This transmits the actuator's force to the drive pulley.

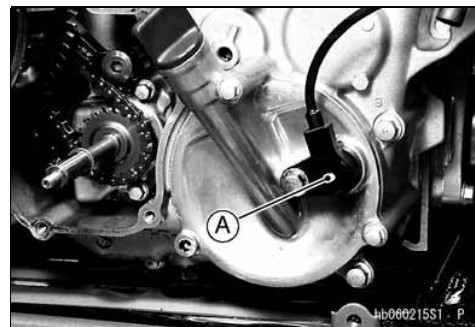
[A] Contact Surface



4) Forward/Reverse Detecting Sensor

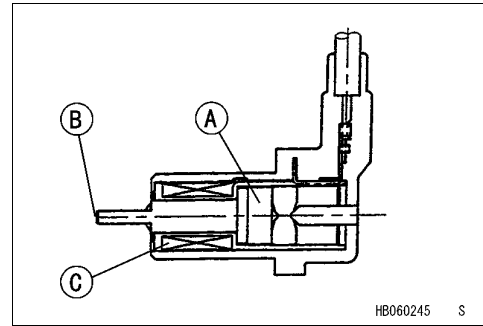
The sensor is installed on the engine and uses the principle of electromagnetic induction. The sensor generates AC voltage according to the speed of the rotor. The output waveforms vary in accordance with the shape of the rotor teeth. The controller detects the running direction from the waveforms.

[A] Forward/Reverse Detecting Sensor

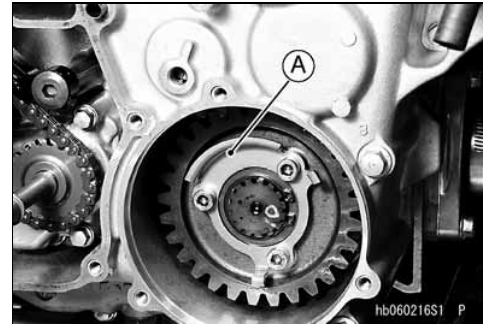


Technical Information — K-EBC System

- [A] Magnet
- [B] Pole
- [C] Coil



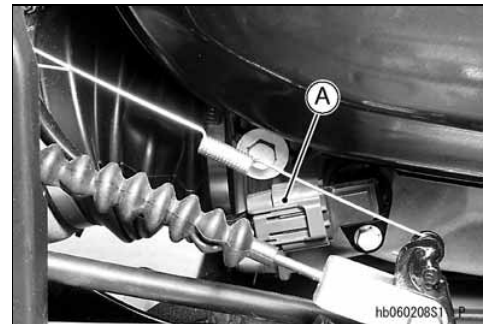
- [A] Rotor Tooth



5) Speed Sensor

The sensor is installed on the engine and generates pulses according to the gap difference between the sensor and the rotating gear. The controller calculates the vehicle's speed by counting the pulse sent from the speed sensor.

- [A] Speed Sensor



1-16 GENERAL INFORMATION

Technical Information — K-EBC System

Description of Actuator Controller Operation

1. Outline

The actuator controller has a microprocessor that detects the vehicle speed, the 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 and selectable 2WD/4WD actuators.

2. Engine Brake Actuator Controls

2-1 Learning Control

After the signal from the forward/reverse detecting sensor stops and 1 second elapses, turning the ignition switch OFF causes the learning control to start.

After the ignition switch is turned OFF and a prescribed length of time elapses, current is applied to the actuator at a prescribed duty factor in order to move the actuator towards engine brake ON position.

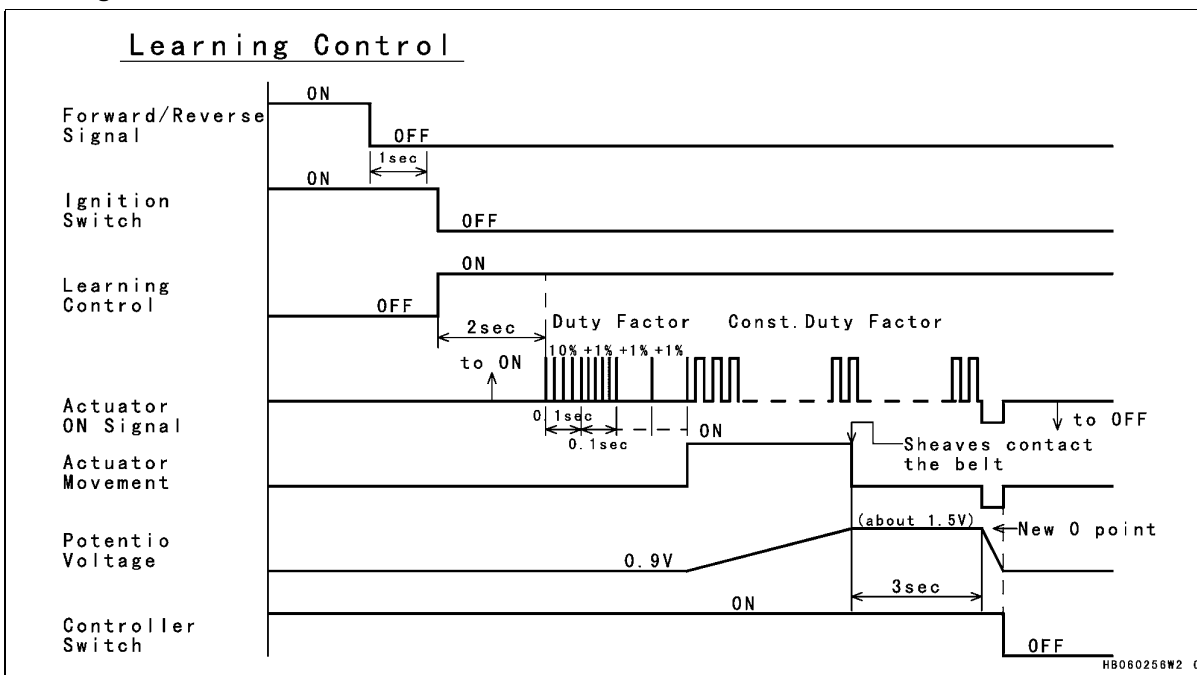
After the application of the current, if the actuator does not move within a prescribed length of time, the duty factor increases in an attempt to move the actuator. This process is repeated until the actuator moves.

Once the actuator starts moving, the actuator continues to move at that duty factor.

The lever moves the drive pulley's movable sheave until it contacts the belt. After contact with the belt, the actuator cannot move any further because of the small duty cycle, and no more play in the system.

After the actuator stops moving, and a prescribed length of time elapses, the voltage (0 point = datum point) of the potentiometer that is installed in the actuator is recorded on the EEPROM. The actuator returns to the engine brake OFF position and the power to the controller turns OFF by the power ON/OFF circuit.

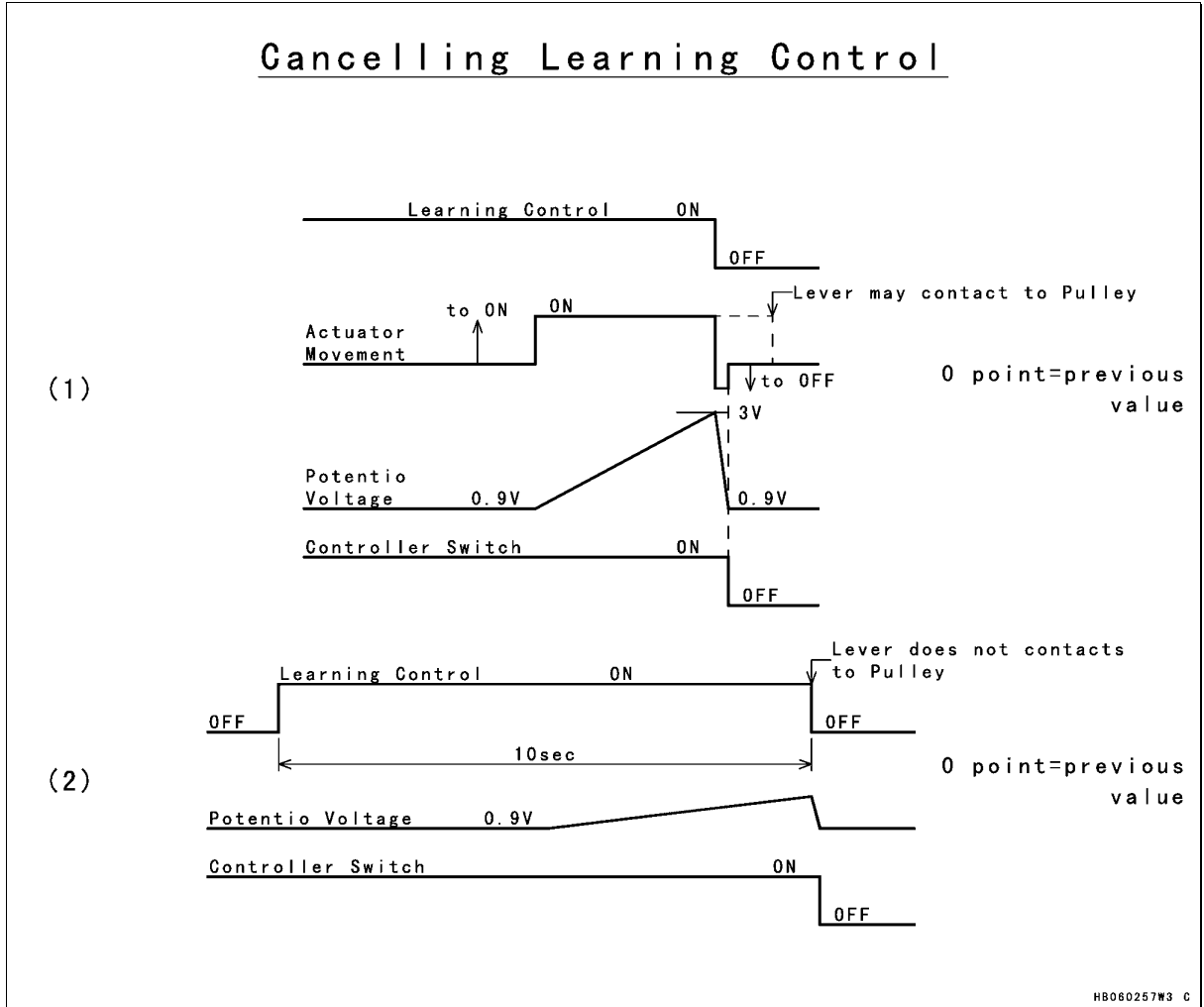
Learning Control



Technical Information — K-EBC System

- In case the Learning Control has failed, the previously learned value is used for the 0-point position of the actuator.
- 1) When the voltage of the potentiometer that is installed in the actuator exceeds a prescribed voltage.
 - 2) When the learning control has not finished within 10 seconds.

Canceling Learning Control



1-18 GENERAL INFORMATION

Technical Information — K-EBC System

2-2 Normal Control

After forward movement is detected from the forward/reverse detecting sensor:

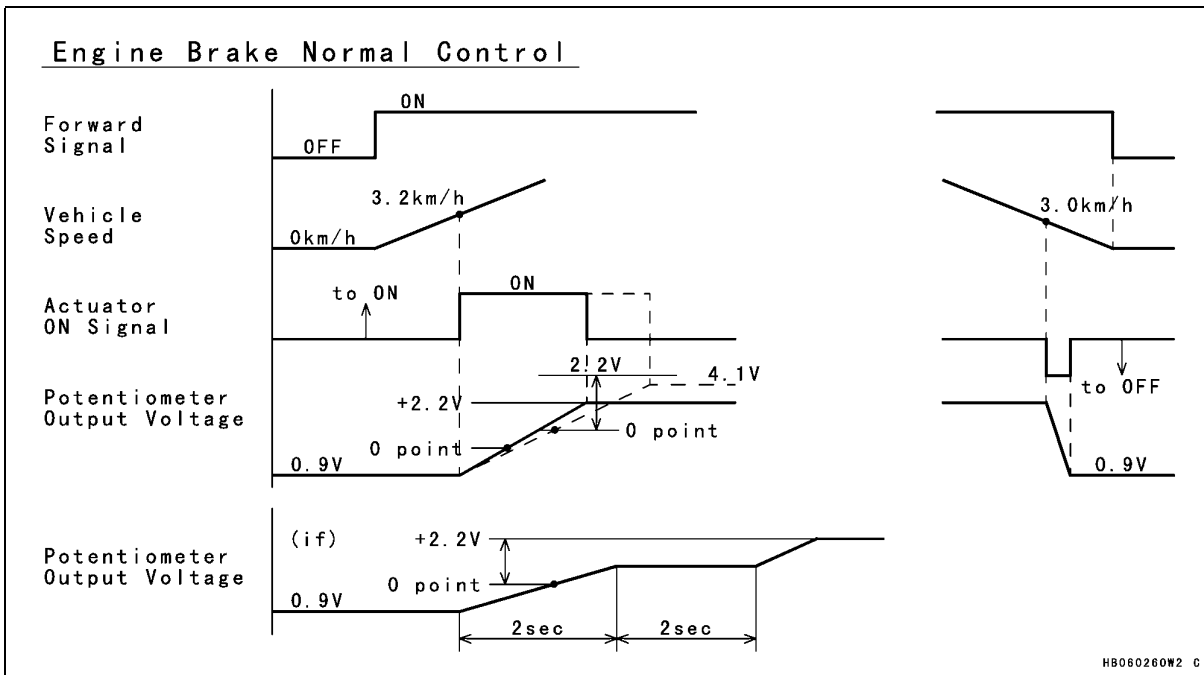
- 1) If the vehicle speed is higher than the prescribed value, the actuator moves towards engine brake ON position.
- 2) If the vehicle speed is less than the prescribed value, the actuator moves towards engine brake OFF position.

The maximum movement of the actuator ranges between the starting position and the ending position. The actuator moves from the learned 0-point position to a position to which a prescribed voltage has been added.

However, if the sum of the learned value and the prescribed voltage exceeds the voltage of the ending position, the actuator stops at the ending position.

During actuator operation, if the target value is not attained even if the actuator is moved longer than a prescribed length of time, the controller stops the actuator temporarily. After a prescribed length of time, the controller resumes the movement of the actuator. This process is repeated until the actuator attains the target value.

Engine Brake Normal Control

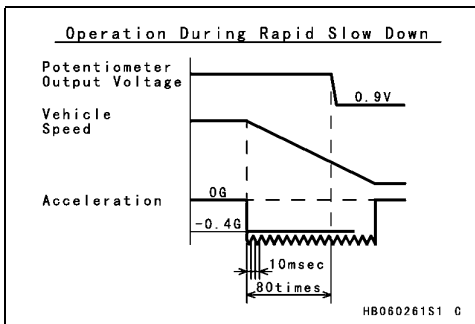


2-3 Operation During Rapid Slow Down

This control works to avoid the engine stopping when the vehicle speeds down rapidly.

When the actuator is in the engine brake ON position, if the deceleration of the vehicle is greater than a prescribed rate and is detected within an interval time of 10 milliseconds, the actuator returns to engine brake OFF position.

Operation During Rapid Slow Down

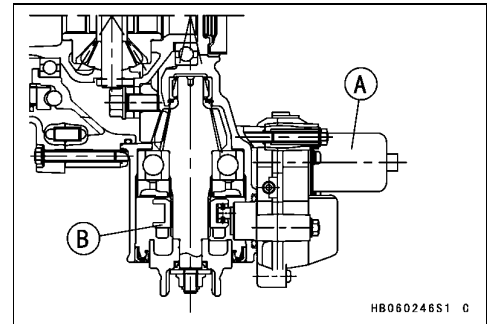


Technical Information — Selectable 2WD/4WD

1. Feature

Selectable 2WD/4WD system allows easy changing between 2WD and 4WD drive systems to suit changing terrain and applications.

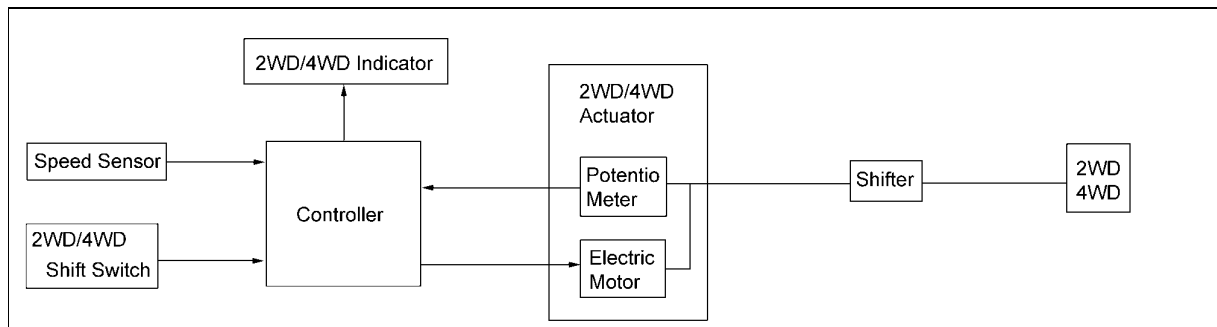
- [A] 2WD/4WD Actuator
- [B] Shifter



2. System Outline and Component Parts

This system consists of a 2WD/4WD shift switch, speed sensor, 2WD/4WD actuator, controller, and indicator for 2WD/4WD.

See the wiring diagram in the K-EBC chapter.



(1) 2WD/4WD Shift Switch

The 2WD/4WD shift switch is installed on the right side of the handlebar. This switch should be used when the vehicle is stopped.



(2) Speed Sensor

The sensor is installed on the right rear of the engine. It generates pulses according to the gap difference between the sensor and the rotating gear.

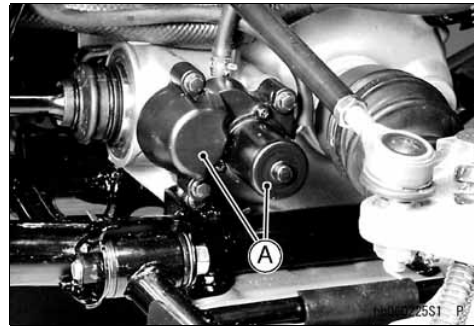
1-20 GENERAL INFORMATION

Technical Information — Selectable 2WD/4WD

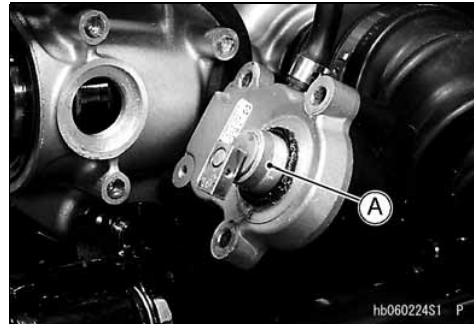
(3) 2WD/4WD Actuator

The actuator is installed on the front gear case. It consists of a DC motor, reduction gears, and potentiometer.

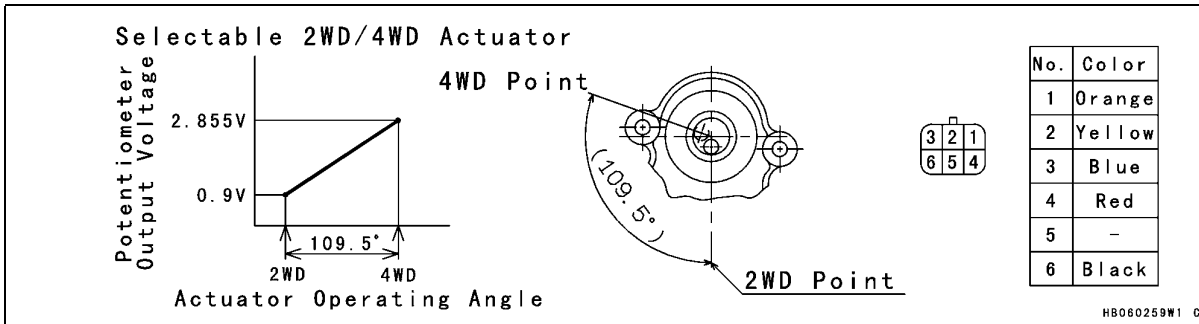
[A] 2WD/4WD Actuator



[A] Output Shaft of Actuator



This figure shows the operation of the actuator.



(4) Controller

Refer to the K-EBC chapter.

Technical Information — Selectable 2WD/4WD

2. Selectable 2WD/4WD Actuator Control

2-1 Switching 2WD to 4WD Control

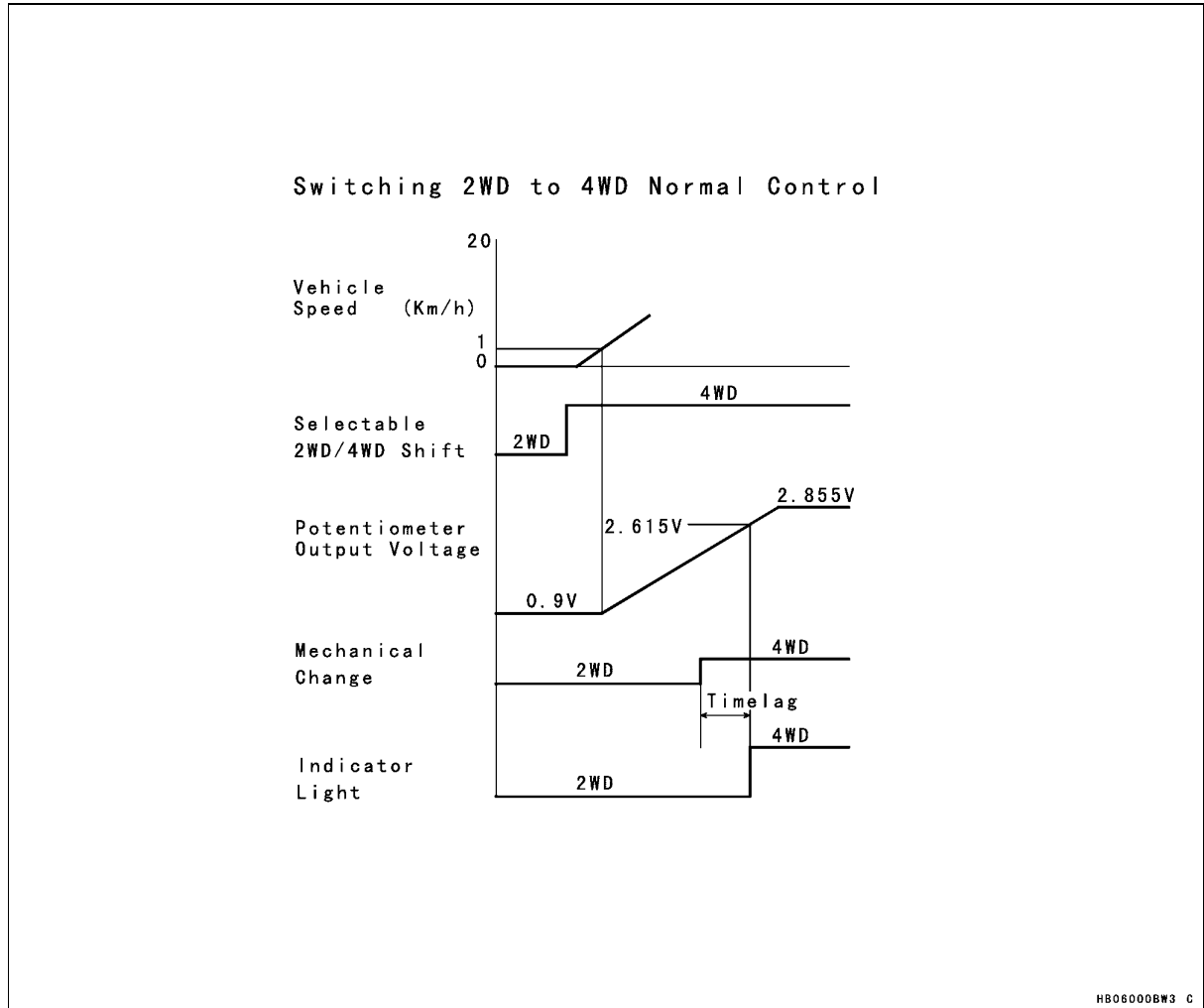
1) Normal Control

This control operates only if the vehicle speed is within the range of 1 km/h and 20 km/h, and the selectable 2WD/4WD shift switch is in 4WD.

The movement range of the actuator is between the starting position for 2WD, and the ending position for 4WD.

During actuator operation, at the time the potentiometer voltage becomes greater than a prescribed voltage, the indicator light on the multifunction meter changes from 2WD to 4WD.

Selectable 2WD/4WD Normal Control



1-22 GENERAL INFORMATION

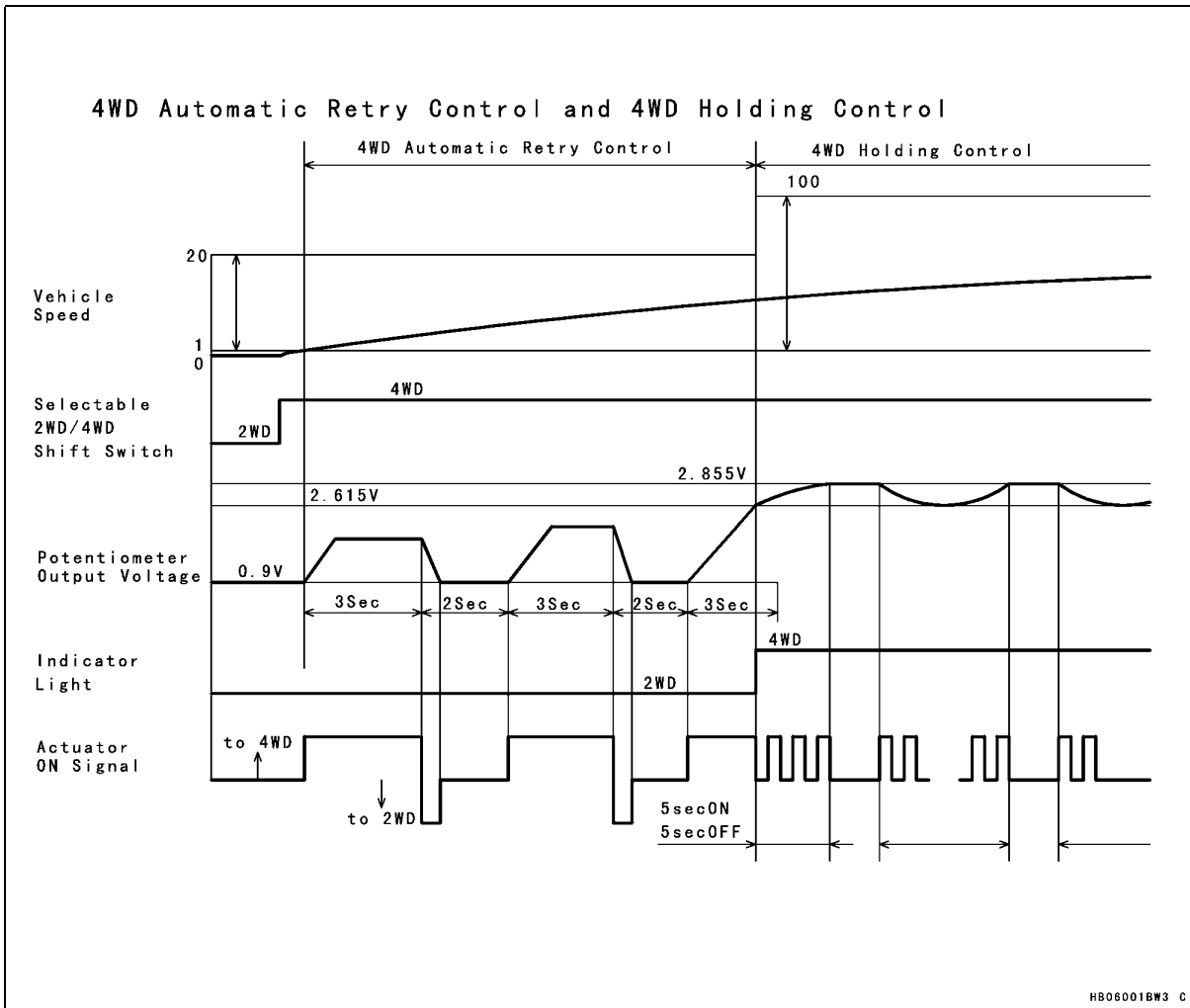
Technical Information — Selectable 2WD/4WD

2) 4WD Automatic Retry Control

During actuator operation, if the actual value does not reach the indicator light switching voltage even after the actuator moves longer than a prescribed length of time, the actuator returns temporarily in the 2WD direction. After a prescribed length of time elapses, the actuator moves again in the 4WD direction. This process is repeated until the actuator reaches the indicator light switching voltage.

This control applies to vehicle speeds that range between 1 km/h and 20 km/h.

4WD Automatic Retry Control



Technical Information — Selectable 2WD/4WD

3) 4WD Holding Control

During the implementation of "4WD Automatic Retry Control", control transfers to "4WD Holding Control" at the time the potentiometer voltage becomes greater than the indicator light switching voltage and the actuator movement is less than the ending position.

If the actuator is pushed back toward the 2WD direction, this control moves the actuator in the 4WD direction in order to return it to the final position. The interval times of the actuator movement consist of ON time toward 4WD and OFF times, which are repeated until the potentiometer voltage reaches the final position.

This control applies to vehicle speeds that range between 1 km/h and 100 km/h. The control ends when the potentiometer voltage reaches the ending position voltage.

When the vehicle speed is above 20 km/h, control continues even if the selectable 2WD/4WD shift switch is switched to 2WD. When the vehicle speed is between 1 km/h to 20 km/h, this control stops and transfers to 2WD control.

2-2 Switching 4WD to 2WD Control

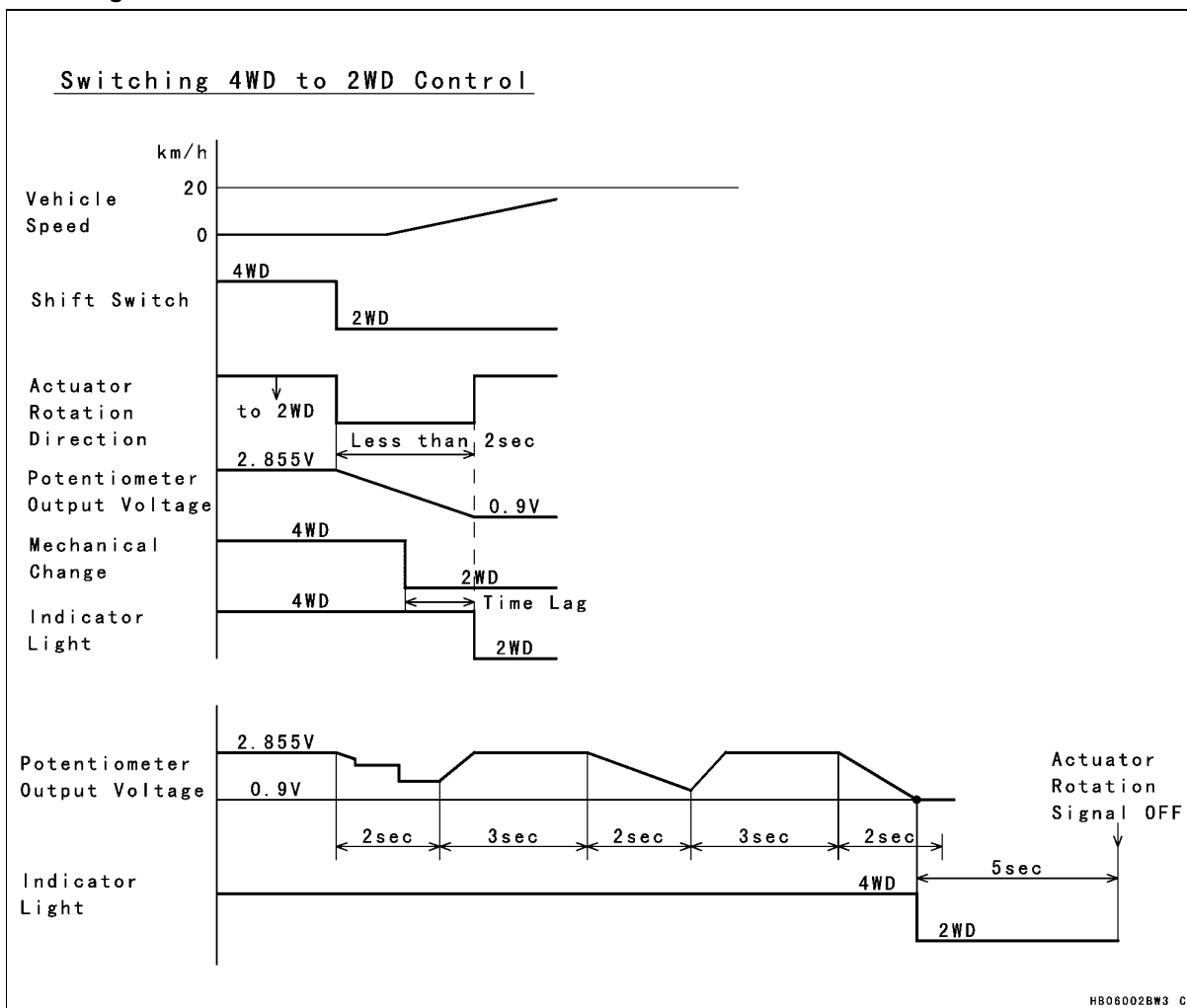
This control is in effect only when the vehicle speed is between 0 km/h and 20 km/h, and the selectable 2WD/4WD shift switch is in 2WD.

The movement range of the actuator is between the starting position for 4WD, and the ending position for 2WD.

During actuator operation, at the time the potentiometer output voltage is ending position voltage, the indicator light on the multifunction meter changes from 4WD to 2WD.

During actuator operation, if the potentiometer output voltage does not reach the ending position voltage even after the actuator moves longer than a prescribed length of time, the actuator returns temporarily in the 4WD direction, and moves again in the 2WD direction. This process is repeated until the actuator reaches 2WD position.

Switching 4WD to 2WD Control



1-24 GENERAL INFORMATION

Technical Information — Drive Belt Failure Detection System

1. Outline

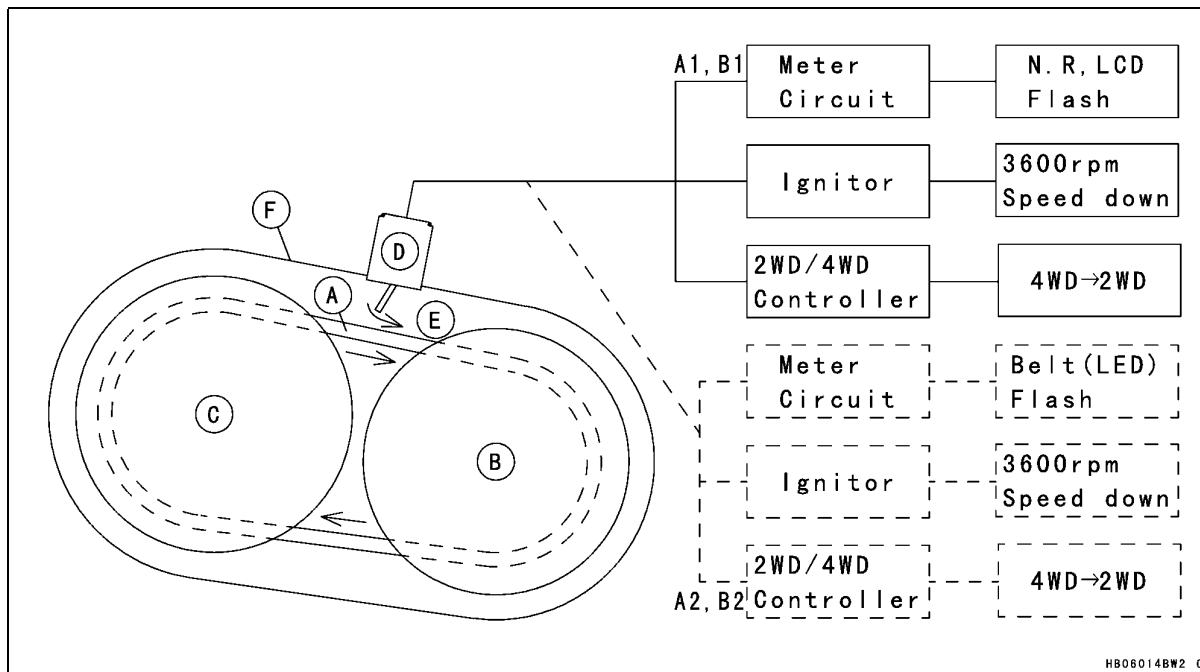
This vehicle is equipped with a drive belt failure detection system which detects excessive belt wear or belt damage.

When a switch in the torque converter cover is activated, the multifunction meter LCD display and reverse indicator light flash (for A2 and B2, belt check indicator light LED) a warning to the rider. The engine slows down (not to exceed 3,600 rpm), and the vehicle will try to shift into 2WD.

Inspection of the drive belt failure detection system is required in accordance with the Periodic Maintenance Chart by an authorized Kawasaki dealer.

If the belt failure detection system is activated, the rider will return the vehicle immediately to an authorized Kawasaki dealer for drive belt inspection, adjustment, or replacement.

2. Components of the system



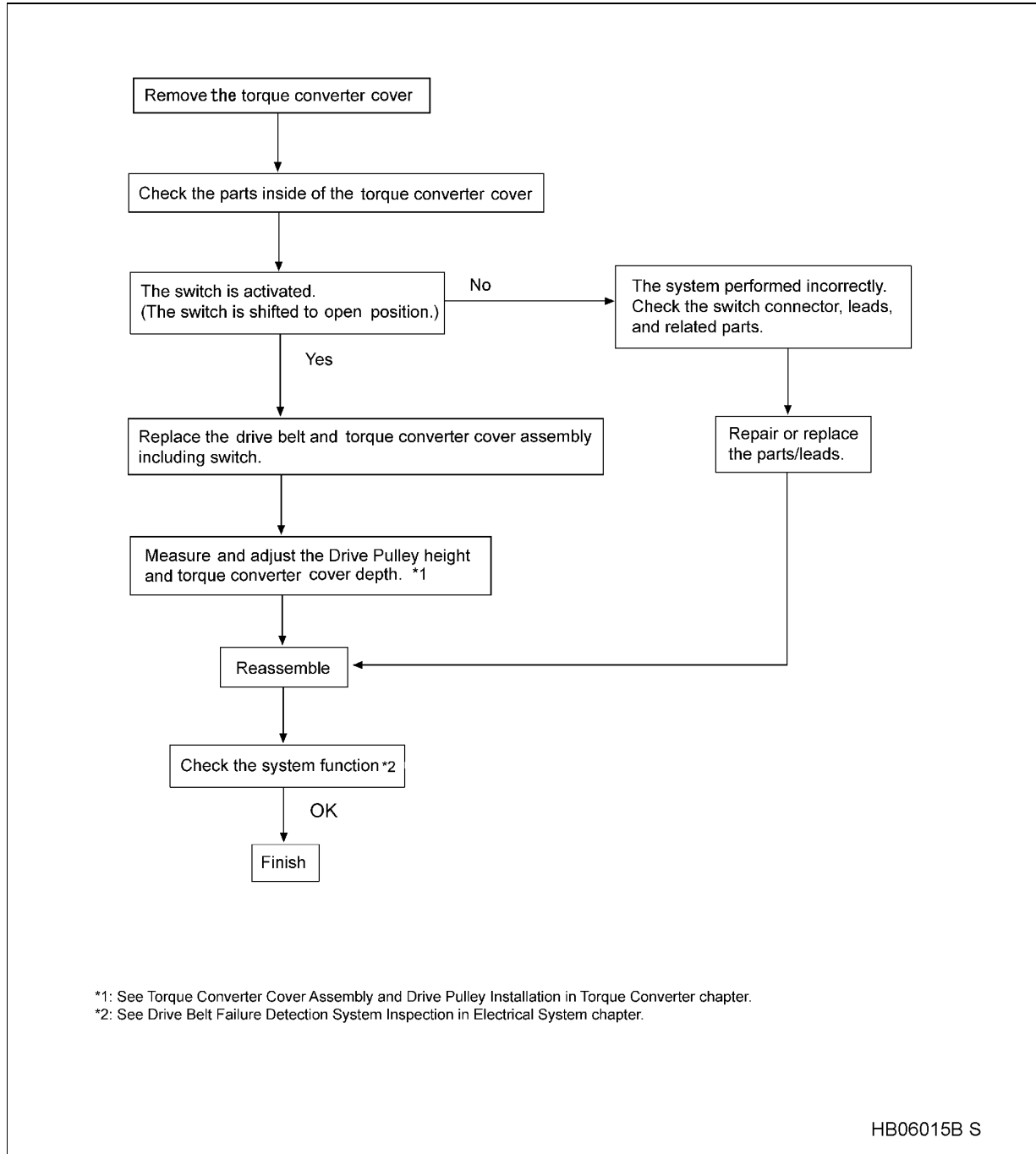
- [A] Drive Belt
- [B] Drive Pulley
- [C] Driven Pulley
- [D] Drive Belt Failure Detection Switch
- [E] Switch Activated
- [F] Torque Converter Cover

Technical Information — Drive Belt Failure Detection System

3. Required action of rider when the system is activated

The rider must immediately return the vehicle to an authorized Kawasaki dealer for drive belt inspection and replacement.

4. Required action of dealer



1-26 GENERAL INFORMATION

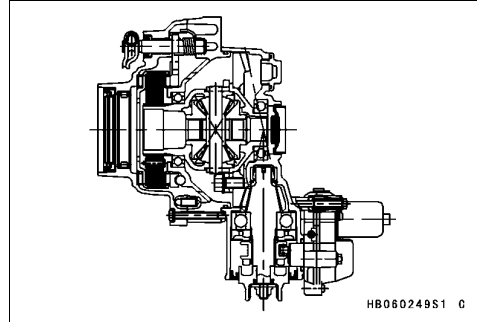
Technical Information — Variable Limited Slip Differential Control

This vehicle is equipped with a variable limited slip differential (LSD) for the front wheels. The differential control lever is located on the left side of the handlebar.

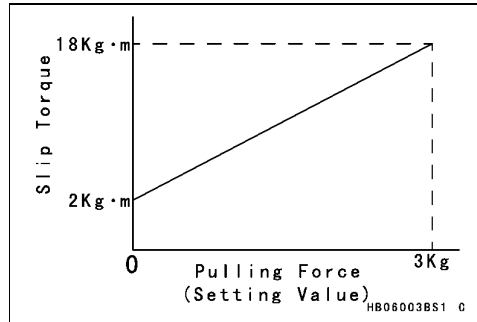
When either front wheel loses traction, it can slip reducing the pulling power of the other front wheel. By pulling the differential control lever, operators can equalize driving force to both front wheels. This is useful when the vehicle is stuck or having difficulty overcoming an obstacle. The differential control lever is effective only when "4WD" is engaged.

When increased traction is needed, the operators can pull the control lever to the hand grip. Operators release the lever when they no longer need greater traction.

The LSD control system consists of a control lever, cam plate, ball, friction plates, steel plates, and housing.



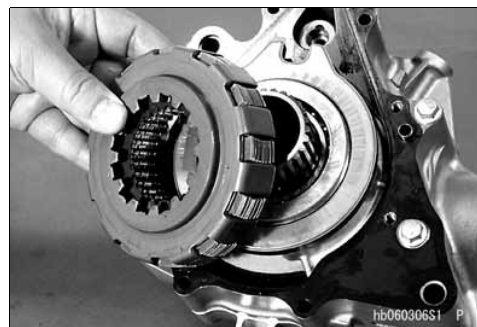
While pulling the LSD control lever towards the handlebar, the front wheels will be converted to the nearly locked-axle mode producing greater traction.



Variable Differential Control Lever
Lever is located on the left side of the handlebar
[A] Variable Differential Lever



Plate Assembly



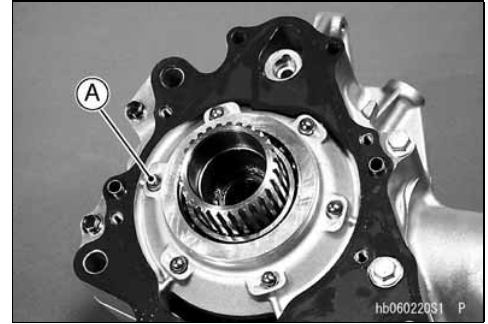
GENERAL INFORMATION 1-27

Technical Information — Variable Limited Slip Differential Control

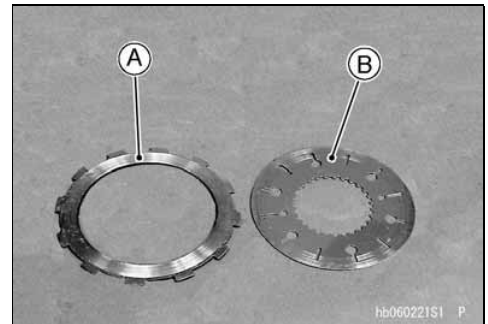
Camplate



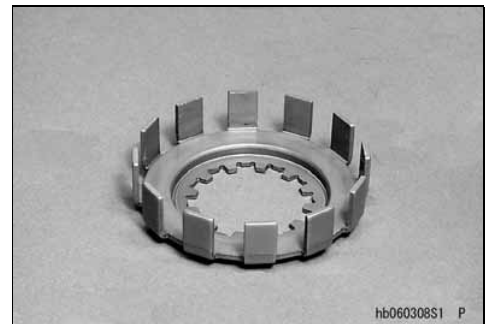
[A] Cam Ball



Plates
[A] Friction Plate (Copper)
[B] Steel Plate



Housing



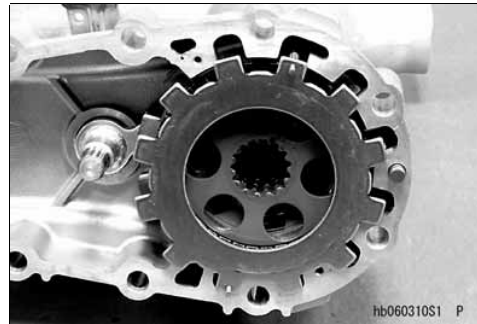
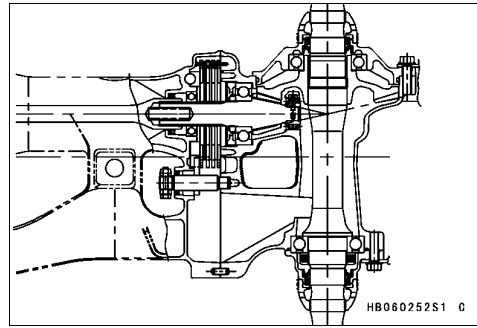
1-28 GENERAL INFORMATION

Technical Information — Rear Brake

The sealed, internal wet brake used at the rear is completely sealed from mud and dust, etc. Its compact design allows ample ground clearance. A new type of oil (Mobilfluid 424) must be used in the housing.

If the brake lever lock is used, the rear brake can be used as a parking brake. To lock the brake lever, first pull in the brake lever. Then pull in the lock lever and while holding it against the brake lever, release the brake lever. When applied correctly the lock lever will contact a projection in the brake lever holder and prevent the brake lever from returning to the off position.

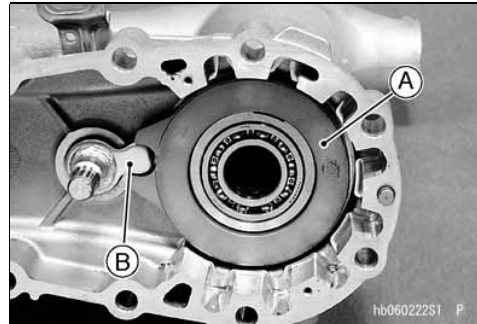
To unlock the brake lever, pull in the brake lever further and release it.



[A] Cam Plate

[B] Lever

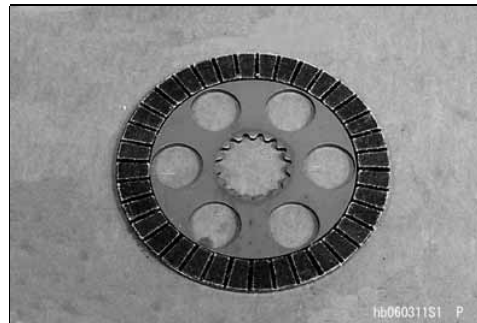
The lever is linked to the left side of the handlebar and to the foot pedal on the right side.



[A] Cam Ball

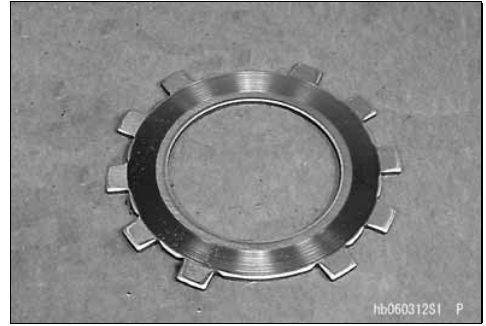


Friction Plate



Technical Information — Rear Brake

Steel Plate



Important Notices at Maintenance

- The brake plates should be replaced in accordance with the Periodic Maintenance Chart (every 6,000 miles). Replacement should be done by an authorized Kawasaki Dealer.
- Use only the specified oil, Mobil Fluid 424, in the final gear case.

1-30 GENERAL INFORMATION

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).

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

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

Lh: Left-hand Threads

R: Replacement Parts

S: Follow the specific tightening sequence.

St: Stake the fasteners to prevent loosening.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System:				
Heat guard plate mounting bolts	8.8	0.9	78 in·lb	
Air cleaner housing bolts (M5)	5.9	0.6	52 in·lb	L
Air cleaner housing bolts (M6) 28.7 mm (1.13 in.)	8.8	0.9	78 in·lb	
Air cleaner housing bolts (M6) 33 mm (1.30 in.)	8.8	0.9	78 in·lb	
Fuel tap plate screws	0.8	0.08	7 in·lb	
Air cleaner element bracket screws (A2, B2)	4.9	0.5	43 in·lb	
Cooling System:				
Radiator fan switch	18	1.8	13	
Water pump cover bolts	8.8	0.9	78 in·lb	
Coolant drain plug	8.8	0.9	78 in·lb	
Water pump fitting bolt	9.8	1.0	87 in·lb	
Water pump impeller	7.9	0.8	69 in·lb	
Thermosta housing cover bolts	8.8	0.9	78 in·lb	
Coolant temperature warning light switch	7.9	0.8	69 in·lb	SS
Radiator fan mounting nut	2.7	0.28	24 in·lb	L
Radiator fan assembly bolts	8.8	0.9	78 in·lb	
Engine Top End:				
Water pipe bolts	9.8	1.0	87 in·lb	
Rocker case bolts 55 mm (2.2 in.)	8.8	0.9	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	
Rocker case bolts 25 mm (1.0 in.)	9.8	1.0	87 in·lb	
Cylinder head bolts (M10), first torque	25	2.5	18	S, MO
Cylinder head bolt (M10), final torque	49	5.0	36	S
Cylinder head bolts (M6)	9.8	1.0	87 in·lb	
Cylinder head jacket plugs	20	2.0	14	L
Valve adjusting cap bolts	8.8	0.9	78 in·lb	
Valve adjusting screw locknuts	12	1.2	104 in·lb	
Rocker shaft bolts	8.8	0.9	78 in·lb	
Chain tensioner mounting bolts	8.8	0.9	78 in·lb	
Chain tensioner cap bolt	22	2.2	16	
Intermediate shaft sprocket nut	44	4.5	33	
Intermediate shaft chain guide bolts	8.8	0.9	78 in·lb	
Intermediate shaft chain tensioner bolts	8.8	0.9	78 in·lb	
Camshaft sprocket bolts	12	1.2	104 in·lb	L
Position plate bolts	8.8	0.9	78 in·lb	
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	

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Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Front cylinder camshaft chain guide bolt	20	2.0	14	
Rear cylinder camshaft chain guide bolt	20	2.0	14	
Exhaust pipe cover bolts	8.8	0.9	78 in-lb	
Muffler cover bolts	8.8	0.9	78 in-lb	
Muffler mounting bolts	20	2.0	14	
Heat guard plate mounting bolts	8.8	0.9	78 in-lb	
Converter System:				
Drive pulley bolt	93	9.5	69	R, Lh
Driven pulley nut	93	9.5	69	
Drive pulley cover bolts	13	1.3	113 in-lb	
Ramp weight nuts	6.9	0.7	61 in-lb	
Spider	275	28	205	Lh
Converter cover bolts	8.8	0.9	78 in-lb	S
Joint duct bolts	8.8	0.9	78 in-lb	
Engine brake actuator mounting bolts	8.8	0.9	78 in-lb	
Recoil Starter:				
Recoil starter mounting bolts	5.9	0.6	104 in-lb	L
Recoil starter flange nut	8.3	0.85	74 in-lb	
Engine Lubrication System:				
Oil filter	18	1.8	13 in-lb	R
Oil pressure switch	15	1.5	11	SS
Oil pipe bolts	8.8	0.9	78 in-lb	
Engine drain plug	20	2.0	14	
Oil pressure relief valve	15	1.5	11	L
Oil pump bolts	8.8	0.9	78 in-lb	
Chain guide bolts	8.8	0.9	78 in-lb	
Oil pump drive chain tensioner bolt	25	2.5	18	
Oil filter mounting bolts	25	2.5	18	L
Oil pressure switch terminal bolt	1.5	0.15	13 in-lb	
Engine Removal/Installation:				
Engine mounting bracket bolts	23	2.3	17	
Engine mounting bolt	59	6.0	43	
Engine mounting nut	59	6.0	43	
Crankshaft/Transmission:				
Connecting rod big end cap nuts	34	3.5	25	MO
Engine drain plug	20	2.0	14	
Crankcase bolts (M8) 75 mm (2.95 in.)	20	2.0	14	S
Crankcase bolts (M8) 110 mm (4.33 in.)	20	2.0	14	S, L(1)
Crankcase bolts (M6) 40 mm (1.57 in.)	9.8	1.0	78 in-lb	
Crankcase bolts (M6) 65 mm (2.56 in.)	9.8	1.0	78 in-lb	
Grip hold nut	9.8	1.0	87 in-lb	
Shift lever assembly bracket bolts	20	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	20	2.0	14	
Shift lever assembly nut	20	2.0	14	
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	0.9	78 in-lb	
Tie-rod end locknut	20	2.0	14	

1-32 GENERAL INFORMATION

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Neutral position switch	15	1.5	11	
Reverse position switch	15	1.5	11	
Wheel/Tires				
Tie-rod adjusting sleeve locknuts	27	2.8	20	
Tie-rod end nuts	42	4.3	31	
Wheel nuts	78	8.0	58	
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	137	14	101	L
Bevel gear holder nut	157	16	116	L
Bearing holder	118	12	87	L
Output shaft holder nut	157	16	116	L
Rotor mounting bolts	12	1.2	104 in·lb	
Output drive bevel gear cover bolts	8.8	0.9	78 in·lb	
(Front Final Gear Case)				
Variable front differential control shift shaft lever bolt	8.8	0.9	78 in·lb	
Front final gear case left cover bolts (M8)	9.8	1.0	87 in·lb	
Ring gear bolts	57	5.8	42	LB
Front final gear case center cover bolts (M6)	9.8	1.0	87 in·lb	L
Oil filler cap	29	3.0	22	
Front final gear case center cover bolts (M8)	24	2.4	17	L
Pinion gear bearing holder nut	127	13	94	St
Pinion gear bearing holder	137	14	101	L
Front final gear case coupling nut (A1, B1-M8)	20	2.0	14	
Front final gear case coupling nut (A2, B2-M10)	25	2.5	18	
Oil drain plug	24	2.4	17	
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	—	—	—	L
Front final gear case bolts and nuts	59	6.0	43	
(Rear Final Gear Case)				
Oil filler cap	29	3.0	22	
Oil drain plug	24	2.4	17	
Pinion gear bearing holder	137	14	101	L
Pinion gear bearing holder nut	157	16	116	L
Rear final gear case right cover bolts (M8)	24	2.4	17	L
Rear final gear case right cover bolts (M10)	49	5.0	36	L
Rear final gear case left cover bolts	49	5.0	36	
Rear final gear case bolts	42	4.3	31	
Brakes:				
Reservoir cap screws	1.5	0.15	13 in·lb	
Brake lever pivot bolt	5.9	0.6	52 in·lb	
Brake lever pivot bolt locknut	5.9	0.6	52 in·lb	
Master cylinder clamp bolts	11	1.1	95 in·lb	
Bake hose banjo bolt	25	2.5	18	
Caliper mounting bolts	25	2.5	18	

GENERAL INFORMATION 1-33

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Bleed valves	7.9	0.8	69 in·lb	
Disc mounting bolts	37	3.8	27	L
Variable differential control lever bolt	–	–	–	L
Gasket screws	–	–	–	L
Suspension:				
Suspension arm pivot bolts	88	9.0	65	
Front shock absorber mounting nuts	74	7.5	54	
Front shock absorber clamp bolts and nuts	42	4.3	31	
Steering knuckle joint nut	42	4.3	31	
Rear shock absorber spring locknut	88	9.0	65	
Rear shock absorber mounting nuts	62	6.3	46	
Swingarm pivot right shaft	152	15.5	112	L
Swingarm pivot left shaft	20	2.0	14	
Swingarm pivot left nut	152	15.5	112	
Steering:				
Handlebar holder bolts	29	3.0	22	S
Tie-rod adjusting sleeve locknuts	27	2.8	20	
Tie-rod end nuts	42	4.3	31	
Steering stem clamp bolts	25	2.5	18	
Steering stem bottom end nut	64	6.5	47	
Master cylinder clamp bolts	11	1.1	95 in·lb	
Front shock absorber clamp bolts and nuts	42	4.3	31	
Steering knuckle joint nut	42	4.3	31	
Variable differential control lever bolt	–	–	–	L
Frame				
Trailer hitch bracket bolts (M8)	24	2.4	17	L
Trailer hitch bracket bolts (M10)	49	5.0	36	L
Front lower guard bolts	29	3.0	22	
Rear carrier lower bolts	54	5.5	40	L
Rear carrier upper bolts and nuts	37	3.8	27	
Engine mounting bracket bolts	23	2.3	17	
Engine mounting nuts	59	6.0	43	
Front final gear case bolts and nuts	59	6.0	43	
Rear carrier upper bolts and nuts	37	3.8	27	
Electrical System:				
Starter motor mounting bolts	8.8	0.9	78 in·lb	
Starter motor terminal nut	4.9	0.5	43 in·lb	
Starter motor terminal locknut	6.9	0.7	61 in·lb	
Starter motor bolts	3.9	0.4	35 in·lb	
Starter motor clutch bolts	34	3.5	25	L
Alternator stator bolts	13	1.3	113 in·lb	
Pickup coil mounting bolts	5.9	0.6	52 in·lb	
Alternator cover plugs	18	1.8	13	
Alternator rotor bolt	127	13	94	O
Alternator cover bolts	8.8	0.9	78 in·lb	
Spark plugs	13	1.3	113 in·lb	
2WD/4WD actuator mounting bolts	9.8	1.0	87 in·lb	L,S
Engine brake actuator mounting bolts	8.8	0.9	78 in·lb	
Forward/Reverse detecting sensor mounting bolt	15	1.5	11	
Speed sensor mounting bolt	8.8	0.9	78 in·lb	
Neutral position switch	15	1.5	11	

1-34 GENERAL INFORMATION

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Reverse position switch	15	1.5	11	
Radiator fan switch	18	1.8	13	
Coolant temperature warning light switch	7.9	0.8	69 in·lb	SS
Oil pressure switch	15	1.5	11	SS
Oil pressure switch terminal bolt	1.5	0.15	13 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
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
5 (0.20)	4T	2.2 ~ 2.6	0.22 ~ 0.27	19 ~ 23 in·lb

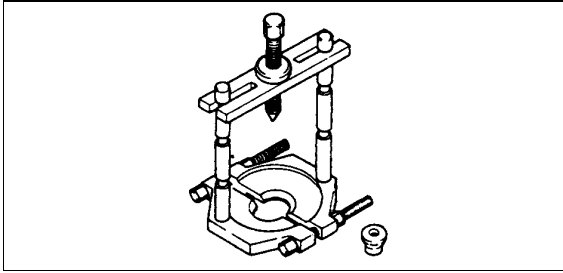
Basic Torque for General Fasteners of Frame Parts

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	19.0 ~ 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 ~ 33	165 ~ 240

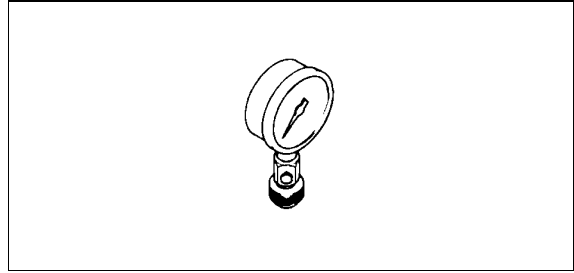
GENERAL INFORMATION 1-35

Special Tools and Sealant

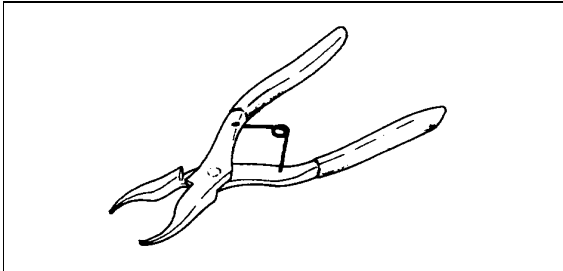
Bearing Puller : 57001-135



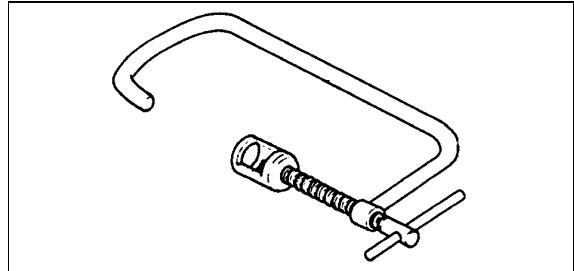
Compression Gauge : 57001-221



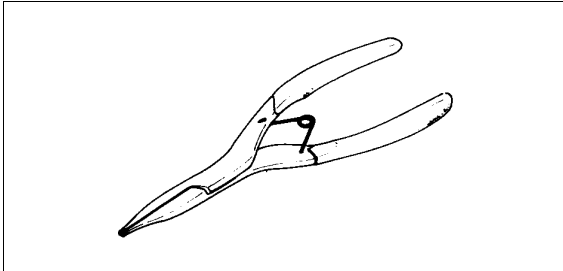
Inside Circlip Pliers : 57001-143



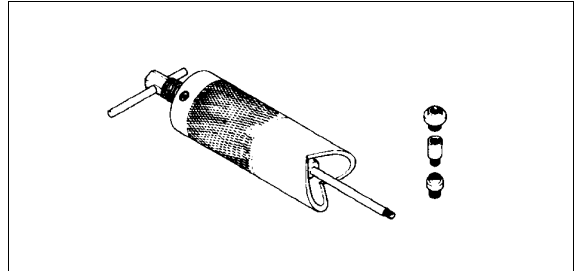
Valve Spring Compressor Assembly : 57001-241



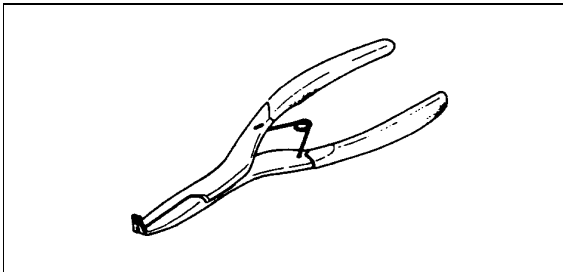
Outside Circlip Pliers : 57001-144



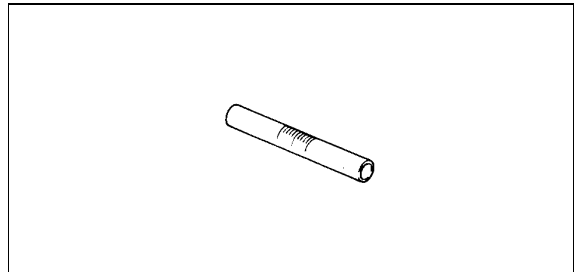
Piston Pin Puller Assembly : 57001-910



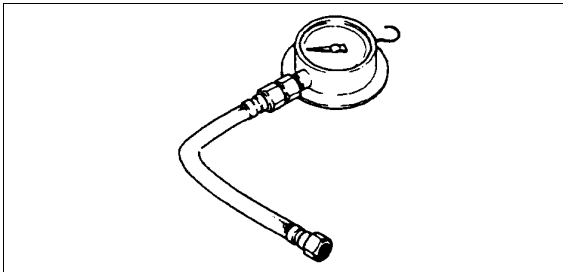
Circlip Pliers : 57001-154



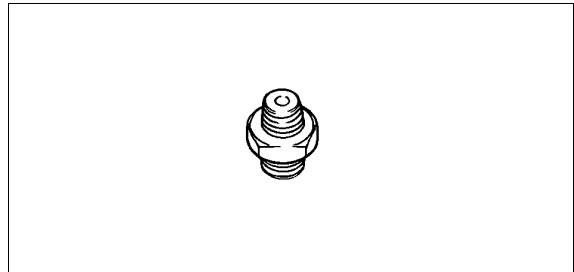
Fuel Level Gauge : 57001-1017



Oil Pressure Gauge, 10 kgf/cm² : 57001-164



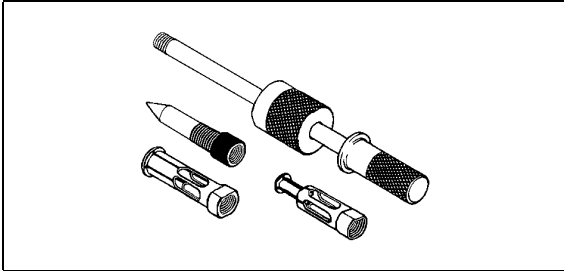
Oil Pressure Gauge Adapter, PT 1/8 : 57001-1033



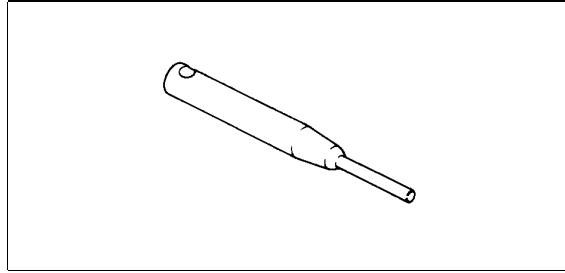
1-36 GENERAL INFORMATION

Special Tools and Sealant

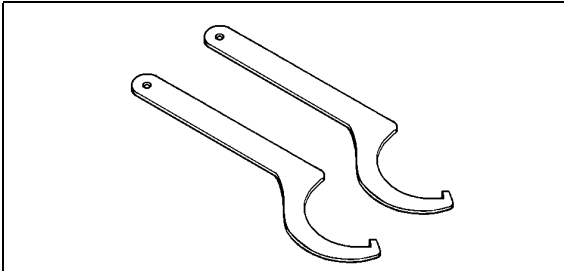
Oil Seal & Bearing Remover : 57001-1058



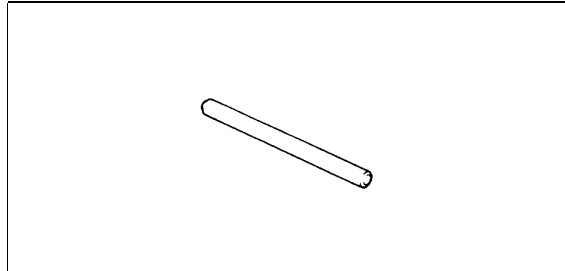
Valve Seat Cutter Holder, $\phi 5$: 57001-1208



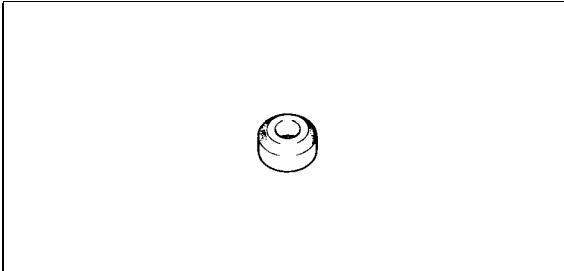
Hook Wrench : 57001-1101



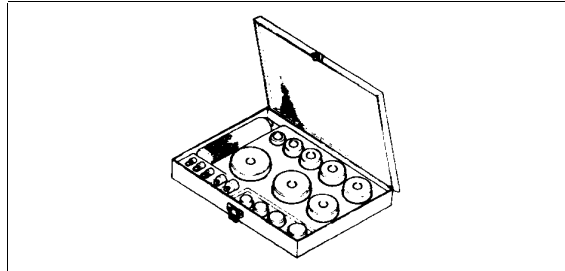
Valve Seat Cutter Holder Bar : 57001-1128



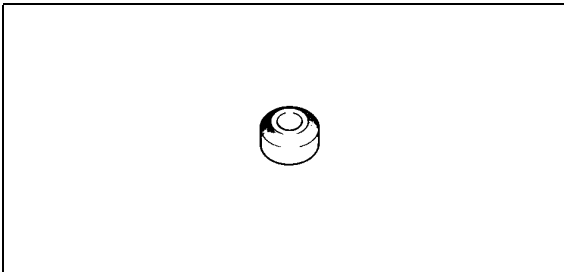
Valve Seat Cutter, $45^\circ - \phi 27.5$: 57001-1114



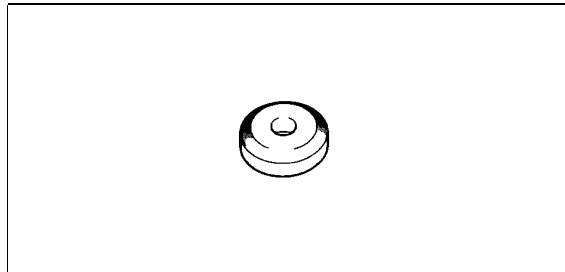
Bearing Driver Set : 57001-1129



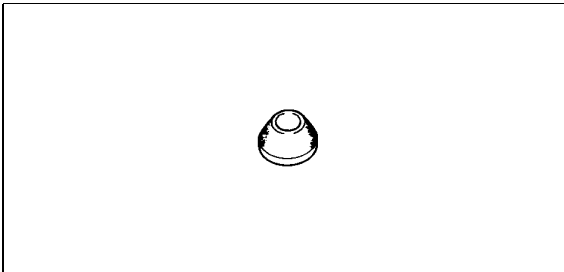
Valve Seat Cutter, $32^\circ - \phi 28$: 57001-1119



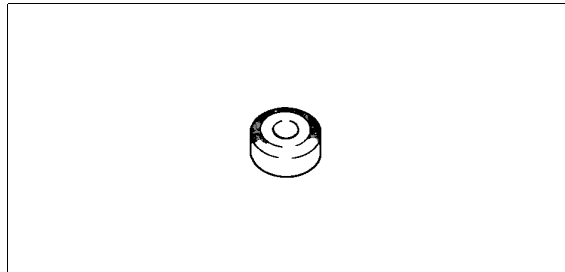
Valve Seat Cutter, $45^\circ - \phi 30$: 57001-1187



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

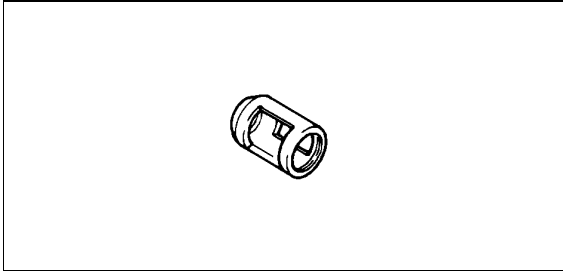


Valve Seat Cutter, $32^\circ - \phi 33$: 57001-1199

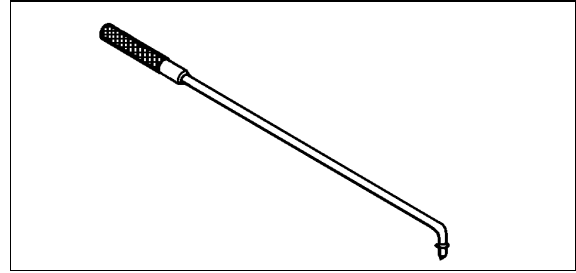


Special Tools and Sealant

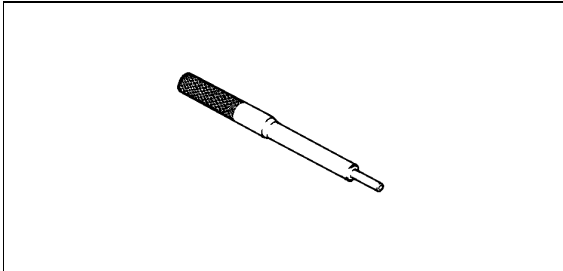
Valve Spring Compressor Adapter, $\phi 22$: 57001-1202



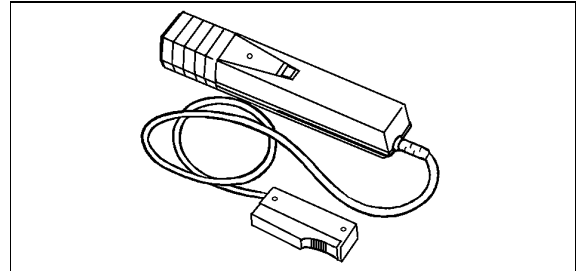
Pilot Screw Adjuster, A : 57001-1239



Valve Guide Arbor, $\phi 5$: 57001-1203



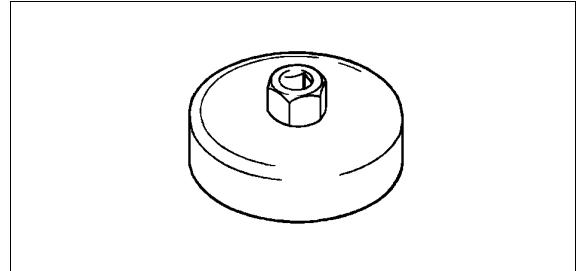
Timing Light : 57001-1241



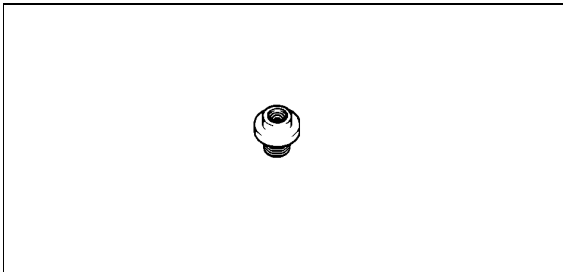
Valve Guide Reamer, $\phi 5$: 57001-1204



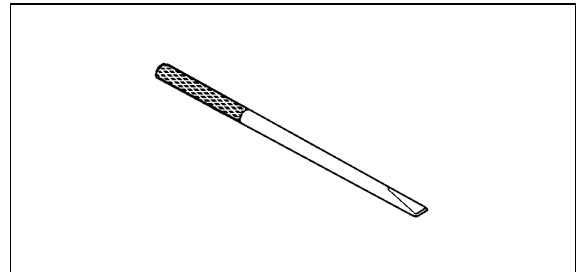
Oil Filter Wrench : 57001-1249



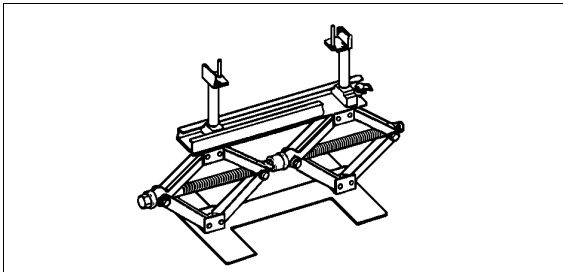
Piston Pin Puller Adapter : 57001-1211



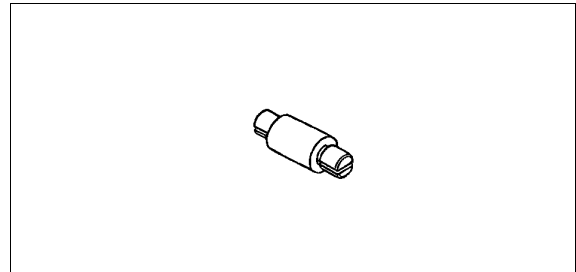
Bearing Remover Shaft, $\phi 9$: 57001-1265



Jack : 57001-1238



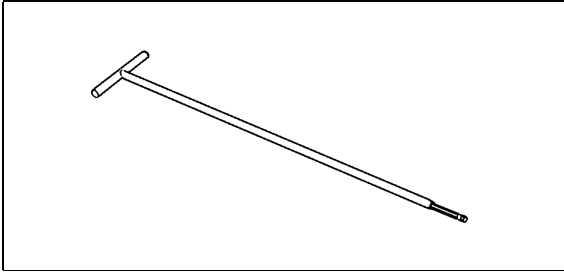
Bearing Remover Head, $\phi 10 \times \phi 12$: 57001-1266



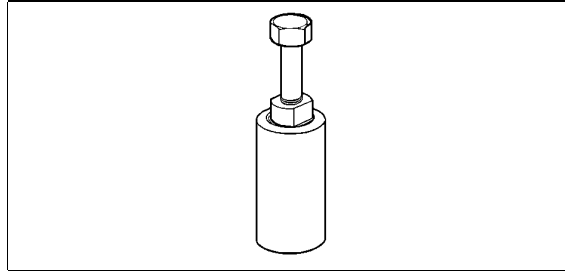
1-38 GENERAL INFORMATION

Special Tools and Sealant

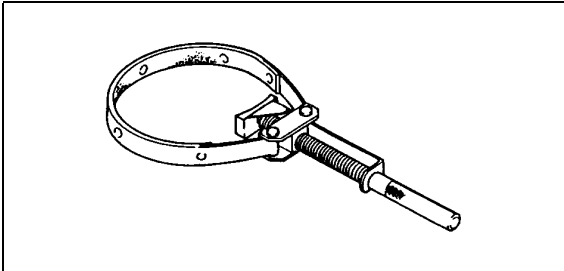
Carburetor Drain Plug Wrench, Hex 3 : 57001-1269



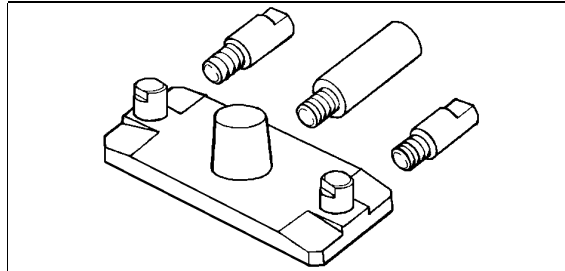
Flywheel Puller Assembly : 57001-1405



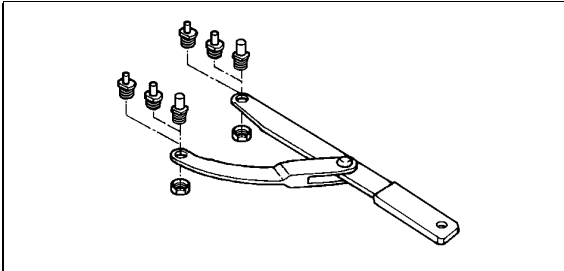
Flywheel Holder : 57001-1313



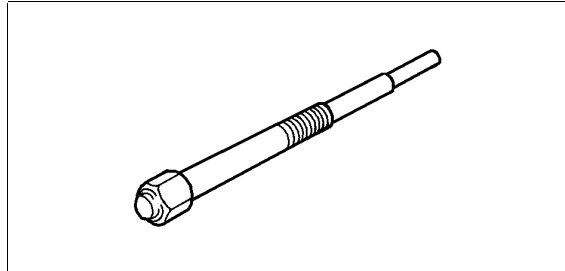
Drive & Driven Pulley Holder : 57001-1412



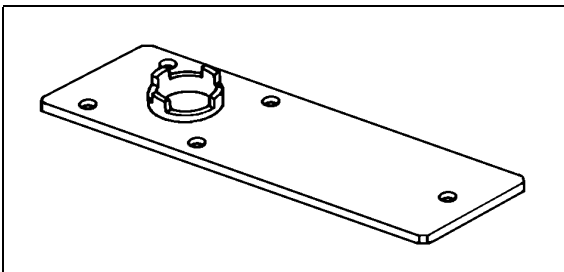
Flywheel & Pulley Holder : 57001-1343



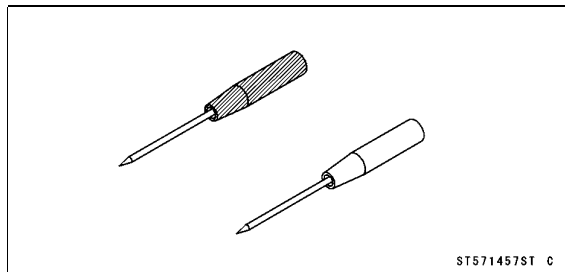
Drive Pulley Puller Bolt : 57001-1429



Socket Wrench : 57001-1363

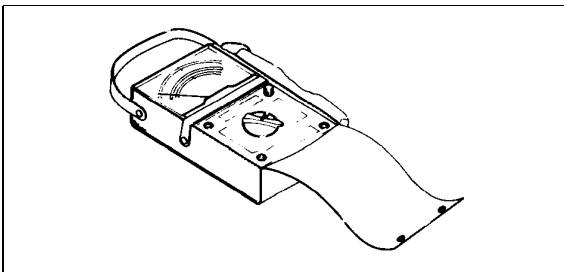


Needle Adapter Set : 57001-1457

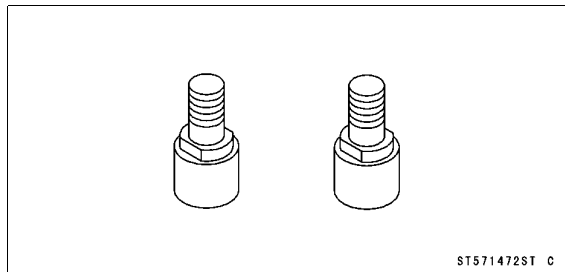


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Hand Tester : 57001-1394



Pulley Holder Attachment : 57001-1472

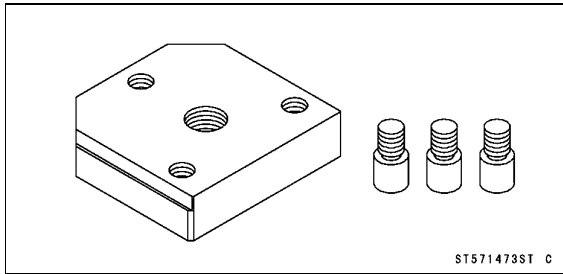


ST571472ST C

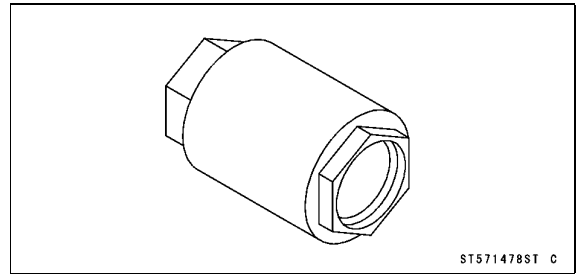
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Special Tools and Sealant

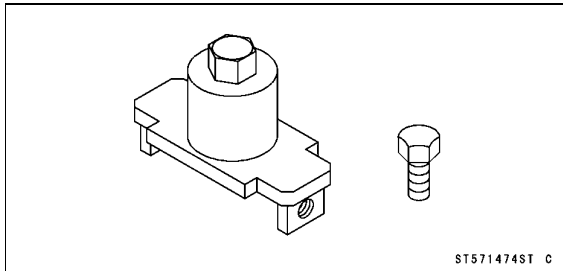
Drive & Driven Pulley Holder : 57001-1473



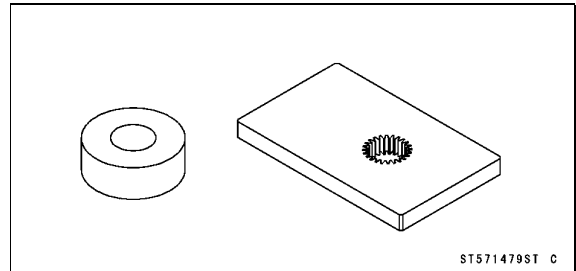
Socket Wrench, Hex 50 : 57001-1478



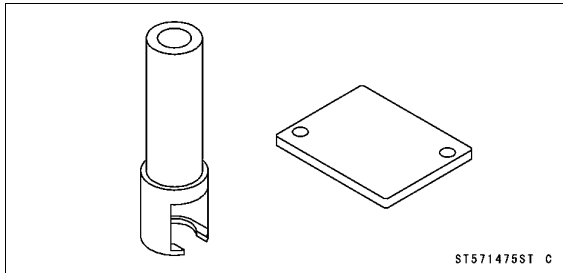
Drive Pulley Wrench : 57001-1474



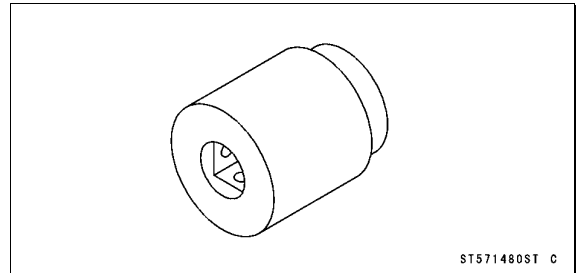
Output Shaft Holder & Spacer : 57001-1479



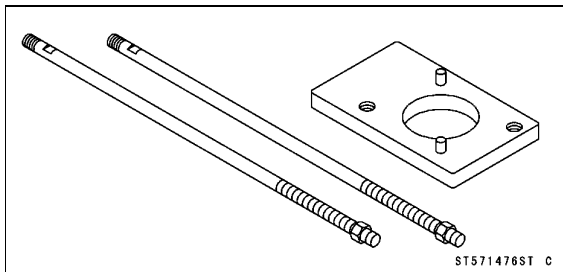
Damper Spring Compressor Set : 57001-1475



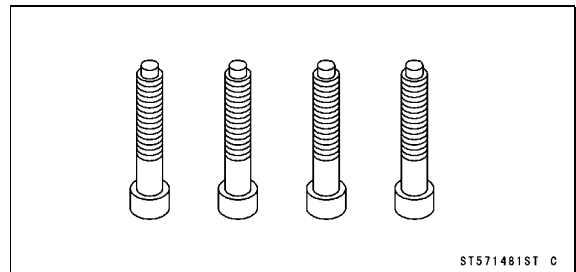
Pinion Gear Holder : 57001-1480



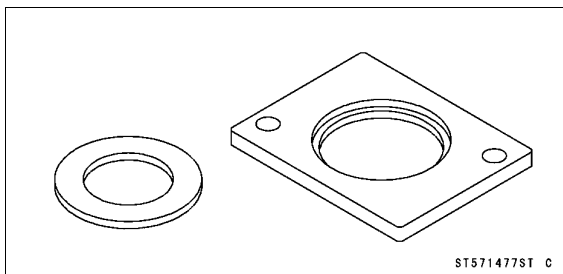
Holder & Guide Arbor : 57001-1476



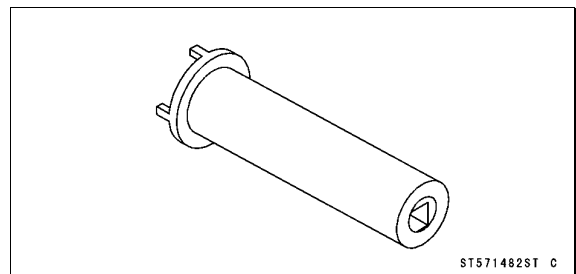
Nut Holding Bolts : 57001-1481



Spacer & Holder : 57001-1477



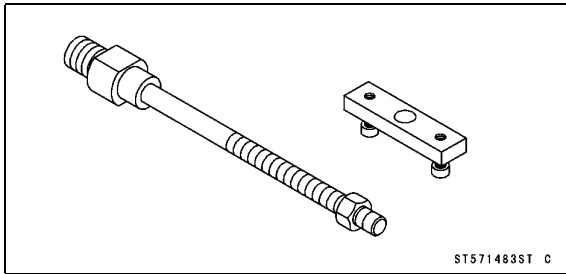
Socket Wench : 57001-1482



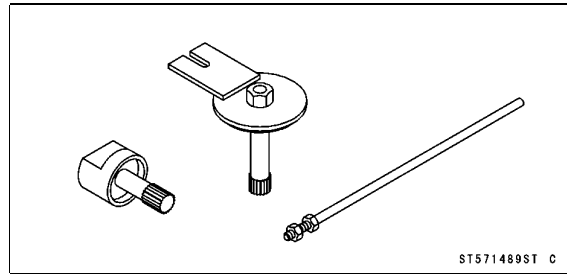
1-40 GENERAL INFORMATION

Special Tools and Sealant

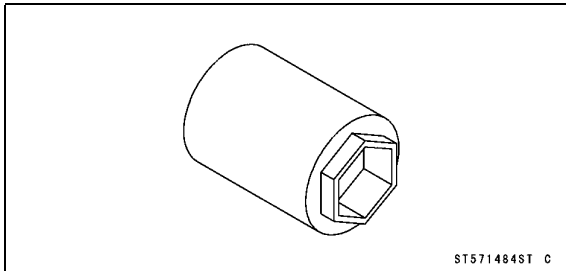
Spring Holder Set : 57001-1483



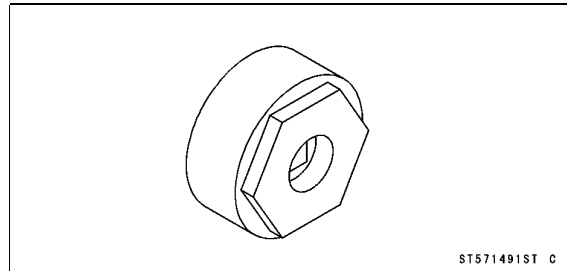
Gear Holder & Socket Wrench, Hex 24 : 57001-1489



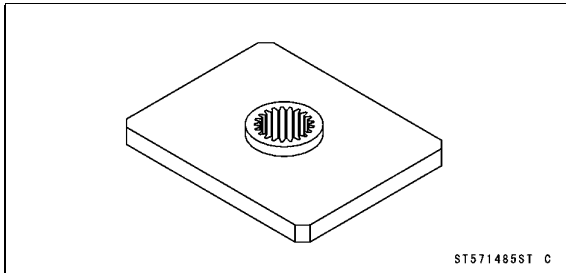
Socket Wrench, Hex 41 : 57001-1484



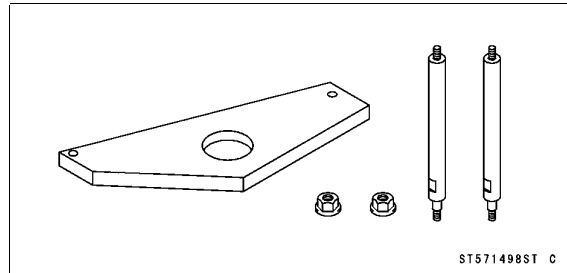
Hexagon Wrench, Hex 41 : 57001-1491



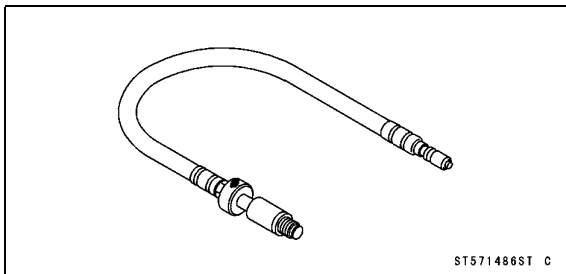
Pinion Gear Holder : 57001-1485



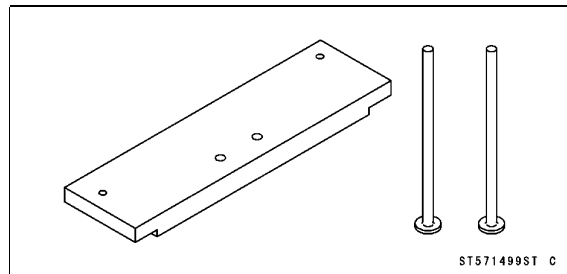
Drive Pulley Measurement Tool : 57001-1498



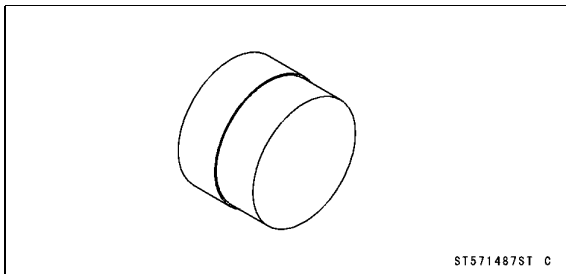
Compression Gauge Adapter, M10 x 1.0 : 57001-1486



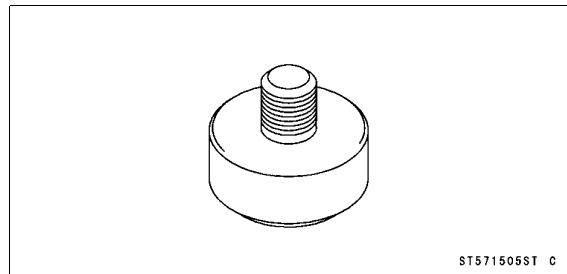
Actuator Lever Measurement Tool : 57001-1499



Oil Seal Driver: 57001-1487



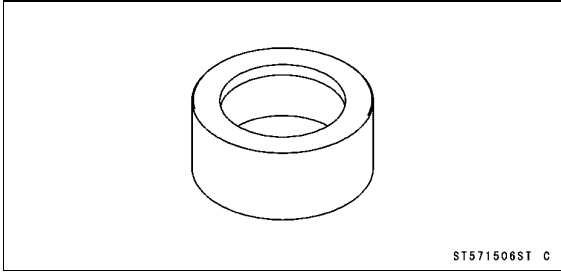
Oil Seal Driver, $\phi 18$: 57001-1505



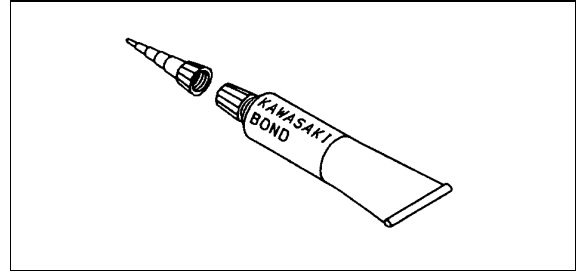
GENERAL INFORMATION 1-41

Special Tools and Sealant

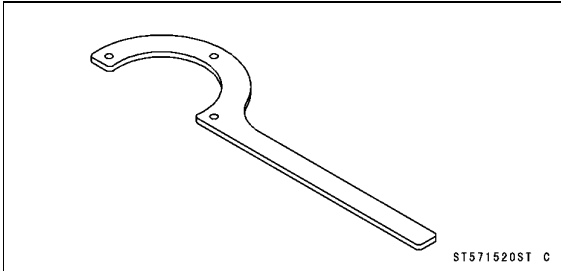
Oil Seal Driver, ϕ 48: 57001-1506



Kawasaki Bond (Silicone Sealant) : 56019-120

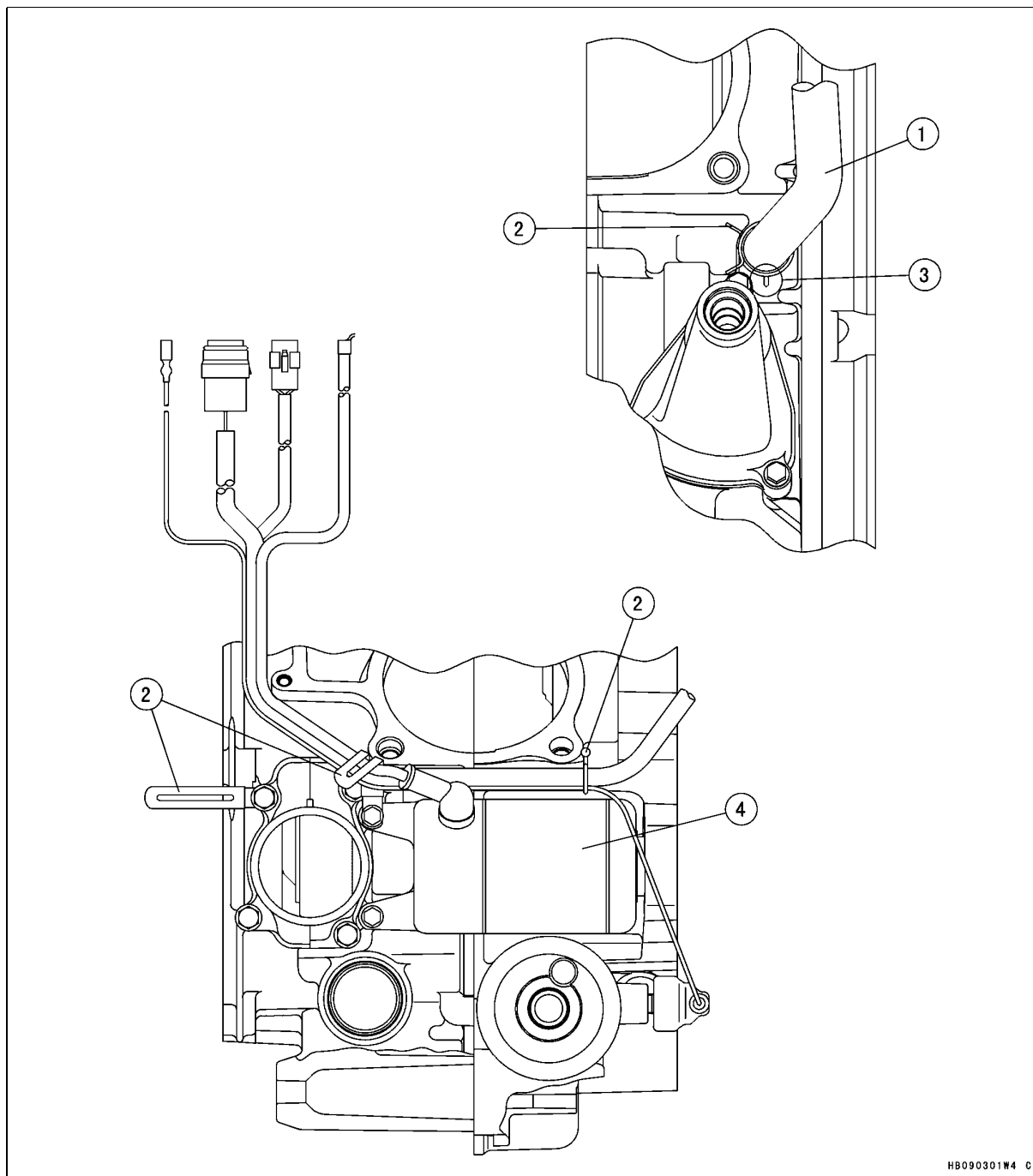


Drive Pulley Holder: 57001-1520



1-42 GENERAL INFORMATION

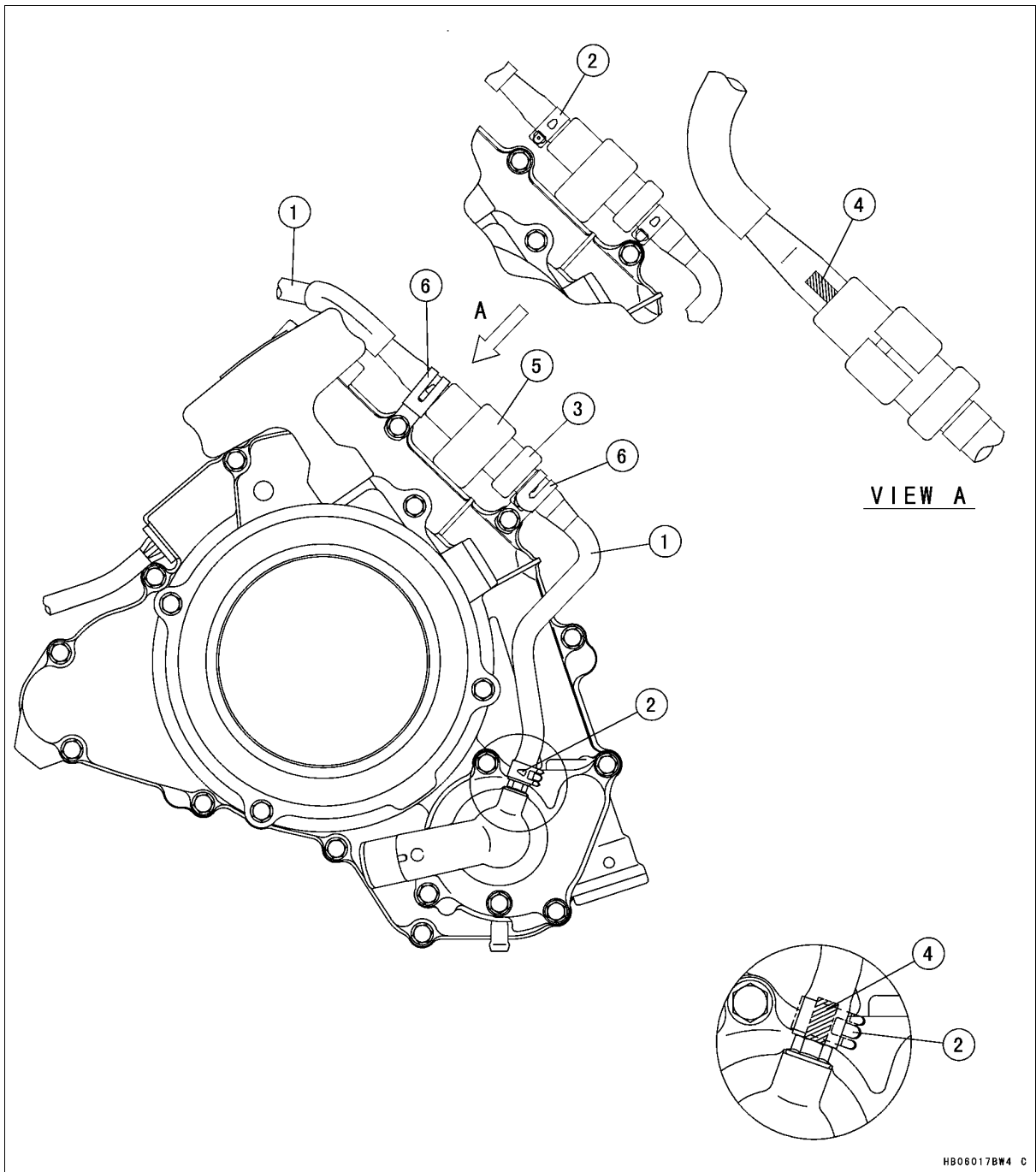
Cable, Wire, and Hose Routing



HB090301W4 C

1. Tube
2. Clamp
3. Align the white paint mark on the tube with the adjustment mark on the crankcase.
4. Electric Starter

Cable, Wire, and Hose Routing

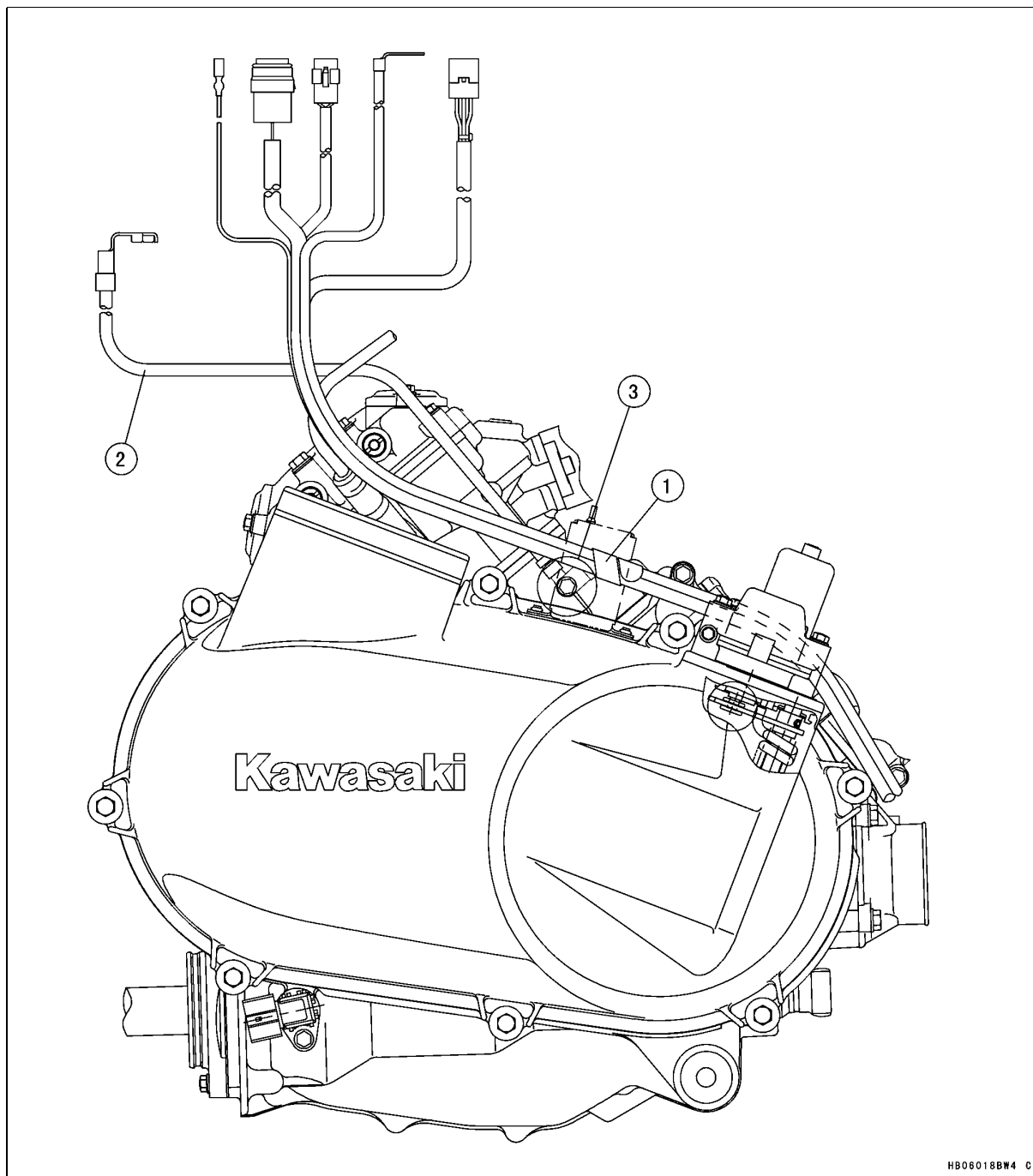


1. Cooling Hoses
2. Clamps (Install the clamps with the tabs direction as shown.)
3. Coolant Valve
4. Position the white marks on the tube as shown.
5. Damper
6. Clamps

HB06017BW4 C

1-44 GENERAL INFORMATION

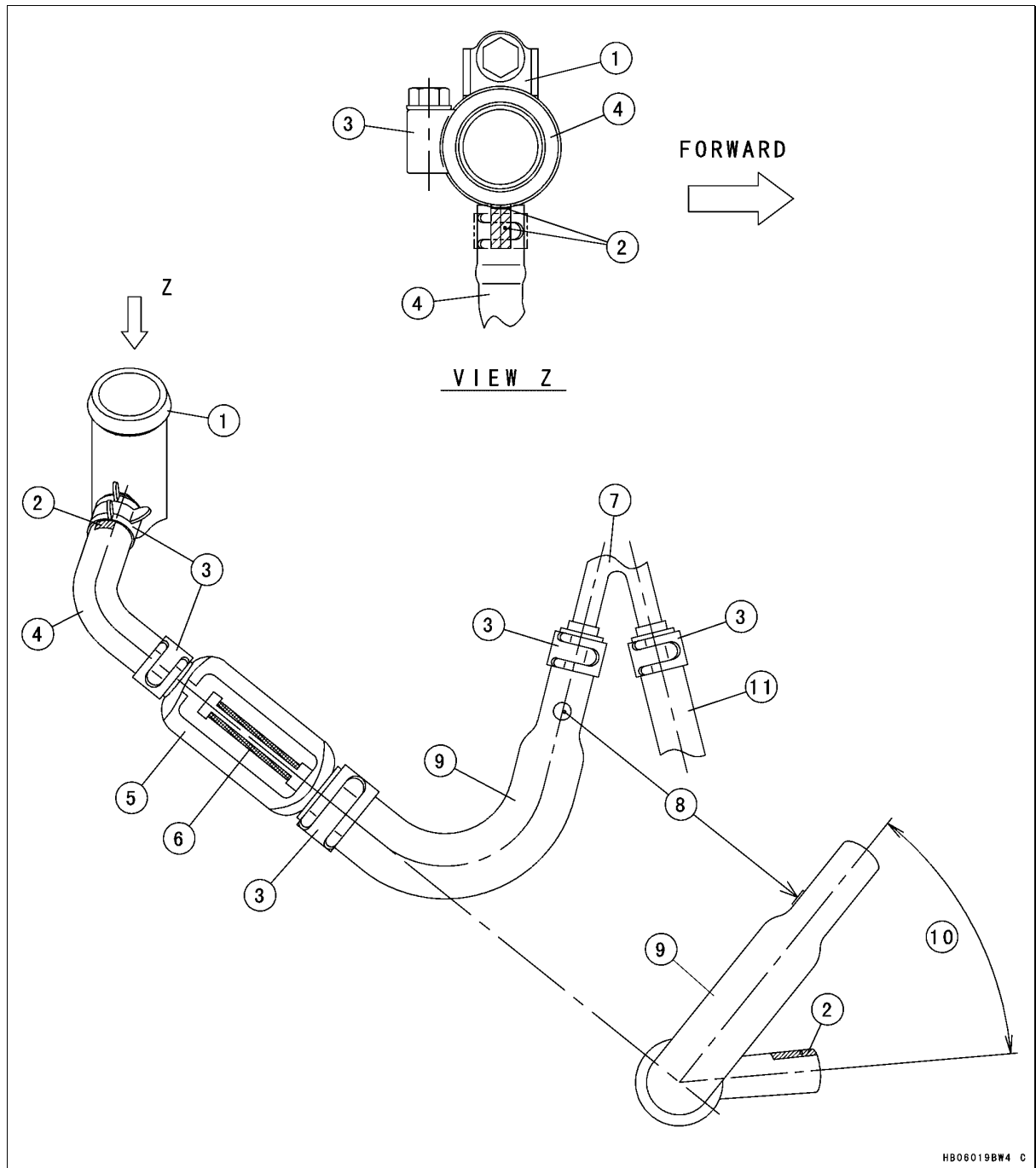
Cable, Wire, and Hose Routing



HB06018BW4 C

1. Clamp
2. Engine Ground Lead
3. Install the clamp on the engine ground lead.

Cable, Wire, and Hose Routing

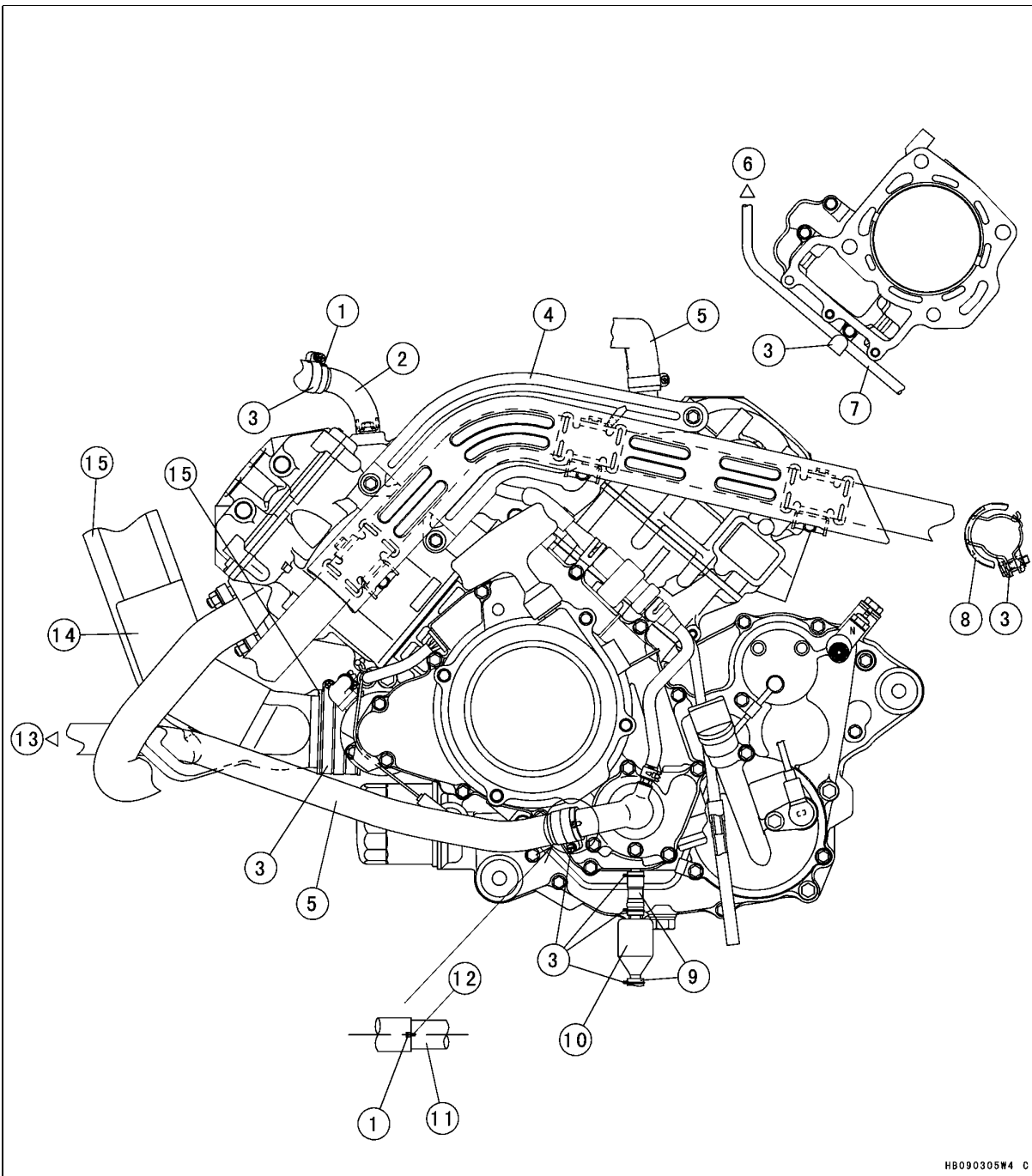


- 1. Water Pipe
- 2. White Paint
- 3. Clamps
- 4. Cooling Hoses
- 5. Coolant Filter Body
- 6. Coolant Filter

- 7. Carburetor
- 8. Mark
- 9. Cooling Hose
- 10. Assemble Angle (about 45°, [4] and [9] hoses)
- 11. Cooling Hose

1-46 GENERAL INFORMATION

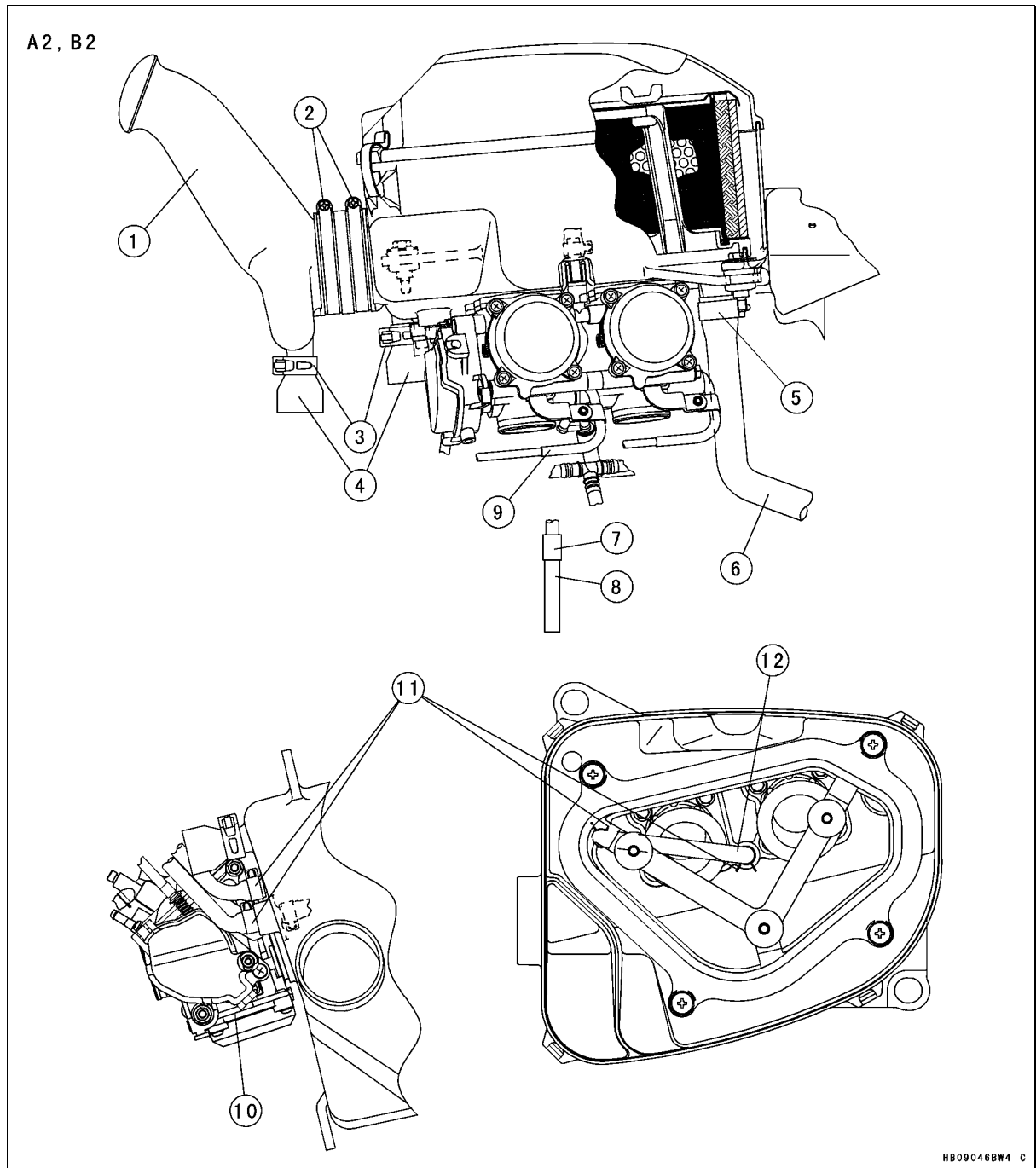
Cable, Wire, and Hose Routing



HB090305W4 C

- | | |
|-----------------------------|-----------------|
| 1. White Paint | 9. Tube |
| 2. Water Pipe | 10. Breather |
| 3. Clamp | 11. Pump Cover |
| 4. Heat Guard Plate | 12. Mark |
| 5. Cooling Hose | 13. To Radiator |
| 6. To Carburetor | 14. Mat |
| 7. Carburetor Overflow Tube | 15. Duct |
| 8. Exhaust Pipe Cover | |

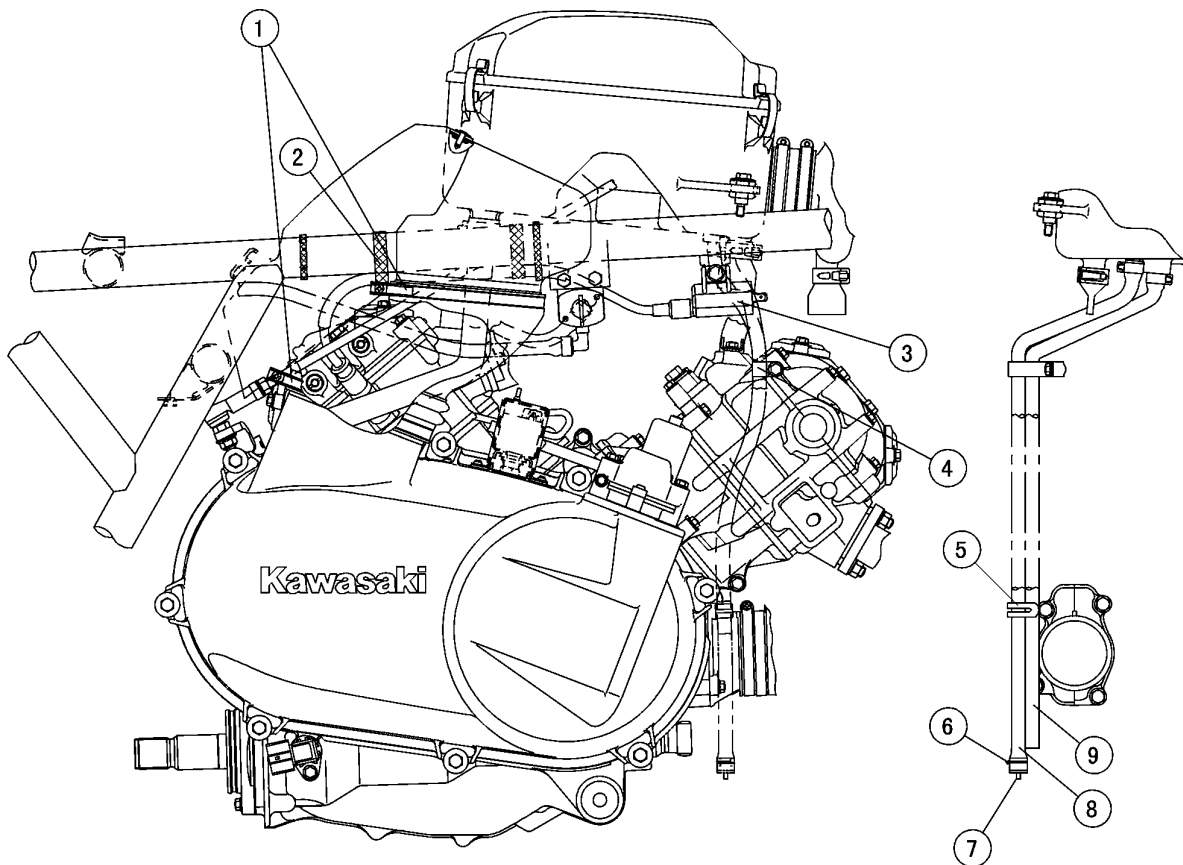
Cable, Wire, and Hose Routing



1-48 GENERAL INFORMATION

Cable, Wire, and Hose Routing

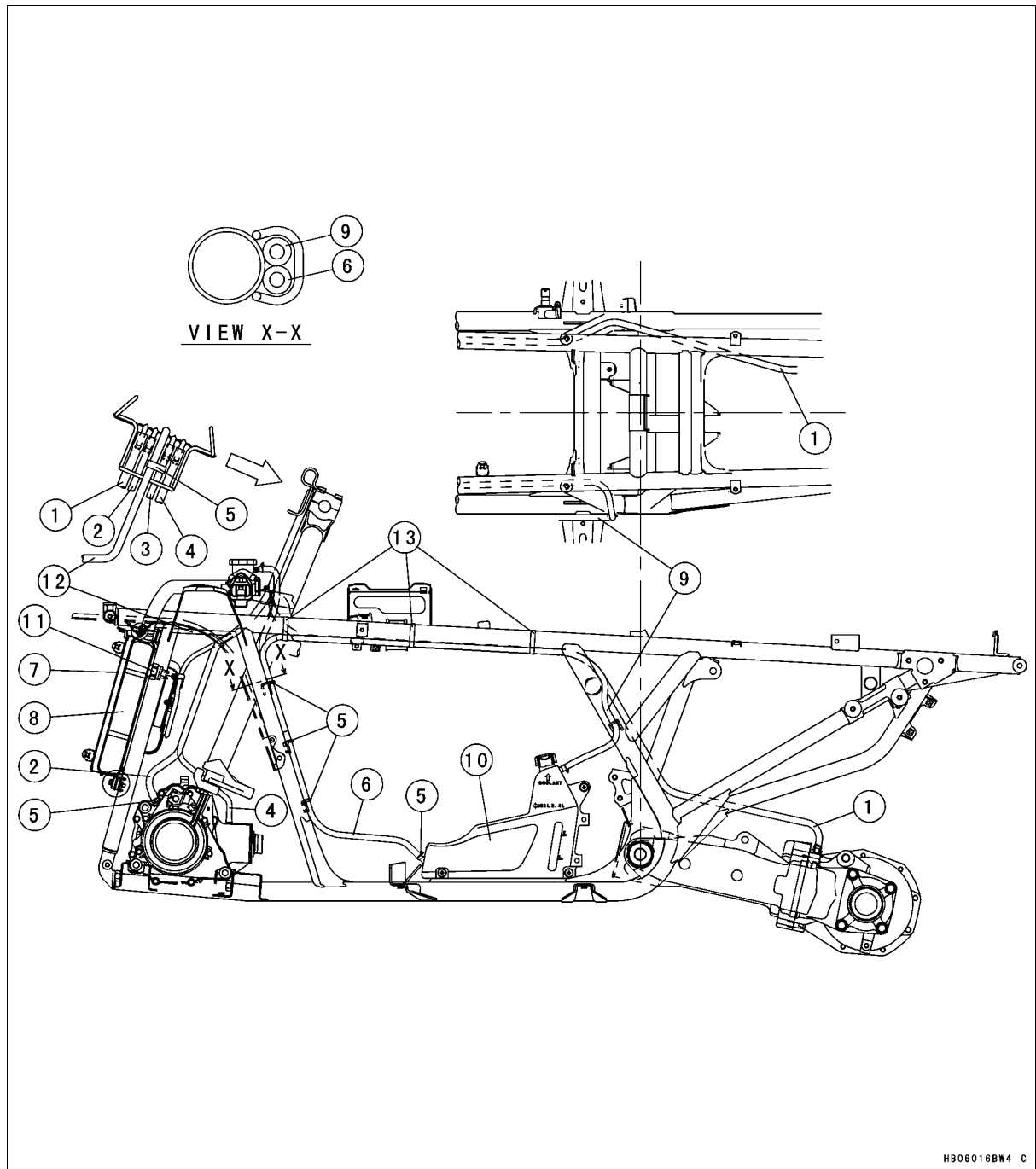
A2, B2



HB09045BW4 C

1. Clamps
2. Bands
3. Ignition Coil (Rear)
4. Clamp
5. Clamp
6. Clamp
7. Drain Plug
8. Drain Hose
9. Vent Hose

Cable, Wire, and Hose Routing

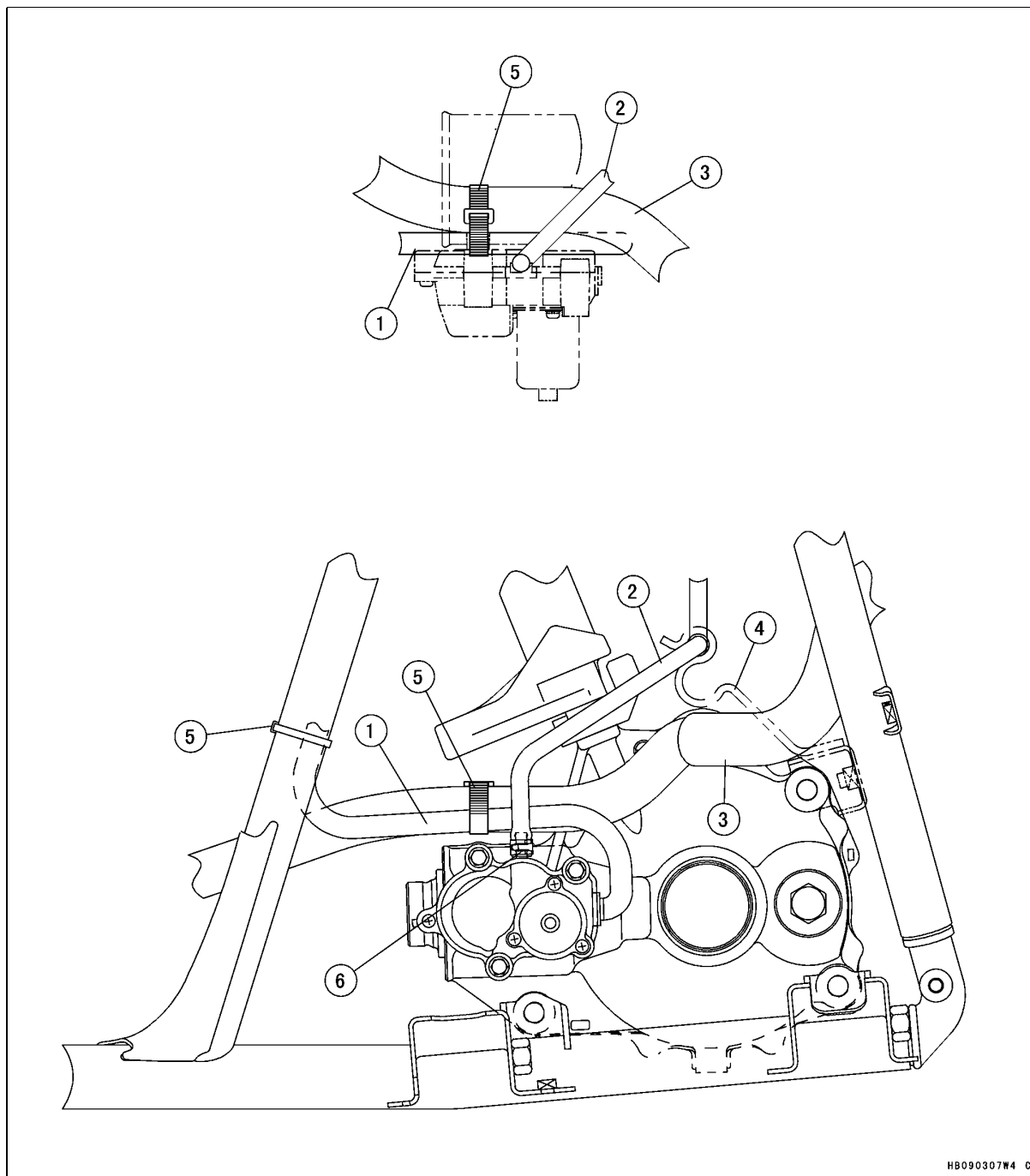


HB06016BW4 C

- | | |
|--|--|
| 1. Rear Final Gear Case Breather Tube | 8. Radiator |
| 2. Front Final Gear Case Breather Tube | 9. Coolant Breather Tube |
| 3. Radiator Fan Motor Breather Tube | 10. Reservoir |
| 4. 2WD/4WD Actuator Breather Tube | 11. Fan Switch |
| 5. Clamp | 12. Fuel Breather Tube (To Frame Hole) |
| 6. Coolant Hose | 13. Band |
| 7. Screen | |

1-50 GENERAL INFORMATION

Cable, Wire, and Hose Routing



HB090307W4 C

1. 2WD/4WD Actuator Lead

2. Breather Tube

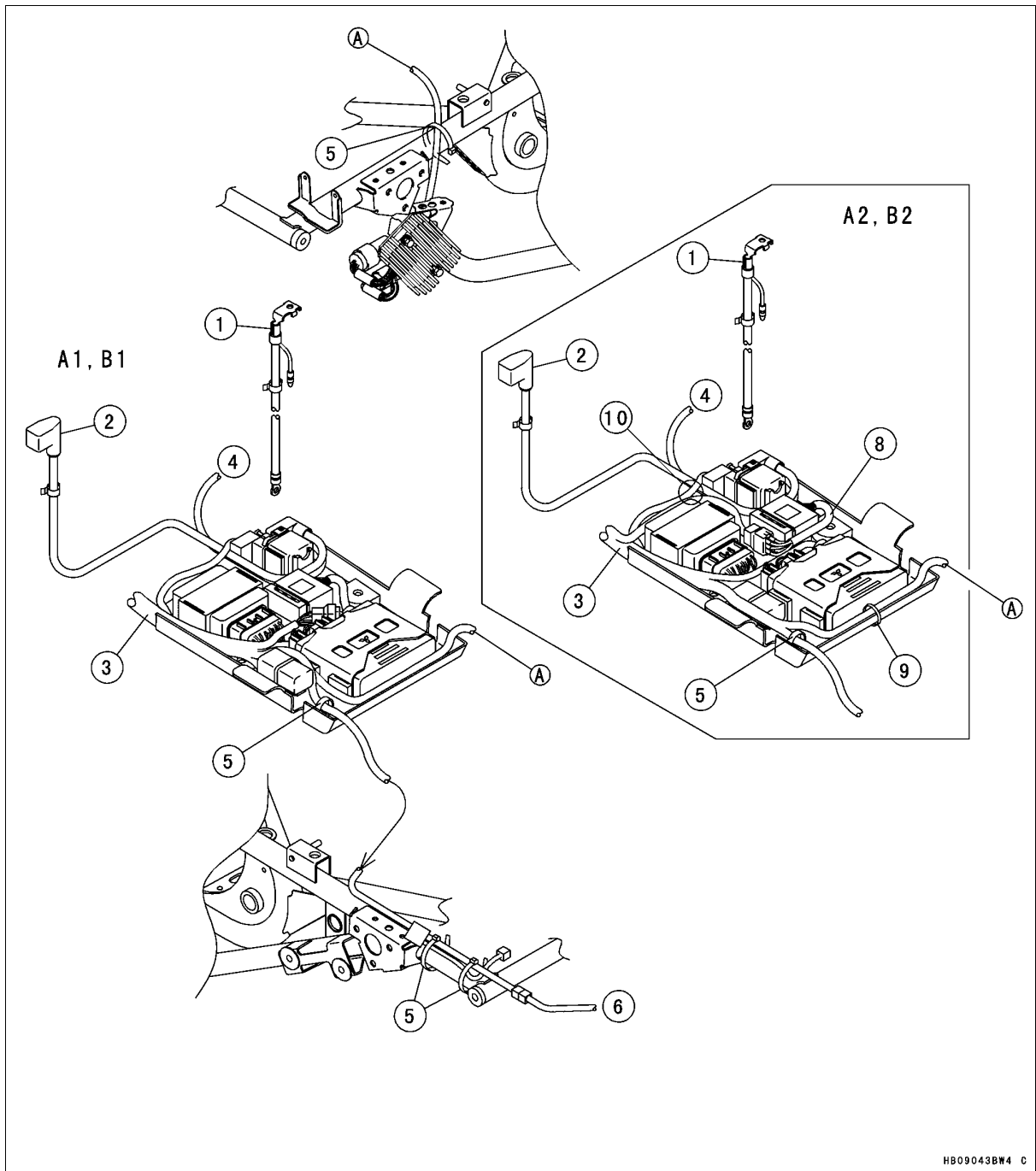
3. Cooling Hose

4. Bracket

5. Band

6. Clamp

Cable, Wire, and Hose Routing

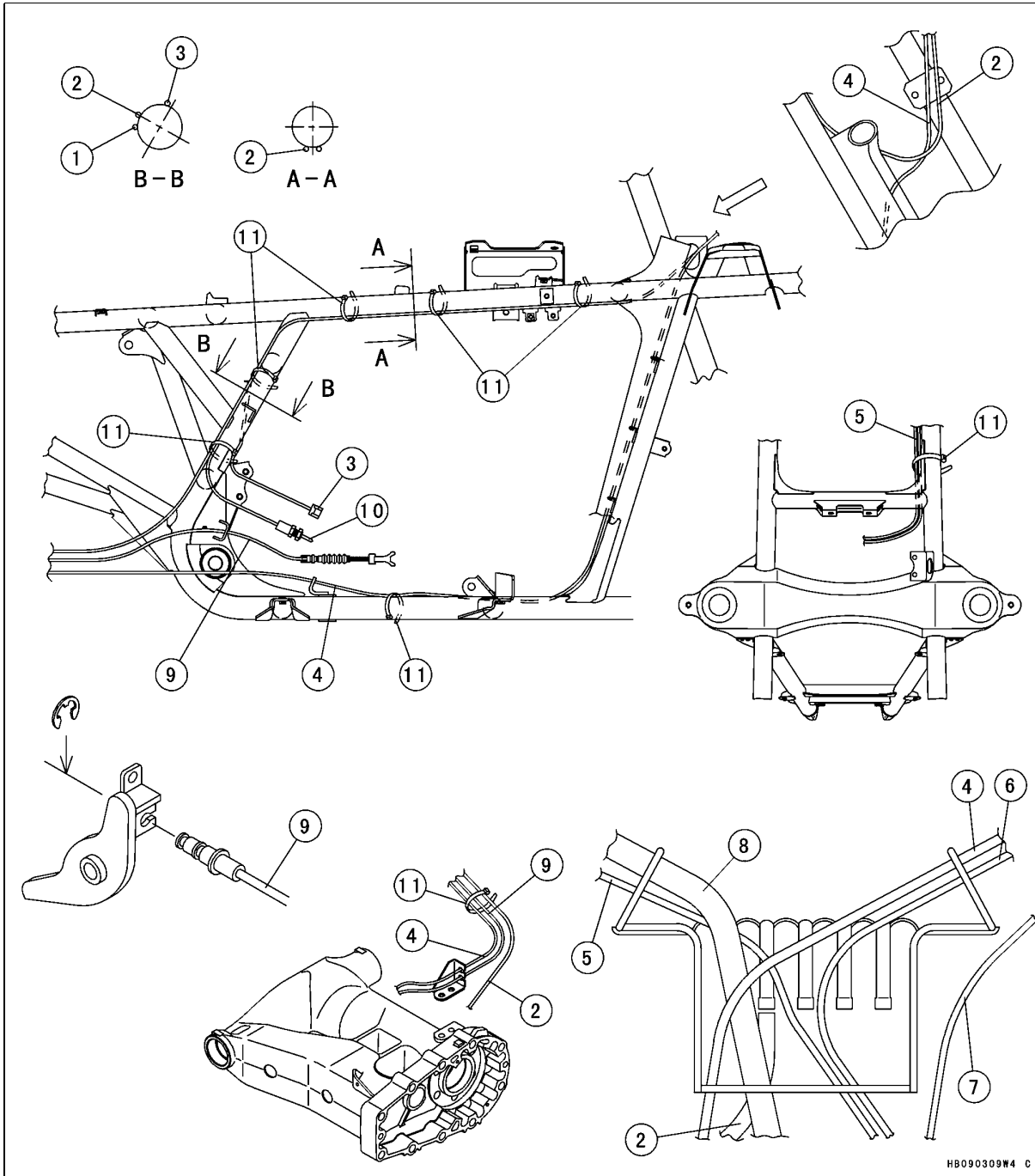


- 1. Battery Negative Lead
- 2. Battery Positive Lead
- 3. Main Harness
- 4. To Engine
- 5. Clamp
- 6. To Tail Lamp

- 7. Band
- 8. Run the fuse lead under the igniter leads.
- 9. Band
- 10. Run the fuse lead under the battery negative and positive leads.

1-52 GENERAL INFORMATION

Cable, Wire, and Hose Routing

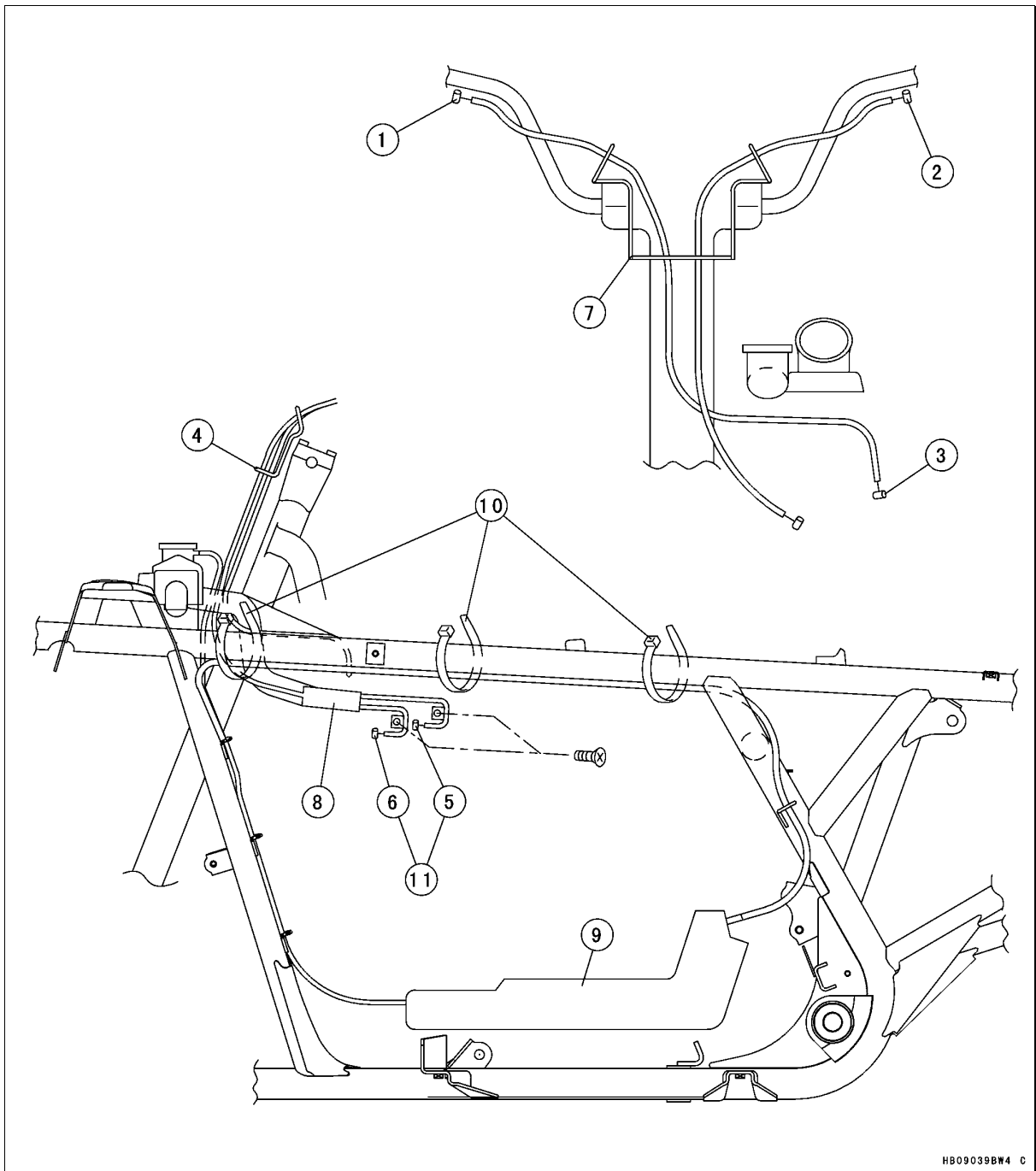


HB090309W4 C

- 1. Brake Switch Lead
- 2. Rear Final Gear Case Breather Tube
- 3. Sensor Harness
- 4. Brake Cable (Parking)
- 5. Throttle Cable
- 6. Starter Cable

- 7. Variable Front Differential Control Cable
- 8. Brake Hose
- 9. Brake Cable (Rear)
- 10. Brake Switch
- 11. Band

Cable, Wire, and Hose Routing



HB09039BW4 C

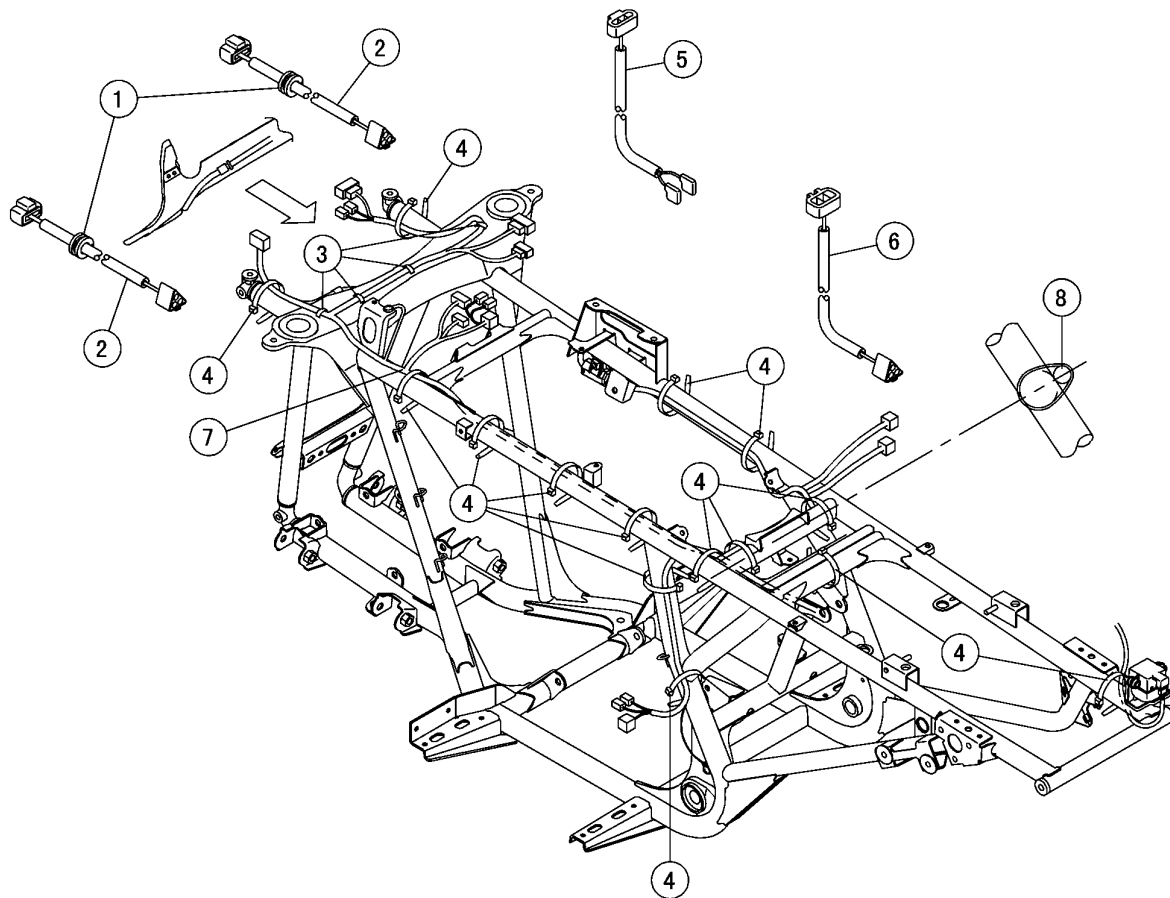
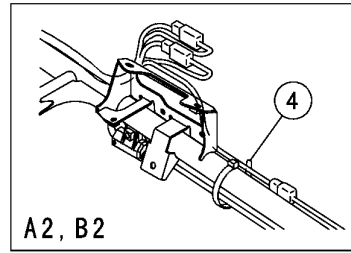
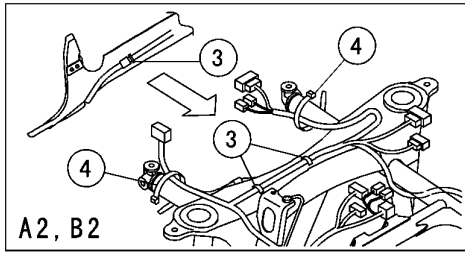
- 1. To Throttle Lever
- 2. To Left Switch Box
- 3. To Carburetor
- 4. Clamp
- 5. To Rear Carburetor
- 6. To Front Carburetor

- 7. Bracket
- 8. Starter Cable
- 9. Reservoir
- 10. Band

11. Set the starter cables to the frame after installing the cable ends to the carburetors.

1-54 GENERAL INFORMATION

Cable, Wire, and Hose Routing

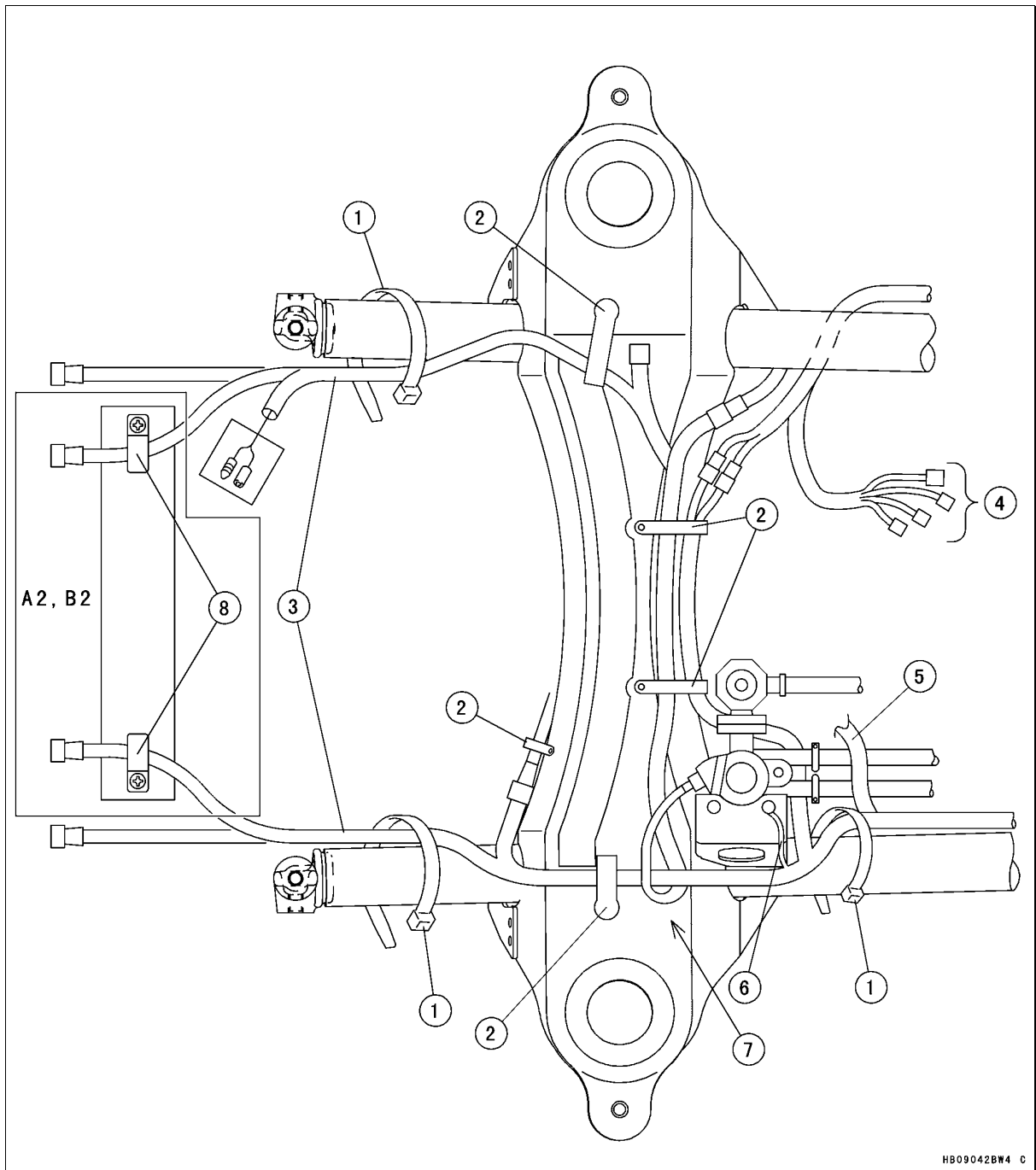


HB09041BW4 C

- 1. Grommet
- 2. Head Lamp Leads
- 3. Clamp
- 4. Band

- 5. Front Brake Lead
- 6. Lead for Speed Sensor
- 7. Main Harness
- 8. Harness (Under of Pipe)

Cable, Wire, and Hose Routing

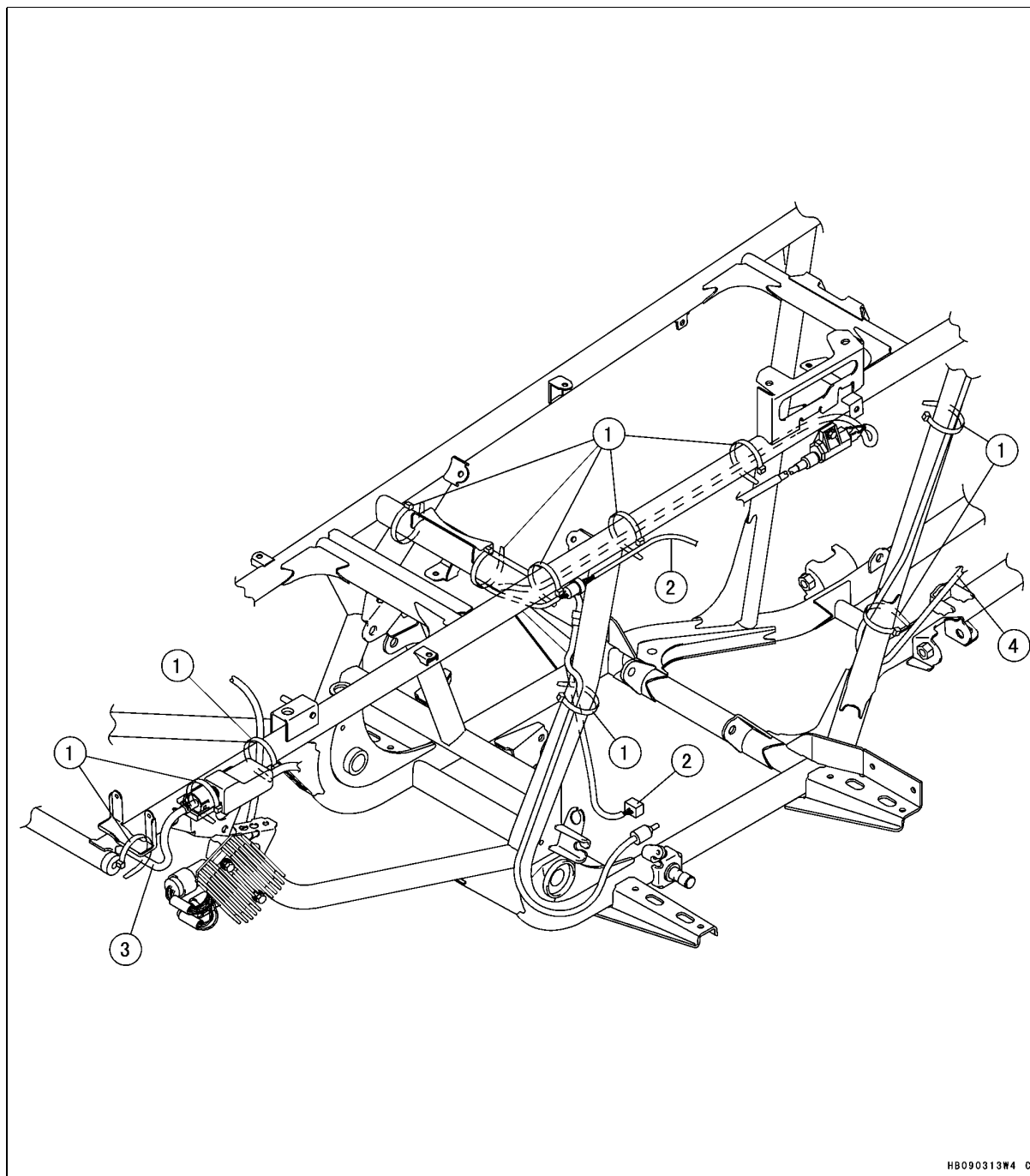


HB09042BW4 C

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Band 2. Clamp 3. Must be inside of frame 4. To Meter and Handlebar Switch | <ul style="list-style-type: none"> 5. To Brake Switch and ACC (on the Hose) 6. Ground Lead (for Multifunction Meter) 7. On the Main Harness 8. Clamps (for the A2, B2 Models) |
|---|---|

1-56 GENERAL INFORMATION

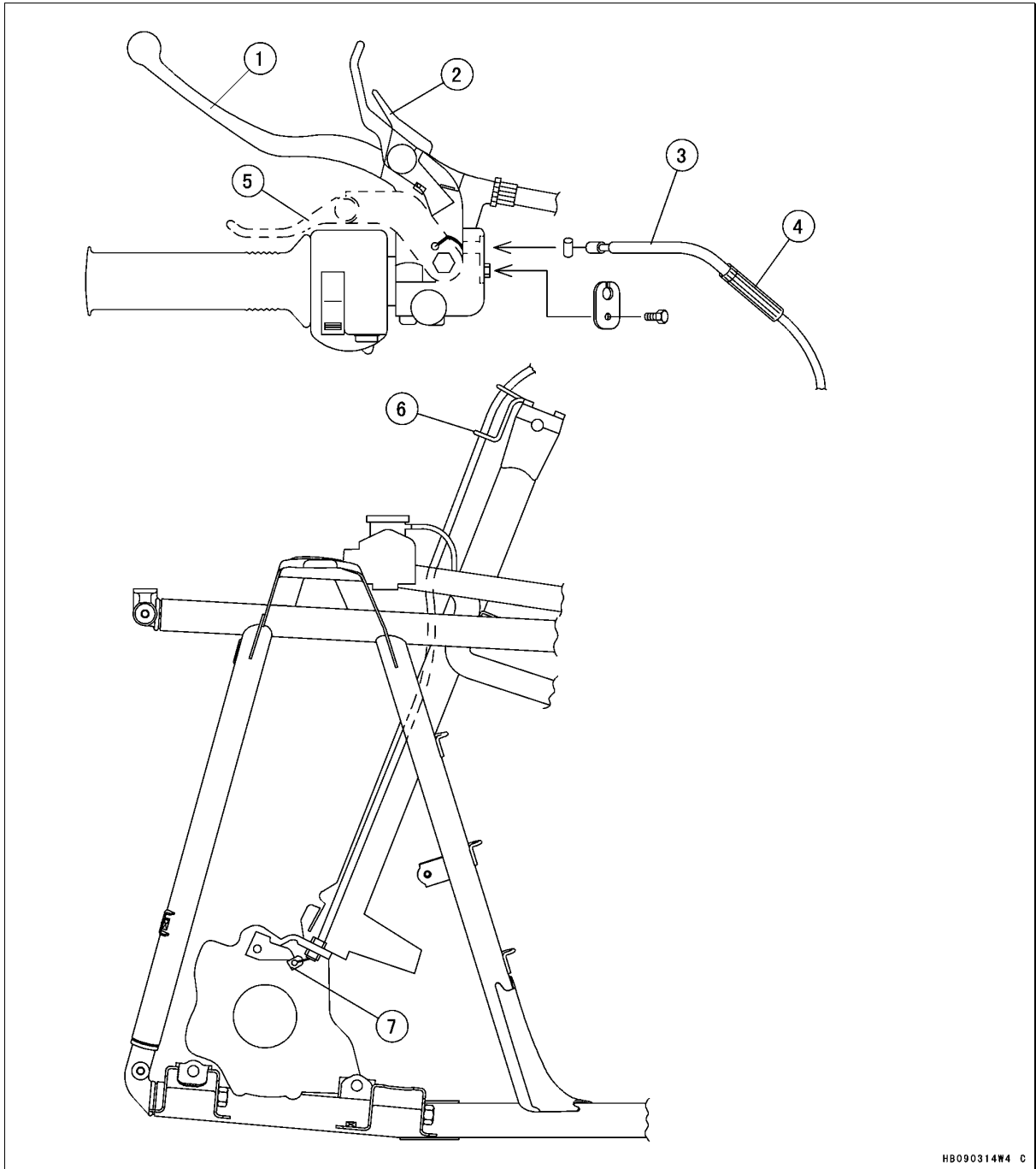
Cable, Wire, and Hose Routing



HB090313W4 C

- 1. Band
- 2. To Engine
- 3. Fuel Breather Tube (To Frame Hole)
- 4. To 2WD/4WD Actuator

Cable, Wire, and Hose Routing

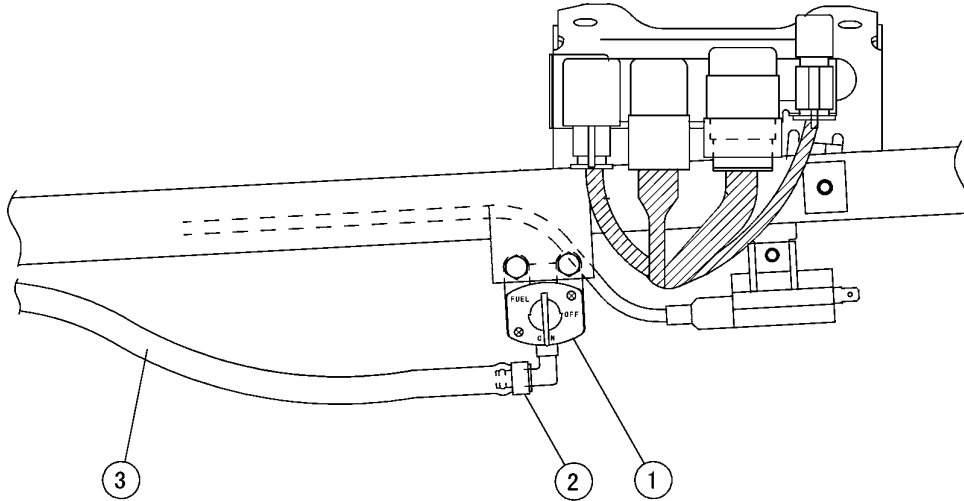


- | | |
|--|--|
| 1. Rear Brake Lever | 5. Variable Front Differential Control Lever |
| 2. Parking Brake Lock Lever | 6. Handle Holder Clamp |
| 3. Variable Front Differential Control Cable | 7. Variable Front Differential Operating Lever |
| 4. Cable Adjuster | |

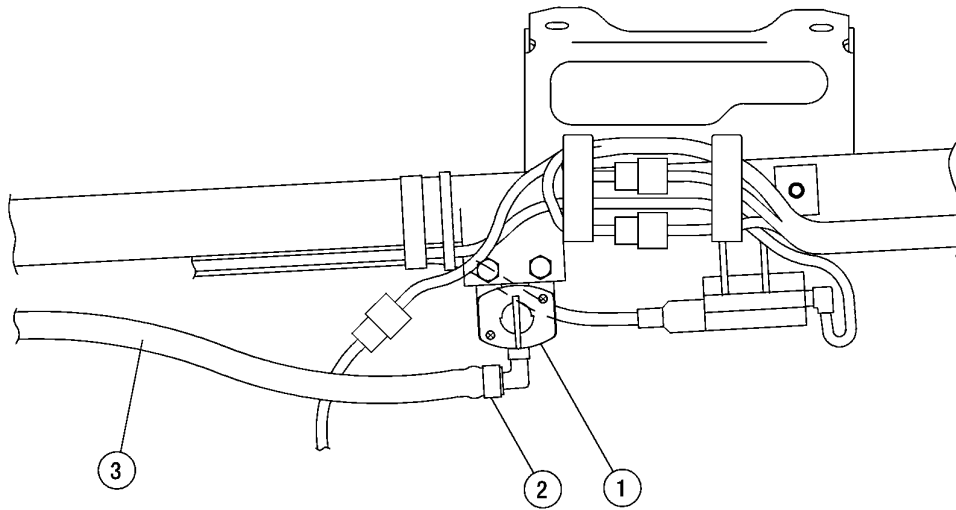
1-58 GENERAL INFORMATION

Cable, Wire, and Hose Routing

A1, B1



A2, B2

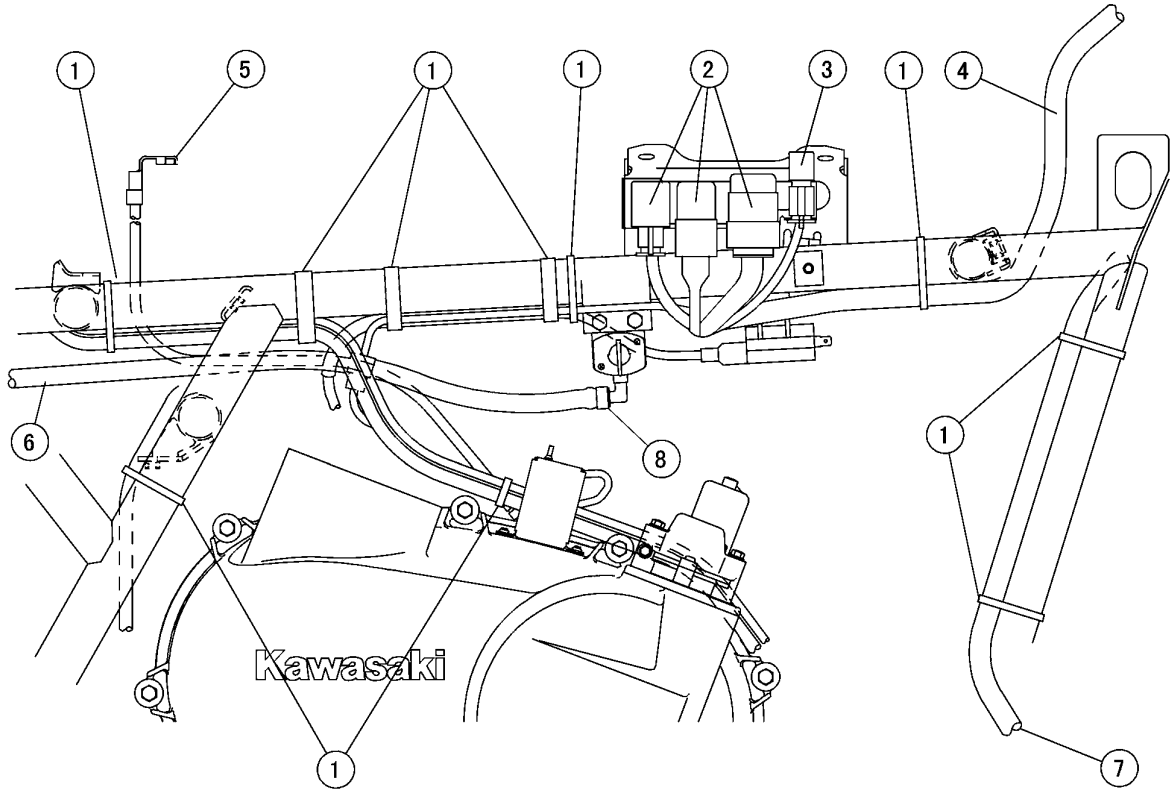


HB09047BW4 C

1. Fuel Tap
2. Clamp (Grip end faces inward.)
3. Fuel Hose

Cable, Wire, and Hose Routing

A1, B1



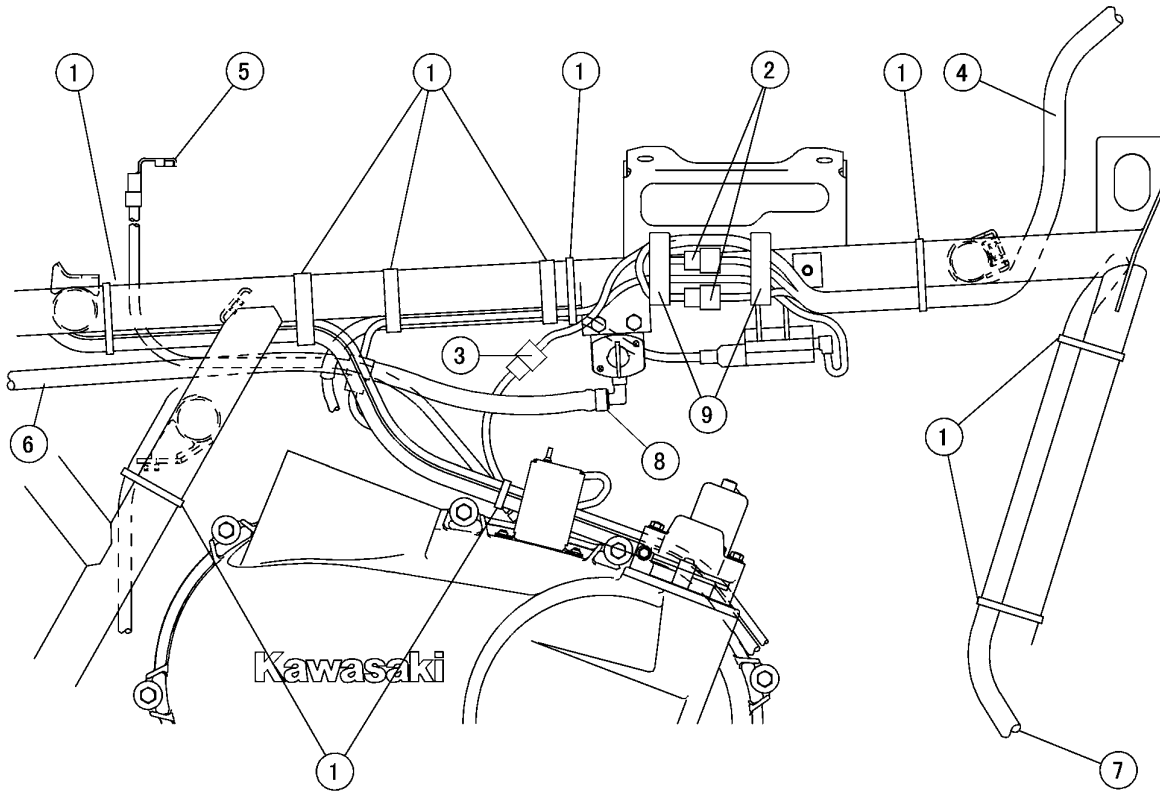
HB09001BW4 C

- | | |
|---------------|-----------------------------------|
| 1. Band | 5. To Battery |
| 2. Relay Assy | 6. To Fuel Pump |
| 3. Diode | 7. To 2WD/4WD Actuator |
| 4. Harness | 8. Clamp (Grip end faces inward.) |

1-60 GENERAL INFORMATION

Cable, Wire, and Hose Routing

A2, B2



HB09044BW4 C

- | | |
|--|-----------------------------------|
| 1. Bands | 6. To Fuel Pump |
| 2. Re-set Connector | 7. To 2WD/4WD Actuator |
| 3. Drive Belt Failure Detection Switch Connector | 8. Clamp (Grip end faces inward.) |
| 4. Harness | 9. Clamp |
| 5. To Battery | |

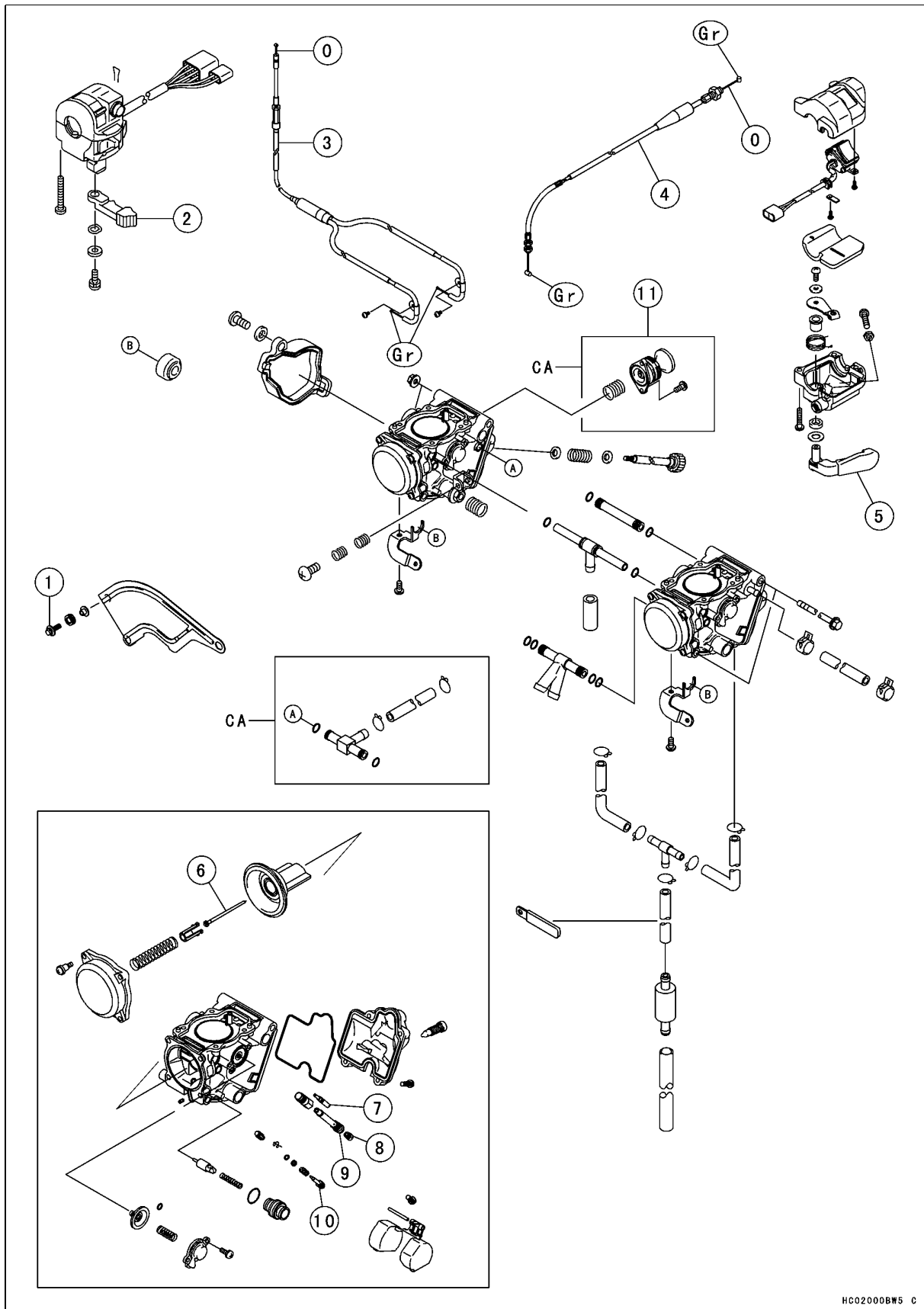
Fuel System

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2-2 FUEL SYSTEM

Exploded View



HC02000BW5 C

FUEL SYSTEM 2-3

Exploded View

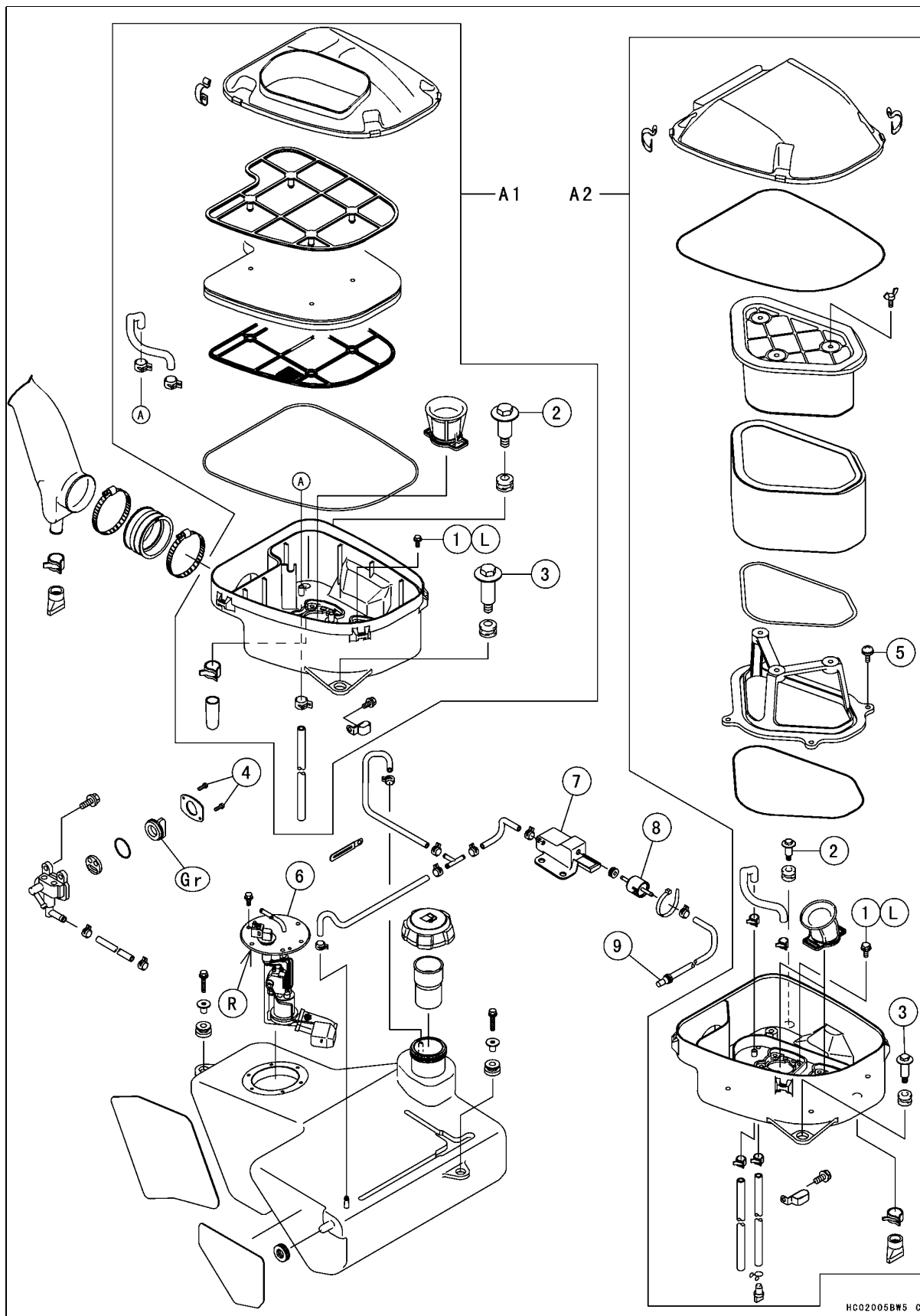
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Heat guard plate mounting bolts	8.8	0.9	78 in·lb	

- 2: Choke lever
- 3: Choke cable
- 4: Throttle cable
- 5: Throttle lever
- 6: Jet needle
- 7: Pilot jet
- 8: Main jet
- 9: Needle jet
- 10: Pilot screw
- 11: Priming pump

O: Apply engine oil.
Gr: Apply grease.
CA: Canada model

2-4 FUEL SYSTEM

Exploded View



FUEL SYSTEM 2-5

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air cleaner housing bolts (M5)	5.9	0.6	52 in·lb	L
2	Air cleaner housing bolts (M6) 28.7 mm (1.13 in.)	8.8	0.9	78 in·lb	
3	Air cleaner housing bolts (M6) 33 mm (1.30 in.)	8.8	0.9	78 in·lb	
4	Fuel tap plate screws	0.8	0.08	7 in·lb	
5	Air cleaner element bracket screws	4.9	0.5	43 in·lb	

- 6: Fuel pump
- 7: Fuel tank breather
- 8: Check valve
- 9: Insert the fuel breather tube end into the frame hole.

- L: Apply a non-permanent locking agent.
- Gr: Apply grease.
- R: Replacement Part (Fuel Pump Gasket)

- A1: KVF650-A1/B1
- A2: KVF650-A2/B2

2-6 FUEL SYSTEM

Specifications

Item	Standard	Service Limit
Throttle Case and Cable:		
Throttle lever free play	2 ~ 3 mm (0.08 ~ 0.12 in.)	---
Choke Lever and Cable:		
Choke lever free play	about 3 mm (0.12 in.)	---
Carburetor:		
Make/Type	KEIHIN, CVKR-D32	---
Main jet:		
Front	#138	---
Rear	#142	---
Main air jet:	#80	---
Needle jet:	#6	---
Jet needle	NAZH	---
Pilot jet	#40	---
Pilot air jet	#130	---
Pilot screw	2 1/4 turns out	---
Carburetor synchronization vacuum	less than 2.7 kPa (2 cmHg) difference between carburetors	---
Starter jet	#100	---
Idle speed	1100 ± 50 r/min (rpm)	---
Service fuel level	15 ± 1 mm (0.59 ± 0.04 in.) (KVF650-A1/B1) 12 ± 1 mm (0.47 ± 0.04 in.) (KVF650-A2/B2) below the punch mark	---
Float height	4.0 ± 1 mm (0.16 ± 0.04 in.)	---
Optional parts:		
Main jet:		
*Altitude:		
0 ~ 500 m (0 ~ 1600 ft):		
Front	#138 (92063-1015)	---
Rear	#142 (92063-1016)	---
500 ~ 1500 m (1600 ~ 4900 ft):		
Front	#135 (92063-1014)	---
Rear	#140 (92063-1013)	---
1500 ~ 2500 m (4900 ~ 8200 ft):		
Front	#132 (92063-1076)	---
Rear	#138 (92063-1015)	---
2500 ~ 3500 m (8200 ~ 11500 ft):		
Front	#130 (92063-1075)	---
Rear	#132 (92063-1076)	---
3500 ~ 4500 m (11500 ~ 14800 ft):		
Front	#125 (92063-1069)	---
Rear	#130 (92063-1075)	---
Air Cleaner:		
Air cleaner element oil	High-quality foam air filter oil	---

*: Refer to pg. 5–26 for high altitude setting in the converter system.

Special Tools - Fuel Level Gauge: 57001–1017

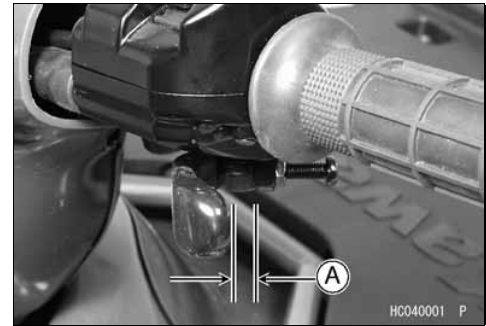
Carburetor Drain Plug Wrench, Hex 3: 57001–1269

Pilot Screw Adjuster, A: 57001–1239

Throttle Lever and Cable

Throttle Lever Free Play Inspection

- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.
- ★ If the throttle lever does not return properly, check the throttle cable routing, lever free play, and for possible 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 cable free play and the cable routing.
- Stop the engine and check the throttle lever free play [A].
- ★ If the free play is not within the specified range, adjust the cable.

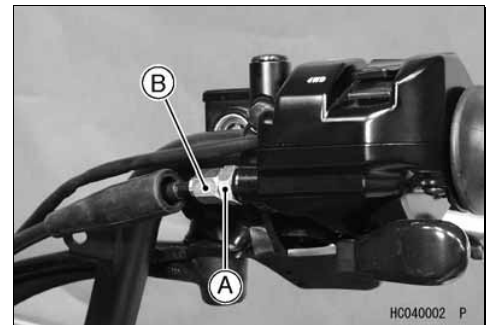


Throttle Lever Free Play

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

Throttle Lever Free Play Adjustment

- Remove the handle cover (see Multifunction Meter Unit Removal in Electrical System chapter).
- 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.

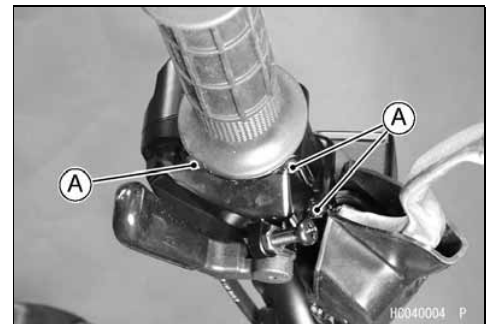


- ★ If the free play cannot be adjusted by using the upper cable adjuster, remove the air cleaner housing and then use the cable adjusting nuts [A] at the lower end of the throttle cable and make the necessary free play.



Throttle Case Removal/Disassembly

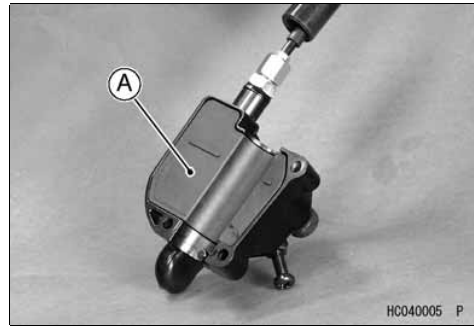
- Remove the throttle case screws [A] and pull the case open.
- Slide the cable adjuster dust cover out of place.



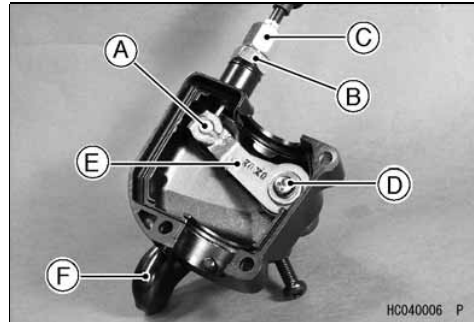
2-8 FUEL SYSTEM

Throttle Lever and Cable

- Remove the rubber cover [A].

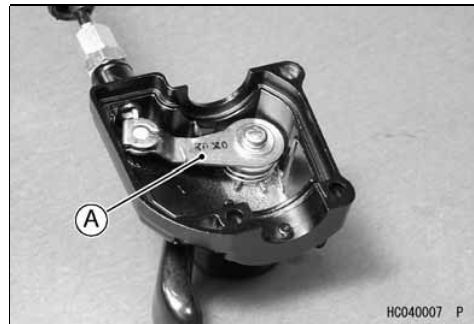


- Pull the cable tip [A] out of the throttle lever catch with the throttle lever opened.
- Loosen the locknut [B] and unscrew the adjuster [C].
- Disassemble the throttle case as follows:
 - Remove the throttle lever screw [D], lockwasher, and flat washer, and lift the throttle lever [E] and return spring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



- 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.

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

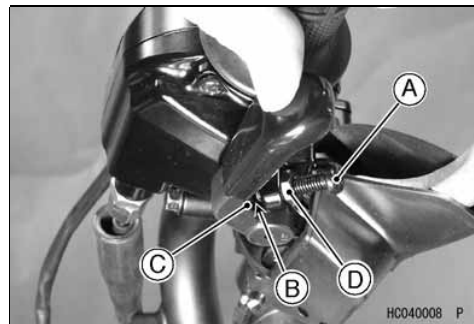
Throttle Cable Installation

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

⚠ WARNING

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

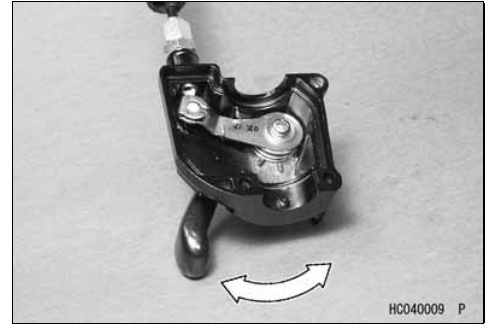
- Check the throttle cable (see Throttle Lever Free Play Inspection).



Throttle Lever and Cable

Throttle Case Inspection

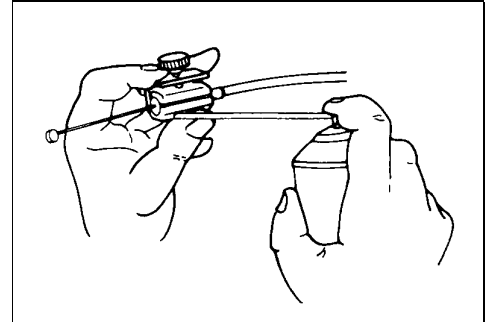
- With the throttle cable disconnected from the throttle lever, the lever should move freely and return smoothly by spring.
- ★ If the lever is heavy, disassemble the throttle case, clean and lubricate the throttle case.
- Examine the lever and case for cracks. Replace the case assembly if it is cracked.



Throttle Cable Lubrication

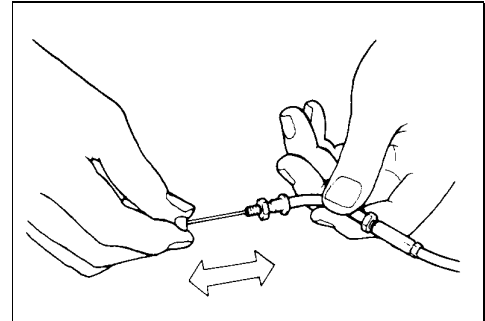
Whenever the throttle cable is removed, lubricate the cable as follows:

- Apply a small amount of multi-purpose grease to the cable both ends.
- Lubricate the cable with a penetrating rust inhibitor through the pressure cable luber.



Throttle Cable Inspection

- With the throttle cable disconnected at both ends, the cable should move freely within the cable housing.
- ★ If the cable does not move freely after lubricating, if the cable is frayed, or if the housing is kinked, replace the cable.



2-10 FUEL SYSTEM

Choke Lever and Cable

Choke Lever Free Play Check

- Check if the choke lever [A] returns properly and if the inner cable slides smoothly.
 - Make sure that the choke lever returns to its released position all the way.
 - To determine the amount of choke cable play at the lever, pull the choke lever to the left until feeling the operation of the lever tough; the amount of choke lever is equivalent to that of cable play.
 - The proper amount of play ranges about 3 mm (0.12 in.) at the choke lever.
- ★ If the free play is not within the specified range, adjust the cable.

Choke Lever Free Play [B]

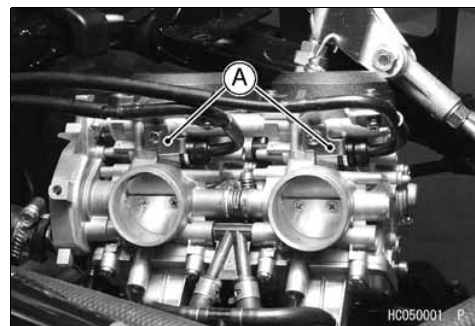
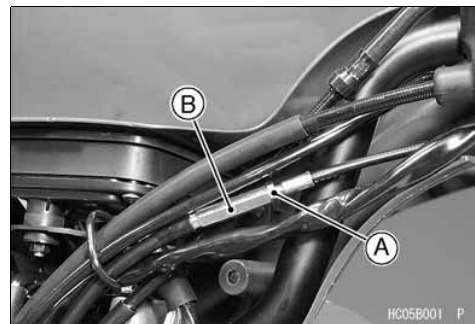
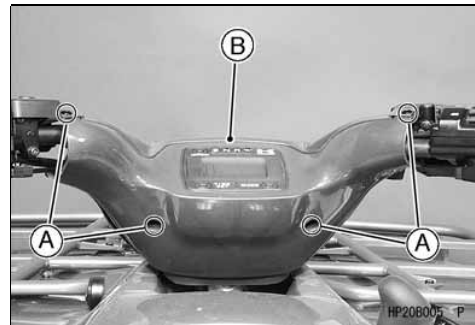
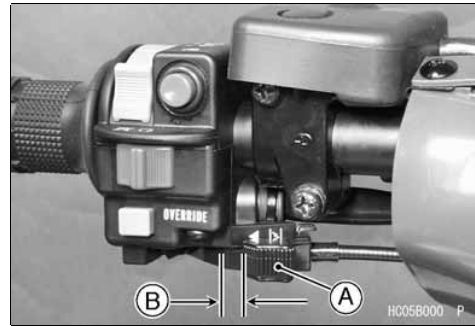
Standard: about 3 mm (0.12 in.)

Choke Lever Free Play Adjustment

- Remove:
 - Handle Cover Screws [A]
 - Handle Cover Front [B]
- Loosen the locknut [A] of the choke cable.
- Turn the adjuster [B] until the cable has proper amount of play.
- Tighten the locknut [B].

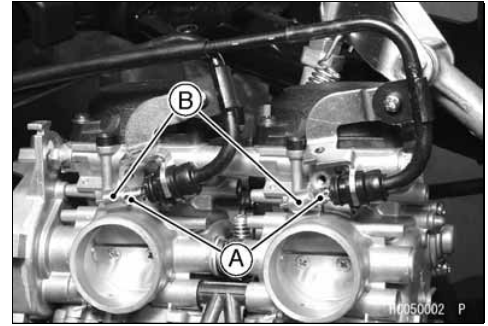
Choke Lever and Cable Removal

- Remove the air cleaner housing (see Air Cleaner Housing Removal).
- Remove the carburetor from the carburetor holder.
- Remove the holder plates [A] and screws.
- Pull out the starter plungers.

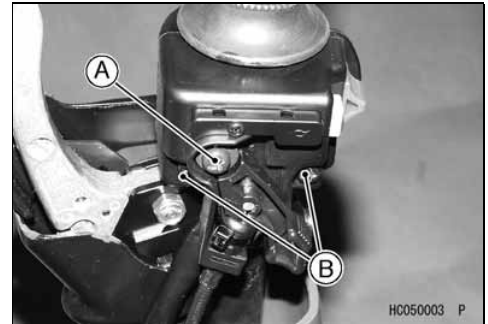


Choke Lever and Cable

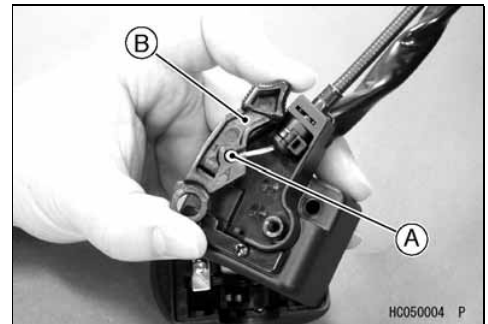
- Hold the starter plunger springs compressed, and free the choke cable lower ends [A] from the plungers [B].



- Remove:
Choke Lever Mounting Screw [A], Plane Washer, and Wave Washer
Switch Case Mounting Screws [B]



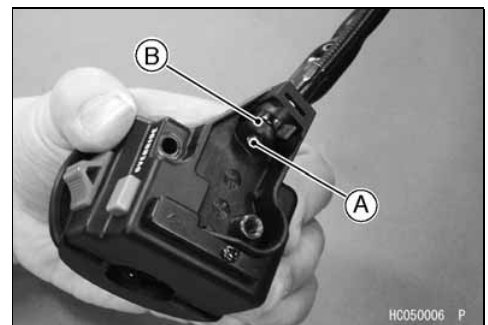
- Free the choke cable upper end [A] from the choke lever [B].



- Pull off the retaining clip [A].



- Fit the cable end [A] in the grommet [B], and free the cable from the switch case.
- Pull the cable out of the vehicle.



2-12 FUEL SYSTEM

Choke Lever and Cable

Choke Lever and Cable Installation

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

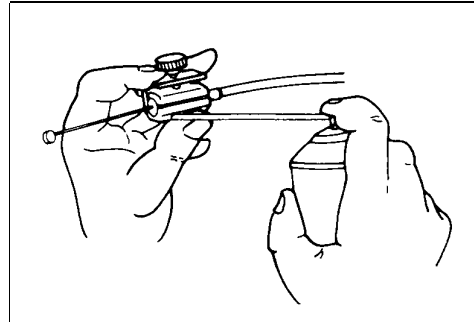
⚠ WARNING

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

Choke Cable Lubrication

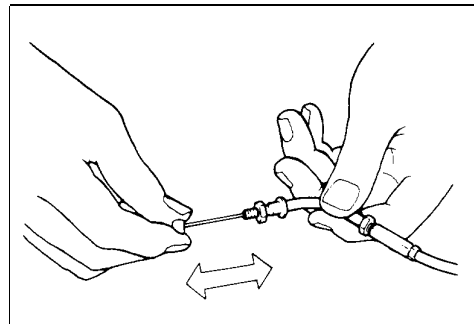
Whenever the choke cable is removed, lubricate the cable as follows:

- Lubricate the cable with a penetrating rust inhibitor through the pressure cable luber.



Choke Cable Inspection

- With the choke cable disconnected at both ends, the cable should move freely in the cable housing.
- ★ If the cable does not move freely after lubricating, if the cable is frayed, or if the housing is kinked, replace the cable.



Carburetor

Idling 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 cables 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.

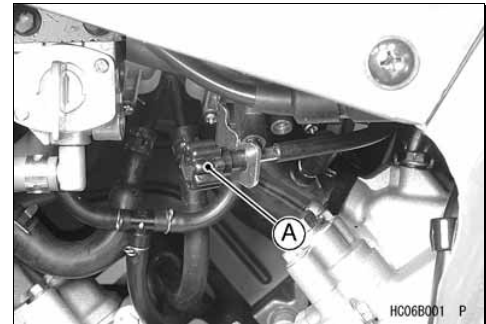
- Check idle speed with a suitable tachometer.
- ★ If the idle speed is out of the specified range, adjust it.

Idle Speed

Standard: 1,100 ± 50 r/min (rpm)

Idle Speed Adjustment

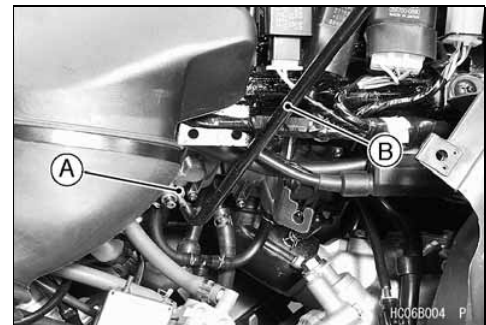
- Start the engine and warm it up thoroughly.
- Turn the idle adjusting screw [A] until the idle speed is correct.
- Open and close the throttle a few times to make sure that the idle speed is within the specified range. Readjust if necessary.



Pilot Screw Adjustment

- Adjust the pilot screw if necessary.
- Remove the air cleaner cover (see Frame chapter).
- Turn the carburetor pilot screw [A] all the way in until it seats lightly.

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



CAUTION

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

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

Carburetor Pilot Screw Setting

Standard: 2 1/4 turns out

Service Fuel Level Inspection

⚠ WARNING

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

- Remove the carburetor (see Carburetor Removal).

2-14 FUEL SYSTEM

Carburetor

- Set the carburetor [A], fuel level gauge [B], and fuel [C] as follows.
 - Special Tool - Fuel Level Gauge: 57001-1017**
 - Place the additional graduation [D] 10 mm (0.39 in.) higher than the top graduation [E].
 - Put the carburetor horizontally and so that the outlet side faces downward.
 - Connect the fuel gauge and hose to the drain fitting of the carburetor.
 - Connect the fuel to the fuel inlet fitting.
 - 210 mm (8.27 in.) [F]
 - 12 mm (0.47 in.) [G]
 - Hold the gauge so that the additional graduation is placed slightly higher than the punch mark [H].
 - Feed the fuel into the carburetor, then loosen the carburetor drain screw.
- Special Tool - Carburetor Drain Plug Wrench, Hex 3: 57001-1269**
- Wait until the fuel level in the gauge settles.
- Hold the gauge vertically and lower it slowly so that the additional graduation aligns with the punch mark.

NOTE

- Do not align the additional graduation on the gauge lower than the punch mark. If it is lowered and then raised, the gauge will show a fluid level that is higher than the actual level, which will require a remeasurement.

- Read the fuel level [G].
- ★ If the fuel level is incorrect, adjust it.

Service Fuel Level

Standard: 12 ± 1 mm (0.47 \pm 0.04 in.) below the punch mark

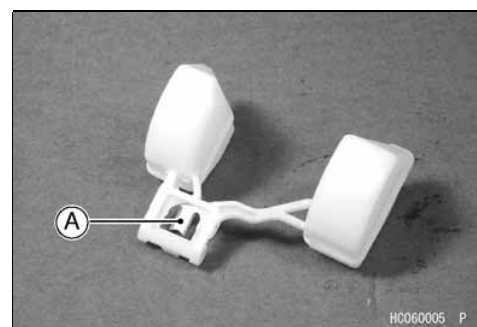
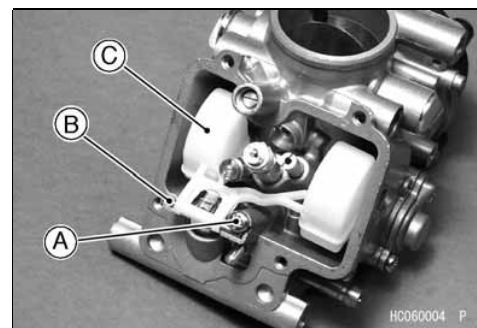
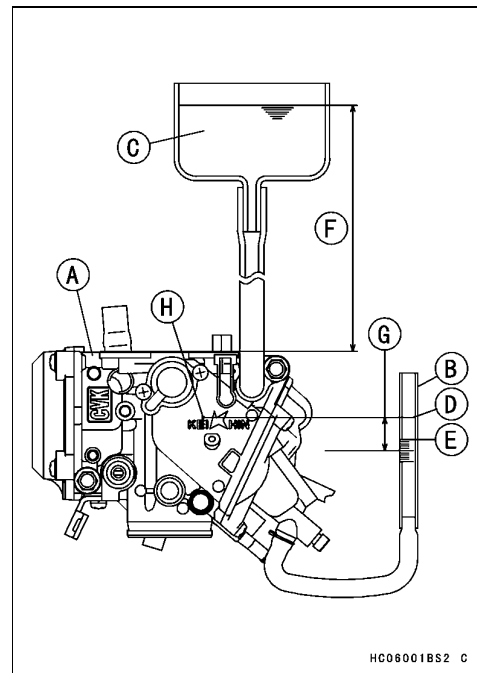
- Tighten the drain screw.
- Repeat the same procedure for the other carburetor.

Service Fuel Level Adjustment

⚠ WARNING

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

- Remove the carburetors, and drain the fuel.
- Remove the float chamber.
- Remove the screw [A].
- Slide out the pivot pin [B] and remove the float [C].
- Bend the tang [A] on the float arm very slightly to change the float height.

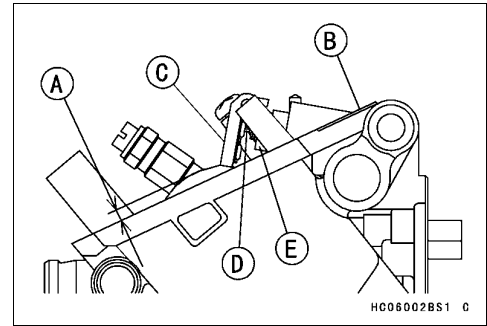


Carburetor

Float Height

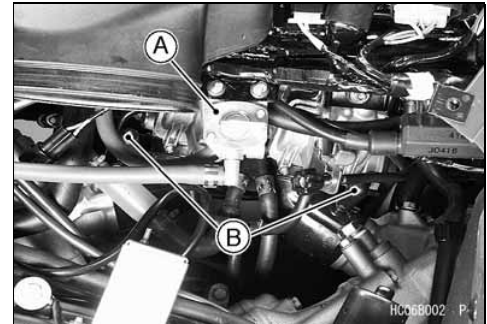
Standard: $4.0 \pm 1 \text{ mm}$ ($0.157 \pm 0.040 \text{ in.}$)

- Measure the float height [A] from the mating surface [B] of float by tilting the carburetor so that the tang of the float [C] just touches the needle rod [D]. At this time, the float valve [E] rod must not be depressed.
- Increasing the float height lowers the fuel level and decreasing the float height raises the fuel level.
- Assemble the carburetor and recheck the fuel level.
- ★ If the fuel level cannot be adjusted by this method, the float or the float valve is damaged.



Carburetor Synchronization Inspection

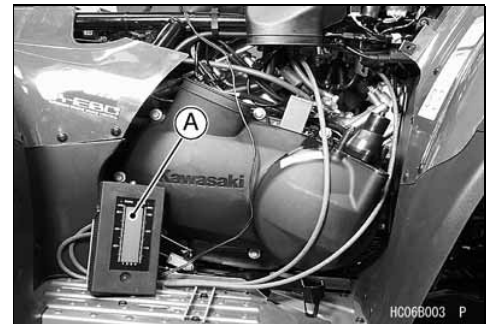
- Check idle speed.
- Remove:
 - Air Cleaner Cover
 - Fuel Tap [A]
 - Caps [B] on the Carburetor Holder



- Connect the battery wires to the battery.
- Attach a suitable vacuum gauge [A] to the fitting on the carburetor holder.
- Start the engine and read the intake vacuum of each carburetor when idling.
- ★ If the vacuum is out of the specified range, adjust it.

Carburetor Synchronization Vacuum

Standard: **Less than 2.7 kPa (2 cmHg) difference between carburetors**



Carburetor Synchronization Adjustment

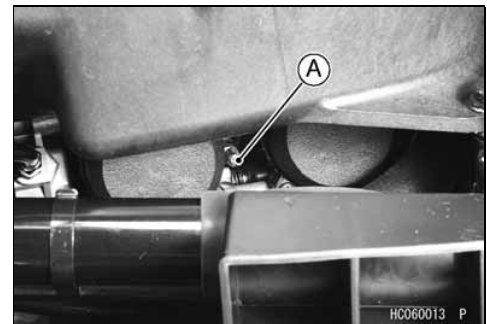
- Turn the adjust screw [A] to synchronize the carburetors.
- ★ If the carburetor synchronization cannot be obtained by using the adjusting screw, check for dirt or blockage, and then check the pilot screw settings.

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

- Check the carburetor synchronization again.

NOTE

- Do not turn the pilot screws carelessly during carburetor synchronization. You may cause poor running at low engine speed.
- Check idle speed.



2-16 FUEL SYSTEM

Carburetor

Fuel System Cleanliness Inspection

⚠ WARNING

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

- Place a suitable container under the drain plugs [A].
- Remove the carburetor drain plug and check to see if water or dirt comes out.
- ★ If any water or dirt appears during the above inspection, clean the carburetors and the fuel tank.

Carburetor Removal

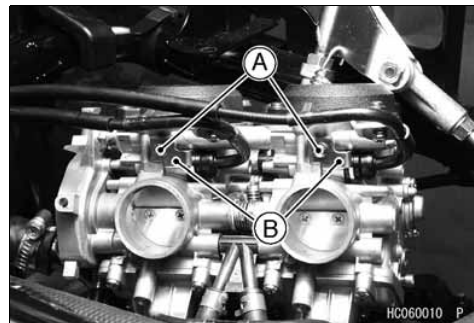
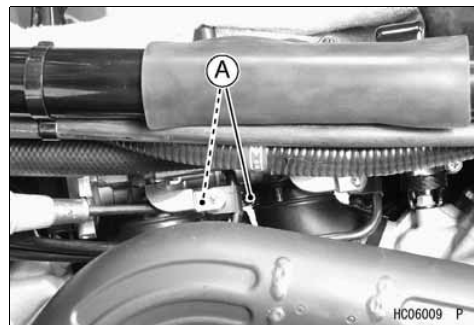
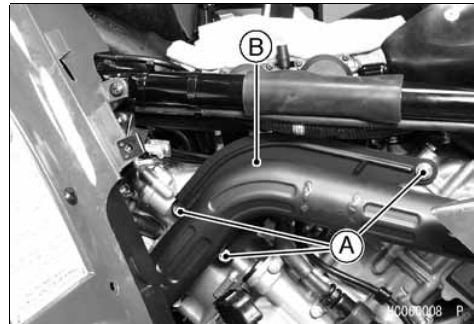
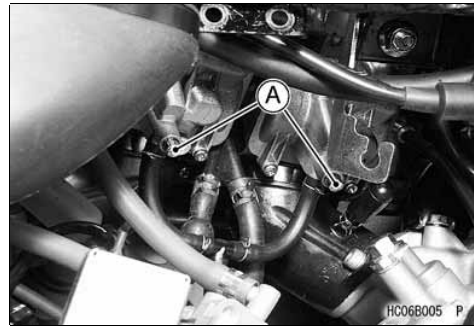
⚠ WARNING

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

- Drain the coolant (see Cooling System chapter).
- Remove:
 - Air Cleaner Housing (see Air Cleaner Housing Removal)
 - Side Cover (see Frame chapter)
 - Bolts [A] and Heat Guard Plate [B]
 - Throttle Cable Lower End
 - Fuel Hose
 - Coolant Hoses

- Loosen the clamp screws [A] on the carburetor holders.
- Remove the carburetor out of the frame.

- Remove the screws [A] and holder plates [B].
- Pull out of the starter plungers.



Carburetor

Carburetor Installation

- Check fuel leakage from the carburetors.

⚠ WARNING

Fuel spilled from the carburetors is hazardous.

- Adjust the idle speed (see Idle Speed Adjustment).
- Check the throttle cable (see Throttle Lever Free Play Inspection).
- Tighten:

Torque - Heat Guard Plate Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)

Carburetor Disassembly

- Remove the carburetors (see Carburetor Removal).

⚠ WARNING

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

NOTE

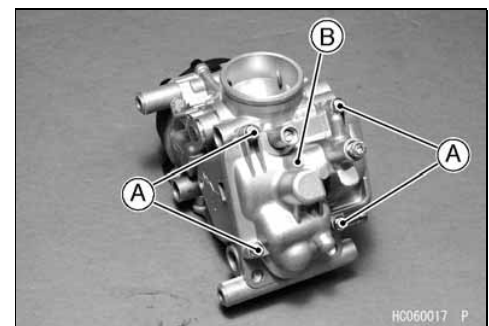
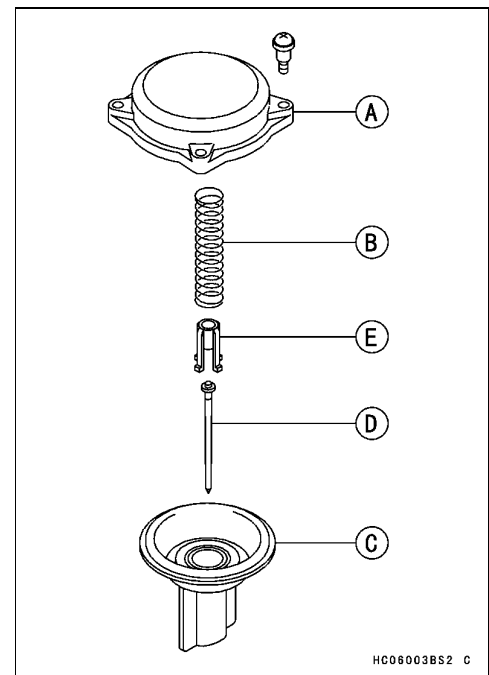
- The carburetors can be disassembled in the joined state.
- Remove the upper chamber cover [A], spring [B], and vacuum piston [C].

CAUTION

During carburetor disassembly, be careful not to damage the diaphragm. Never use a sharp edge to remove the diaphragm.

- Remove the jet needle [D] from the vacuum piston. These can be detached together with the spring seat [E].
- Do not remove the pilot screw if possible, synchronization of the carburetors is necessary if pilot screws are removed (see Pilot Screw Adjustment).

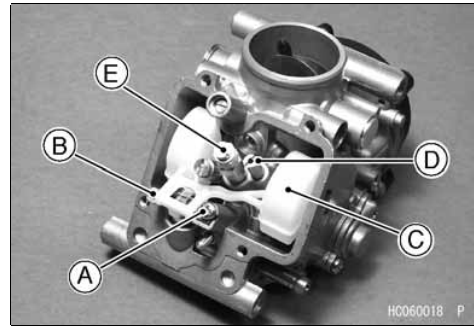
- Remove:
 - Screws [A]
 - Float Chamber [B]



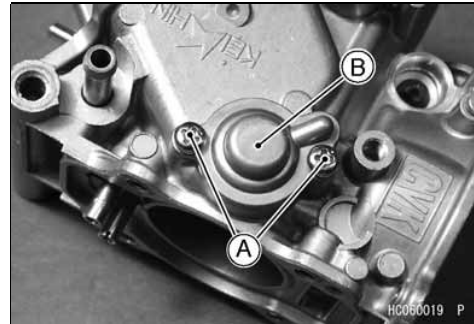
2-18 FUEL SYSTEM

Carburetor

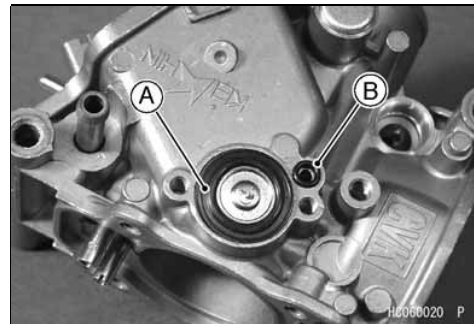
- Remove:
 - Screw [A]
 - Float Pivot Pin [B], Float [C], and Float Needle Valve
 - Pilot Jet [D]
 - Main Jet [E]



- Remove:
 - Screws [A]
 - Coasting Enricher Cover [B]



- Remove:
 - Diaphragm [A]
 - O-ring [B]



Carburetor Assembly

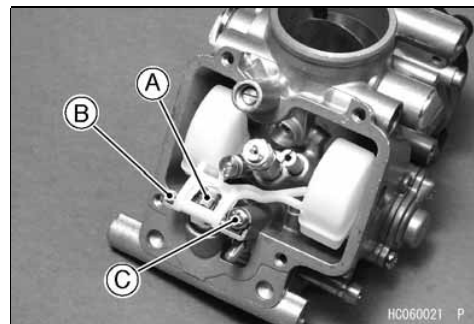
WARNING

Fuel spilled from the carburetors is hazardous.

CAUTION

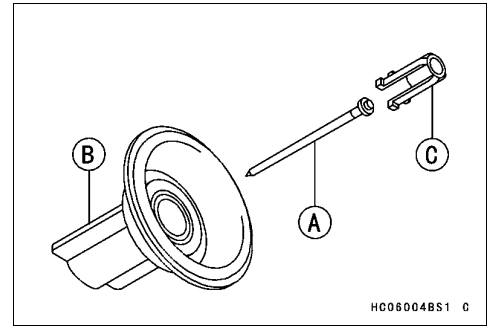
Do not apply force to the jet or overtighten it, or this could damage the jet or the carburetor body, requiring replacement.

- Install the float valve needle in the valve seat and hook the needle hanger [A] onto the float tang.
- Insert the float pivot pin [B] into the pivot post and the float.
- Tighten the screw [C].
- Set the float to the standard height (see Service Fuel Level Adjustment).

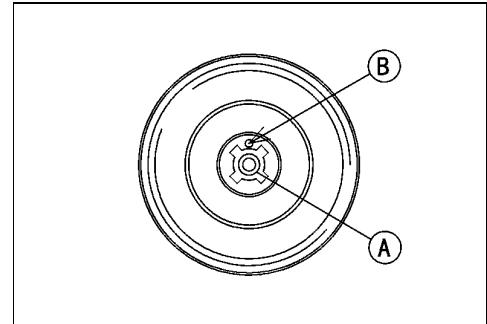


Carburetor

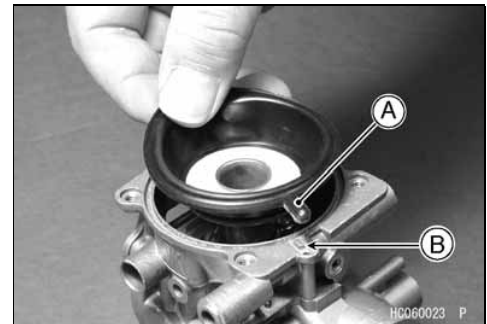
- Insert the jet needle [A] into the hole in the center of the vacuum piston [B], and place the spring seat [C] over the needle.



- Slip the needle through the hole in the center of the vacuum piston, and put the spring seat [A] on the top of the needle. Turn the seat so that it does not block the hole [B] at the bottom of the vacuum piston.
- After installing the upper chamber cover, check that the vacuum piston slides up and down smoothly without binding in the carburetor bore.

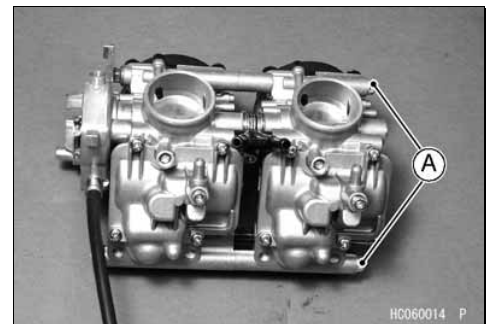


- Fit the projection [A] of the vacuum piston diaphragm in the recess [B] of the body.
- After installing the upper chamber cover, check to make sure that the vacuum piston moves smoothly in the carburetor body.



Carburetor Separation

- Remove:
 - Carburetor (see Carburetor Removal)
 - Carburetor Joining Bolts [A] and Nuts
- Separate the carburetors.



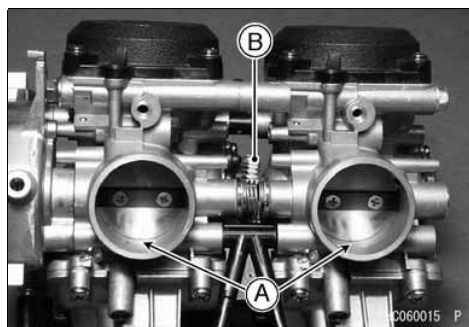
Carburetor Joining

- The center lines of the carburetor bores must be parallel both horizontally and vertically. If they are not, loosen the mounting screws and align the carburetors on a flat surface.
- Retighten the carburetor joining bolts.

2-20 FUEL SYSTEM

Carburetor

- Visually synchronize the throttle (butterfly) valves.
- Check to see that all throttle valves open and close smoothly without binding when turning the pulley.
- Visually check the clearance [A] between the throttle valve and the carburetor bore in each carburetor.
- ★ If there is a difference between two carburetors, turn the balance adjusting screw [B] to obtain the same clearance.
- Install the carburetors (see Carburetor Installation).
- Adjust the synchronization (see Synchronization Adjustment).



Carburetor Cleaning

⚠ WARNING

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

CAUTION

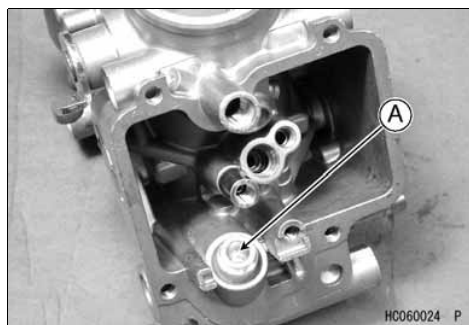
Do not use compressed air on an assembled carburetor, the float may be crushed by the pressure, and the vacuum piston diaphragm may be damaged.

Remove as many rubber or plastic parts from the carburetor as possible before cleaning the carburetor with a cleaning solution. This will prevent damage or deterioration of the parts.

The carburetor body has plastic parts that cannot be removed. Do not use a strong carburetor cleaning solution which could attack these parts; instead, use a mild high flash-point cleaning solution safe for plastic parts.

Do not use wire or any other hard instrument to clean carburetor parts, especially jets, as they may be damaged.

- Disassemble the carburetor and clean all the metal parts in a carburetor cleaning solution.
- Rinse the parts in water and dry them with compressed air.
- Blow through the air and fuel passages with compressed air.
- Remove the float valve, spray cleaning solution from the valve seating surface into the fuel passage, and clean the strainer (press-fitted) with compressed air [A].
- Assemble the carburetor (see Carburetor Assembly).



Carburetor Inspection

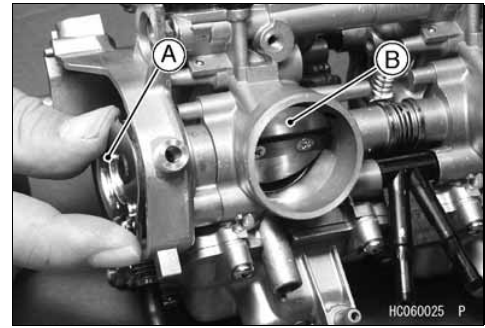
⚠ WARNING

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

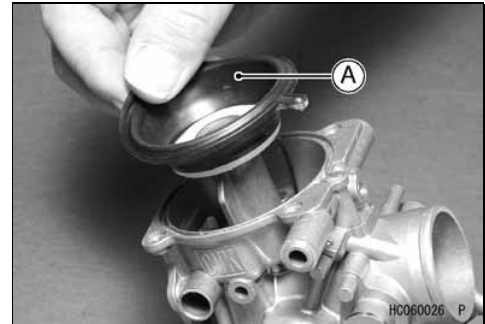
- Remove the carburetor (see Carburetor Removal).
- Before disassembling the carburetors, check the fuel level (see Fuel Level Inspection).

Carburetor

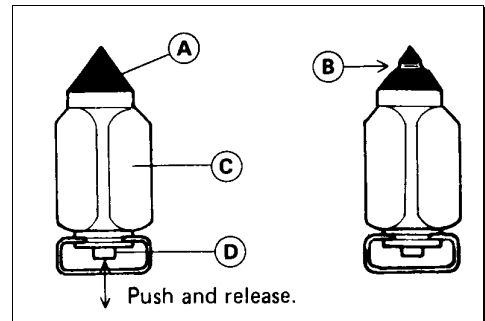
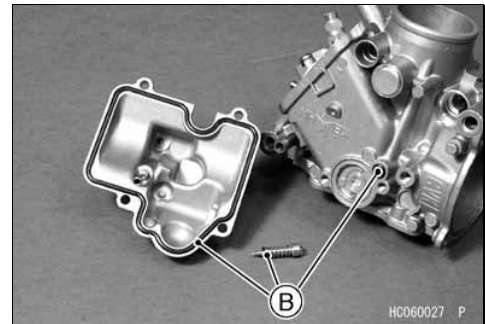
- Turn the throttle cable pulley [A] to check that the throttle butterfly valve [B] moves smoothly and return back with the spring tension.
- ★ If the throttle valve does not move smoothly, replace the carburetor.



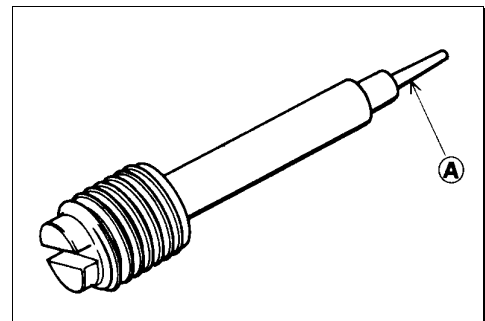
- Disassemble the carburetors (see Carburetor Disassembly).
- Clean the carburetor (see Carburetor Cleaning).
- Check the vacuum piston diaphragm [A], and the O-rings [B] on the float bowl, pilot screw, coasting enricher, and starter plunger cap.
- ★ If any of the diaphragm or O-rings are not in good condition, replace them.



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



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



2-22 FUEL SYSTEM

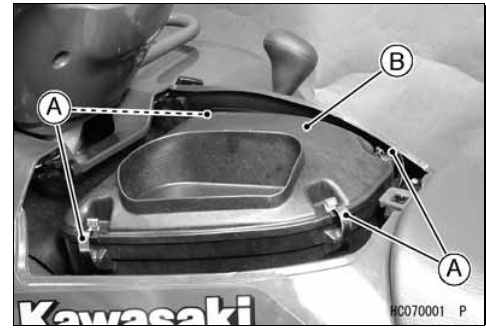
Carburetor

- Check that the vacuum piston moves smoothly in the carburetor body.
The surface of the piston must not be excessively worn.
- ★ If the vacuum piston does not move smoothly, or if it is very loose in the carburetor body, replace both the body and the vacuum piston.

Air Cleaner

Air Cleaner Element Removal (KVF650-A1/B1)

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



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

⚠ WARNING

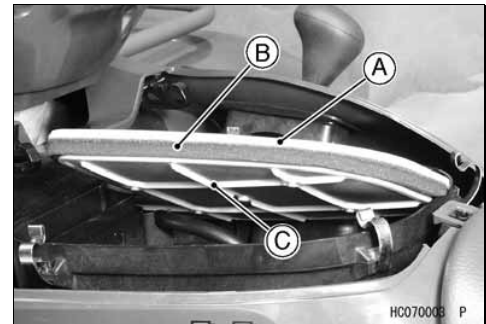
If dirt or dust is allowed to pass through into the carburetors, the throttle may become stuck, possibly causing an accident.

CAUTION

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

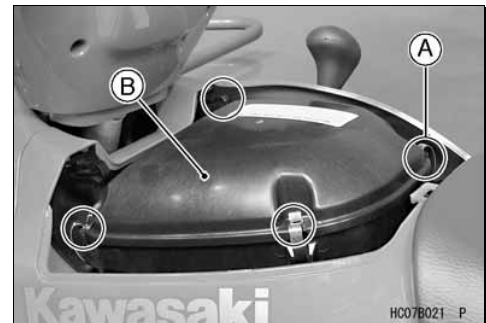


- Remove:
 - Upper Holder [A]
 - Element [B]
 - Lower Holder [C]



Air Cleaner Element Removal (KVF650-A2/B2)

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



2-24 FUEL SYSTEM

Air Cleaner

- Remove:
 - Thumbscrew [A]
 - Metal mesh [B] with element
- After removing the element, stuff pieces of lint-free, clean cloth into the air cleaner ducts to keep dirt out of the carburetor and engine.

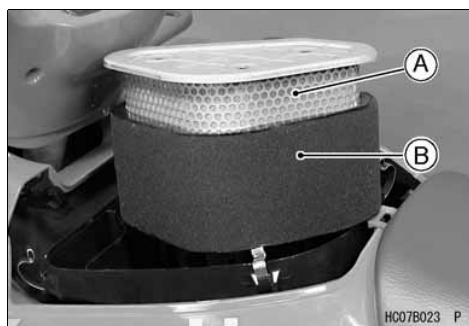
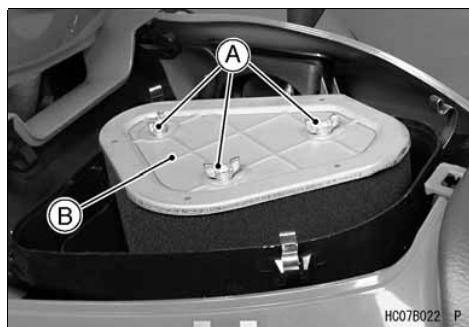
⚠ WARNING

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

CAUTION

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

- Separate metal mesh [A] and element [B].



Air Cleaner Element Installation (KVF650–A1/B1)

- Install the element with the yellow side facing up.

Air Cleaner Element Cleaning and Inspection

NOTE

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

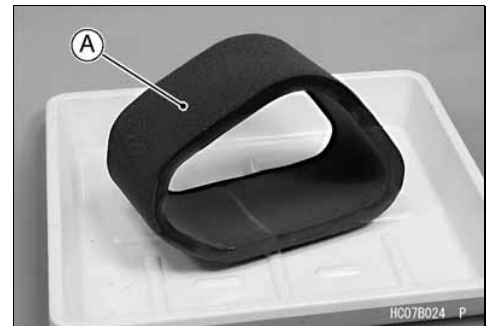
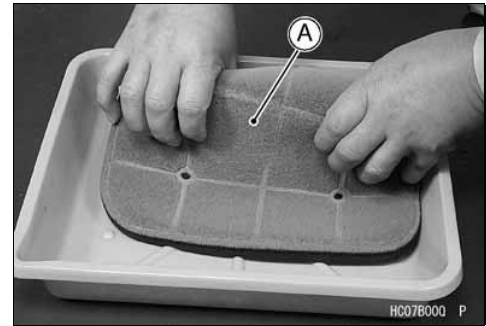
⚠ WARNING

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

- Remove the air cleaner element.

Air Cleaner

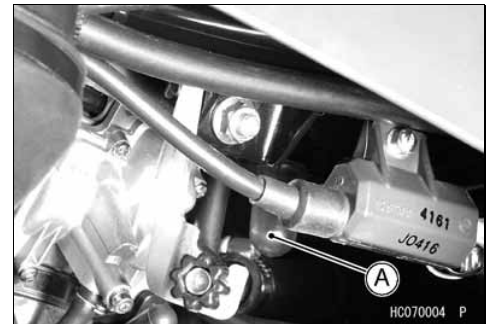
- Clean the element [A] in a bath of high flash-point solvent.
- Squeeze it dry in a clean towel. Do not wring the element or blow it dry; the element can be damaged.
- Inspect the element for damage.
- ★ If it is torn, punctured, or hardened, replace it.
- After cleaning, saturate the element with a 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 (KVF650–A1/B1)

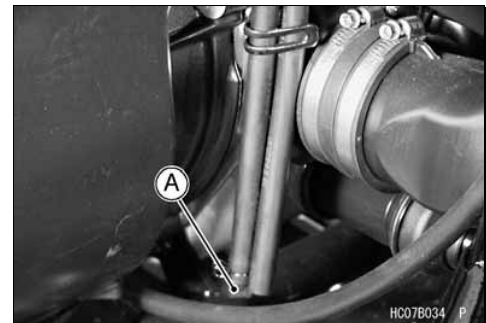
A drain tube [A] is connected to the bottom of the air cleaner housing to drain water or oil accumulated in the housing.

- Visually check the drain tube if the water or oil accumulates in the tube.
- ★ If any water or oil accumulates in the tube, drain it by taking off the tube. After draining, be sure to install the tube and clamp firmly.



Air Cleaner Draining (KVF650–A2/B2)

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



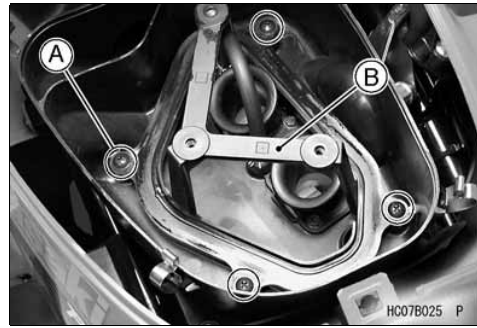
Air Cleaner Housing Removal

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Air Cleaner Housing Cap
 - Air Cleaner Element (Air Cleaner Element Removal)

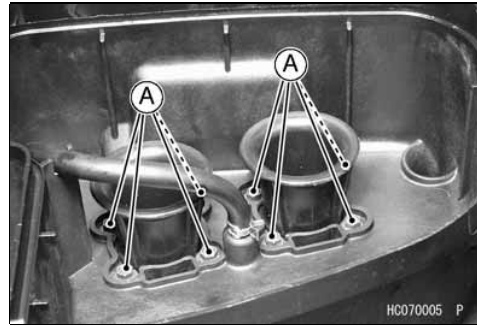
2-26 FUEL SYSTEM

Air Cleaner

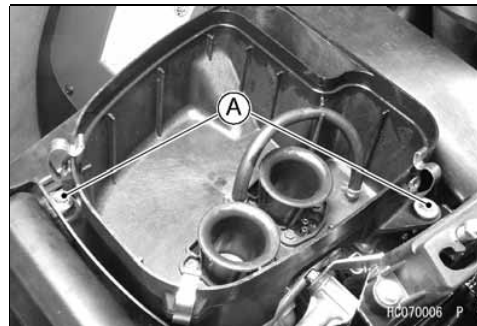
- Remove: (KVF650-A2/B2)
Screws [A]
Element Bracket [B]



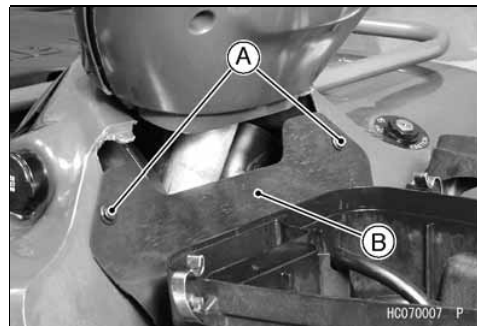
- Remove:
Air Cleaner Housing Bolts (M5) [A]



- Remove:
Air Cleaner Housing Bolts [A]

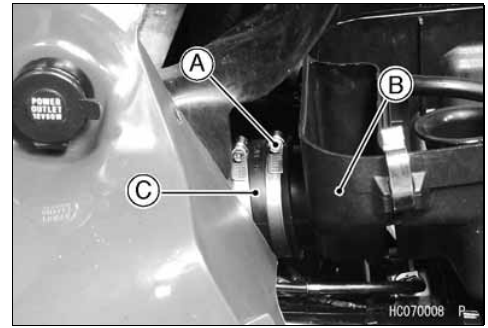


- Remove:
Rivets [A]
- Move the rubber cover [B] to loosen the clamp screw.

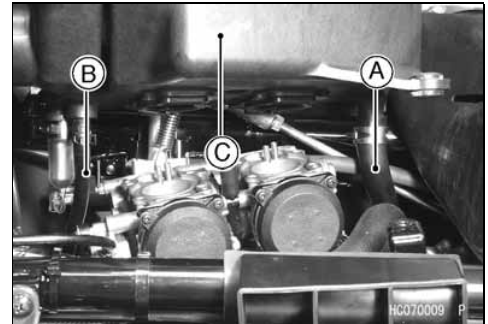


Air Cleaner

- Loosen the clamp screw [A].
- Remove the housing [B] from the duct [C].

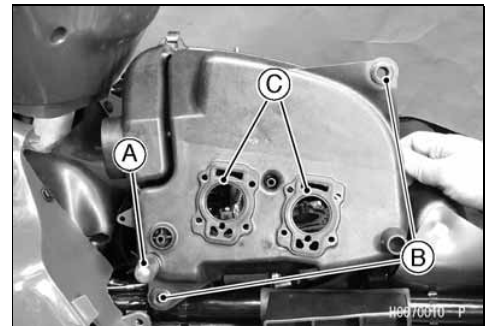


- Remove:
 - Breather Hose [A]
 - Air Vent Hose [B]
 - Air Cleaner Housing [C]

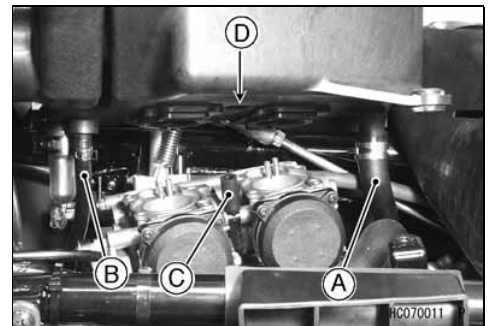


Air Cleaner Housing Installation

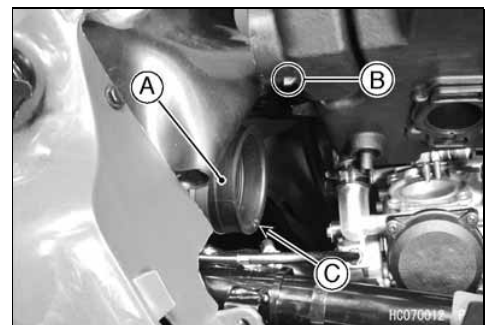
- Install:
 - Drain Tube [A]
 - Grommets [B]
 - Air Ducts [C]



- Install:
 - Breather Hose [A]
 - Air Vent Hose [B]
- Insert the carburetor air vent tube [C] in the fitting [D] of the housing.



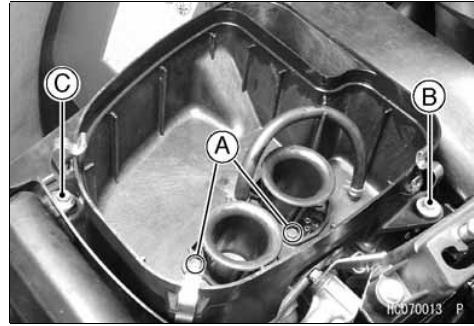
- Insert the fitting of the housing in the duct [A], and fit the projection [B] under the fitting in the groove [C] in the duct.



2-28 FUEL SYSTEM

Air Cleaner

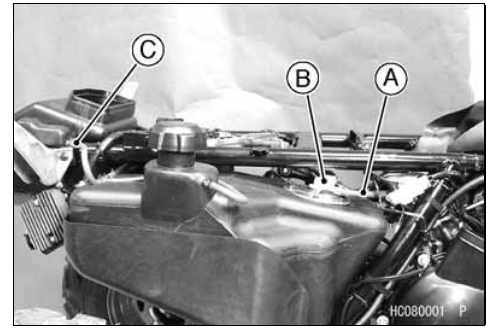
- Apply a non-permanent locking agent to the air cleaner housing bolts (M5) [A] and tighten them.
Torque - Air Cleaner Housing Bolts (M5): 5.9 N·m (0.6 kgf·m, 52 in·lb)
- Tighten:
Torque - Air Cleaner Housing Bolts (M6):
28.7 mm (1.13 in.) [B]: 8.8 N·m (0.9 kgf·m, 78 in·lb)
33 mm (1.30 in.) [C]: 8.8 N·m (0.9 kgf·m, 78 in·lb)
- Tighten:
Clamp Screw
- Install:
Rubber cover
Rivets
Air Cleaner Element (see Air Cleaner Element Installation)



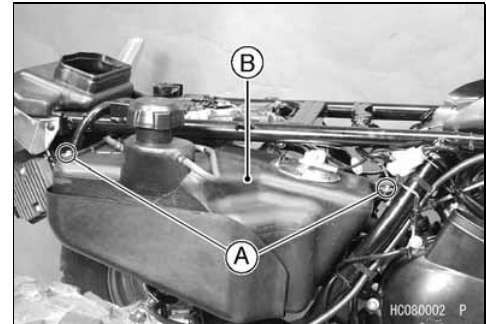
Fuel Tank

Fuel Tank Removal

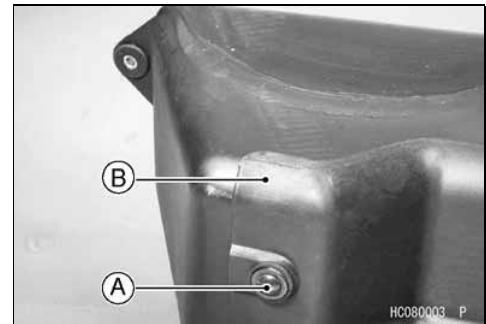
- Remove:
 - Rear Fender (see Frame chapter)
 - Fuel Hose [A]
 - Fuel Pump Lead Connector [B]
 - Breather Hose [C]



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

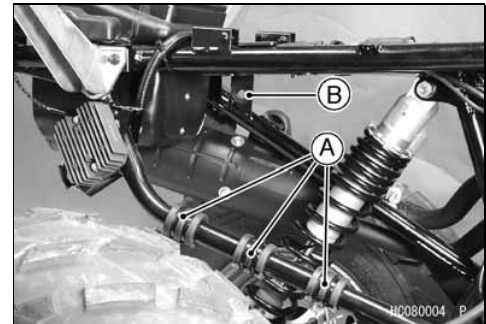


- Remove:
 - Screw [A]
 - Tank Cover [B]

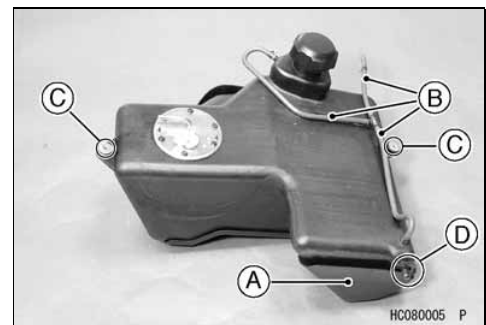


Fuel Tank Installation

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



- Install:
 - Screw and Tank Cover [A]
 - Breather Hoses [B]
 - Grommets and Collars [C]
- Insert the projection [D] on the fuel tank into the grommet in the frame.
- Be sure the fuel hose is clamped to the fuel pump fitting.



2-30 FUEL SYSTEM

Fuel Tank

Fuel Tank Cleaning

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

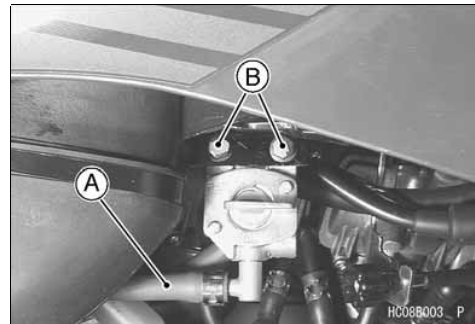
⚠ WARNING

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

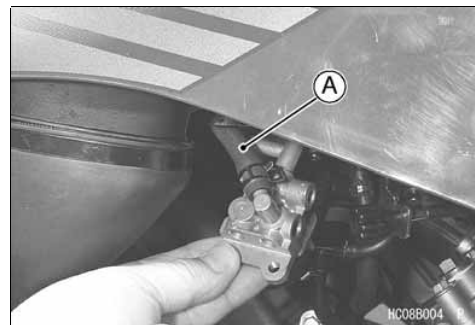
- Pour the solvent out the tank.
- Install the fuel tank (see Fuel Tank Installation).

Fuel Tap Removal

- Remove:
 - Fuel Hose [A]
 - Fuel Tap Mounting Bolts [B]

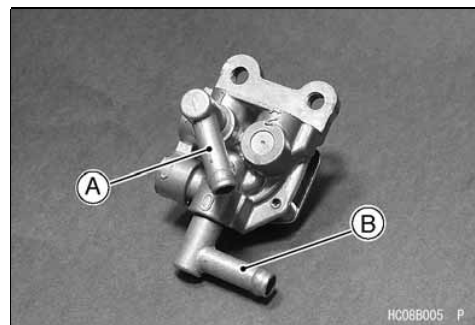


- Remove:
 - Fuel Hose [A]



Fuel Tap Installation

- Connect the fuel hoses to the fuel tap as follows.
 - Carburetor Hose to Fitting [A]
 - Fuel Tank Hose to Fitting [B]
- Be sure to clamp the fuel hoses to the fuel tap to prevent leakage.

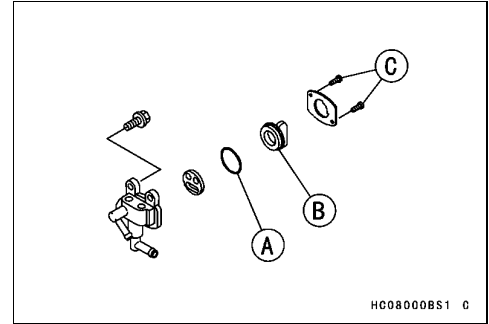


Fuel Tank

Fuel Tap Inspection

- Be sure the O-ring [A] is in good condition to prevent leakage.
- Apply grease to the lever [B].
- Tighten:

Torque - Fuel Tap Plate Screws [C]: 0.8 N·m (0.08 kgf·m, 7 in·lb)



2-32 FUEL SYSTEM

Fuel Pump

Fuel Pump Removal

CAUTION

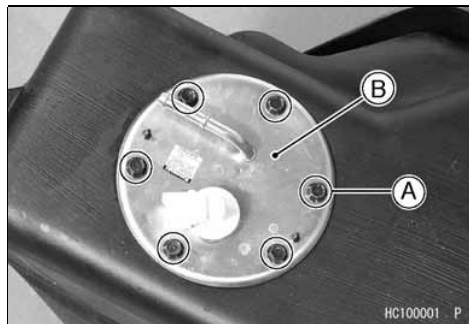
Never drop the fuel pump, especially on a hard surface. Such a shock to the pump can damage it.

WARNING

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

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

- Remove the fuel tank (see Fuel Tank Removal).
- Be careful of fuel spillage from the fuel tank since fuel still remains in the fuel tank and fuel pump.
- Unscrew the fuel pump bolts [A], and take out the fuel pump assembly [B] and gasket.
- Do not contact the float and fuel filter with the fuel tank.
- Discard the fuel pump gasket.

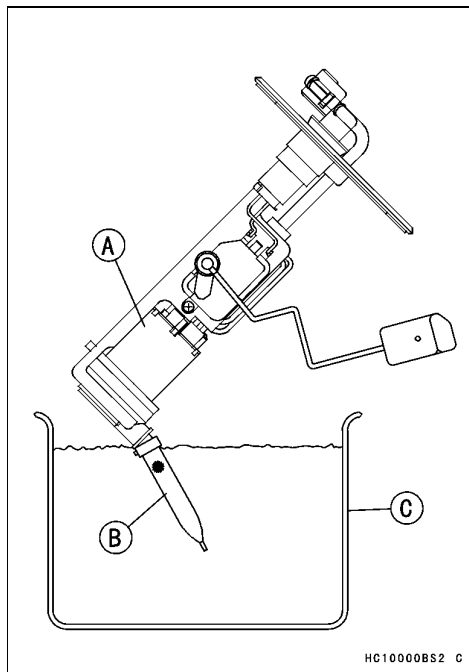


Pump Filter Cleaning

WARNING

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

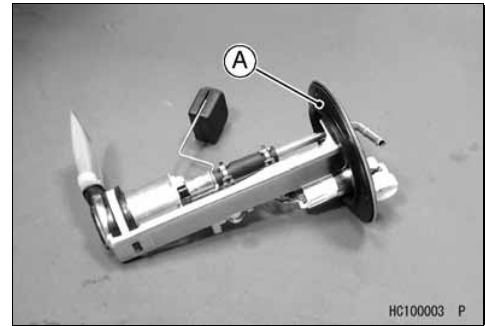
- Remove the fuel pump [A] along with the pump filter [B].
- Prepare a container [C] filled with a high-flash point solvent.
- Dip and shake the fuel filter only in the solvent to remove dirt and fuel deposits from the filter.
- Dry the pump and filter by lightly applying compressed air.
- Install the fuel pump (see Fuel Pump Installation).



Fuel Pump

Fuel Pump Installation

- Clean the pump filter (see Pump Filter Cleaning).
- Remove dirt or dust from the fuel pump by lightly applying compressed air.
- Replace the fuel pump gasket [A] with a new one.
- Install the fuel pump assembly so that the float and fuel filter do not contact with the fuel tank.



Fuel Pump Inspection

Refer to the Electrical System chapter.

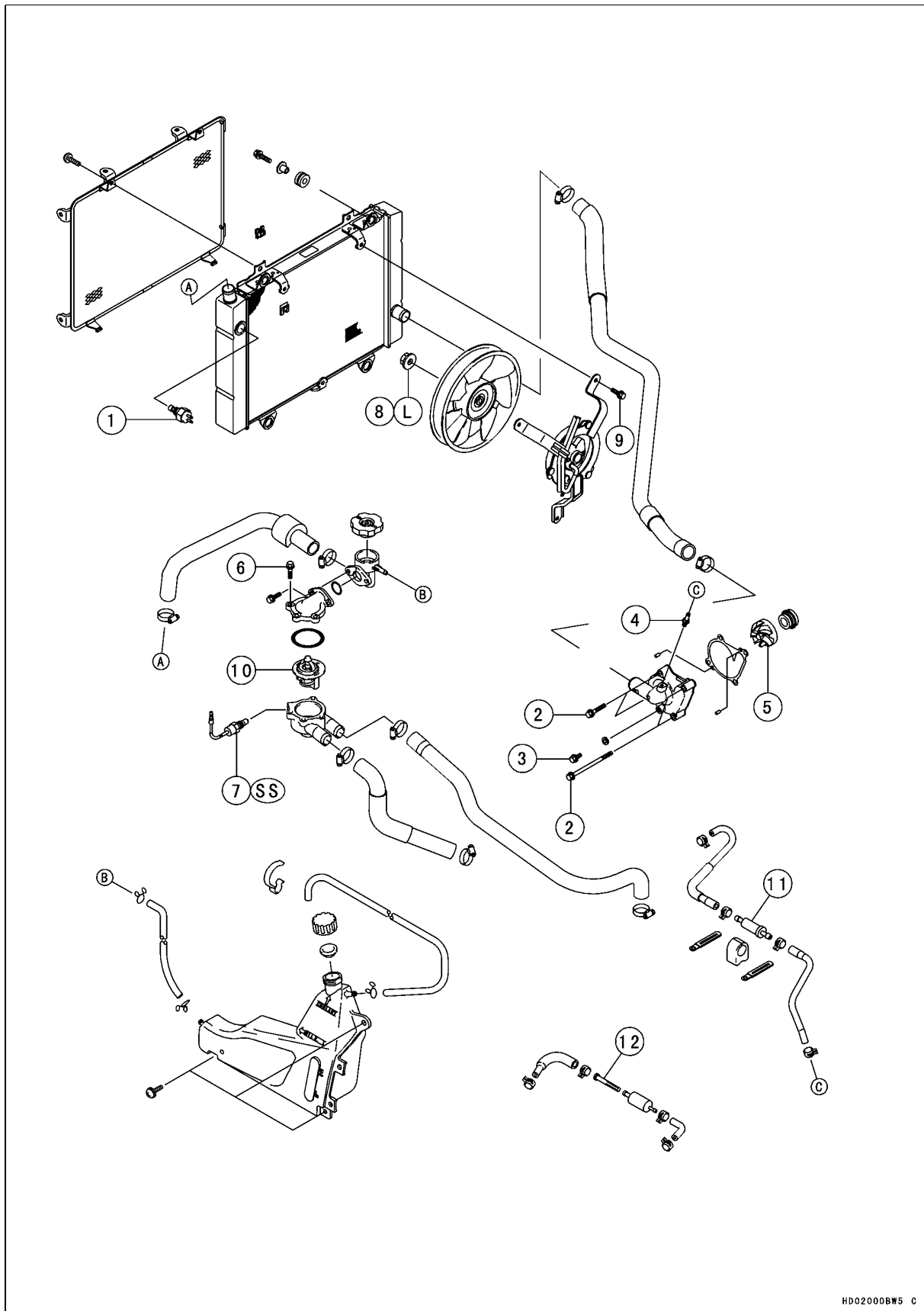
Cooling System

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3-2 COOLING SYSTEM

Exploded View



HD02000BWS C

COOLING SYSTEM 3-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Radiator fan switch	18	1.8	13	
2	Water pump cover bolts	8.8	0.9	78 in·lb	
3	Coolant drain plug	8.8	0.9	78 in·lb	
4	Water pump fitting bolt	9.8	1.0	87 in·lb	
5	Water pump impeller	7.9	0.8	69 in·lb	
6	Thermostat housing cover bolts	8.8	0.9	78 in·lb	
7	Coolant temperature warning light switch	7.9	0.8	69 in·lb	SS
8	Radiator fan mounting nut	2.7	0.28	24 in·lb	
9	Radiator fan assembly bolts	8.8	0.9	78 in·lb	

10: Thermostat

11: Coolant valve

12: Coolant filter

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

3-4 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.

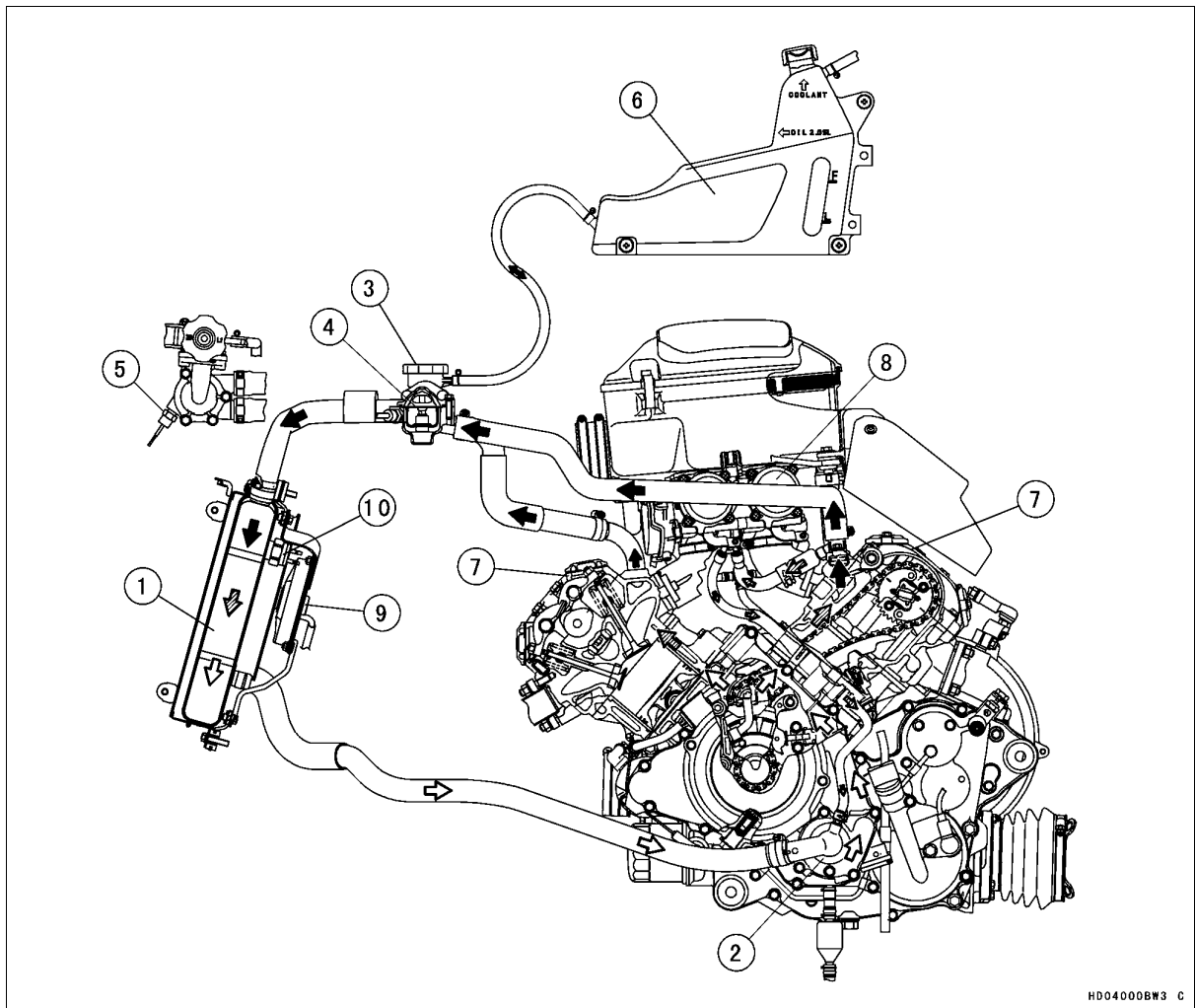
The thermostat is a wax pellet type which opens or closes with coolant temperature changes. The thermostat continuously changes its valve opening to keep the coolant temperature at the proper level. When coolant temperature is below $69.5 \sim 72.5^{\circ}\text{C}$, the thermostat closes so that the coolant flow is restricted through the air bleeder hole, causing the engine to warm up more quickly. When coolant temperature is more than $69.5 \sim 72.5^{\circ}\text{C}$, the thermostat opens and the coolant flows. When the coolant temperature goes up beyond $96 \sim 100^{\circ}\text{C}$, the radiator fan switch conducts to operate the radiator fan. The radiator fan draws air through the radiator core when there is not sufficient air flow such as at low speeds. This increases up the cooling action of the radiator. When the temperature is below $91 \sim 95^{\circ}\text{C}$, the fan switch opens and the radiator fan stops.

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

The system is pressurized by the radiator cap to suppress boiling and the resultant air bubbles which can cause engine overheating. As the engine warms up, the coolant in the radiator and the water jacket expands. The excess coolant flows through the radiator cap and hose to the reserve tank to be stored there temporarily. Conversely, as the engine cools down, the coolant in the radiator and the water jacket 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 $0.95 \sim 1.25 \text{ kgf/cm}^2$, 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 $0.95 \sim 1.25 \text{ kgf/cm}^2$. 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



HD04000BW3 C

- 1. Radiator
- 2. Water Pump
- 3. Radiator Cap
- 4. Thermostat
- 5. Coolant Temperature Warning Light Switch

- 6. Reserve Tank
- 7. Cylinder, Cylinder Head
- 8. Carburetor
- 9. Radiator Fan
- 10. Radiator Fan Switch

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

3-6 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	2.1 L (2.22 US qt) (reserve tank full level including radiator and engine)	---
Radiator cap:		
Relief pressure	93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm ² , 14 ~ 18 psi)	---
Thermostat:		
Valve opening temperature	69.5 ~ 72.5°C (157 ~ 162°F)	---
Valve full opening lift	8 mm or more @85°C (185°F)	---
Coolant Filter/Valve:		
Coolant valve closing temperature (for reference)	65°C (149°F) or more at 25 kPa (0.25 kgf/cm ² , 3.6 psi)	---

Special Tools - Hook Wrench: 57001-1101

Bearing Remover Shaft, $\phi 9$: 57001-1265

Bearing Remover Head, $\phi 10$ x $\phi 12$: 57001-1266

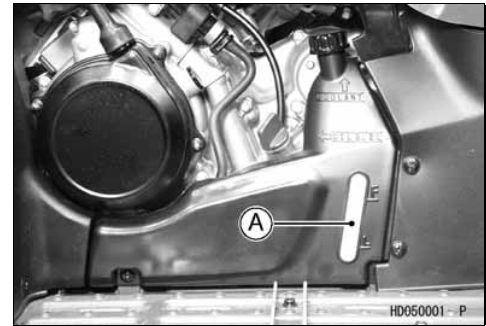
Bearing Driver Set: 57001-1129

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

Coolant

Coolant Deterioration Inspection

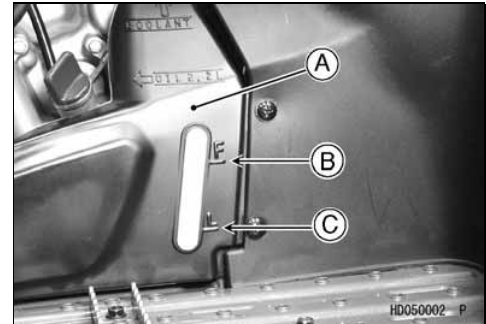
- Visually inspect the coolant in the reserve tank [A].
- ★ If whitish cotton-like wafts are observed, aluminum parts in the cooling system are corroded. If the coolant is brown, iron or steel parts are rusting. In either case, flush the cooling system.
- ★ If the coolant gives off an abnormal smell, 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]



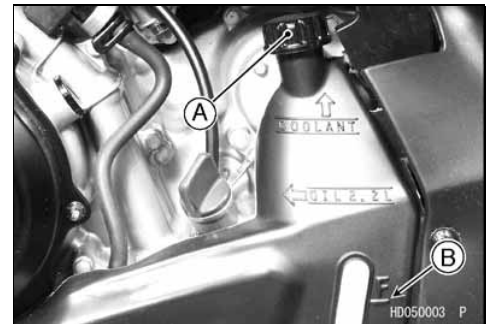
- ★ If the coolant level is lower than the L mark, Remove the reserve tank cap [A], then add coolant to the F mark [B].

CAUTION

For refilling, add the specified mixture of coolant and soft water. Adding water alone dilutes the coolant and degrades its anticorrosion properties.

The diluted coolant can attach the aluminum engine parts. In an emergency, soft water can be added. But the diluted coolant must be returned to the correct mixture ration 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

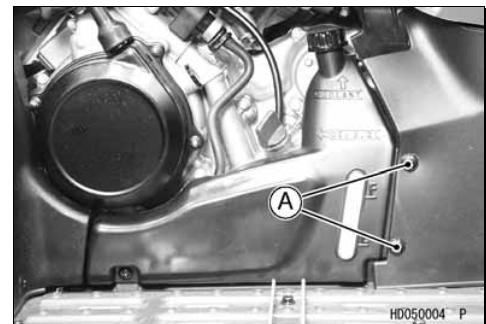
⚠ WARNING

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

Coolant on tires will make them slippery and can cause an accident and injury. Immediately wash away any coolant that spills on the frame, engine, or wheels.

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

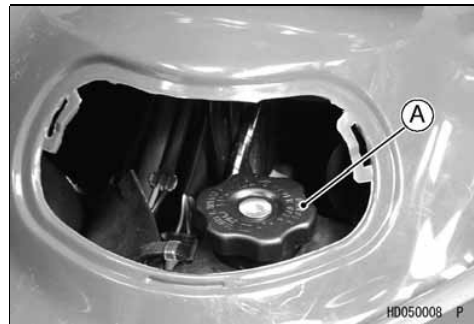
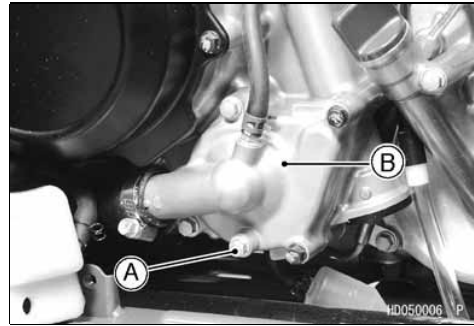
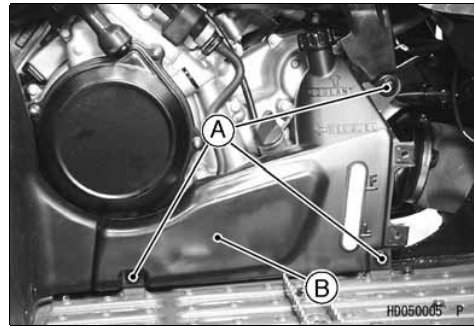
- Remove:
 - Rear Fender Flap Screws [A]



3-8 COOLING SYSTEM

Coolant

- Remove:
 - Reserve Tank Screws [A]
 - Reserve Tank [B] with Hose
- Place a container under the drain plug [A] at the bottom of the water pump [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.
- Remove the reserve tank cap, and pour the coolant into a container.



Coolant

Coolant Filling

- Tighten the drain plug.
- Torque - Coolant Drain Plug: 8.8 N·m (0.9 kgf·m, 78 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.

CAUTION

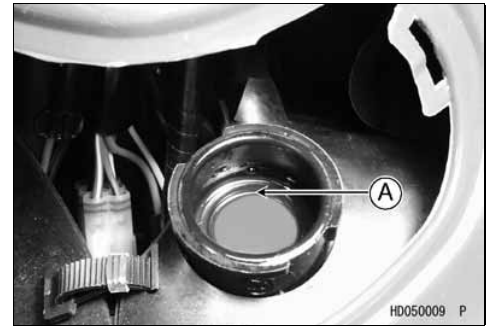
Soft or distilled water must be used with antifreeze (see Specifications in this chapter) in the cooling system. If hard water is used in the system, it causes scale accumulation in the water passages, considerably reducing the efficiency of the cooling system.

Water and Coolant Mixture Ratio (when shipping)

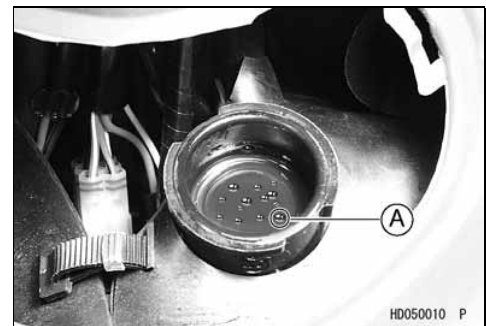
Soft Water:	50%
Coolant:	50%
Freezing Point:	-35°C (-31°F)
Total Amount:	2.1 L (2.22 US qt)

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.



HD050009 P



HD050010 P

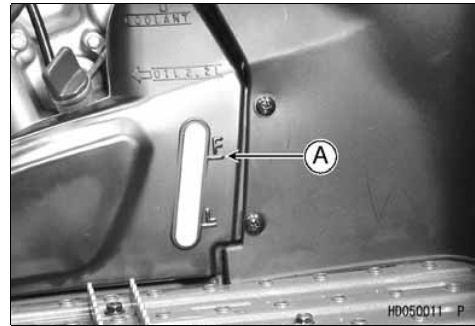
3-10 COOLING SYSTEM

Coolant

- 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.

CAUTION

Do not add more coolant above the F mark.



Pressure Testing

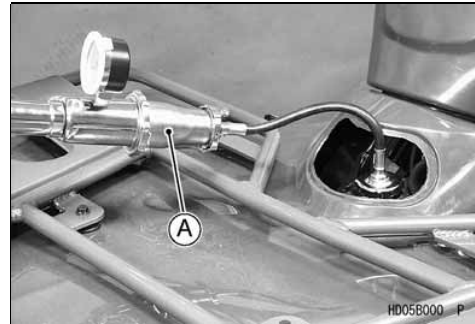
- Remove the radiator cap, and install a cooling system pressure tester [A] on the radiator filler neck.

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).

CAUTION

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).

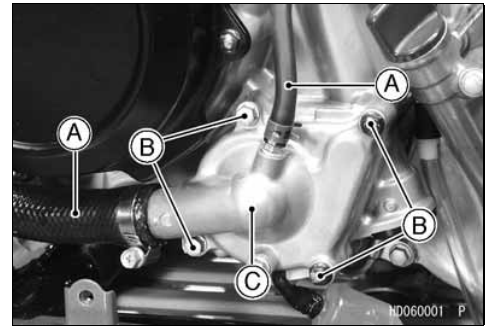


- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the system is alright.
- ★ If the pressure drops soon, check for leaks.

Water Pump

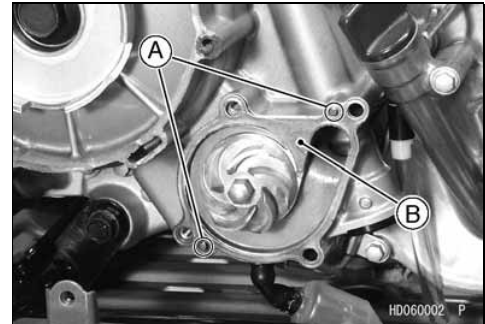
Water Pump Cover Removal

- Drain the coolant (see Coolant Draining).
- Remove:
 - Coolant Reserve Tank
 - Water Hoses [A]
 - Water Pump Cover Bolts [B]
 - Water Pump Cover [C]



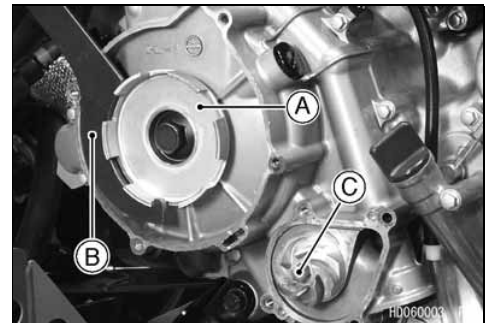
Water Pump Cover Installation

- Install:
 - Knock Pins [A]
 - New Gasket [B]
- Tighten:
 - Torque - Water Pump Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)



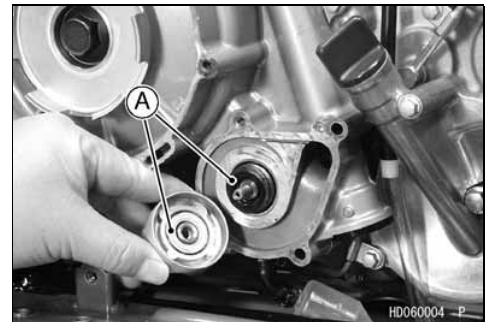
Impeller Removal

- Drain the coolant (see Coolant Draining).
- Remove:
 - Water Pump Cover (see Water Pump Cover Removal)
 - Recoil starter (see Engine Left Side chapter)
- Holding the recoil starter pulley [A] steady with the hook wrench [B], loosen the water pump impeller [C] counterclockwise.
- Special Tool - Hook Wrench: 57001-1101



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.
- Special Tool - Hook Wrench: 57001-1101
- Torque - Water Pump Impeller: 7.9 N·m (0.8 kgf·m, 69 in·lb)

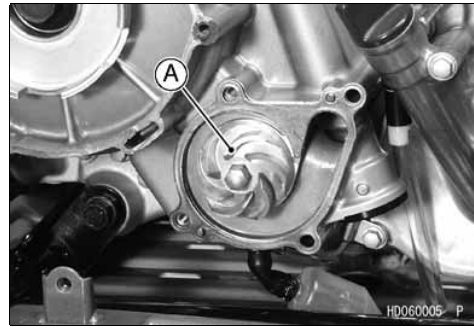


3-12 COOLING SYSTEM

Water Pump

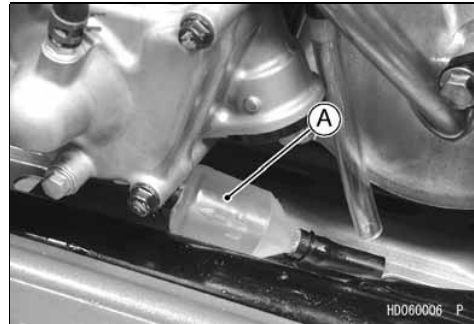
Water Pump Impeller Inspection

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



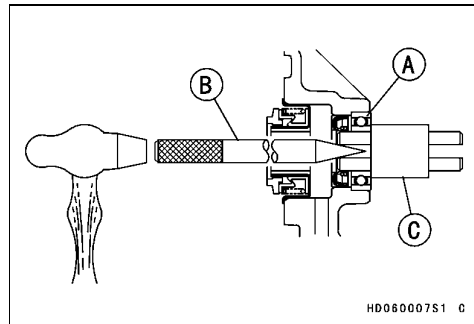
Water Pump Leakage Inspection

- 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).

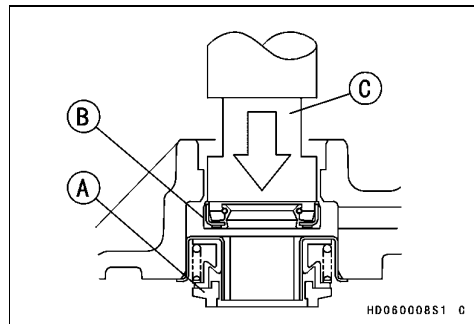


Mechanical Seal Replacement

- Remove:
 - Water Pump Impeller (see Water Pump Impeller Removal)
 - Alternator Cover (see Electrical System chapter)
- Take the bearing [A] out of the alternator cover, using the bearing remover.
 - Special Tools - Bearing Remover Shaft, $\phi 9$: 57001-1265 [B]**
 - Bearing Remover Head, $\phi 10 \times \phi 12$: 57001-1266 [C]**



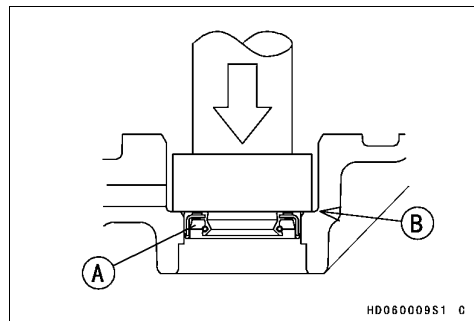
- Press out the mechanical seal [A] and oil seal [B] from the inside of the alternator cover with the bearing driver set [C].
 - Special Tool - Bearing Driver Set: 57001-1129**



CAUTION

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.

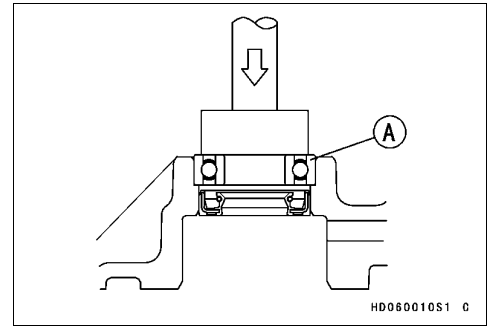
- Apply heat-resistance grease on the oil seal lip.
- From outside the alternator cover, press and insert the oil seal [A] flush [B] in the direction as shown.
 - Special Tool - Bearing Driver Set: 57001-1129**



Water Pump

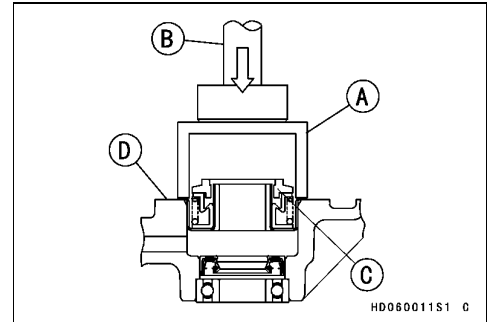
- From inside the alternator cover, press and insert the ball bearing [A] until it is bottomed.

Special Tool - Bearing Driver Set: 57001-1129



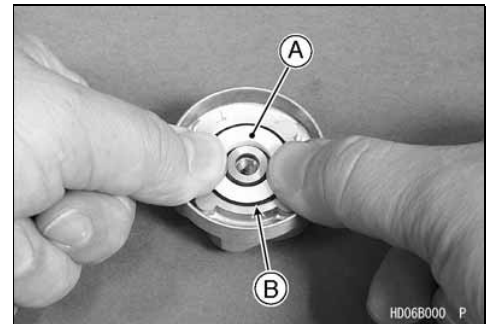
- Using a suitable socket [A] and the bearing driver [B], press and insert a new mechanical seal [C] until its flange stops at the step [D] of the hole.

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 the bolt clockwise.

Torque - Water Pump Impeller: 7.9 N·m (0.8 kgf·m, 69 in·lb)



3-14 COOLING SYSTEM

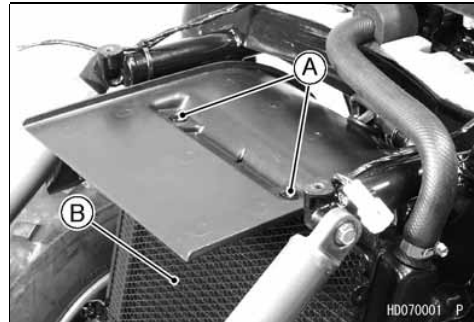
Radiator

Radiator Removal

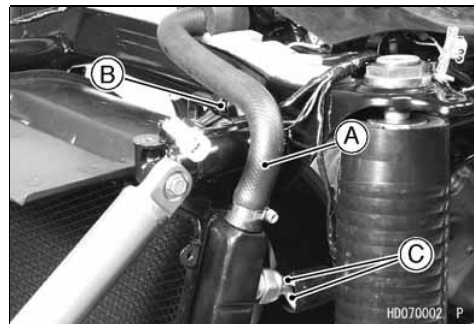
⚠ WARNING

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

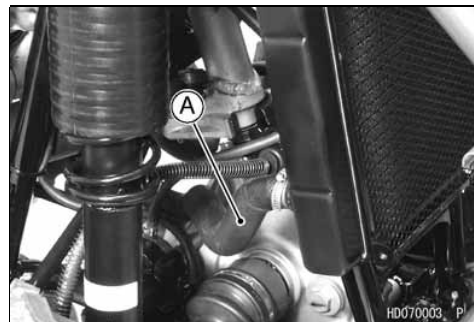
- Drain the coolant (see Coolant Draining).
- Remove:
 - Front Guard (see Frame chapter)
 - Right and Left Front Side Covers (see Frame chapter)
 - Screws [A]
 - Screen [B]



- Remove:
 - Radiator Hose [A]
 - Radiator Fan Wire Connector [B]
 - Radiator Fan Switch Connectors [C]



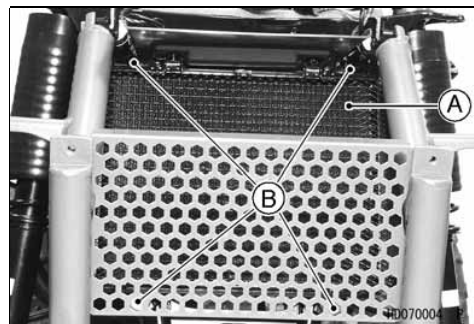
- Remove:
 - Radiator Hose [A]



- Remove the radiator [A] by taking off four mounting bolts [B].

CAUTION

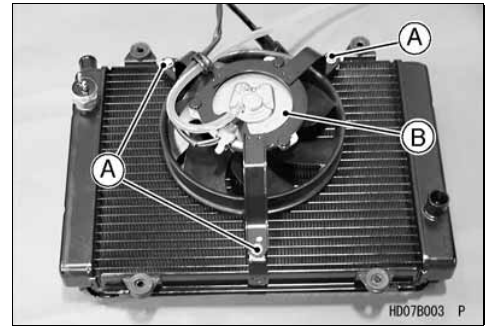
Do not touch the radiator core. This could damage the radiator fins, resulting in loss of cooling efficiency.



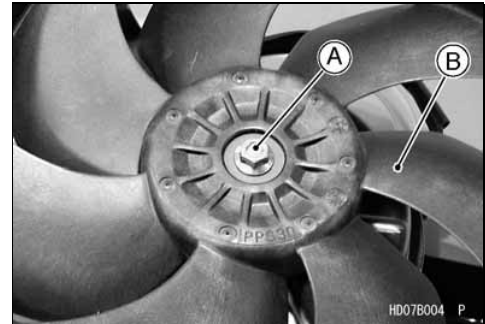
Radiator

Radiator Fan Removal

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

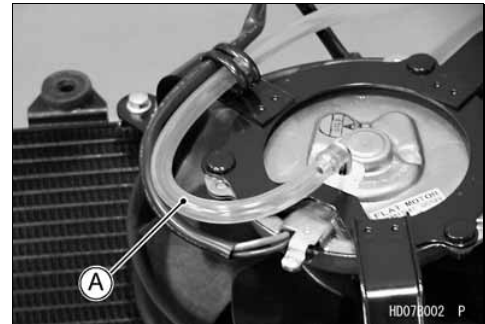


- Remove:
 - Radiator Fan Mounting Nut [A]
 - Radiator Fan [B]



NOTE

- When removing and installing the fan motor tube [A], do not crush the tube.

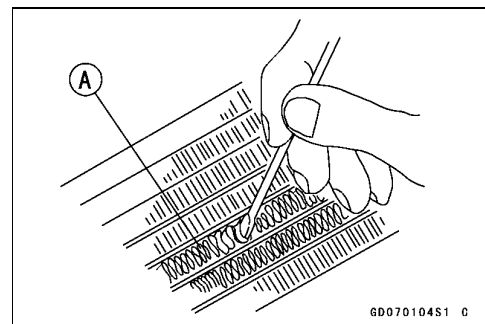


Radiator Fan Installation

- Install:
 - Radiator Fan
- Apply a non-permanent locking agent to the threads and tighten the mounting nut.
 - Torque - Radiator Fan Mounting Nut: 2.7 N·m (0.28 kgf·m, 24 in·lb)**
- Install:
 - Radiator Fan Assembly
- Tighten:
 - Torque - Radiator Fan Assembly Bolts: 8.8 N·m (0.9 kgf·m, 78 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.



3-16 COOLING SYSTEM

Radiator

Radiator Cleaning

CAUTION

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.

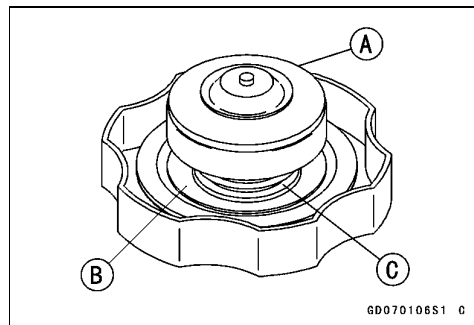
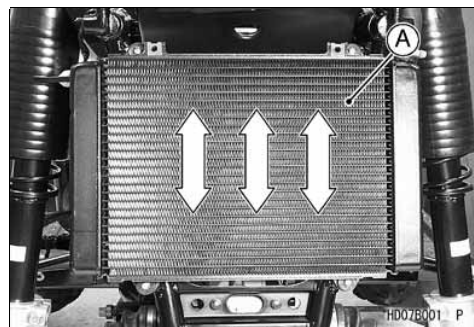
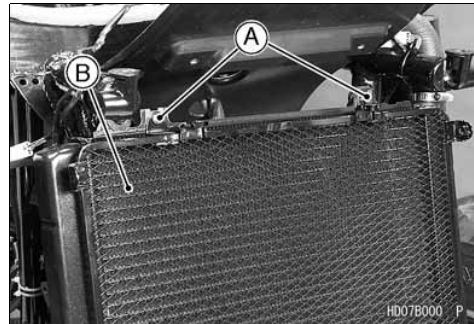
- Remove:
 - Front Guard (see Frame chapter)
 - Right and Left Front Side Covers (see Frame chapter)
 - Unscrew four mounting screws [A].
 - Raise the radiator screen [B] to clear the stoppers and remove the radiator screen.
 - Clean the radiator screen in a bath of tap water, and then dry it with compressed air or by shaking it.
-
- Clean the radiator.

CAUTION

When cleaning the radiator with steam cleaner, be careful of the following to prevent radiator damage.
Keep the steam gun away more than 0.5 m (20 in.) from the radiator core [A].
Hold the steam gun perpendicular to the core surface.
Run the steam gun following the core fin direction.

Radiator Cap Inspection

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



Radiator

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

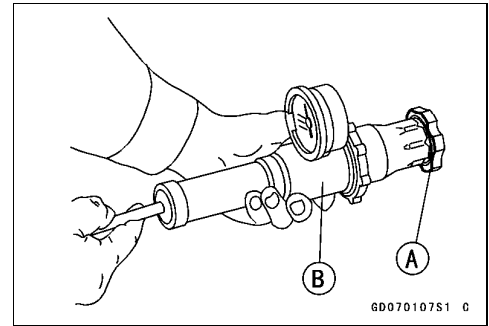
NOTE

- *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.

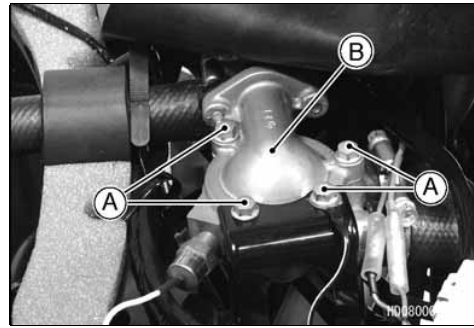


3-18 COOLING SYSTEM

Thermostat

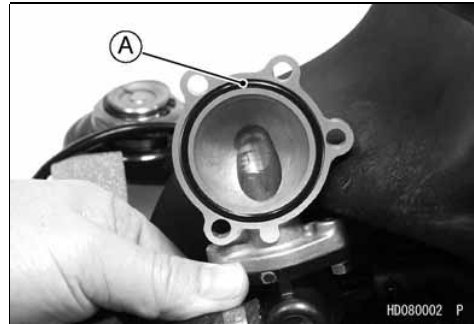
Thermostat Removal

- Drain the coolant (see Coolant Draining).
- Remove:
 - Front Fender (see Frame chapter)
 - Thermostat Housing Cover Bolts [A]
 - Thermostat Housing Cover [B]



Thermostat Installation

- Be sure to install the O-ring [A] on the housing cover.

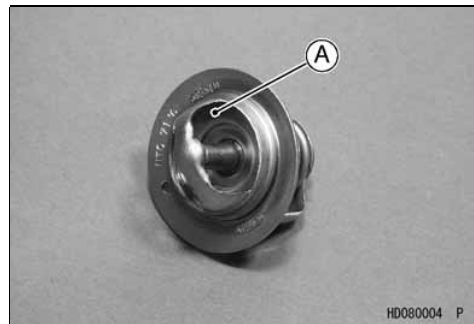


- Install the ground wire terminal [A] as shown.
- Tighten:
 - Torque - Thermostat Housing Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**
- Add coolant (see Coolant Filling).



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.



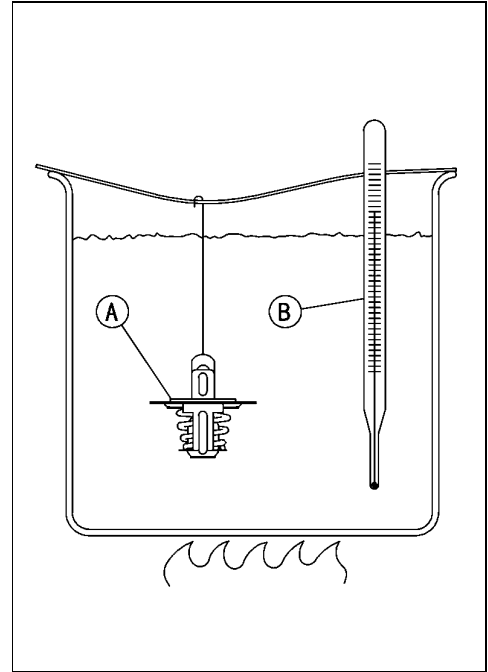
Thermostat

- To check valve opening temperature, suspend the thermostat in a container of water and raise the temperature of the water.
- ★ If the measurement is out of the specified range, replace the thermostat.

Thermostat Valve Opening Temperature

69.5 ~ 72.5°C (157 ~ 162°F)

- The thermostat [A] must be completely submerged and must not touch the container sides or bottom. Suspend an accurate thermometer [B] in the water. It must not touch the container, either.



3-20 COOLING SYSTEM

Radiator Fan Switch

Radiator Fan Switch Removal

CAUTION

<p>The fan switch should never be allowed to fall on a hard surface. Such a shock to the part can damage it.</p>

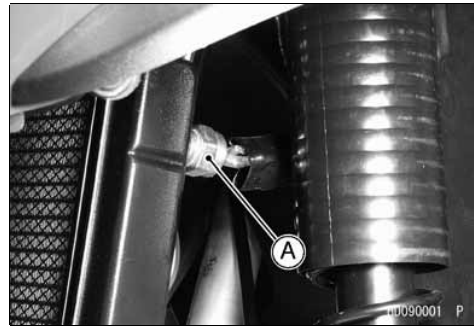
- Drain the coolant (see Coolant Draining).
- Remove:
 - Left Front Side Cover (see Frame chapter)
- Disconnect the fan switch leads.
- Remove the radiator fan switch [A].

Radiator Fan Switch Installation

- Tighten:
 - Torque - Radiator Fan Switch: 18 N·m (1.8 kgf·m, 13 ft·lb)**
- Fill the coolant (see Coolant Filling).

Radiator Fan Switch Inspection

Refer to the Electrical System chapter.



Coolant Temperature Warning Light Switch

Coolant Temperature Warning Light Switch Removal

CAUTION
<p>The coolant temperature warning light switch should never be allowed to fall on a hard surface. Such a shock to the part can damage it.</p>

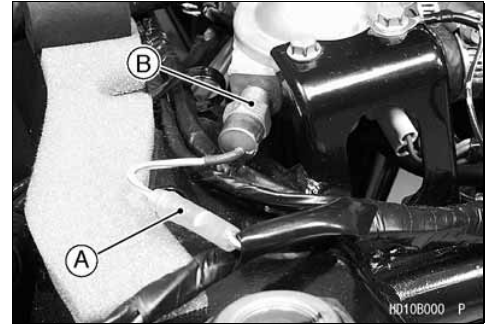
- Drain the coolant (see Coolant Draining).
- Remove the air cleaner duct.
- Disconnect the switch lead [A].
- Remove the switch [B].

Coolant Temperature Warning Light Switch Installation

- Apply silicone sealant to the threads of the switch and tighten it.
Sealant - Kawasaki Bond (Silicone Sealant): 56019-120
Torque - Coolant Temperature Warning Light Switch: 7.9 N·m (0.8 kgf·m, 69 in·lb)
- Fill the coolant (see Coolant Filling).

Coolant Temperature Warning Light Switch Inspection

Refer to the Electrical System chapter.



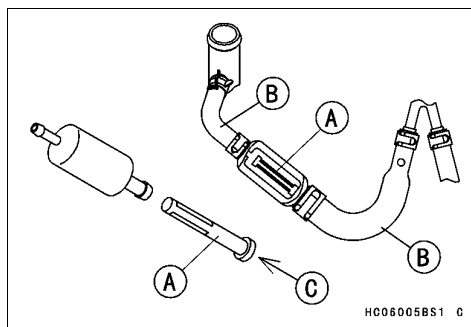
3-22 COOLING SYSTEM

Coolant Filter/Valve

Coolant Filter Cleaning

Before winter season starts, clean the filter of carburetor system.

- Remove the fuel tank (see Fuel Tank Removal).
- Drain the coolant (see Cooling System chapter).
- Remove the filter [A] from the cooling hoses [B] of carburetor system.
- Blow [C] off dirt and sediment on the filter with compressed air.

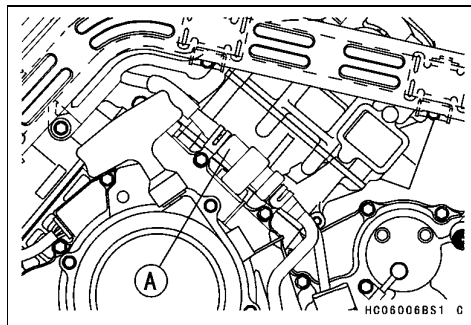


Coolant Valve Inspection

- Drain the coolant (see Cooling System chapter).
- Remove the coolant valve [A] on the engine left side.
- Inspect the coolant valve at room temperature.
- ★ If the valve is closed, replace the valve with a new one.
- To check valve opening just blow through the valve.

Valve Closing Temperature (for reference)

Standard: 65°C (149°F) or more at 25 kPa (0.25 kgf/cm², 3.6 psi)



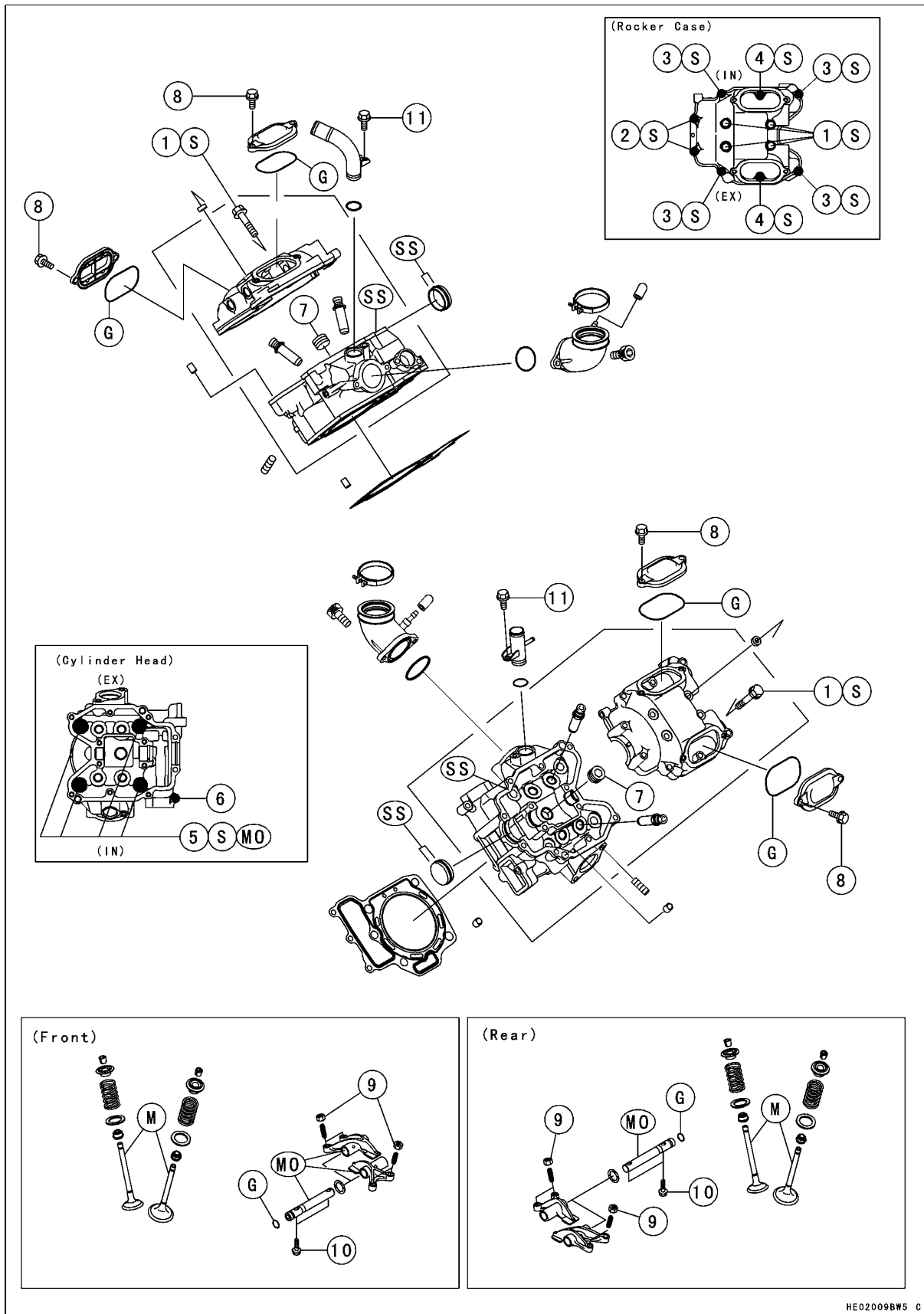
Engine Top End

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Cylinder Head.....	4-23	Spark Arrester Cleaning.....	4-37
Cylinder Compression Measurement.....	4-23	Muffler and Exhaust Pipe Removal.....	4-37
Cylinder Head Removal.....	4-23	Muffler and Exhaust Pipe Installation.....	4-38
Cylinder Head Installation.....	4-24	Exhaust System Inspection.....	4-38
Cylinder Head Cleaning.....	4-24		

4-2 ENGINE TOP END

Exploded View



HE02009BWS C

ENGINE TOP END 4-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rocker case bolts 55 mm (2.2 in.)	8.8	0.9	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	S
6	Cylinder head bolts (M6)	9.8	1.0	87 in·lb	
7	Cylinder head jacket plugs	20	2.0	14	
8	Valve adjusting cap bolts	8.8	0.9	78 in·lb	
9	Valve adjusting screw locknuts	12	1.2	104 in·lb	
10	Rocker shaft bolts	8.8	0.9	78 in·lb	
11	Water pipe bolts	9.8	1.0	87 in·lb	

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

M: Apply molybdenum disulfide grease.

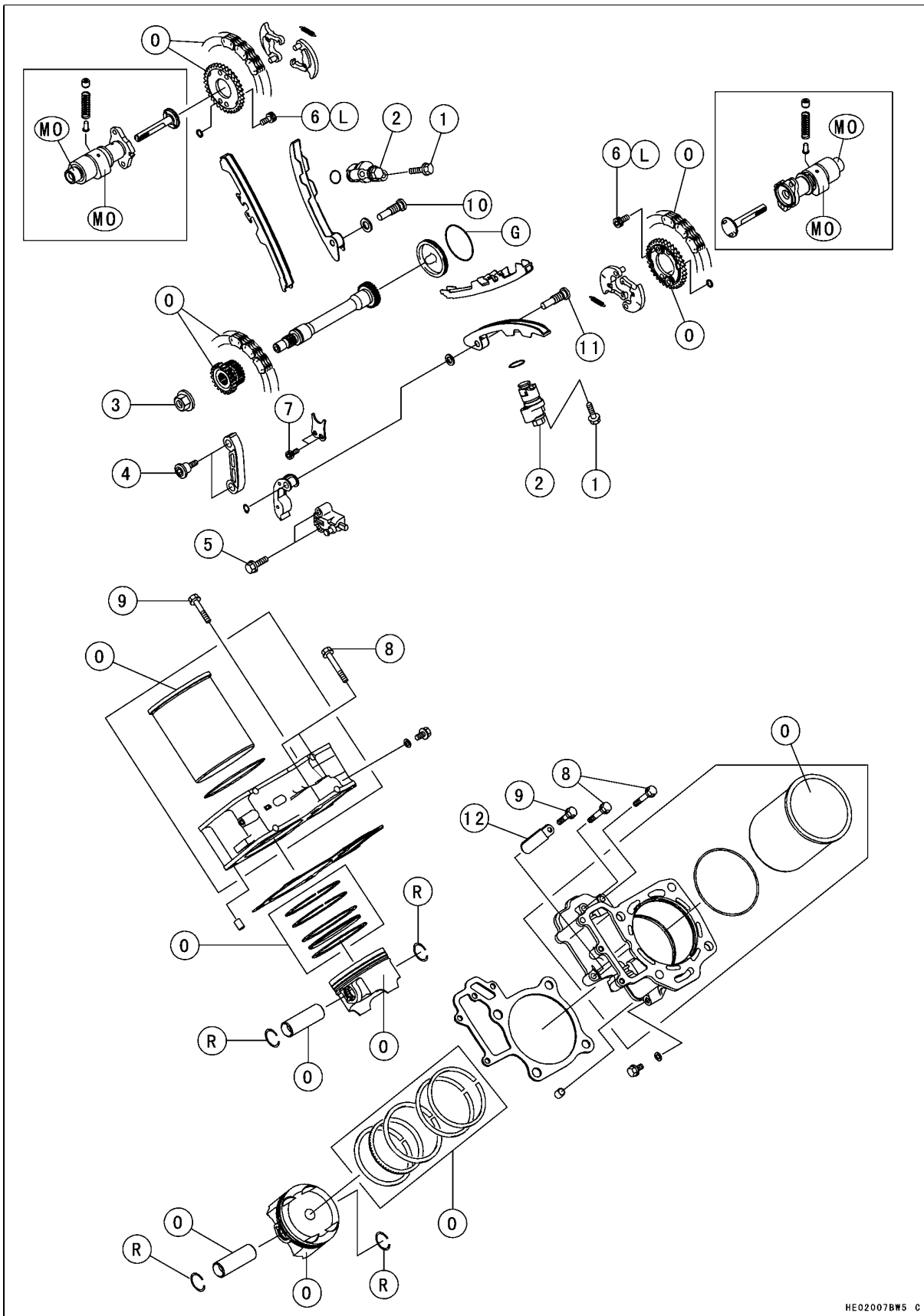
MO: Apply molybdenum disulfide oil.

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

S: Follow the specific tightening sequence.

4-4 ENGINE TOP END

Exploded View



HE02007BWS C

ENGINE TOP END 4-5

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Chain tensioner mounting bolts	8.8	0.9	78 in·lb	
2	Chain tensioner cap bolt	22	2.2	16	
3	Intermediate shaft sprocket nut	44	4.5	33	
4	Intermediate shaft chain guide bolts	8.8	0.9	78 in·lb	
5	Intermediate shaft chain tensioner bolts	8.8	0.9	78 in·lb	
6	Camshaft sprocket bolts	12	1.2	104 in·lb	L
7	Position plate bolts	8.8	0.9	78 in·lb	
8	Cylinder bolts 40 mm (1.6 in.)	9.8	1.0	87 in·lb	
9	Cylinder bolts 30 mm (1.2 in.)	9.8	1.0	87 in·lb	
10	Front cylinder camshaft chain guide bolt	20	2.0	14	
11	Rear cylinder camshaft chain guide bolt	20	2.0	14	

12: Clamp

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

L: Apply a non-permanent locking agent.

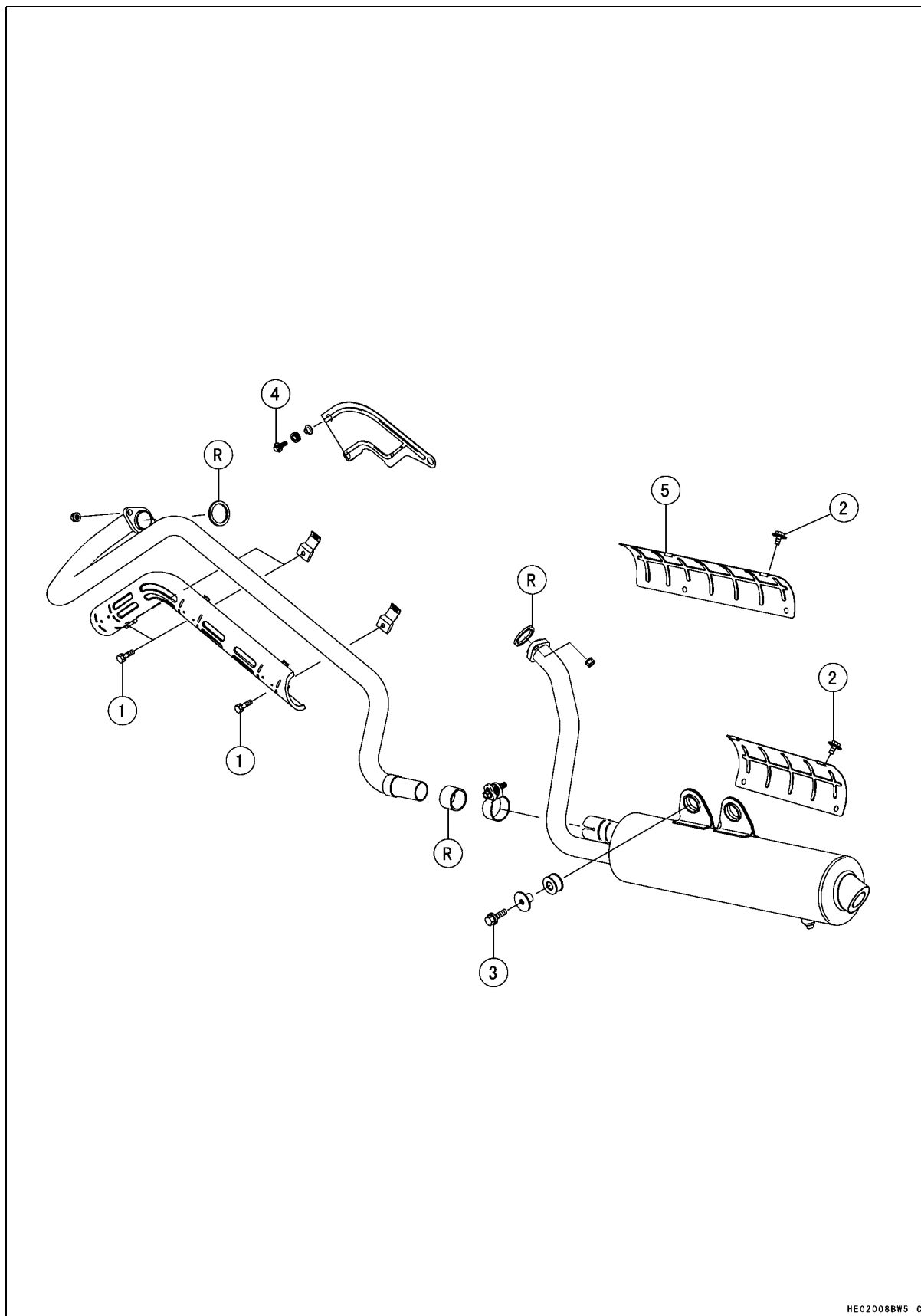
O: Apply engine oil.

MO: Apply molybdenum disulfide oil.

R: Replacement Parts

4-6 ENGINE TOP END

Exploded View



HE02008BW5 C

ENGINE TOP END 4-7

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Pipe cover bolts	8.8	0.9	78 in·lb	
2	Muffler cover bolts	8.8	0.9	78 in·lb	
3	Muffler mounting bolts	20	2.0	14	
4	Heat guard plate mounting bolts	8.8	0.9	78 in·lb	

5. Muffler Cover for KVF650-A2, B2

R: Replacement Parts

4-8 ENGINE TOP END

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	11.973 ~ 11.984 mm (0.4714 ~ 0.4718 in.)	11.95 mm (0.470 in.)
Camshafts:		
Cam height:		
Exhaust	35.363 ~ 35.477 mm (1.3932 ~ 1.3967 in.)	35.26 mm (1.388 in.)
Inlet	35.622 ~ 35.736 mm (1.4024 ~ 1.4069 in.)	35.52 mm (1.398 in.)
Camshaft bearing clearance:		
ϕ 18	0.016 ~ 0.052 mm (0.0006 ~ 0.0020 in.)	0.14 mm (0.0055 in.)
ϕ 22	0.020 ~ 0.062 mm (0.0008 ~ 0.0024 in.)	0.15 mm (0.0059 in.)
Camshaft journal diameter:		
ϕ 18	17.966 ~ 17.984 mm (0.7073 ~ 0.7080 in.)	17.94 mm (0.706 in.)
ϕ 22	21.959 ~ 21.980 mm (0.8645 ~ 0.8653 in.)	21.93 mm (0.863 in.)
Camshaft bearing inside diameter:		
ϕ 18	18.000 ~ 18.018 mm (0.7087 ~ 0.7094 in.)	18.08 mm (0.712 in.)
ϕ 22	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 \pm 30 r/min (rpm)	---
Cylinder Head:		
Cylinder compression (usable range)		
Electric starter	320 ~ 560 kPa (3.3 ~ 5.7 kgf/cm ² , 47 ~ 81 psi) @ 240 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.)	---
Inlet	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	---
Valve head thickness:		
Exhaust	0.8 mm (0.031 in.)	0.5 mm (0.020 in.)
Inlet	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.)
Inlet	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.)
Inlet	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.08 mm (0.20 in.)
Valve/valve guide clearance (wobble method):		
Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.34 mm (0.0133 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.28 mm (0.0110 in.)
Valve seat cutting angle	45°, 32°, 60°	---
Valve seating surface:		
Outside diameter:		
Exhaust	25.2 ~ 25.4 mm (0.992 ~ 1.000 in.)	---
Inlet	29.4 ~ 29.6 mm (1.157 ~ 1.165 in.)	---
Width:		
Exhaust	0.5 ~ 1.0 mm (0.02 ~ 0.04 in.)	---
Inlet	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.)
Inlet	41.3 mm (1.626 in.)	39.5 mm (1.555 in.)

Specifications

Item	Standard	Service Limit
Cylinder, Piston:		
Cylinder inside diameter	79.994 ~ 80.006 mm (3.1494 ~ 3.1498 in.)	80.09 mm (3.153 in.)
Piston diameter	79.949 ~ 79.964 mm (3.1476 ~ 3.1481 in.)	79.80 mm (3.142 in.)
Piston/cylinder clearance	0.030 ~ 0.057 mm (0.0012 ~ 0.0022 in.)	— — —
Piston ring/groove clearance:		
Top	0.040 ~ 0.080 mm (0.0016 ~ 0.0032 in.)	0.18 mm (0.0071 in.)
Second	0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Piston ring groove width:		
Top	1.030 ~ 1.050 mm (0.0405 ~ 0.0413 in.)	1.13 mm (0.0445 in.)
Second	1.020 ~ 1.040 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.)	0.9 mm (0.035 in.)
Second	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.9 mm (0.035 in.)
Piston ring end gap:		
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.)

- Special Tools - Outside Circlip Pliers: 57001-144**
Compression Gauge: 57001-221
Valve Spring Compressor Assembly: 57001-241
Piston Pin Puller Assembly: 57001-910
Valve Seat Cutter, 45° - ϕ 27.5: 57001-1114
Valve Seat Cutter, 32° - ϕ 28: 57001-1119
Valve Seat Cutter, 60° - ϕ 30: 57001-1123
Valve Seat Cutter Holder, ϕ 5: 57001-1208
Valve Seat Cutter Holder Bar: 57001-1128
Valve Seat Cutter, 45° - ϕ 30: 57001-1187
Valve Seat Cutter, 32° - ϕ 33: 57001-1199
Valve Spring Compressor Adapter, ϕ 22: 57001-1202
Valve Guide Arbor, ϕ 5: 57001-1203
Valve Guide Reamer, ϕ 5: 57001-1204
Piston Pin Puller Adapter: 57001-1211
Compression Gauge Adapter, M10 x 1.0: 57001-1486
- Sealant - Kawasaki Bond (Silicone Sealant): 56019-120**

4-10 ENGINE TOP END

Camshaft Chain Tensioner

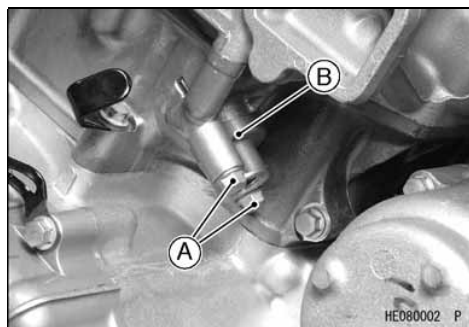
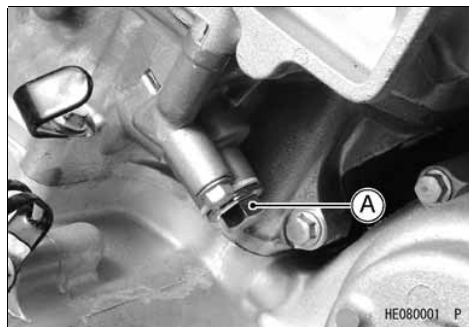
Camshaft Chain Tensioner Removal

CAUTION

This is a non-return type cam chain tensioner. The push rod does not return to its original position once it moves out to take up 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".

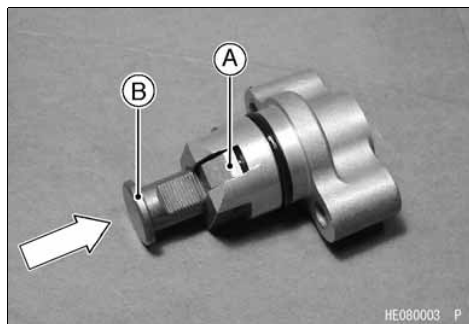
Do not turn over the crankshaft while the tensioner is removed. This could upset the cam chain timing, and damage the valves.

- Remove:
 - Cap Bolt [A] and Washer
 - Pin and Spring
- Remove:
 - Tensioner Mounting Bolts [A]
 - Camshaft Chain Tensioner [B]

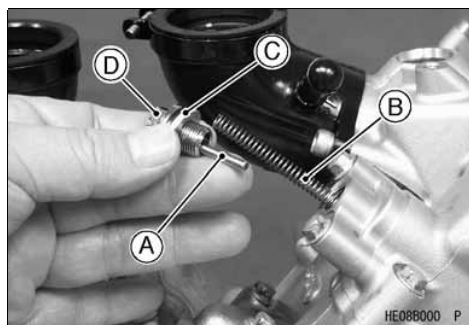


Camshaft Chain Tensioner Installation

- Push the stopper [A] to release the ratchet and push the push rod [B] into the tensioner body.



- Tighten:
 - Torque - Chain Tensioner Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)
- Install:
 - Pin [A] and Spring [B]
 - Washer [C] and Chain Tensioner Cap Bolt [D]
- Tighten:
 - Torque - Chain Tensioner Cap Bolt: 22 N·m (2.2 kgf·m, 16 ft·lb)



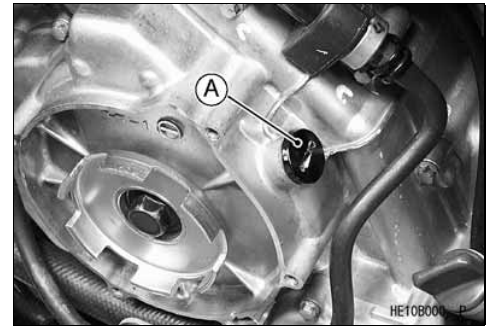
Rocker Case

Rocker Case Removal

Front Rocker Case:

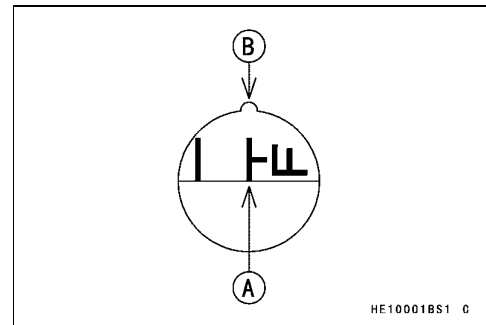
- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Front Fender (see Frame chapter)
 - Inner Cover Rear (see Frame chapter)
 - Recoil Starter (see Engine Left Side chapter)
 - Timing Inspection Plug [A]
 - Valve Adjusting Caps

- Using a wrench on the alternator bolt, turn the crankshaft counter-clockwise 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.

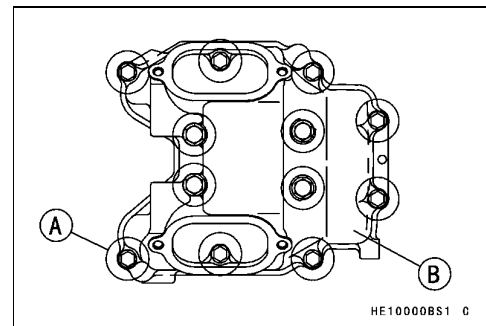


CAUTION

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:
 - Front Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Rocker Case Bolts [A]
 - Front Rocker Case [B]
- Lift the rocker case clear of the dowel pins in the cylinder head and slide the rocker case out of the frame.

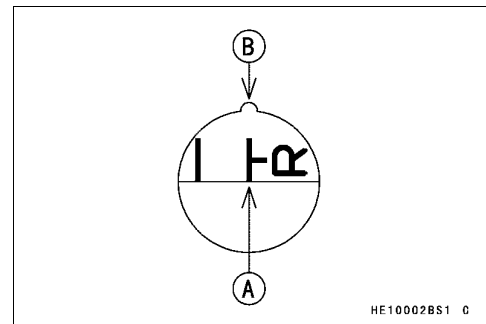


Rear Rocker Case:

- Remove:
 - Front Rocker Case (see this section)
 - Torque Converter Cover Upper Air Duct
- Using a wrench on the alternator bolt, turn the crankshaft **counter-clockwise** (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.

CAUTION

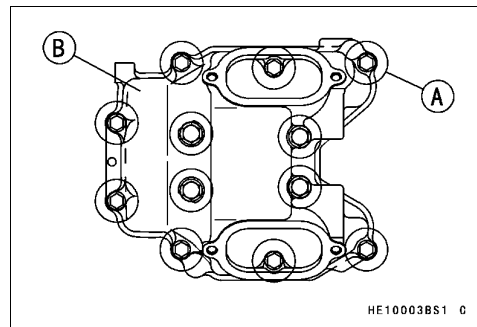
Be sure to position the crankshaft at TDC of the end of the compression stroke when removing or installing the rocker case. The rocker arms could bend the valves.



4-12 ENGINE TOP END

Rocker Case

- Remove:
 - Rear Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Rocker Case Bolts [A]
 - Rear Rocker Case [B]
- Lift the rocker case clear of the dowel pins in the cylinder head and slide the rocker case out of the frame.



Rocker Case Installation

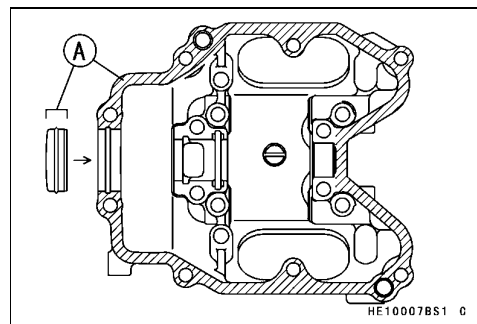
- Install the rear camshaft and then the front camshaft (see Camshaft Installation in this chapter).
- Check that the crankshaft is positioned at TDC and at the end of the compression stroke.

CAUTION

Be sure to position the crankshaft is at TDC of the end of the compression stroke. The rocker arms could bend the valves.

- Apply silicone sealant [A] to the outer surface of the cap [B] and the cylinder head upper surface as shown.

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



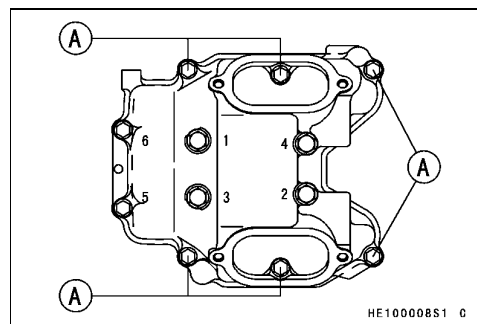
- Tighten the rocker case bolts following the tightening sequence shown.

Torque - Rocker Case Bolts [1 ~ 4, L=55 mm (2.2 in.) with washers]: 8.8 N·m (0.9 kgf·m, 78 in·lb)

Rocker Case Bolts [5 ~ 6, L=130 mm (5.1 in.)]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Rocker Case Bolts [A] [L=30 mm (1.2 in.), L=25 mm (1.0 in.)]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

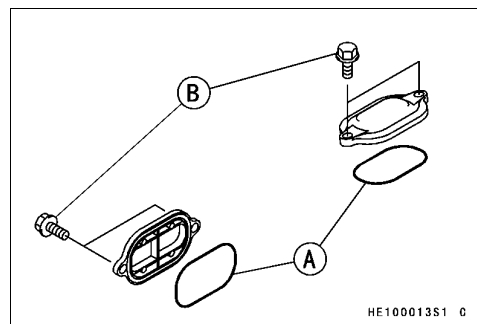
- Check the valve clearance and adjust it if necessary.



- Apply grease to the O-ring [A].

- Tighten:

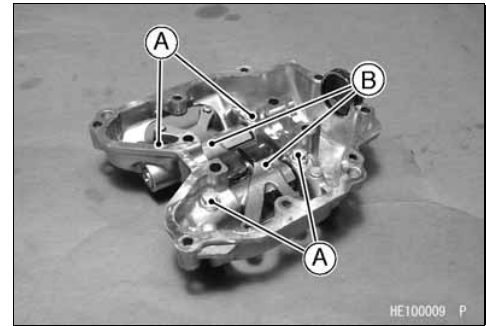
Torque - Valve Adjusting Cap Bolts [B]: 8.8 N·m (0.9 kgf·m, 78 in·lb)



Rocker Case

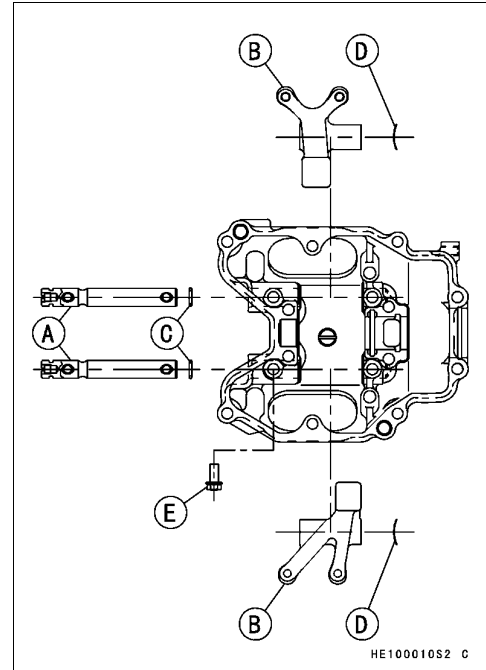
Rocker Arm Removal

- Remove:
 - Rocker Case Rocker Shaft Bolts [A] (see Rocker Case Removal)
 - Rocker Shaft [B]
 - Washers
- 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.



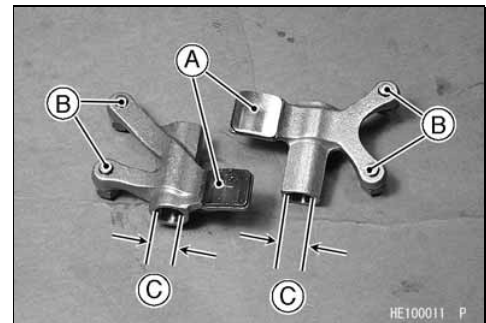
Rocker Arm Installation

- Apply molybdenum disulfide oil:
 - Rocker Shaft [A]
 - Hole in Rocker Arm [B]
- Apply grease to the O-rings [C].
- Install:
 - Wave Washers [D] (as shown)
 - Rocker Arms (as shown)
 - Rocker Shafts and O-rings
- Tighten:
 - Torque - Rocker Shaft Bolts [E]: 8.8 N·m (0.9 kgf·m, 78 in·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.)

4-14 ENGINE TOP END

Rocker Case

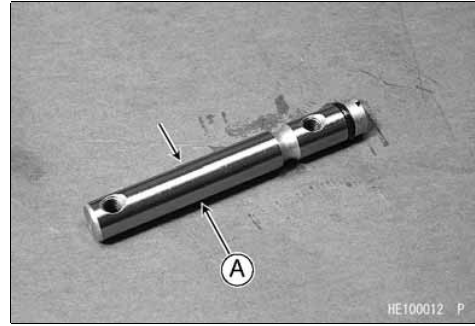
Rocker Shaft Diameter Measurement

- 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: 11.973 ~ 11.984 mm (0.4714 ~ 0.4718 in.)

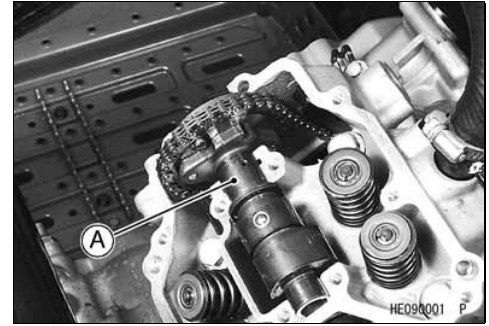
Service Limit: 11.95 mm (0.470 in.)



Camshaft

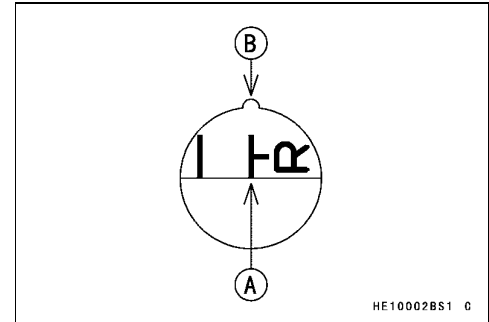
Camshaft Removal

- Remove:
 - Both Camshaft Chain Tensioners (see Camshaft Chain Tensioner Removal)
 - Both Rocker Cases (see Rocker Case Removal)
 - Both Camshafts [A]
- Support the chain using a suitable tool.

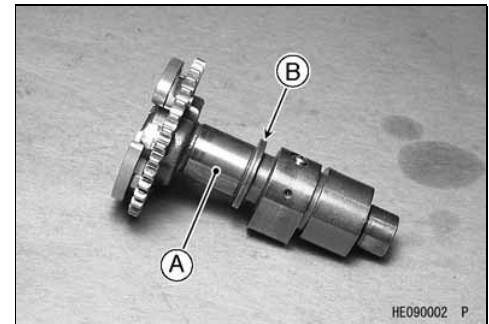


Camshaft Installation

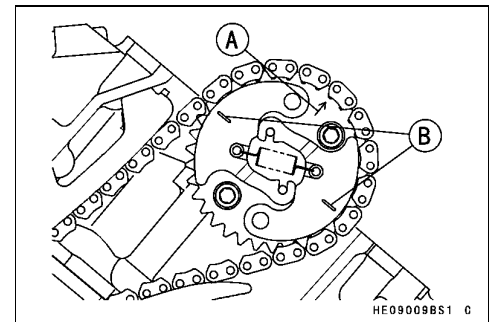
- Using a wrench on the alternator bolt, turn the crankshaft **clockwise** until "T-R" mark [A] is aligned with the notch [B] in the inspection window.



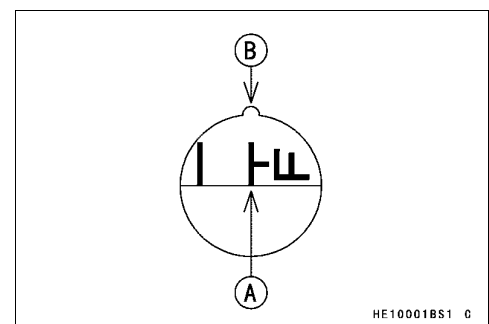
- The rear camshaft [A] has a groove [B].
- First, install the rear camshaft.



- 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.



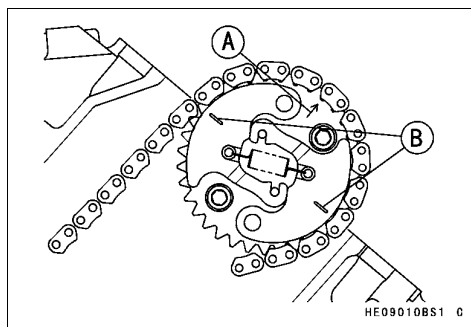
- Using a wrench on the alternator bolt, turn the crankshaft **clockwise** 270°.
- Align the "T-F" mark [A] with the notch [B] in the inspection window.



4-16 ENGINE TOP END

Camshaft

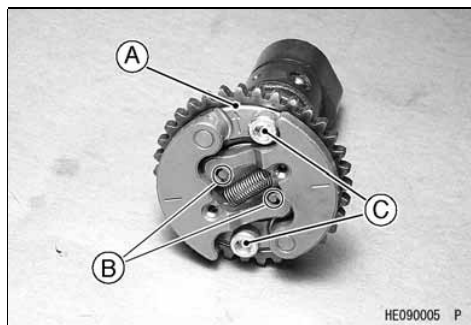
- Face the arrow [A] of the front camshaft sprocket upward (right side view).
- Engage the front camshaft chain with the front camshaft sprocket.
- Align the marks [B] on the weights with the front cylinder head upper surface.



- 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, 104 in·lb)

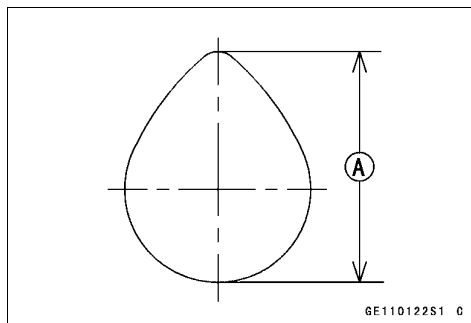


Cam Wear

- 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	Service Limit
Exhaust	35.363 ~ 35.477 mm (1.3932 ~ 1.3967 in.)	35.26 mm (1.388 in.)
Inlet	35.622 ~ 35.736 mm (1.4024 ~ 1.4069 in.)	35.52 mm (1.398 in.)



Camshaft Bearing Wear

- 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.

Camshaft

- 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 ($\phi 18$)

Standard: 0.016 ~ 0.052 mm (0.0006 ~ 0.0020 in.)

Service Limit: 0.14 mm (0.0055 in.)

Camshaft Bearing Clearance ($\phi 22$)

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 ($\phi 18$)

Standard: 17.966 ~ 17.984 mm (0.7073 ~ 0.7080 in.)

Service Limit: 17.94 mm (0.706 in.)

Camshaft Journal Diameter ($\phi 22$)

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.



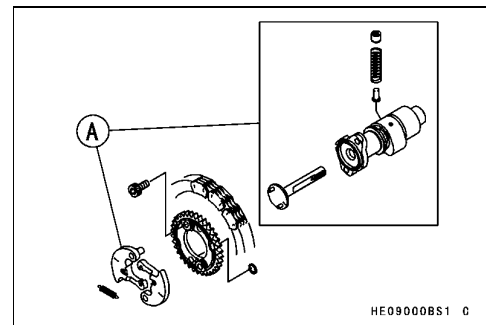
CAUTION

The cylinder head and rocker case are machined as a set, and must be replaced as a set.

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.



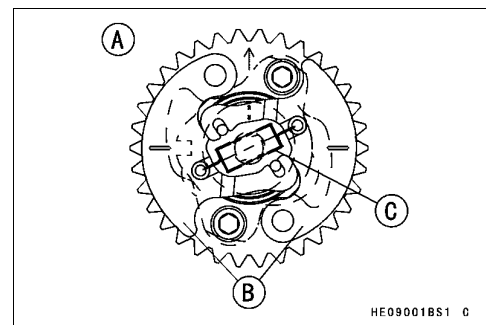
(1) If compression is not released during starting, the weights are not returning to their rest position.

- 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



4-18 ENGINE TOP END

Camshaft

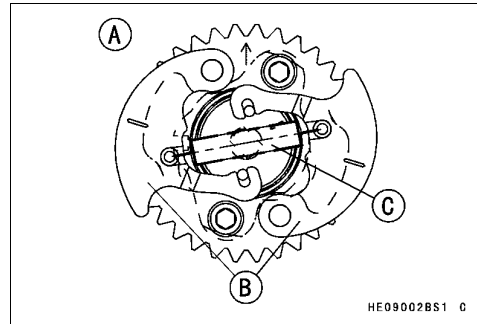
(2) If compression is released while the engine is running, the weights are not swinging out.

- 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)

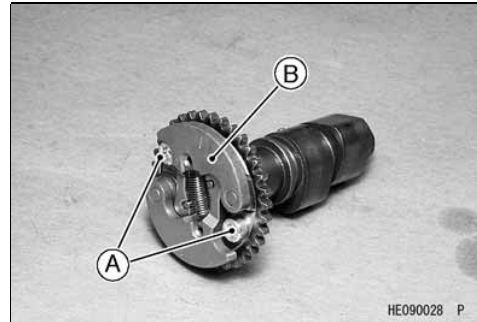
[B] Weights

[C] Spring

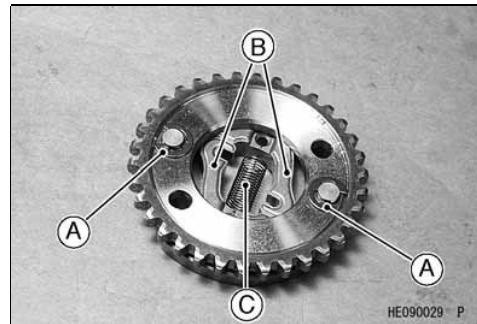


KACR Removal

- Remove:
 - Camshaft (see Camshaft Removal)
 - Camshaft Sprocket Bolts [A]
 - KACR Unit [B]

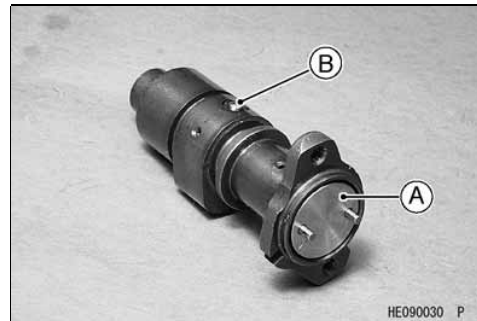


- Remove:
 - Circlips [A]
 - Weights [B]
 - Spring [C]



NOTE

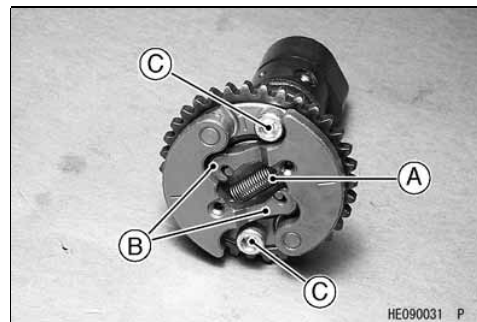
- Do not remove the shaft [A] and pin [B].
- If the parts are removed, they cannot be reinstalled.



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, 104 in·lb)



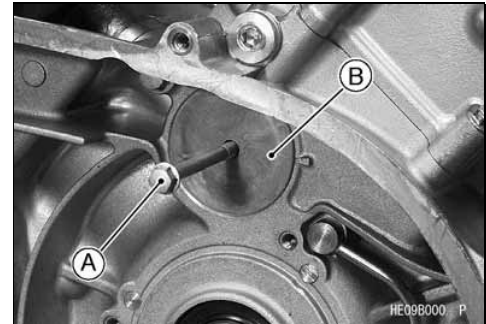
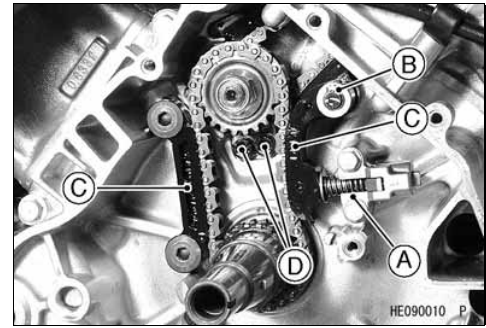
Camshaft

Camshaft Chain Removal

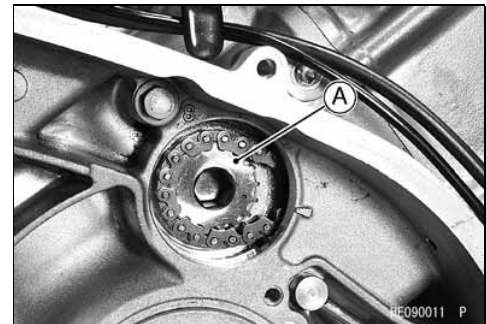
- Remove (left side view):
 - Rear and Front Camshafts (see Camshaft Removal)
 - Alternator Rotor (see Electrical System chapter)
 - Oil Pump (see Engine Lubrication System chapter)
 - Intermediate Shaft Chain Tensioner [A]
 - Circlip [B] and Washer

Special Tool - Outside Circlip Pliers: 57001-144

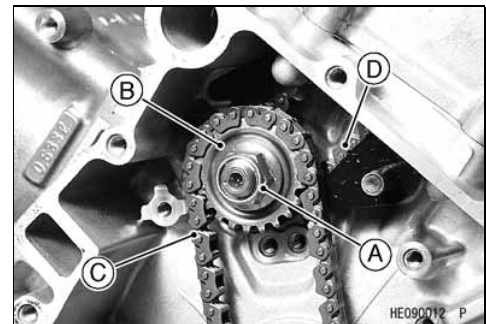
- Remove:
 - Intermediate Shaft Chain Guides [C]
 - Position Plate Bolts [D] and Position Plate
- Remove (right side view):
 - Torque Converter (see Converter System chapter)
- Using a M6 bolt [A], pull out the cover [B].



- Using an Allen wrench, hold the intermediate shaft [A].



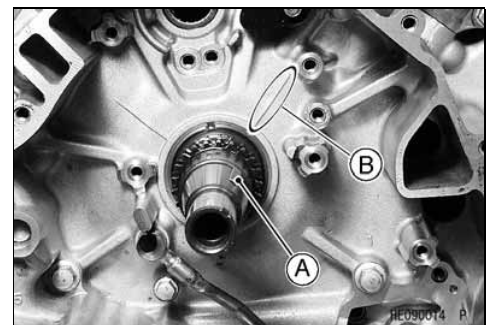
- Remove (left side view):
 - Intermediate Shaft Sprocket Nut [A]
 - Intermediate Shaft Sprocket [B]
 - Intermediate Shaft Drive Chain [C]
 - Rear Camshaft Chain [D]
 - Front Camshaft Chain



Camshaft Chain Installation

Rear Camshaft Chain:

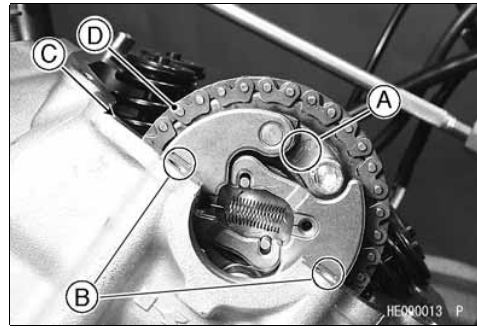
- Align the key groove [A] on the crankshaft with the embossed line [B] on the crankcase (left side view).



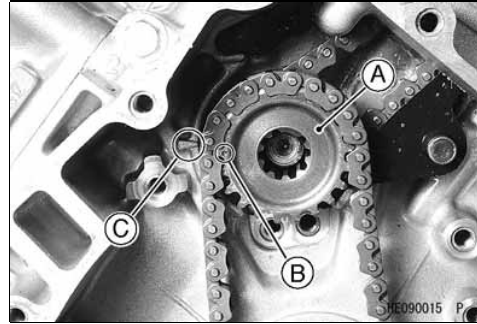
4-20 ENGINE TOP END

Camshaft

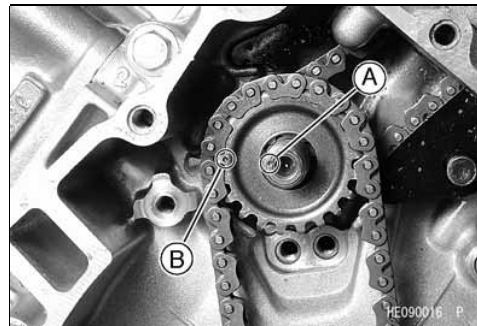
- Face the arrow [A] of the rear camshaft sprocket upward.
- Align the marks [B] on the weights with the rear cylinder head upper surface [C].
- Place the rear camshaft chain [D] onto the rear camshaft sprocket.



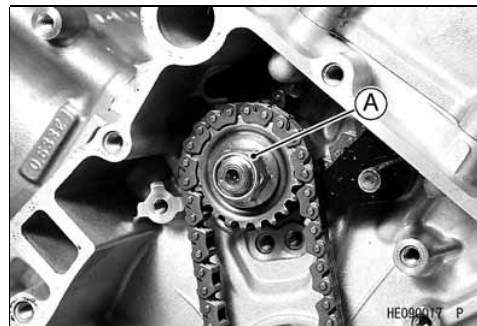
- Engage the camshaft and intermediate shaft chains on the intermediate shaft sprocket [A] (left side view).
- Align the punch mark [B] on the intermediate shaft sprocket with the embossed mark [C] on the crankcase.



- Install the intermediate shaft and align the punch mark [A] on the intermediate shaft with the punch mark [B] on the intermediate sprocket nut.

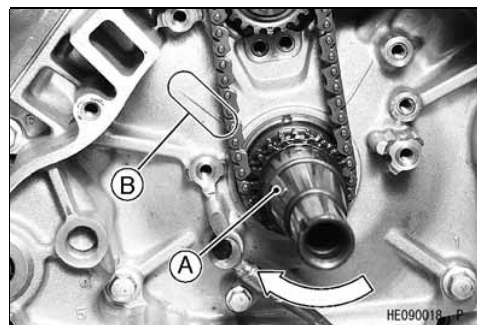


- Using an Allen wrench, hold the intermediate shaft.
- Tighten:
Torque - Intermediate Shaft Sprocket Nut [A]: 44 N·m (4.5 kgf·m, 33 ft·lb)



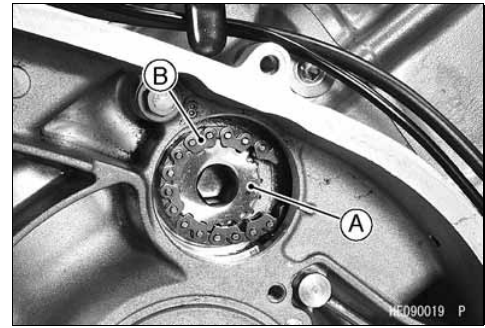
Front Camshaft Chain:

- Rotate the crankshaft **clockwise** 270°.
- Align the key groove [A] on the crankshaft with the embossed line [B] on the crankcase.

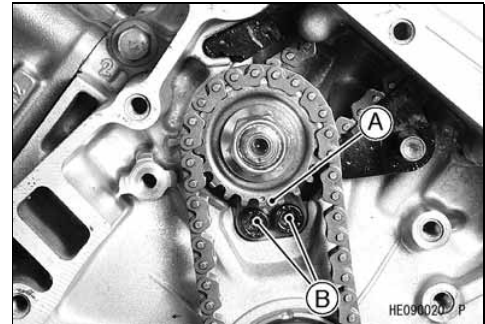


Camshaft

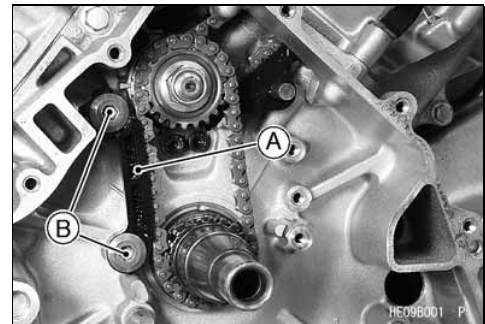
- Move the intermediate shaft [A] to the right side of the engine.
- Engage the front camshaft chain [B] with the sprocket on the intermediate shaft.



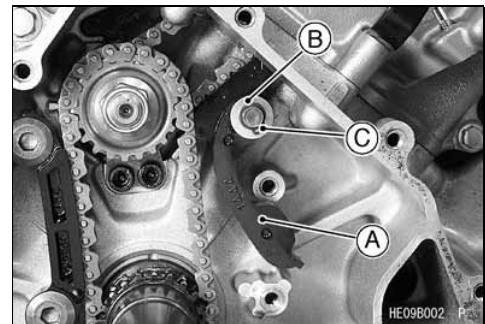
- Install (left side view):
Position Plate [A]
- Tighten:
Torque - Position Plate Bolts [B]: 8.8 N·m (0.9 kgf·m, 78 in·lb)



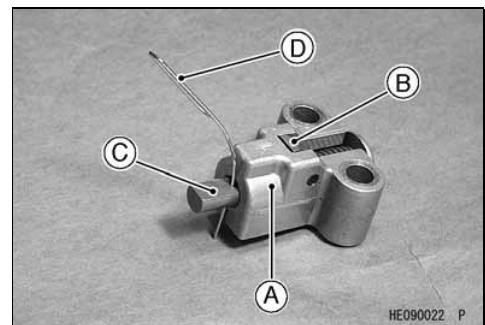
- Install:
Intermediate Shaft Chain Guide [A] (front)
- Tighten:
Torque - Intermediate Shaft Chain Guide Bolts [B]: 8.8 N·m (0.9 kgf·m, 78 in·lb)



- Install:
Intermediate Shaft Chain Guide [A] (Rear)
Washer [B]
Circlip [C]
- Special Tool - Outside Circlip Pliers: 57001-144



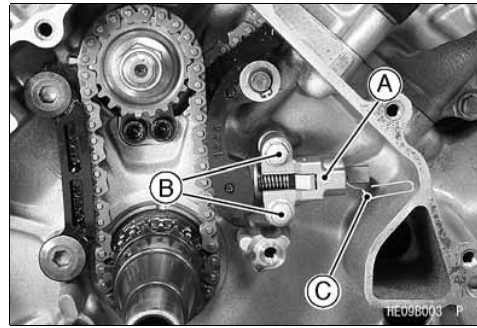
- Install the intermediate shaft chain tensioner [A] as follows:
- Release the stopper [B] and push the push rod [C] into the tensioner body.
- Insert a wire [D] into the rod hole to hold the rod in place.



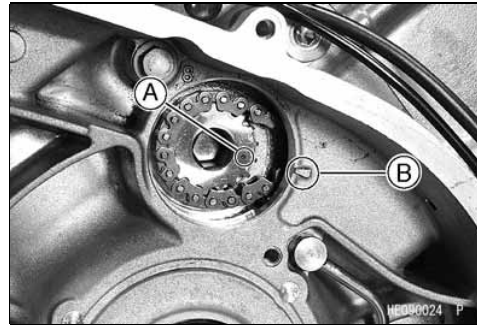
4-22 ENGINE TOP END

Camshaft

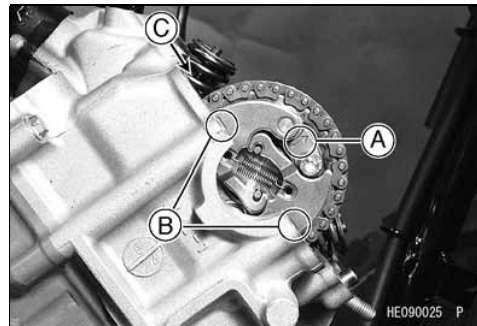
- Install:
Intermediate Shaft Chain Tensioner [A]
- Tighten:
Torque - Intermediate Shaft Chain Tensioner Bolts [B]: 8.8 N·m (0.9 kgf·m, 78 in·lb)
- Remove the wire [C] to free the push rod.



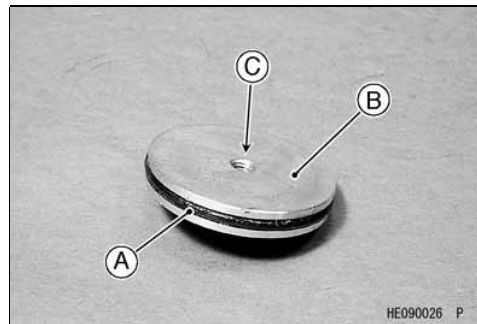
- Confirm that the punch mark [A] on the intermediate shaft sprocket (Right Side) is aligned with the embossed mark [B] on the crankcase.



- 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.



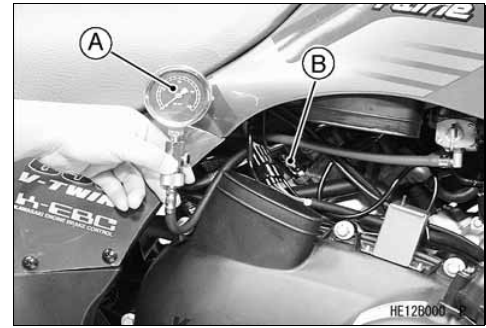
- Install:
Both Rocker Cases (see Rocker Case Installation)
Both Camshaft Chain Tensioners (see Camshaft Chain Tensioner Installation)
- Check the valve clearances (see Valve Clearance Inspection).

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 Electrical System chapter).
 - Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.
- Special Tools - Compression Gauge: 57001-221**
Compression Gauge Adapter, M10 × 1.0: 57001-1486
- 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)

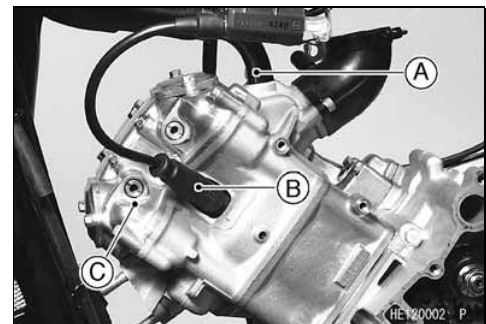
**Electric Starter: 320 ~ 560 kPa (3.3 ~ 5.7 kgf/cm²,
47 ~ 81 psi) @240 r/min (rpm)**

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 Removal

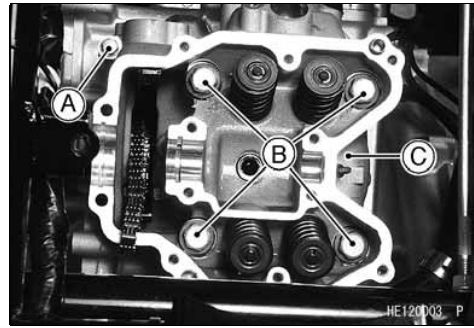
- Drain the coolant (see Cooling System chapter).
- Remove:
 - Carburetor (see Fuel System chapter)
 - Exhaust Pipe (see Exhaust Pipe Removal)
 - Water Pipe [A]
 - Spark Plug Cap [B]
 - Rocker Case [C]
 - Camshaft (see Camshaft Removal)



4-24 ENGINE TOP END

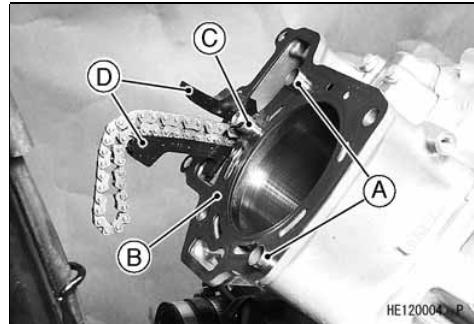
Cylinder Head

- Remove:
 - Cylinder Head Bolt (M6) [A]
 - Cylinder Head Bolts (M10) [B] and Washers
 - Cylinder Head [C] and Gasket
- Lift the cylinder head to clear the dowel pins in the cylinder, and slide the cylinder head out of the frame.



Cylinder Head Installation

- Install:
 - Dowel Pins [A]
 - New Cylinder Head Gasket [B]
 - Oil Pipe [C]
 - Camshaft Chain Guides [D]
- Tighten:
 - Torque - Front Cylinder Camshaft Chain Guide Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)



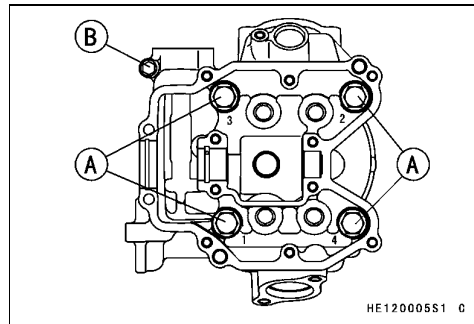
- Apply molybdenum disulfide oil to the threads and seating surface of the cylinder head bolts and both sides of the washers.
- Tighten the cylinder head bolts following the tightening sequence as shown.

First Torque - Cylinder Head Bolts (M10) [A]: 25 N·m (2.5 kgf·m, 18 ft·lb)

Final Torque - Cylinder Head Bolts (M10) [A]: 49 N·m (5.0 kgf·m, 36 ft·lb)

- Tighten the cylinder head bolts (M6).

Torque - Cylinder Head Bolts (M6) [B]: 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.

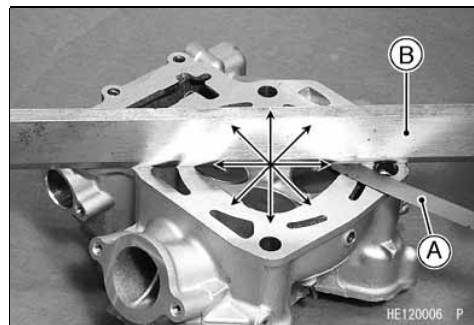
Cylinder Head Warp

- 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).

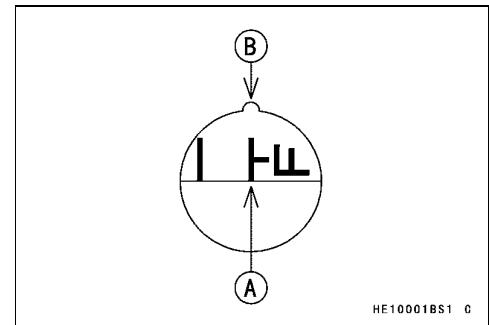
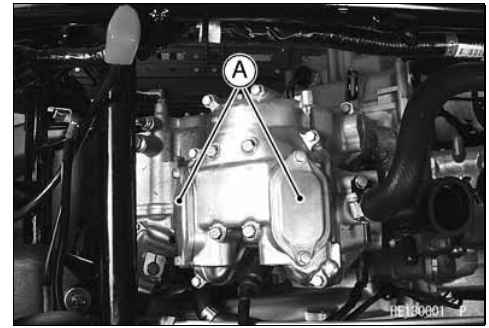


Valves

Valve Clearance Inspection

NOTE

- Check the valve clearance when the engine is cold (at room temperature).
- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Front Fender (see Frame chapter)
 - Front Inner Covers (see Frame chapter)
 - Valve Adjusting Caps [A]
 - Recoil Starter (see Engine Left Side chapter)
- Remove the timing inspection plug.
- 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.

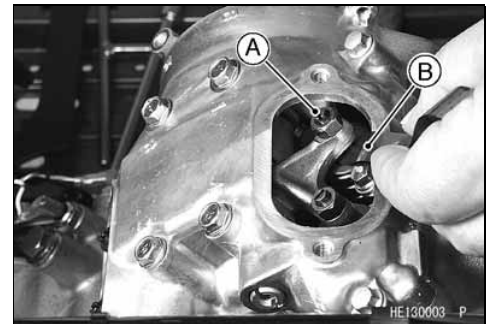


- Measure the clearance for all four valves, one at a time between the end of the valve stem and the adjusting screw [A] with the thickness gauge [B].

Valve Clearance (when cold)

Exhaust: 0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)
 Inlet: 0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)

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

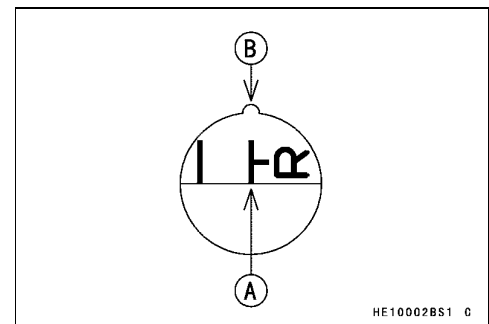


- Then, turn the crankshaft **counterclockwise** with a wrench on the alternator rotor bolt until "T-R" mark [A] on the alternator rotor aligns with the notch [B] as shown: the end of the compression stroke in the rear cylinder head.
- Measure the clearance for all four valves, one at a time between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

Valve Clearance (when cold)

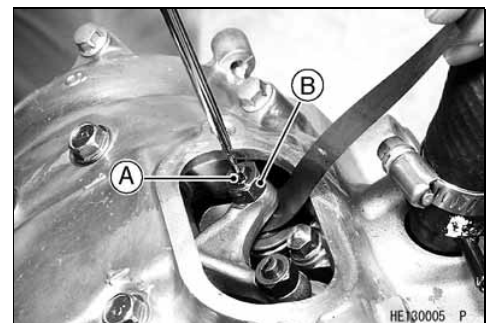
Exhaust: 0.20 ~ 0.25 mm (0.0079 ~ 0.0098 in.)
 Inlet: 0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)

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



Valve Clearance Adjustment

- 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, 104 in·lb)
- Recheck the clearance.
- ★ If the clearance is incorrect, repeat the adjustment procedure.



4-26 ENGINE TOP END

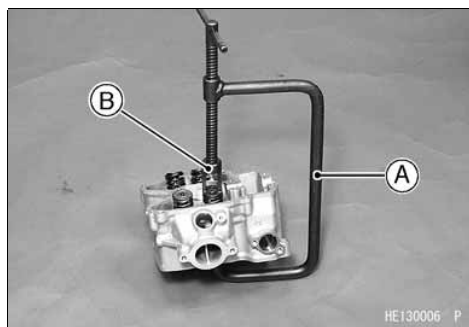
Valves

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.

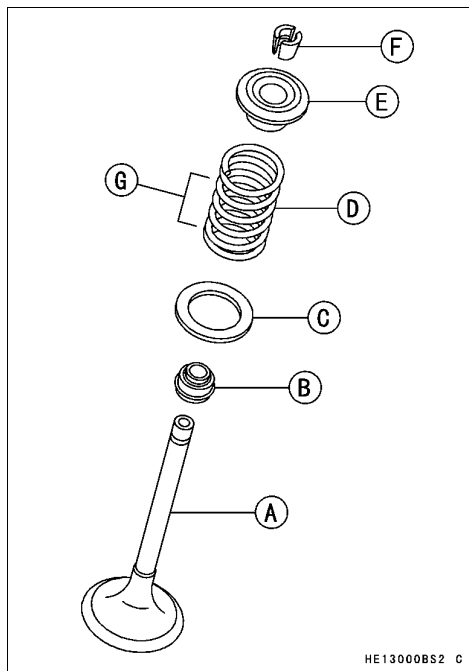
**Special Tools - Valve Spring Compressor Assembly: 57001-241 [A]
Valve Spring Compressor Adapter, ϕ 22: 57001-1202 [B]**



Valve Installation

- Replace the valve stem oil seal.
- ★ If a new valve is to be used, check the valve-to-guide clearance (see this chapter).
- ★ 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.

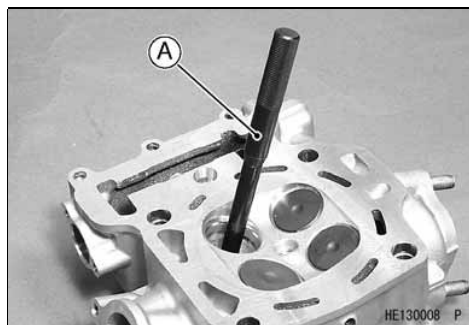
Valve Stem [A]
Oil Seal [B]
Spring Seat [C]
Spring [D]
Retainer [E]
Split Keepers [F]
Closed Coil End [G]



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, ϕ 5 : 57001-1203



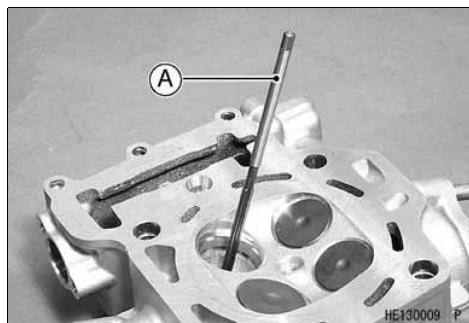
Valve Guide Installation

- Lightly oil the valve guide outer surface.
- Using the valve guide arbor, drive the valve guide until its flange touches the cylinder head.

Special Tool - Valve Guide Arbor, ϕ 5 : 57001-1203

- Ream the valve guide with the valve guide reamer [A], if may be necessary to ream the guide even if the old guide is reused.

Special Tool - Valve Guide Reamer, ϕ 5 : 57001-1204

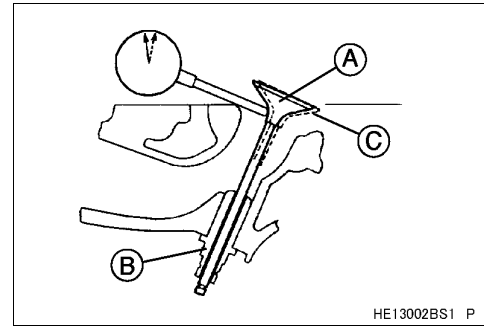


Valves

Valve-to-Guide Clearance Measurement

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

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



NOTE

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

Valve/Valve Guide Clearance (Wobble Method)

	Standard	Service Limit
Exhaust:	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.34 mm (0.0133 in.)
Inlet:	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.28 mm (0.0110 in.)

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.)
Inlet:	29.4 ~ 29.5 mm (1.157 ~ 1.165 in.)

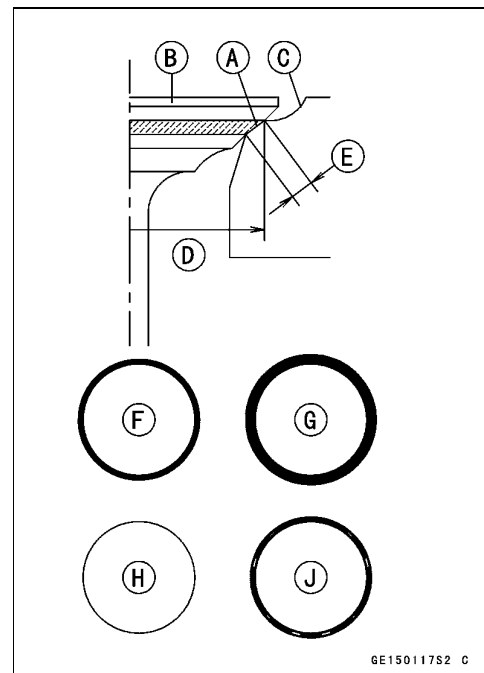
NOTE

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



4-28 ENGINE TOP END

Valves

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° - ϕ 27.5: 57001-1114

Valve Seat Cutter, 32° - ϕ 28: 57001-1119

Valve Seat Cutter, 60° - ϕ 30: 57001-1123

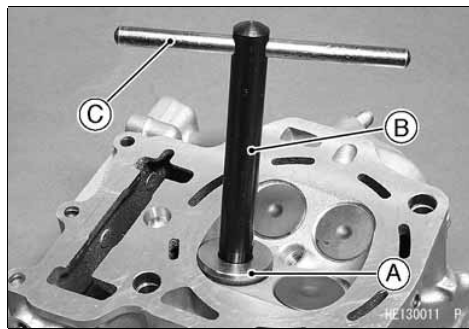
Inlet Valves: Valve Seat Cutter, 45° - ϕ 30: 57001-1187

Valve Seat Cutter, 32° - ϕ 33: 57001-1199

Valve Seat Cutter, 60° - ϕ 30: 57001-1123

Holder & Bar: Valve Seat Cutter Holder, ϕ 5: 57001-1208 [B]

Valve Seat Cutter Holder Bar: 57001-1128 [C]



- ★ If the manufacturer's instructions are not available, use the following procedure.

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

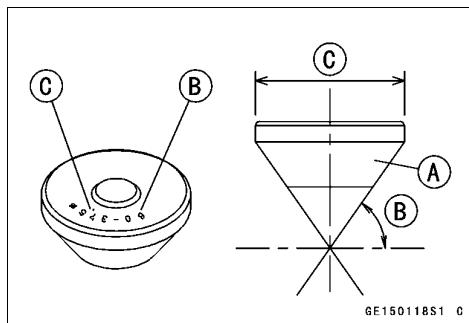
- Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.
5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter:

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

60° Cutter angle [B]

37.5 ϕ Outer diameter of cutter [C]



Operating Procedures:

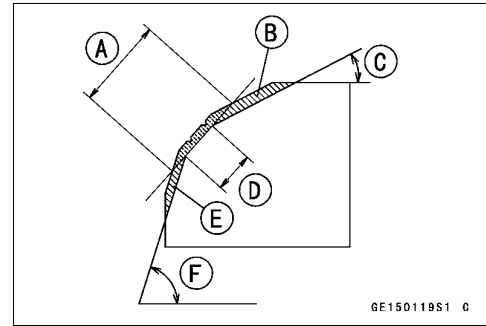
- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

CAUTION

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

Valves

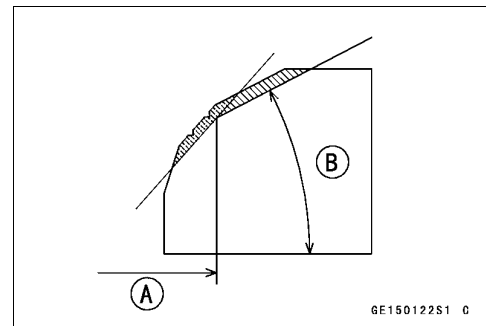
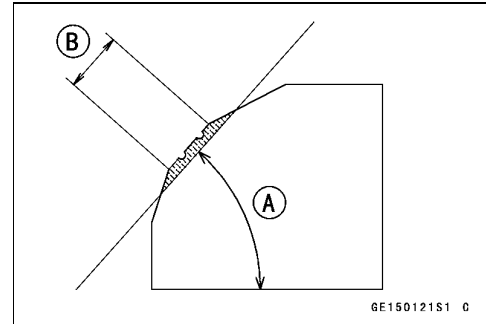
Widened Width [A] of engagement by machining with 45° cutter
 Ground Volume [B] by 32° cutter
 32° [C]
 Correct Width [D]
 Ground Volume [E] by 60° cutter
 60° [F]



- 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

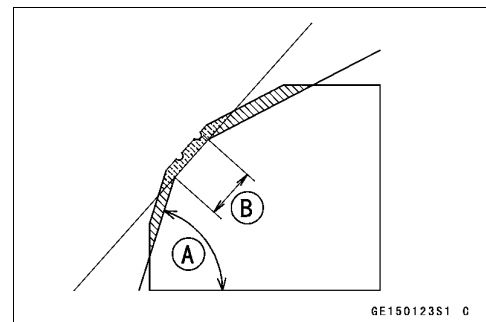
- Remove all pittings of flaws from 45° ground surface.
 - After grinding with 45° cutter, apply thin coat of machinist's dye to seating surface. This makes seating surface distinct and 32° and 60° grinding operation easier.
 - When the valve guide is replaced, be sure to grind with 45° cutter for centering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



CAUTION

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

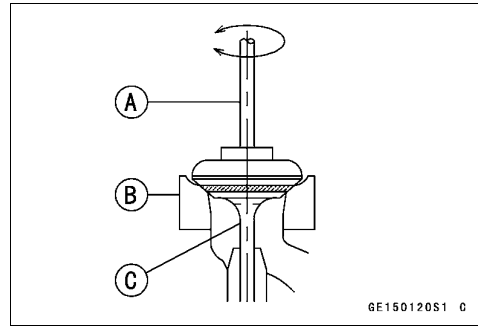
- After making the 32° grind, return to the seat O.D. measurement step above.
- To measure the seat width, use vernier calipers to measure the width of the 45° angle portion of the seat at several places around the seat.
- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.
- ★ 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]



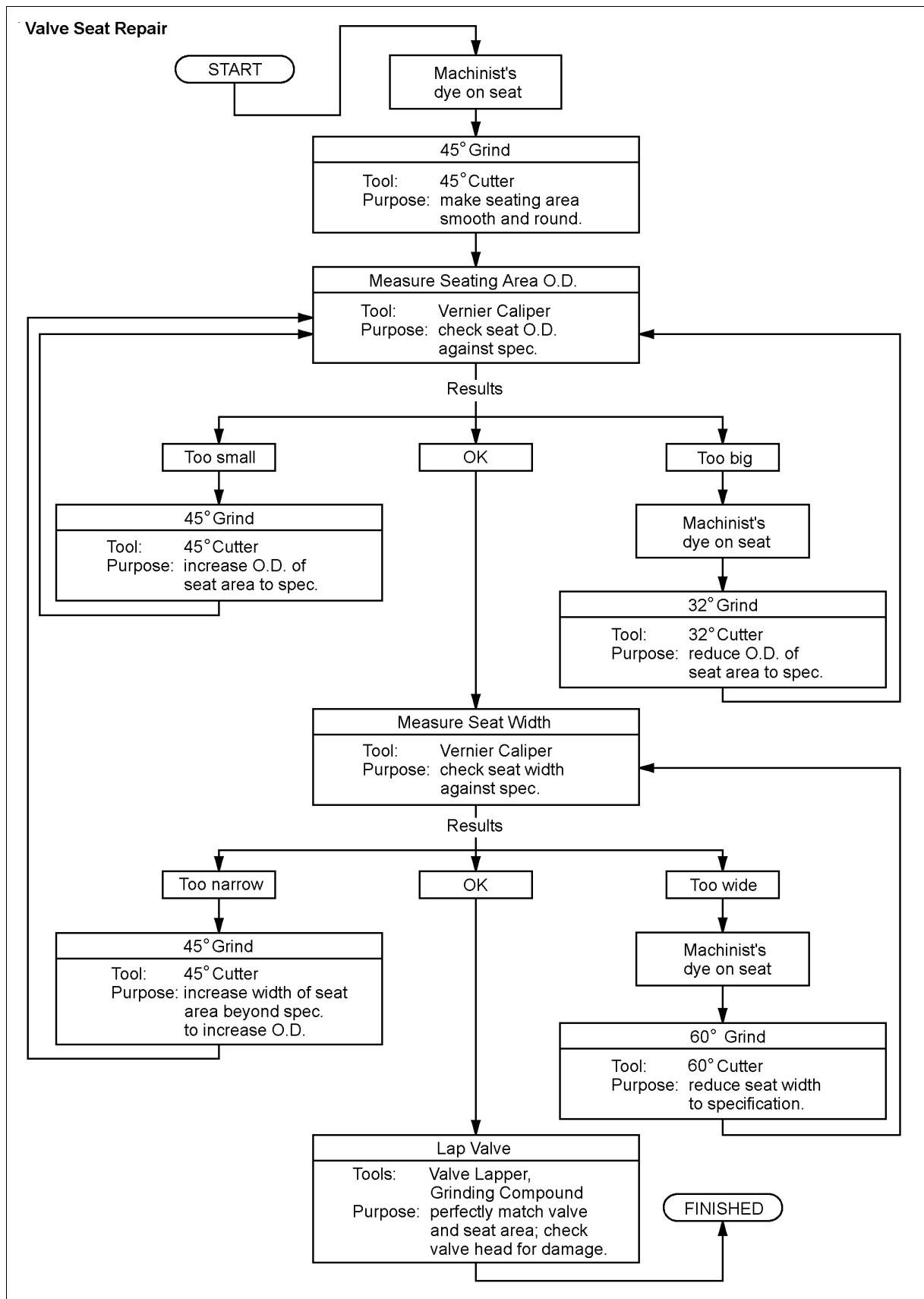
4-30 ENGINE TOP END

Valves

- 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).



Valves

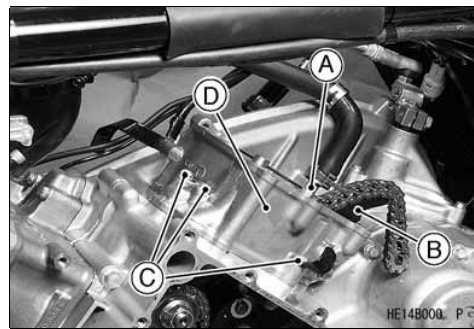


4-32 ENGINE TOP END

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

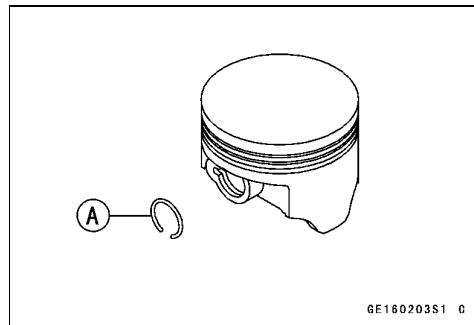


Piston Removal

- 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.

CAUTION

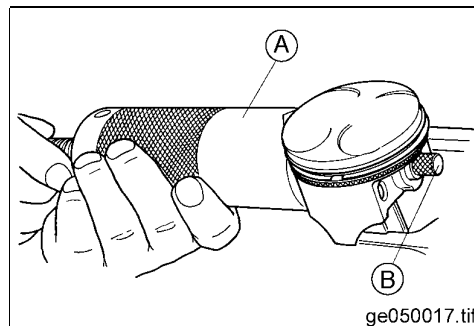
Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.



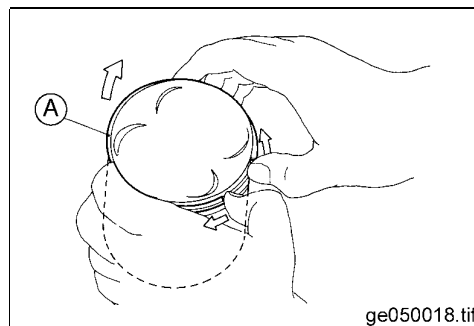
- Using the piston pin puller assembly (special tool), remove the piston pins.

Special Tools - Piston Pin Puller Assembly [A]: 57001-910
Piston Pin Puller Adapter [B]: 57001-1211

- Remove the piston.



- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



Cylinder, Piston Installation

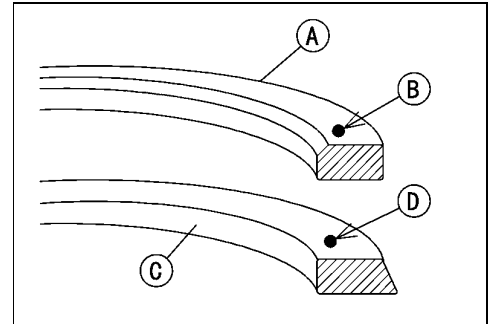
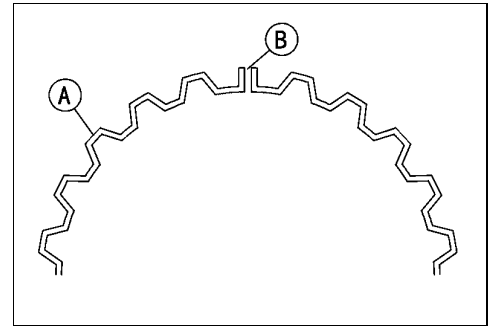
NOTE

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

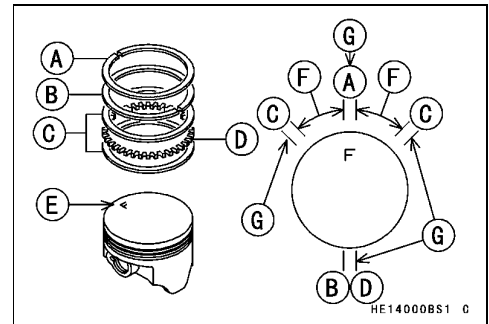
Cylinder and Piston

NOTE

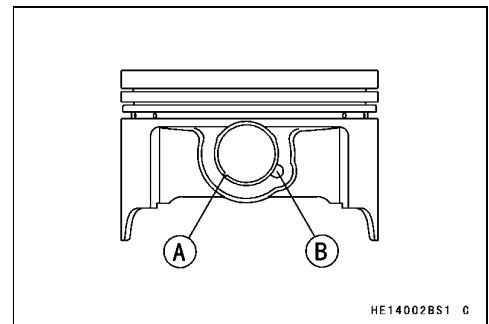
- The oil ring rails have no "top" or "bottom".
 - Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
 - Install the oil ring steel rails, one above the expander and one below it.
 - Spread the rail with your thumbs, but only enough to fit the rail over 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 must be about 30 ~ 40° [F] of angle from the opening of the top ring.
- Top Ring [A]
 Second Ring [B]
 Oil Ring Steel Rails [C]
 Oil Ring Expander [D]
 F mark [E] must be faced toward Front Side for front and rear pistons
 Opening Positions [G]



- 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.



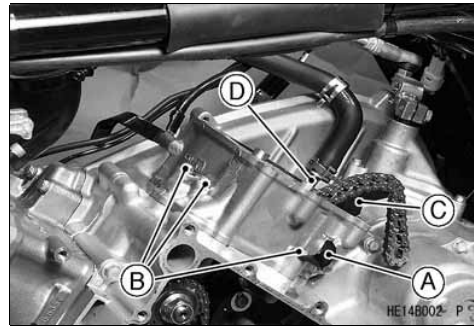
- Install:
 - Dowel Pins [A]
 - New Cylinder Base Gasket [B]



4-34 ENGINE TOP END

Cylinder and Piston

- Install:
 - Cylinder
 - Clamp [A] (rear only)
- Tighten:
 - Torque - Cylinder Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in-lb)**
- Install:
 - Chain Guide [C]
 - Oil Pipe [D]



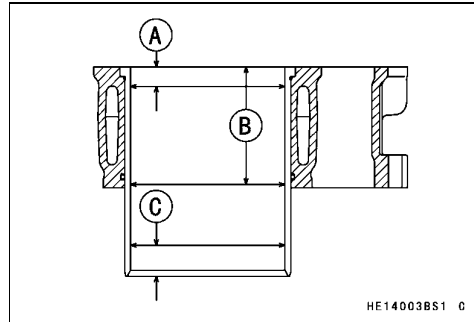
Cylinder Wear

- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the three locations (total of six measurements) shown in the figure.
- ★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.
 - 10 mm (0.4 in.) [A]
 - 60 mm (2.4 in.) [B]
 - 20 mm (0.8 in.) [C]

Cylinder Inside Diameter

Standard: 79.994 ~ 80.006 mm (3.1494 ~ 3.1498 in.), and less than 0.01 mm (0.0004 in.) difference between any two measurements.

Service Limit: 80.09 mm (3.153 in.), or more than 0.05 mm (0.0020 in.) difference between any two measurements.



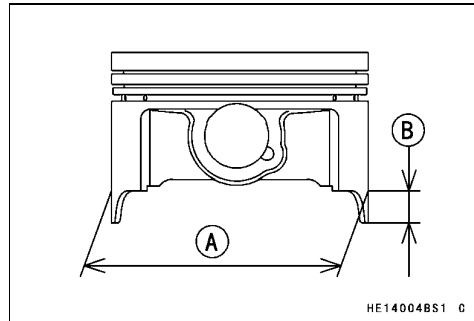
Piston Wear

- Measure the outside diameter [A] of each piston 5 mm (0.20 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.
- ★ If the measurement is under service limit, replace the piston.

Piston Diameter

Standard: 79.949 ~ 79.964 mm (3.1476 ~ 3.1481 in.)

Service Limit: 79.80 mm (3.142 in.)



Piston/Cylinder Clearance

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

Piston/Cylinder Clearance

Standard: 0.030 ~ 0.057 mm (0.0012 ~ 0.0022 in.)

Cylinder and Piston

Piston Ring, Piston Ring Groove Wear

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

Piston Ring/Groove Clearance

	Standard:	Service Limit:
Top:	0.040 ~ 0.080 mm (0.0016 ~ 0.0032 in.)	0.18 mm (0.0071 in.)
Second:	0.030 ~ 0.070 mm (0.0012 ~ 0.0028 in.)	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

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

Piston Ring Groove Width

	Standard	Service Limit
Top:	1.030 ~ 1.050 mm (0.0405 ~ 0.0413 in.)	1.13 mm (0.0445 in.)
Second:	1.020 ~ 1.040 mm (0.0402 ~ 0.0409 in.)	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

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

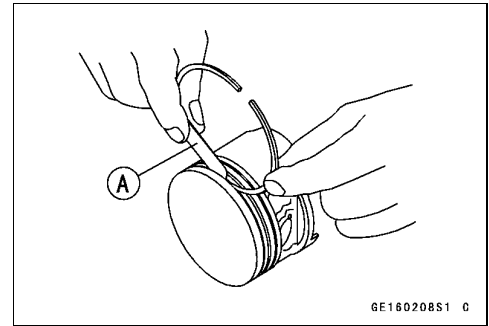
Piston Ring Thickness

	Standard	Service Limit
Top:	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.9 mm (0.035 in.)
Second:	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.9 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.



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4-36 ENGINE TOP END

Cylinder and Piston

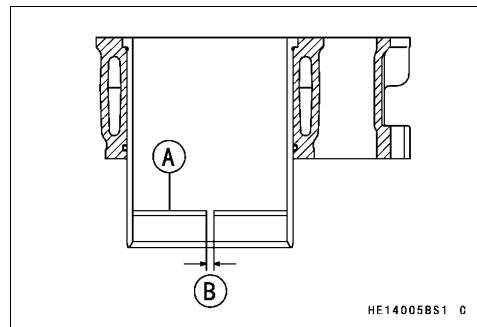
Piston Ring End Gap

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

Piston Ring End Gap

	Standard	Service Limit
Top:	0.20 ~ 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.)

- ★ 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 U.S. 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

⚠ WARNING

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

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

⚠ WARNING

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

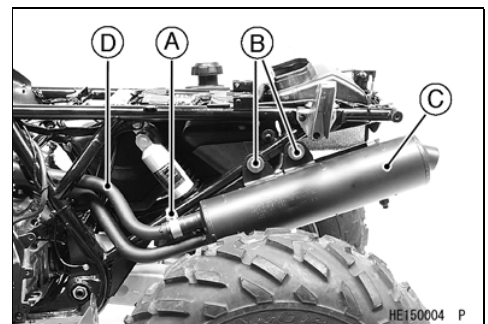
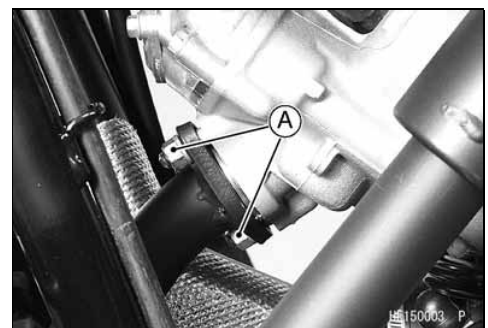
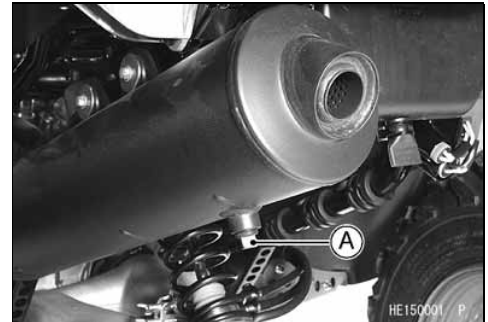
- Stop the engine.
- Install the drain plug.

Muffler and Exhaust Pipe Removal

- Remove:
 - Rear Fender (see Frame chapter)
 - Engine Left Side Cover (see Frame chapter)
 - Front Left Flap
 - Front Inner Cover
 - Rear Exhaust Pipe Nuts [A]

- Remove:
 - Front Exhaust Pipe Nuts [A]

- Remove:
 - Muffler Clamp Bolt [A]
 - Muffler Mounting Bolts [B]
 - Muffler [C] and Rear Exhaust Pipe
 - Front Exhaust Pipe [D]



4-38 ENGINE TOP END

Exhaust System

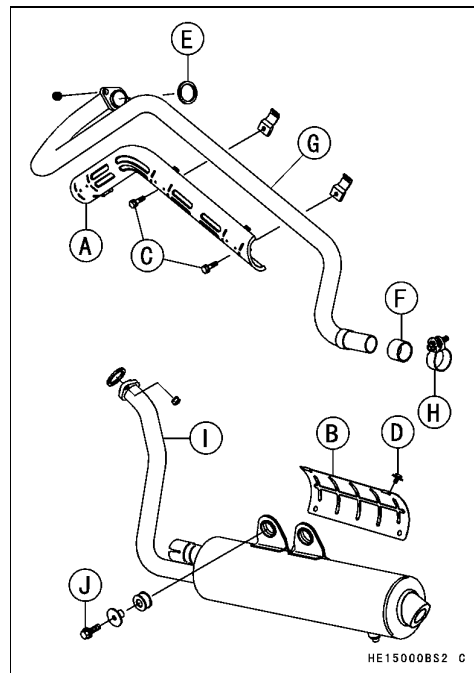
Muffler and Exhaust Pipe Installation

- If the exhaust pipe cover [A] or muffler cover [B] were removed, tighten them.

Torque - Exhaust Pipe Cover Bolts [C]: 8.8 N·m (0.9 kgf·m, 78 in·lb)
Muffler Cover Bolts [D]: 8.8 N·m (0.9 kgf·m, 78 in·lb)

- Replace the exhaust pipe holder gaskets [E] and clamp gasket [F] with new ones.
- Install (But do not tighten the following nuts and bolts.):
Front Exhaust Pipe [G], Clamp [H], Muffler and Nuts
Rear Exhaust Pipe [I] and Nuts
Muffler Mounting Bolts [J]
- Tighten:
Exhaust Pipe Holder Nuts evenly
Muffler Clamp Bolt

Torque - Muffler Mounting Bolts: 20 N·m (2.0 kgf·m, 14 ft·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 Exhaust Pipe and Muffler Removal).
- Inspect the gasket for damage and signs of leakage.
- ★ If the gasket is damaged or has been leaking, replace it.
- Check the exhaust pipe and muffler for dents, cracks, rust and holes.
- ★ If the exhaust pipe or muffler is damaged or has holes, it should be replaced for best performance and least noise.

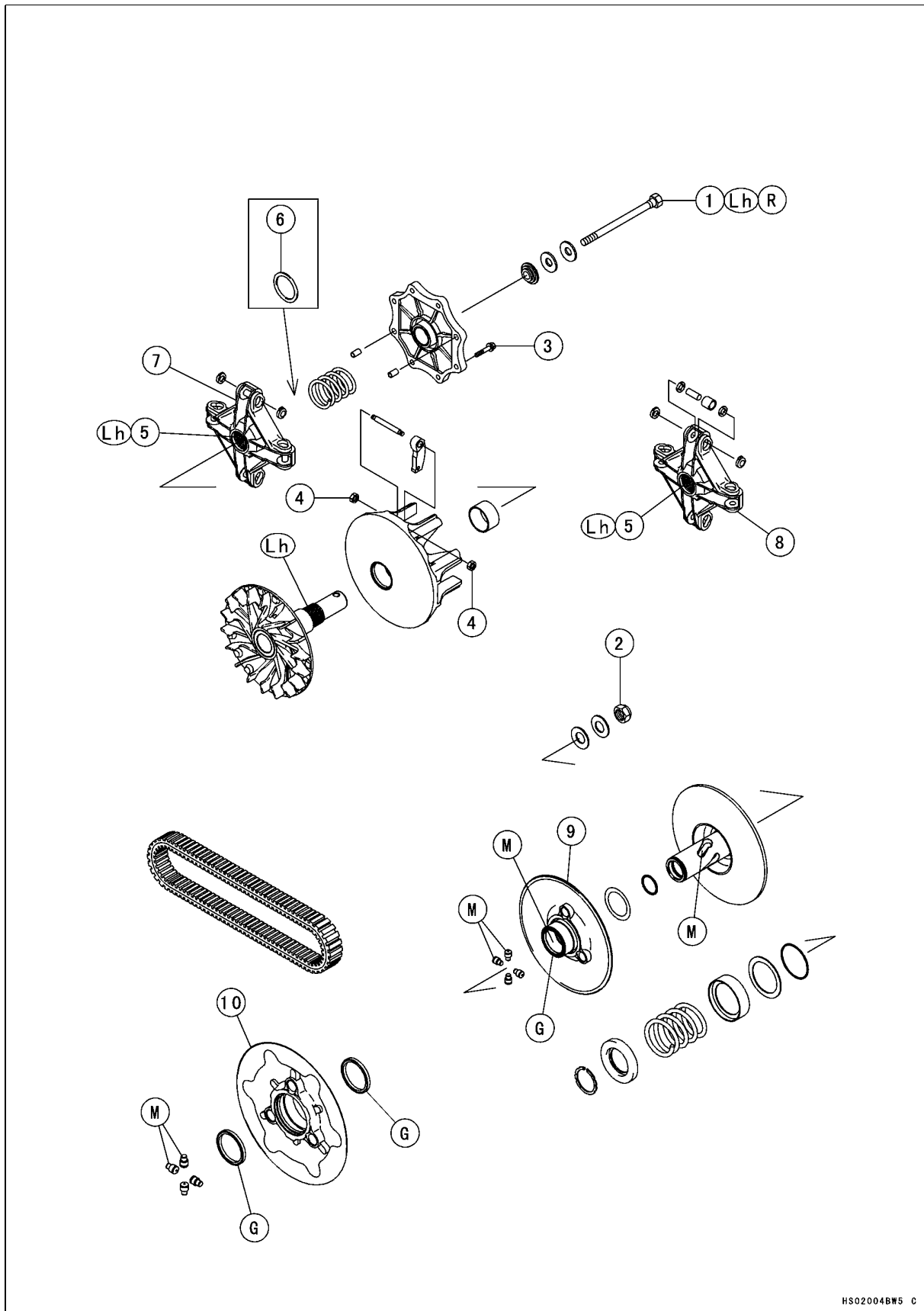
Converter System

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5-2 CONVERTER SYSTEM

Exploded View



HS02004BWS C

CONVERTER SYSTEM 5-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Drive pulley bolt	93	9.5	69	R, Lh
2	Driven pulley nut	93	9.5	69	
3	Drive pulley cover bolts	13	1.3	113 in·lb	
4	Ramp weight nuts	6.9	0.7	61 in·lb	
5	Spider (tapped hole)	275	28	205	Lh

6: Spring Spacer (P/No. 92026–1603, 1.0 mm, yellow) for KVF650–A2 Late, B2

7: Spider [A2 Early, A1, B1]

8: Spider [A2 Late, B2]

9: Movable Sheave [A2 Early, A1, B1]

10: Movable Sheave [A2 Late, B2]

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

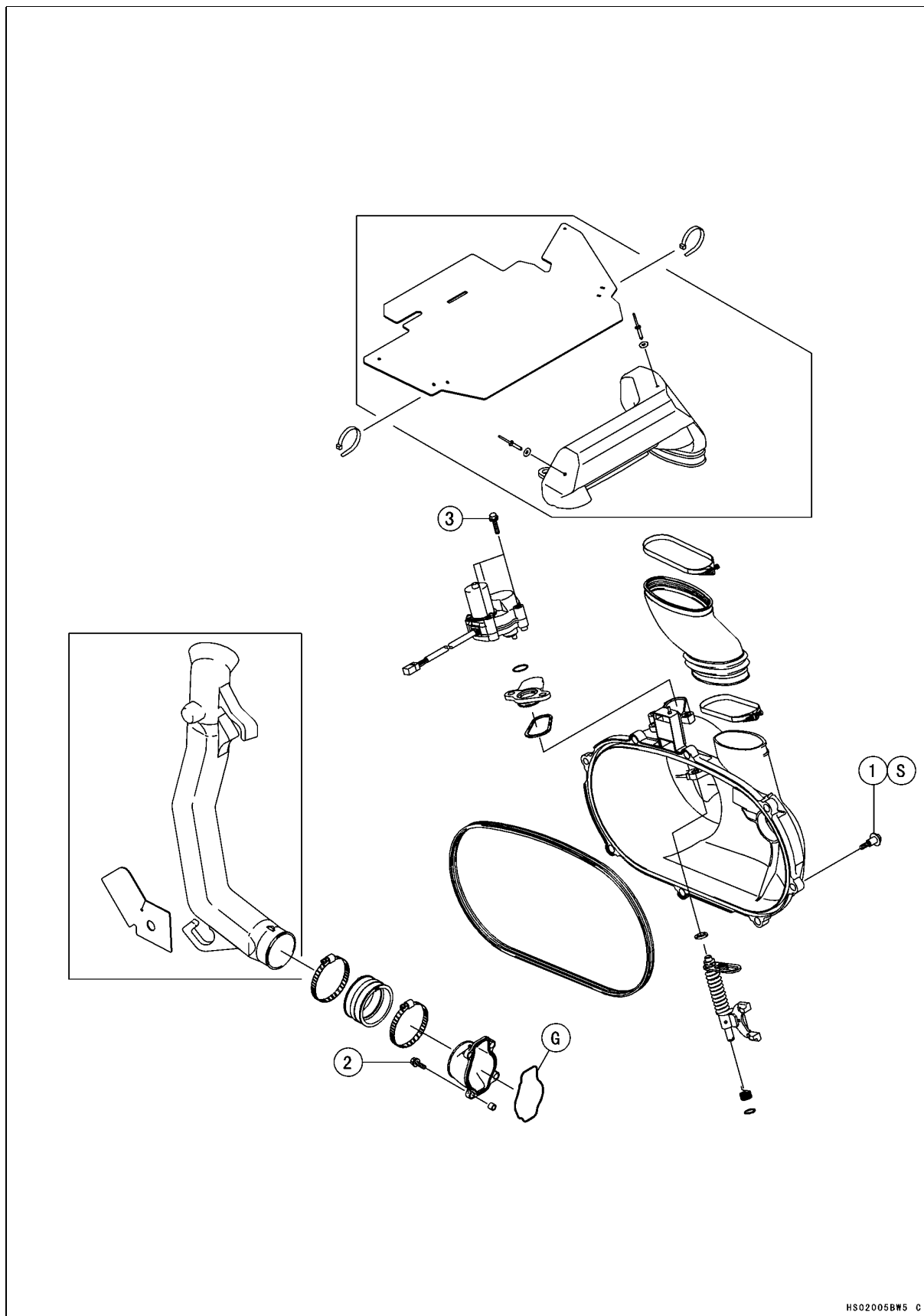
M: Apply molybdenum disulfide grease.

Lh: Left-hand Threads

R: Replacement Parts

5-4 CONVERTER SYSTEM

Exploded View



HS02005BWS C

CONVERTER SYSTEM 5-5

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Converter cover bolts	8.8	0.9	78 in·lb	S
2	Joint duct bolts	8.8	0.9	78 in·lb	
3	Engine brake actuator mounting bolts	8.8	0.9	78 in·lb	

S: Follow the specific tightening sequence.

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

5-6 CONVERTER SYSTEM

Specifications

Item	Standard	Service Limit
Torque Converter: Actuator lever guide shoe	---	6 mm (0.24 in.)
Drive Belt: Belt deflection Belt width	22 ~ 27 mm (0.87 ~ 1.06 in.) 29.2 ~ 30.4 mm (1.15 ~ 1.20 in.)	--- 28.8 mm (1.13 in.)
Drive Pulley: Shoe side clearance Cover bushing inside diameter Sheave bushing inside diameter Spring free length	0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.) 27.985 ~ 28.085 mm (1.1018 ~ 1.1057 in.) 37.985 ~ 38.085 mm (1.4955 ~ 1.4994 in.) 62 mm (2.44 in.)	--- 28.12 mm (1.107 in.) 38.12 mm (1.501 in.) ---
Driven Pulley: Sheave bushing inside diameter (A2 Early, A1, B1) (A2 Late, B2) Spring free length	39.994 ~ 40.104 mm (1.5746 ~ 1.5789 in.) 40.040 ~ 40.079 mm (1.5764 ~ 1.5779 in.) 99.5 mm (3.92 in.)	40.13 mm (1.580 in.) 40.11 mm (1.579 in.) ---

Special Tools - Circlip Pliers: 57001-154
Flywheel & Pulley Holder: 57001-1343
Drive & Driven Pulley Holder: 57001-1412
Drive Pulley Puller Bolt: 57001- 1429
Pulley Holder Attachment: 57001-1472
Drive & Driven Pulley Holder: 57001-1473
Drive Pulley Wrench: 57001-1474
Spring Holder Set: 57001-1483
Drive Pulley Measurement Tool: 57001-1498
Actuator Lever Measurement Tool: 57001-1499
Drive Pulley Holder: 57001-1520

Torque Converter

⚠ 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.

CAUTION

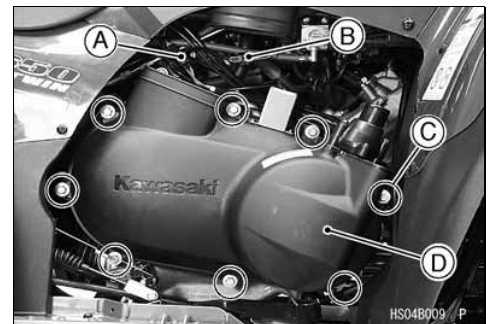
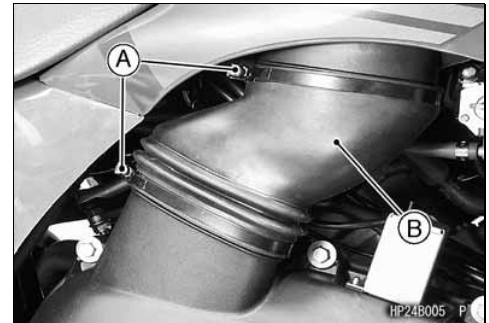
Do not turn the ignition switch OFF position from ON position, while the torque converter cover is removed. If it is done, the learning control of K-EBC system works and the engine brake actuator works an error operation.

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 together with the switch (see Torque Converter Cover Removal/Installation in this chapter).

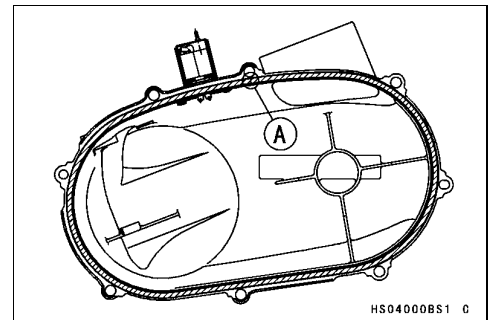
Torque Converter Cover Removal

- Confirm that the ignition switch is in OFF position.
- Remove:
 - Clamp Screws [A] and Clamps
 - Rubber Air Duct [B]
- Remove:
 - Actuator Lead Connector [A]
 - Drive Belt Failure Detection Switch Lead Connector [B]
 - Torque Converter Cover Bolts [C]
 - Torque Converter Cover [D]



Torque Converter Cover Installation

- Check the actuator lever assembly installation length (see Torque Converter Cover Assembly).
- Fit the trim seal into the converter cover.
- Position the glued joint [A] of the seal as shown.



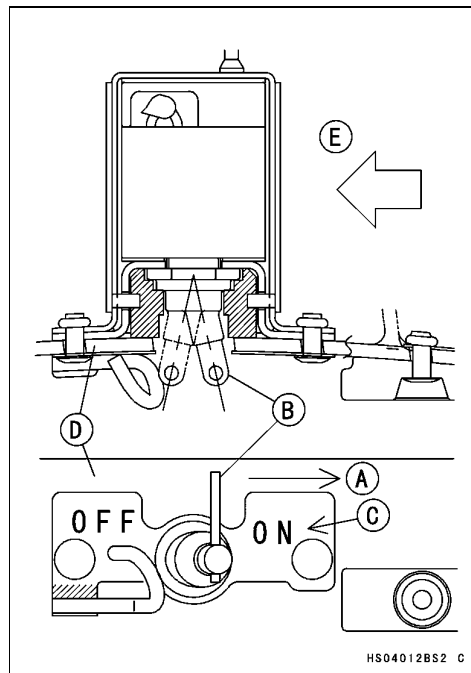
5-8 CONVERTER SYSTEM

Torque Converter

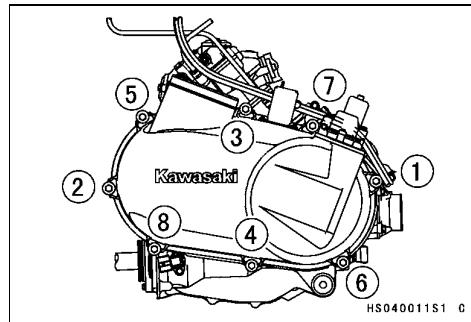
- Check:
 - Drive Belt Failure Detection Switch (see Switch Inspection section in Electric System chapter)
- Set [A] the switch lever [B] to the ON mark side [C].
Converter Cover [D]
Front [E]

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.

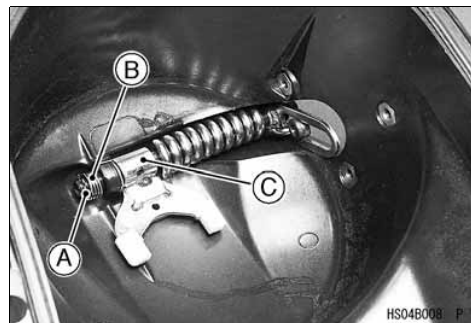


- Tighten the cover bolts following the tightening sequence as shown.
Torque - Converter Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)



Torque Converter Cover Disassembly

- Remove:
 - Torque Converter Cover (see Torque Converter Cover Removal)
 - Engine Brake Actuator (see Electrical System chapter)
 - Circlip [A]
 - Spring [B]
 - Actuator Lever Assembly [C]

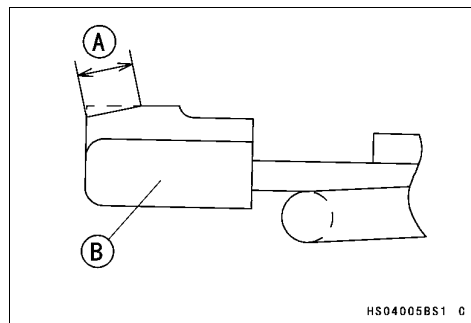


Actuator Lever (Engine Brake Control Lever) Assembly Inspection

- 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.)



Torque Converter

Torque Converter Cover Assembly

- Install:
 - New Circlip
 - Spring
 - Actuator Lever Assembly
 - Engine Brake Actuator (see Electrical System chapter)
- 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.)

- Install the actuator lever measurement tool (plate [A] and rods [B]) on the torque converter cover [C] and tighten the two cover bolts.

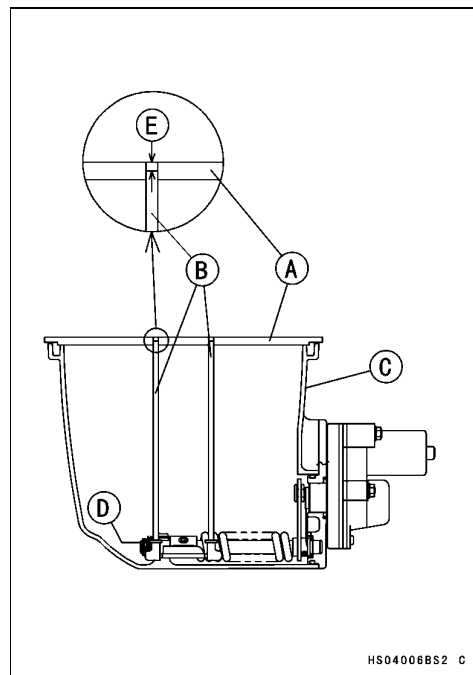
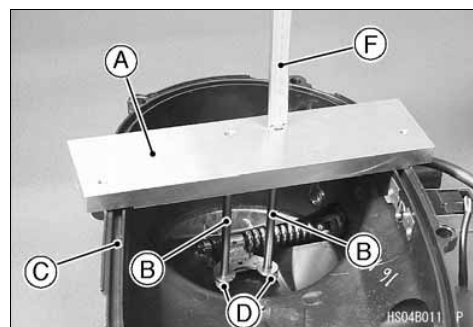
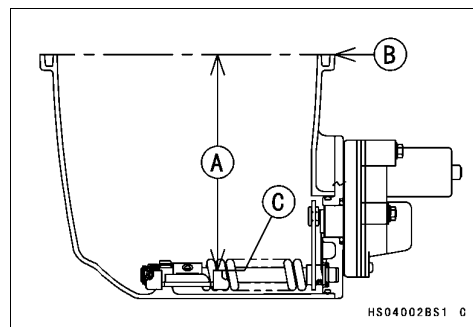
Special Tool - Actuator Lever Measurement Tool: 57001-1499

- 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]

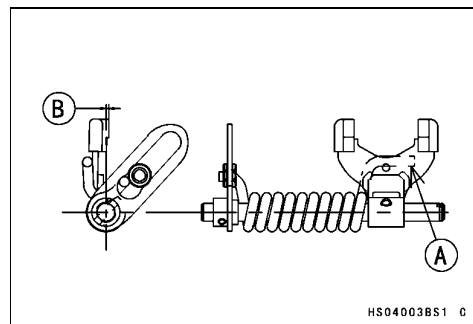
Standard: 1.33 ~ 2.47 mm (0.052 ~ 0.097 in.)

- ★ If the measurement is less than 1.33 mm (0.052 in.), use the actuator lever assembly (13236-1385) of yellow paint.
- ★ If the measurement is more than 2.47 mm (0.097 in.), use the actuator lever assembly (13236-1386) 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 (13236-1387).



Actuator Lever Assemblies

Part Number	Paint Color [A]	Length [B]
13236-1385	Yellow	0.4 ± 0.1 mm (0.016 ± 0.004 in.)
13236-1387	None	1.0 ± 0.1 mm (0.039 ± 0.004 in.)
13236-1386	Green	1.6 ± 0.1 mm (0.063 ± 0.004 in.)



5-10 CONVERTER SYSTEM

Drive Belt

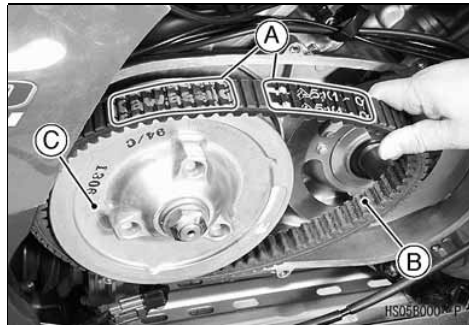
Drive Belt Removal

- Remove the drive pulley [A] (see Drive Pulley Removal).



NOTE

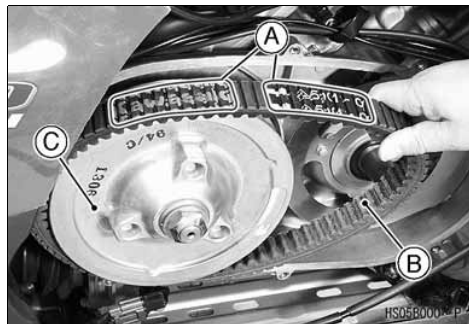
- Before removing, observe the direction the belt's printed information [A] (such as manufacturer's name) is facing so that it may be reinstalled on the pulleys to rotate in the same direction as originally installed.
- Lift the drive belt [B] off the driven pulley [C].



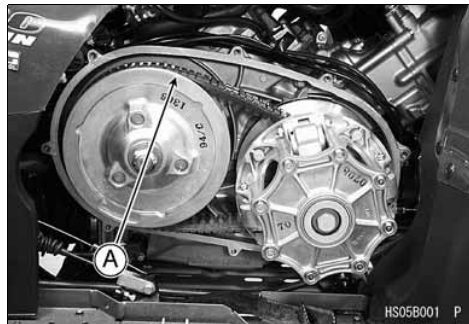
Drive Belt Installation

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.

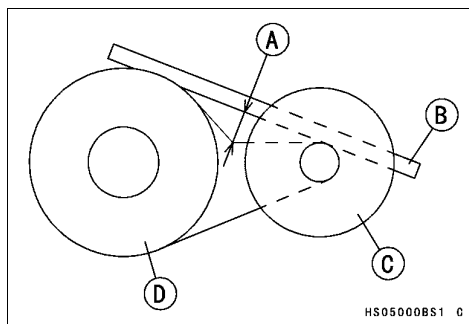


Drive Belt Deflection Inspection

- Remove the torque converter cover (see Torque Converter Removal).
- 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.)



Drive Belt

- ★ If the belt deflection is not within the specified range, first measure the drive belt width (see Drive Belt Inspection). Adjust the deflection by adding or removing spacers between the driven pulley shaft hub and cam ramp.
- 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.

Drive Belt Deflection Adjustment

- Disassemble the driven pulley (see Driven Pulley Disassembly).
- ★ 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 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.

Spacers

Part No.	Thickness
92026-1569	0.6 mm (0.024 in.)
92026-1617	0.8 mm (0.031 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).
- 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 attachments, tighten the driven pulley nut.

Special Tools - Flywheel & Pulley Holder: 57001-1343

Pulley Holder Attachment: 57001-1472

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

Drive Belt Inspection

Inspection of the drive belt is required at least every 90 days of vehicle use (average 12 mile/day) not to exceed 1,100 mile. More frequent inspection is necessary if the vehicle is subjected to hard usage.

⚠ WARNING

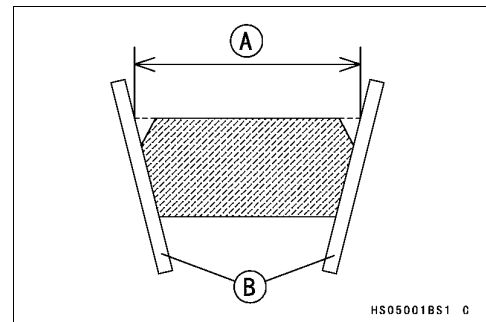
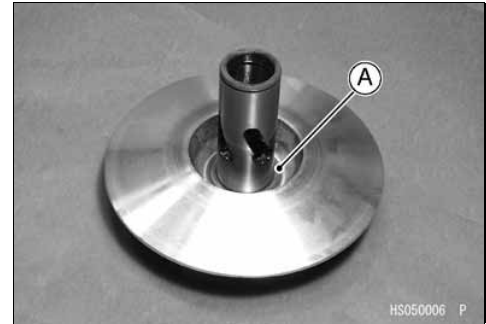
Neglect, abuse, or failure to maintain the transmission can result in a severely worn or damaged drive belt locking up the transmission and wheels. This can cause the operator to lose control and have an accident resulting in injury or death.

- 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: 29.2 ~ 30.4 mm (1.15 ~ 1.20 in.)

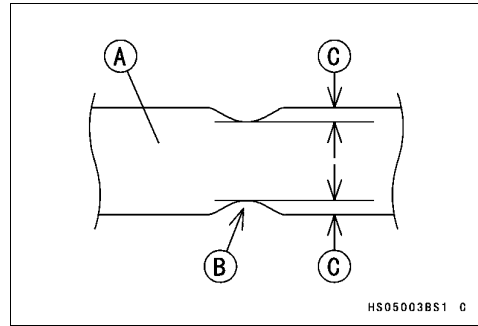
Service Limit: 28.8 mm (1.13 in.)



5-12 CONVERTER SYSTEM

Drive Belt

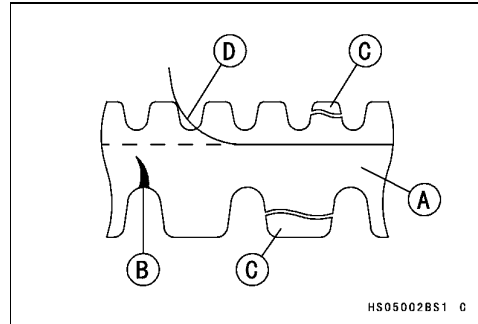
- Check the belt [A] for abnormal wear [B].
- Measure the width [C] of the belt at abnormal wear point.
- ★ If any measurements exceed 0.5 mm (0.02 in.), replace the belt.
- When using the belt of large abnormal wear, the drive belt failure detection switch could be activated.



- 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.

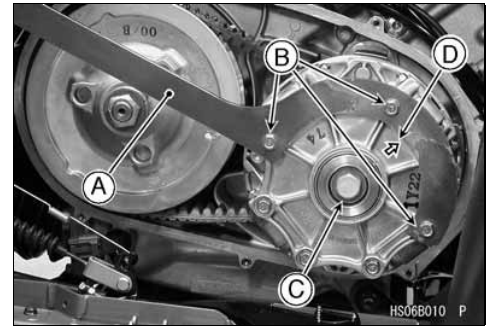


Drive Pulley

Drive Pulley Removal

- Remove the torque converter cover (see Torque Converter Cover Removal).
- Be sure to remove the three cover bolts [B] in the positions shown and install the drive pulley holder [A] in the position shown. Note the holder's relative position to the arrow mark [D].
- Tighten the three bolts:

Torque - Drive Pulley Cover Bolts :13 N·m (1.3 kgf·m, 113 in·lb)



CAUTION

Be sure to install three bolts in the specified positions shown. Otherwise, the tapped holes will be damaged.

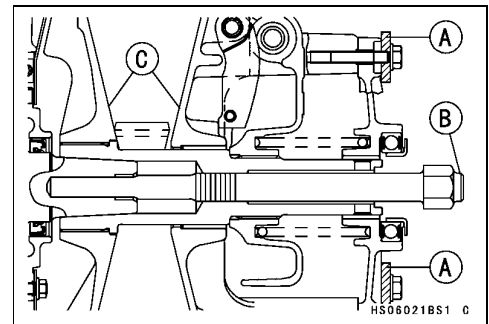
Special Tool - Drive Pulley Holder : 57001-1520

- Loosen the drive pulley bolt [C] (left-hand threads), holding the drive pulley with the drive pulley holder.
- Remove the drive pulley bolt, two washers, and the stepped washer, but do not remove the drive pulley holder yet.

NOTE

- *The drive pulley bolt has left-hand threads. Turn the wrench clockwise for loosening.*
- Remove the drive pulley [C] from the crankshaft by screwing the drive pulley puller bolt [B] **clockwise**, while holding the drive pulley with the drive pulley holder [A].

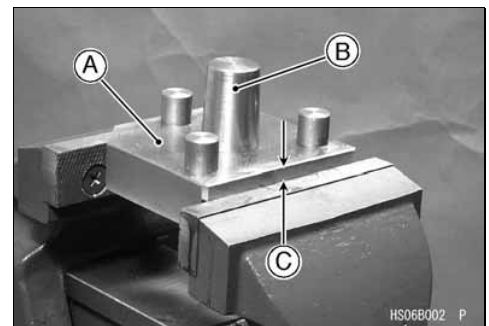
Special Tool - Drive Pulley Puller Bolt: 57001-1429



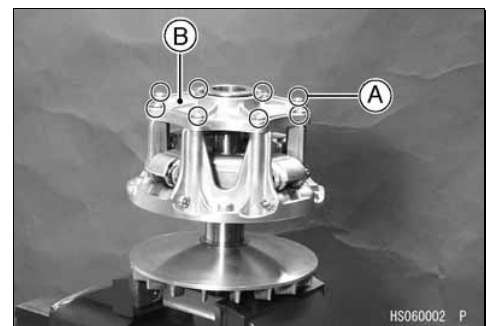
Drive Pulley Disassembly

- 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



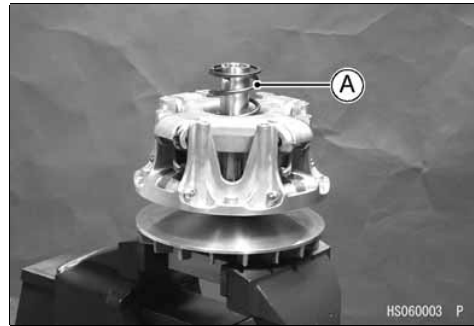
- Set the pulley onto the pulley holder.
- Remove:
 - Drive Pulley Cover Bolts [A]
 - Drive Pulley Cover [B]



5-14 CONVERTER SYSTEM

Drive Pulley

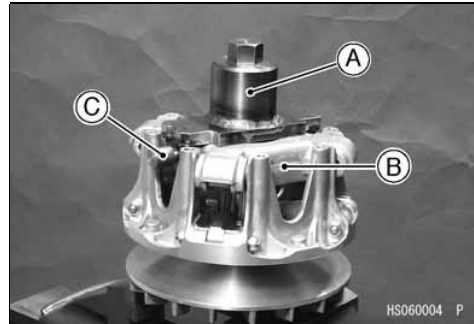
- Remove:
Spring [A]
Spacer(s) under the spring (A2 Early, A1, B1: one for high altitude setting only. A2 Late, B2: one for STD and another for high altitude setting)



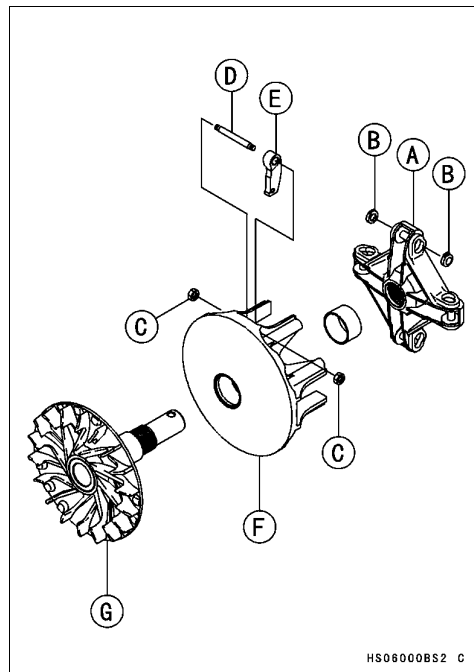
- Put the drive pulley wrench [A] on the spider [B] and tighten the bolt [C].
Special Tool - Drive Pulley Wrench: 57001-1474
- Turn the wrench clockwise and remove the spider with the movable sheave.

NOTE

- The spider has left-hand threads. Turn the wrench clockwise for loosening.

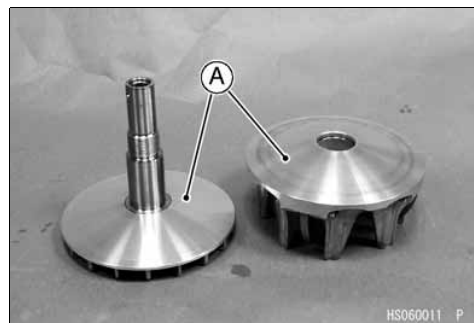


- Remove:
Spider [A]
Shoes [B]
Nuts [C]
Ramp Weight Pin [D]
Ramp Weight [E]
Movable Sheave [F]
Fixed Sheave [G]



Drive Pulley Inspection

- ★ If the sheave surfaces [A] appear damaged, replace the sheaves.

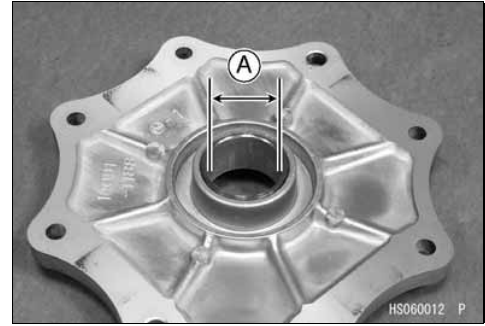


Drive Pulley

- ★ If the cover bushing is damaged or worn, replace the drive pulley cover.

Cover Bushing Inside Diameter [A]

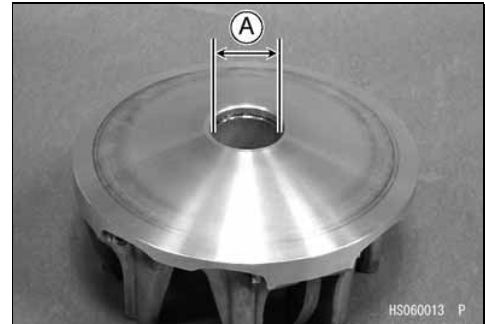
Standard: 27.985 ~ 28.085 mm (1.1018 ~ 1.1057 in.)
Service Limit: 28.12 mm (1.107 in.)



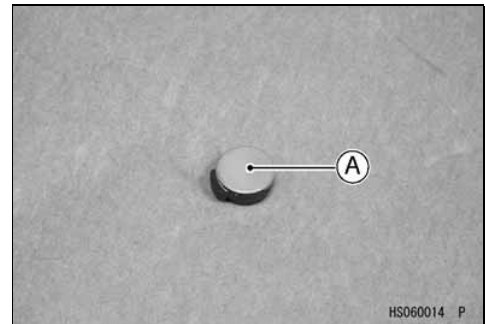
- ★ If the sheave bushing is damaged or worn, replace it.

Sheave Bushing Inside Diameter [A]

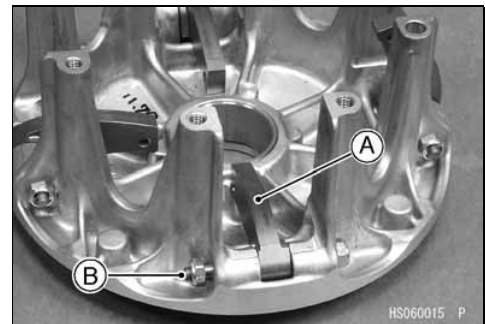
Standard: 37.985 ~ 38.085 mm (1.4955 ~ 1.4994 in.)
Service Limit: 38.12 mm (1.501 in.)



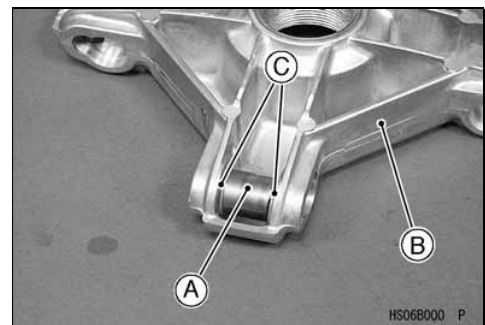
- ★ If the spider shoes [A] are damaged, replace them.
- Check the spider shoe side clearance (see Spider Shoe Side Clearance Inspection in this section).



- ★ 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.



- ★ If the rollers [A] are damaged or worn, replace the spider [B].
- ★ If the washers [C] are damaged or worn, replace the spider.



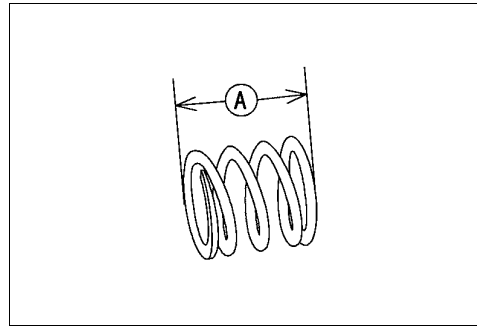
5-16 CONVERTER SYSTEM

Drive Pulley

★ If the spring is worn or damaged, replace the spring.

Spring Free Length [A]

Standard: 62 mm (2.44 in.)



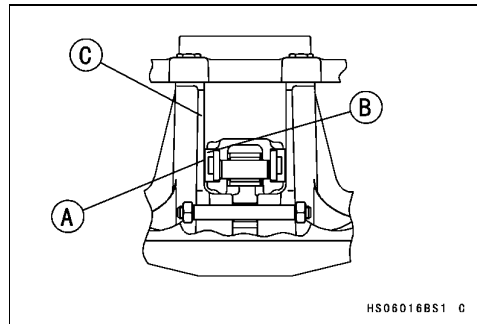
Spider Shoe Side Clearance Adjustment

- 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 sheave spring yet.
- Turn the movable sheave clockwise.
- Measure the resulting clearance [A] between the shoe [B] and the post [C] on the movable sheave at all four arms.

Shoe Side Clearance

Standard: 0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.)

★ If any of the measurements are greater than the maximum, replace all shoes (see Drive Pulley Disassembly) with standard shoes (see the next tables).



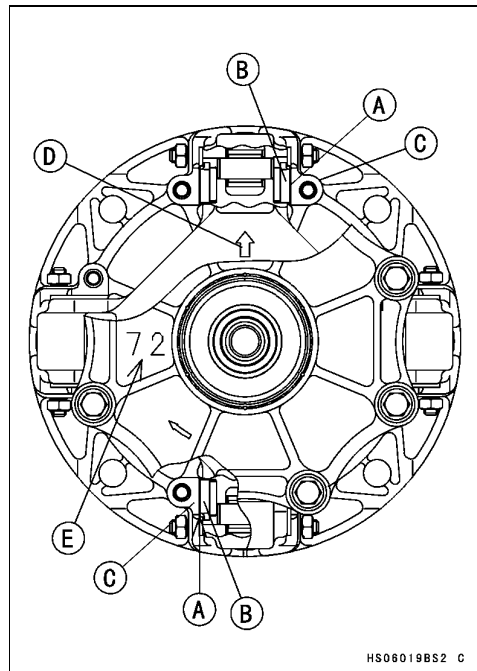
HS06016BS1 C

- Turn the movable sheave clockwise.
- 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
- ★ If the clearance is not within the specified range, adjust it according to following tables and each identification number [E].

KVF650-A1, B1 and A2 Early Model

Identification No. of Torque Converter Cover: 72

Clearance Measurement	Present Shoes	
	Part Number	Thickness
Less than 0.15 mm (0.0059 in.) (no clearance)	49048-1078	7.2 mm (0.283 in.)
	49048-1079	7.3 mm (0.287 in.)
0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.) (standard clearance)	no change, standard (49048-1080)	
	49048-1081	7.4 mm (0.291 in.)
over 0.30 mm (0.012 in.)	49048-1082	7.5 mm (0.295 in.)
	49048-1083	7.6 mm (0.299 in.)
	49048-1084	7.7 mm (0.303 in.)
	49048-1085	7.8 mm (0.307 in.)
	49048-1086	7.9 mm (0.311 in.)



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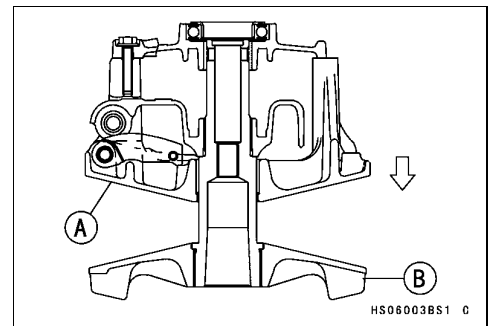
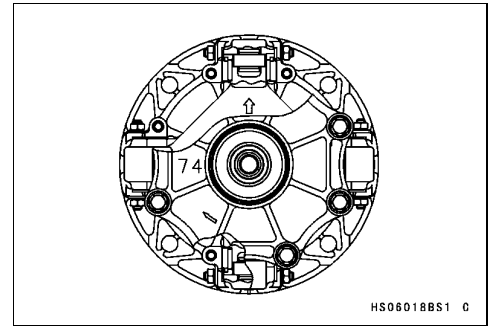
Drive Pulley

KVF650-A2 Late, B2 Models

Identification No. of Torque Converter Cover: 74

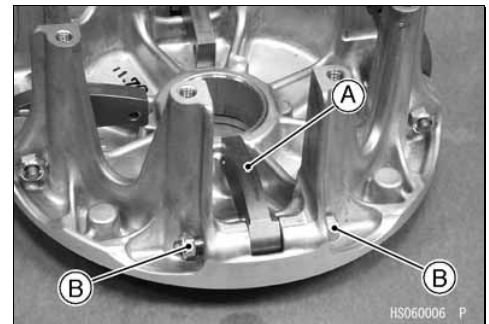
Clearance Measurement	Present Shoes	
	Part Number	Thickness
less than 0.15 mm (0.0059 in.) (no clearance)	49048-1087	7.2 mm (0.283 in.)
	49048-1088	7.3 mm (0.287 in.)
0.15 ~ 0.30 mm (0.0059 ~ 0.012 in.) (standard clearance)	no change, standard (49048-1089)	
	49048-1089	7.4 mm (0.291 in.)
over 0.30 mm (0.012 in.)	49048-1090	7.5 mm (0.295 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.)

- Check that the movable sheave [A] moves smoothly after the shoe side clearance adjustment.
- Push down on the drive pulley as shown, the movable sheave must move freely towards the fixed sheave [B] with no more force than 9.8 N (1 kgf, 2.2 lbs).
- ★ If the movable sheave does not move smoothly, readjust the shoe side clearance.

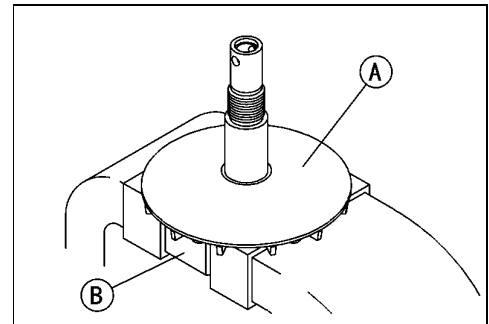


Drive Pulley Assembly

- Install the ramp weight [A] as shown.
- Tighten:
 - Torque - Ramp Weight Nuts [B]: 6.9 N·m (0.7 kgf·m, 61 in·lb)
- Check that the ramp weights swing smoothly.



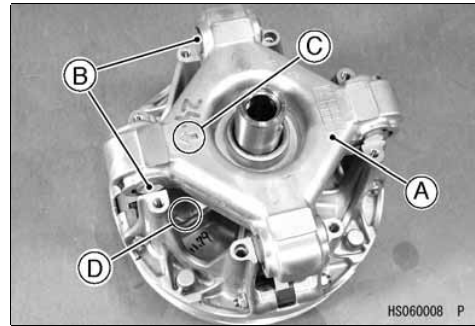
- Hold the fixed sheave [A] with the drive pulley holder [B] in a vise.
- Special Tool - Drive Pulley Holder: 57001-1473



5-18 CONVERTER SYSTEM

Drive Pulley

- 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.



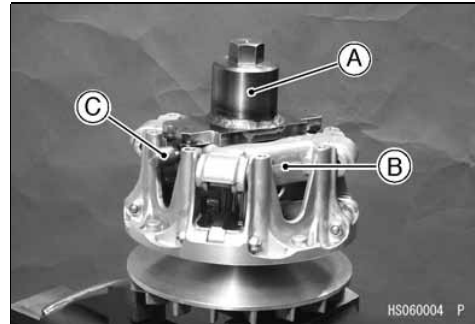
- Put the drive pulley wrench [A] on the spider [B] and tighten the bolt [C].

Special Tool - Drive Pulley Wrench: 57001-1474

- Turn the wrench counterclockwise for tightening.

Torque - Spider: 275 N·m (28 kgf·m, 205 ft·lb)

- Remove the drive pulley wrench.



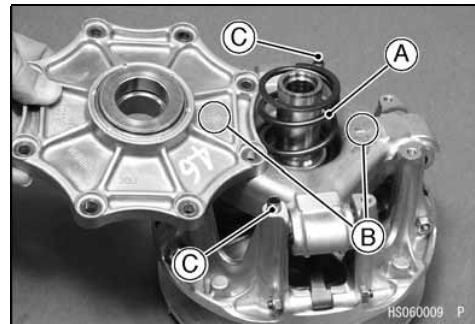
- ★ Install the spring spacer (92026-1603: t1.0 mm, yellow , see High Altitude Setting Information) behind the spring.

KVF650-A2 Early, A1, B1: one spring spacer for high altitude setting only
 KVF650-A2 Late, B2: one spring spacer for STD and another for high altitude setting

- Put the spring [A] in the groove of the spider.
- Align the arrows [B] on the drive pulley cover and spider.
- Install the dowel pins [C] and the drive pulley cover.
- Tighten:

Torque - Drive Pulley Cover Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)

- Clean the surface of the sheaves with an oil-less cleaning fluid.

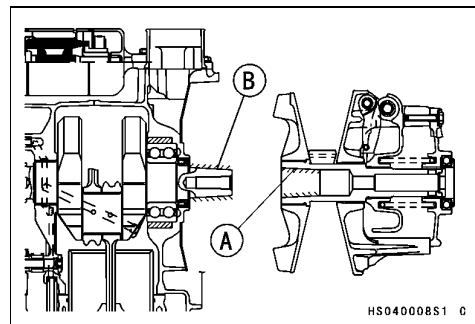


Drive Pulley Installation

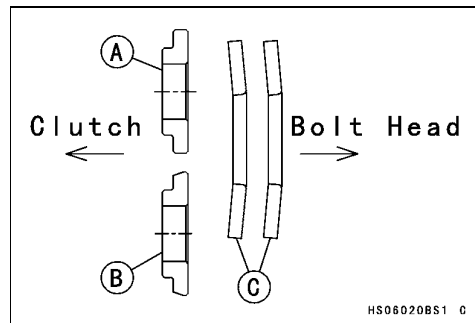
- Clean the following portions with an oil-less cleaning fluid such as trichloroethylene or acetone.
 - Fixed Sheave Tapered Portion [A]
 - Crankshaft Tapered Portion [B]

⚠ WARNING

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



- Install the drive pulley, stepped washer, and two washers on the drive pulley bolt as shown.
 - [A] Stepped Washer for KVF650-A2 Early, A1, B1
 - [B] Stepped Washer for KVF650-A2 Late, B2
 - [C] Two Washers



Drive Pulley

- Install the drive pulley cover and be sure to install the drive pulley holder [A] along with three cover bolts [B] in the position shown. Note the holder's relative position to the arrow mark [D].
- Tighten the three cover bolts [B] to the specified torque.

Special Tool - Drive Pulley Holder: 57001-1520

- Tighten:

Torque - Drive Pulley Cover Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)
Drive Pulley Bolt [C] (new, left-hand threads): 93 N·m (9.5 kgf·m, 69 ft·lb)

- Remove the drive pulley holder and install three drive pulley cover bolts.
- 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 shown.

Drive Pulley Installation Length [A]

Standard: 149.85 ~ 150.95 mm (5.900 ~ 5.943 in.)

- Install the drive pulley measurement tool (legs [A] and plate [B]) on the crankcase [C].

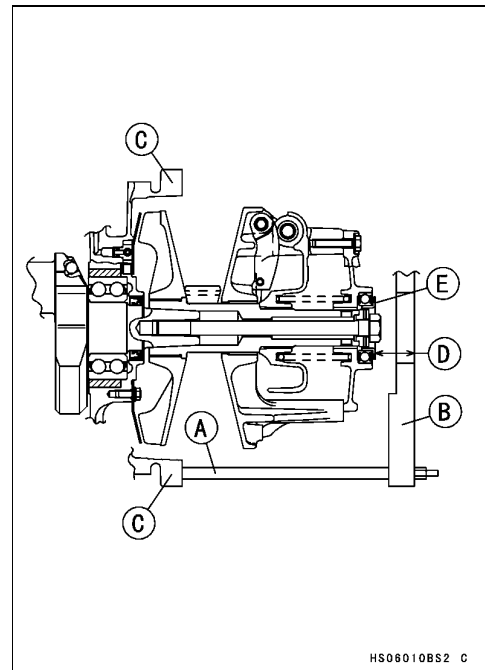
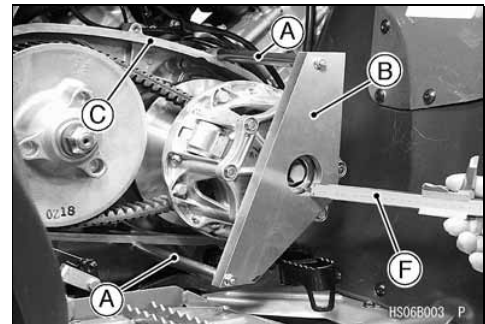
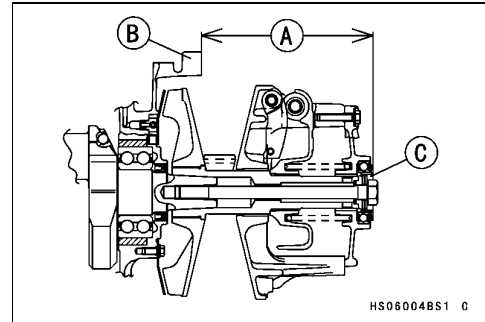
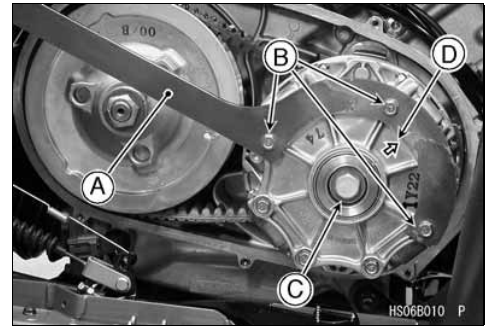
Special Tool - Drive Pulley Measurement Tool: 57001-1498

- 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 less than 14.55 mm (0.573 in.), use the drive pulley cover (14041-1148 for A1, B1 or 1159 for A2, B2) of red paint.
- ★ If the measurement is more than 15.65 mm (0.616 in.), use the drive pulley cover (14041-1149 for A1, B1 or 1160 for A2, B2) of blue paint.
- ★ If the length is not within the specified length after the drive pulley cover is replaced, replace the drive pulley assembly.



5-20 CONVERTER SYSTEM

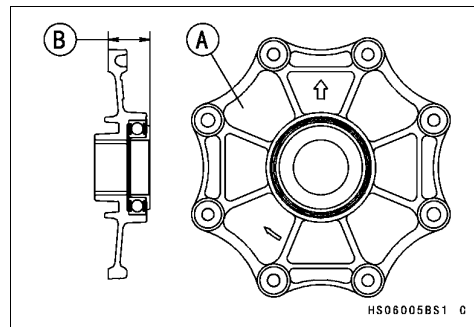
Drive Pulley

Drive Pulley Covers for KVF650-A2 Early, A1, B1 Models

Part Number	Paint Color [A]	Length [B]
14041-1148	Red	24.0 mm (0.945 in.)
14041-1149	Blue	25.4 mm (1.000 in.)
14041-1150	None	24.7 mm (0.972 in.)

Drive Pulley Covers for KVF650-A2 Late, B2 Models

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	None	24.7 mm (0.972 in.)



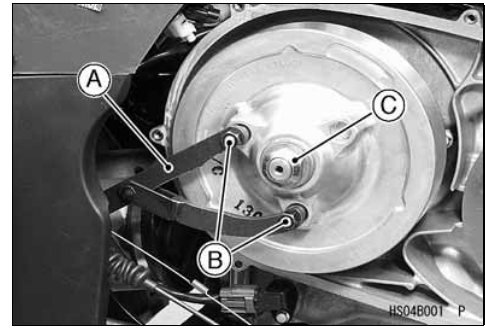
Driven Pulley

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: 57001-1343
Pulley Holder Attachment: 57001-1472

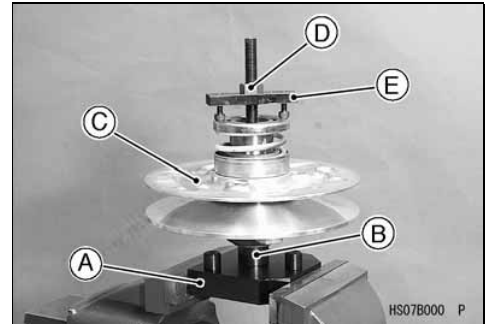
- Remove:
 - Driven Pulley



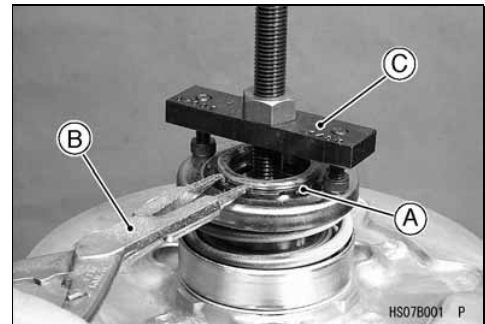
Driven Pulley Disassembly

- 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].

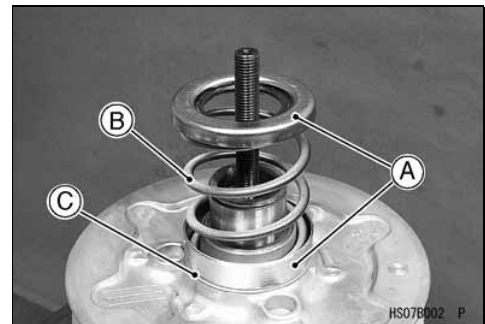
Special Tool - Spring Holder Set: 57001-1483



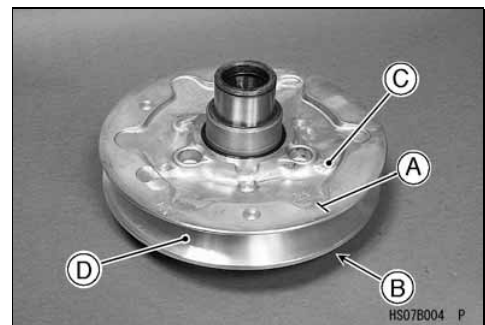
- Remove the circlip [A] with circlip pliers [B].
 - Special Tool - Circlip Pliers: 57001-154**
- Remove the nut and spring holder [C].



- Remove:
 - Spring Seats [A]
 - Spring [B]
 - Thrust Plate [C]



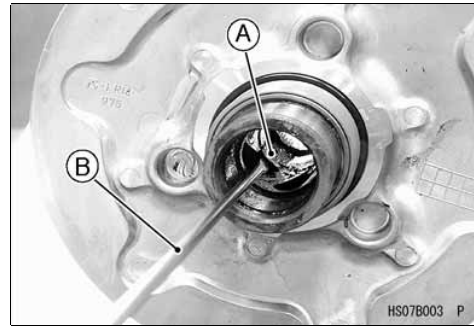
- Make match-marks [A] and [B] on the sheaves so that it can be installed later in the same position.
 - Movable Sheave [C]
 - Fixed Sheave [D]



5-22 CONVERTER SYSTEM

Driven Pulley

- 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.

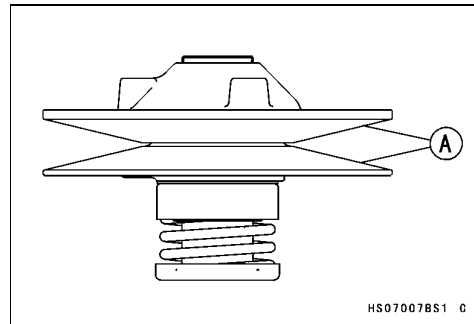


- Remove:
Spacer(s) [A] (for Drive Belt Deflection Adjustment)

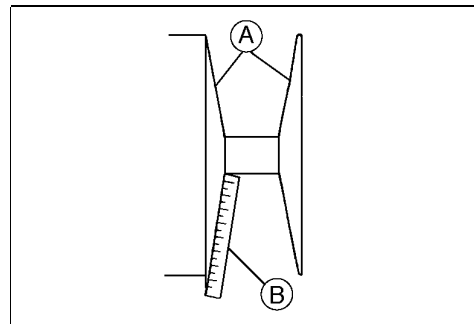


Driven Pulley Inspection

- ★ If the sheave cone surfaces [A] appear damaged, replace the sheaves.



- Replace the sheave with uneven wear on the belt contacting surfaces.
[A] Sheave Surface
[B] Straight Edge



- ★ If the sheave bushings [A] are damaged or worn, replace the movable sheave.

Sheave Bushing Inside Diameter

KVF650-A2 Early, A1, B1 Models

Standard: 39.994 ~ 40.104 mm (1.5746 ~ 1.5789 in.)

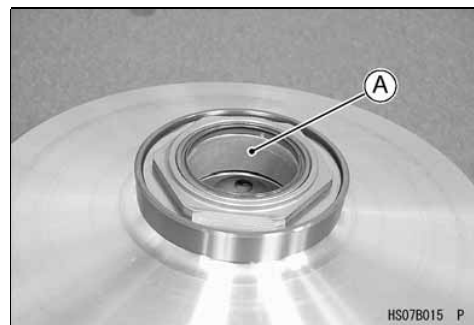
Service Limit: 40.13 mm (1.580 in.)

KVF650-A2 Late, B2 Models

Standard: 40.040 ~ 40.079 mm (1.5764 ~ 1.5779 in.)

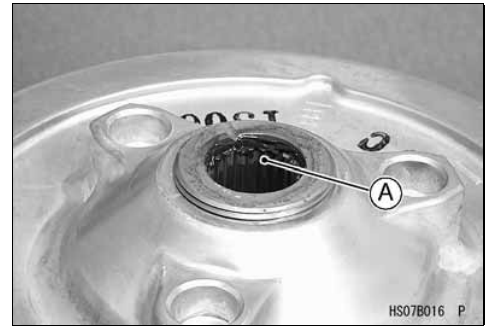
Service Limit: 40.11 mm (1.579 in.)

- Inspect seals for damage.
- ★ If seals are damaged, replace the movable sheave.



Driven Pulley

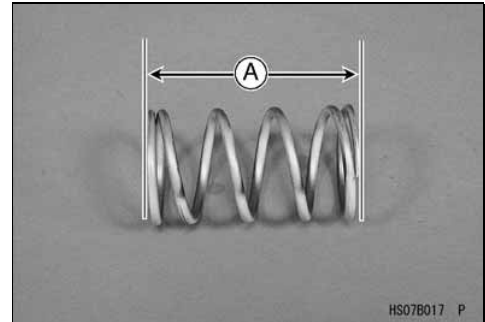
★ If the splines [A] are damaged or worn, replace the fixed sheave.



★ If the spring is damaged or worn, replace the spring.

Spring Free Length [A]
Standard: 99.5 mm (3.92 in.)

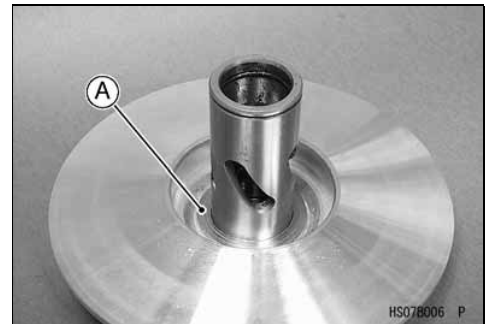
★ If the spring coils are distorted, replace the spring.



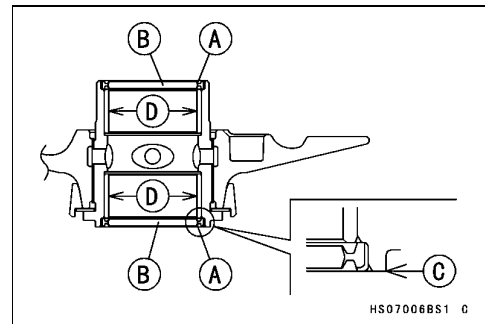
Driven Pulley Assembly

- Clean off any grease or dirt on the movable and fixed sheaves, and dry them with a clean cloth.

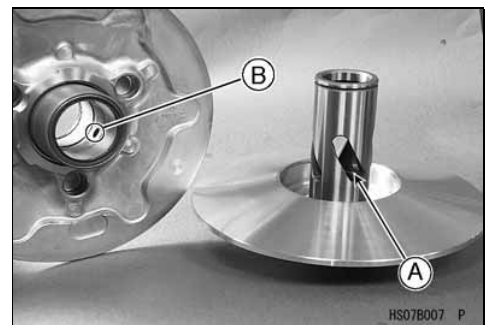
- Install:
 Spacers [A] (for Drive Belt Deflection Adjustment)



- 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] molybdenum disulfide grease to the inner surfaces of the busings



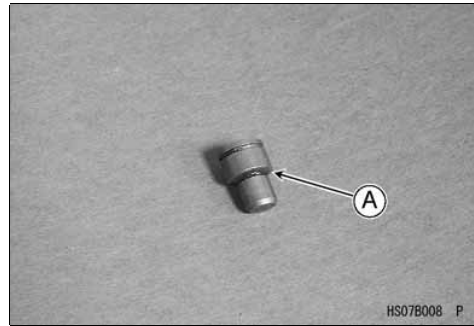
- Align the match-marks on the sheaves, made when disassembled, and the opening [A] and hole [B] will be matched easily.



5-24 CONVERTER SYSTEM

Driven Pulley

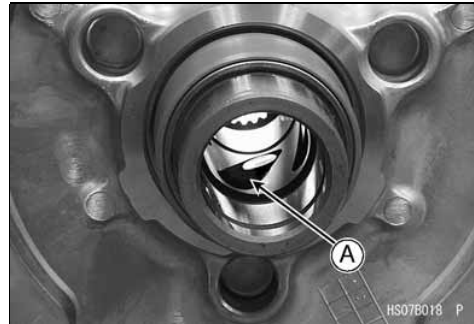
- Apply molybdenum disulfide grease to the seating surface [A] of the pins, and insert them into the holes in the movable sheave.



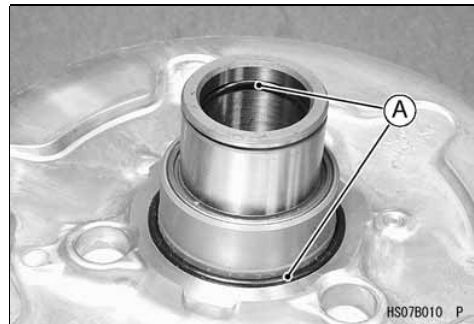
- Draw the movable sheave onto the fixed sheave, and apply molybdenum disulfide grease of 1 g (0.035 oz) to all openings [A].

NOTE

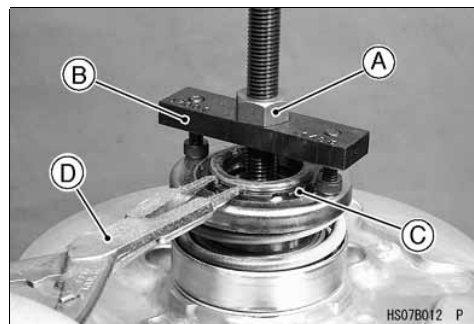
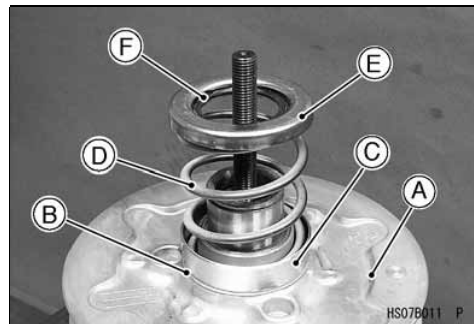
- Do not heap up the grease out of the openings.



- Check that the O-rings [A] are in good condition.
★ If any of the O-rings are damaged, replace them.



- 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: 57001-154
- Remove the driven pulley from the spring holder set.
- Clean the surface of the sheaves with an oil-less cleaning fluid.



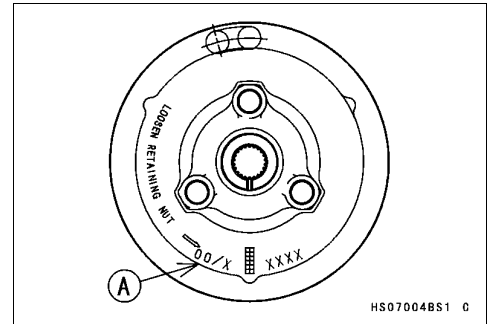
Driven Pulley

Driven Pulley Installation

- Each driven pulley has an identification mark [A] as shown. Be careful not to confuse them.

KVF650–A2 Early, A1, B1: 94/A, B, or C

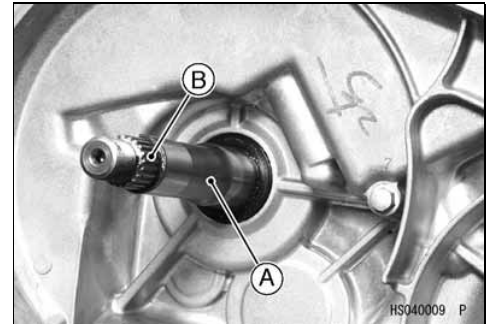
KVF650–A2 Late, B2: 00/A, B, or C



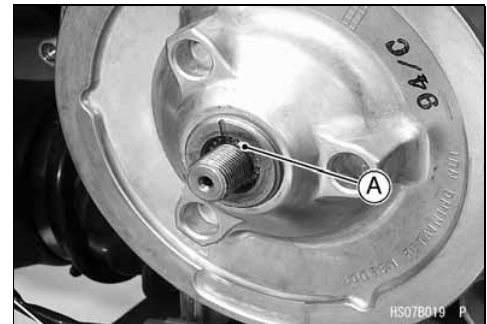
- Clean the transmission driven shaft [A].
- Install:
Driven Pulley

NOTE

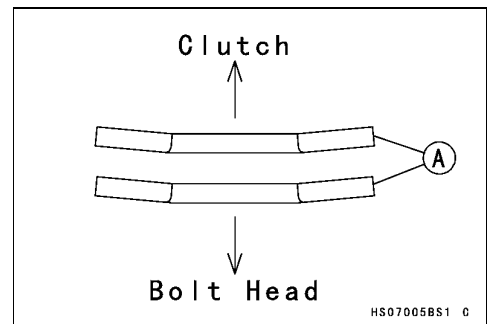
- When engaging the spline on the driven pulley with the spline [B] on the shaft, do not damage the pulley's spline. If any damage occurs, remove it with a file.



- Clean the driven shaft and driven pulley ends to open the air vent passage. Wipe off any extra grease.
- Wipe off any protruding grease [A].



- Install two washers [A] on the shaft as shown.

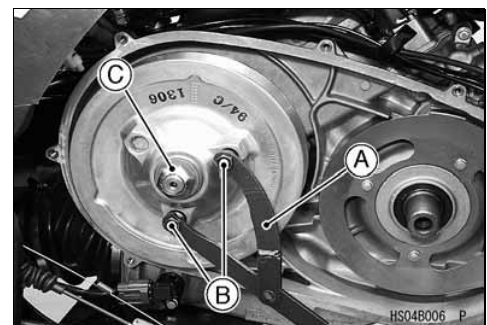


- Using a flywheel & pulley holder [A] and attachments [B], tighten the driven pulley nut [C].

Special Tools - Flywheel & Pulley Holder: 57001–1343

Pulley Holder Attachment: 57001–1472

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



5-26 CONVERTER SYSTEM

High Altitude Setting Information

Specifications

KVF650–A2 Early, A1, B1 Models

Altitude m (ft)	Drive Pulley			Carburetor
	Ramp Weights	Spring Spacer	(qty)	Main Jet
0 ~ 500 (0 ~ 1,600)	P/No. 39152-1081 (STD, C)	—	(0)	Front: #138 (P/No. 92063-1015) (STD) Rear: #142 (P/No. 92063-1016) (STD)
500 ~ 1,600 (1,700 ~ 4,900)	P/No. 39152-1081 (STD, C)	—	(0)	Front: #135 (P/No. 92063-1014) Rear: #140 (P/No. 92063-1013)
1,600 ~ 2,500 (4,900 ~ 8,200)	P/No. 39152-1081 (STD, C)	—	(0)	Front: #132 (P/No. 92063-1076) Rear: #138 (P/No. 92063-1015)
2,500 ~ 3,500 (8,200 ~ 11,500)	P/No. 39152-1088 (C1)	P/No. 92026-1603 t=1 mm (0.04 in)	(1)	Front: #130 (P/No. 92063-1075) Rear: #132 (P/No. 92063-1076)
3,500 ~ 4,500 (11,500 ~ 14,800)	P/No. 39152-1088 (C1)	P/No. 92026-1603 t=1 mm (0.04 in)	(1)	Front: #125 (P/No. 92063-1069) Rear: #130 (P/No. 92063-1075)

C, C1: Identification marks

qty: quantity

KVF650–A2 Late, B2 Models

Altitude m (ft)	Drive Pulley			Carburetor
	Ramp Weights	Spring Spacer	(qty)	Main Jet
0 ~ 500 (0 ~ 1,600)	P/No. 39152-1081 (STD, C)	P/No. 92026-1603 t=1 mm (0.04 in)	(1)	Front: #138 (P/No. 92063-1015) (STD) Rear: #142 (P/No. 92063-1016) (STD)
500 ~ 1,600 (1,700 ~ 4,900)	P/No. 39152-1081 (STD, C)	P/No. 92026-1603 t=1 mm (0.04 in)	(1)	Front: #135 (P/No. 92063-1014) Rear: #140 (P/No. 92063-1013)
1,600 ~ 2,500 (4,900 ~ 8,200)	P/No. 39152-1081 (STD, C)	P/No. 92026-1603 t=1 mm (0.04 in)	(1)	Front: #132 (P/No. 92063-1076) Rear: #138 (P/No. 92063-1015)
2,500 ~ 3,500 (8,200 ~ 11,500)	P/No. 39152-1088 (C1)	P/No. 92026-1603 t=1 mm (0.04 in)	(2)	Front: #130 (P/No. 92063-1075) Rear: #132 (P/No. 92063-1076)
3,500 ~ 4,500 (11,500 ~ 14,800)	P/No. 39152-1088 (C1)	P/No. 92026-1603 t=1 mm (0.04 in)	(2)	Front: #125 (P/No. 92063-1069) Rear: #130 (P/No. 92063-1075)

C, C1: Identification marks

qty: quantity

- Refer to the Drive Pulley section in this chapter and Carburetor section in the Fuel System chapter for the parts replacement.

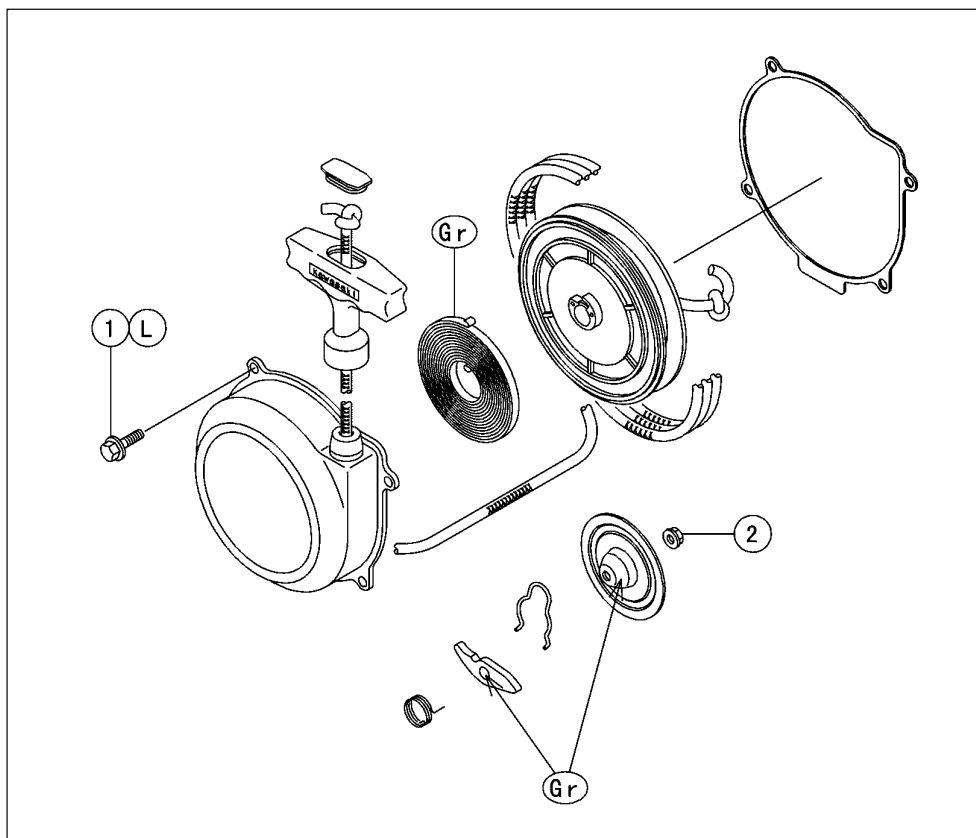
Recoil Starter

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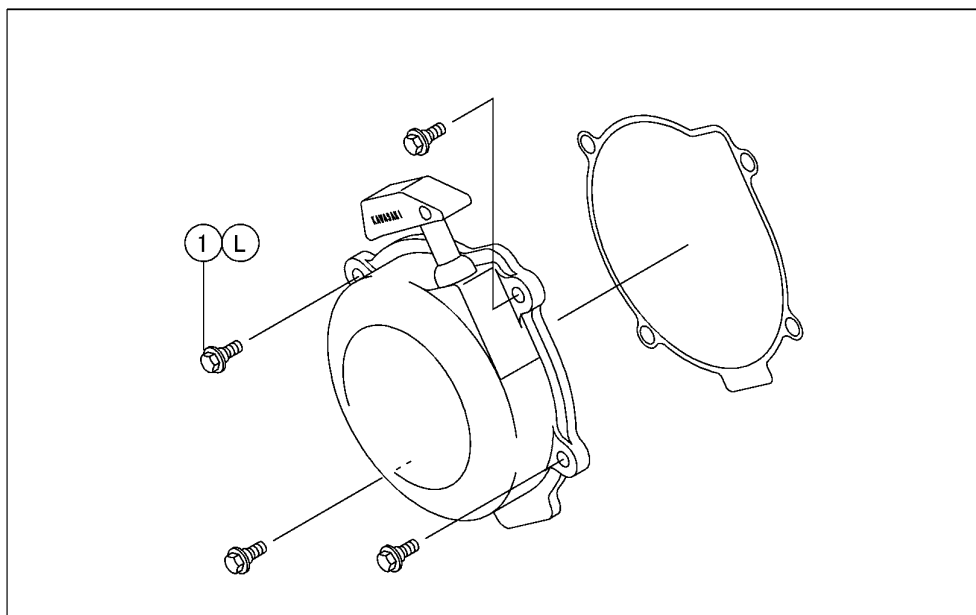
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6-2 RECOIL STARTER

Exploded View



A1



A2

HT02003BWS C

RECOIL STARTER 6-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Recoil starter mounting bolts	12	1.2	104 in·lb	L
2	Recoil starter flange nut	8.3	0.85	74 in·lb	

L: Apply a non-permanent locking agent.
Gr: Apply grease.

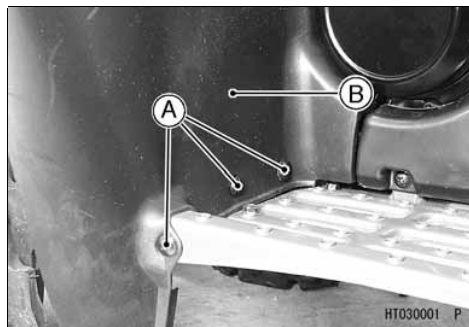
A1: KVF650-A1/B1
A2: KVF650-A2/B2

6-4 RECOIL STARTER

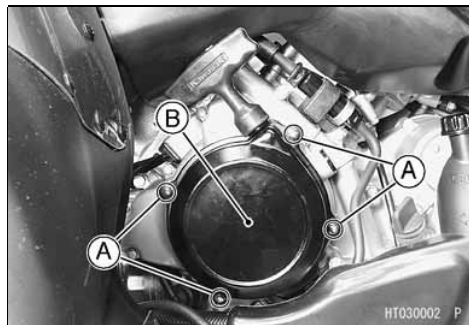
Recoil Starter

Recoil Starter Removal

- Remove the left flap lower screws [A]. (KVF650-A1/B1)
- Move the left flap lower part [B] forward. (KVF650-A2/B2)



- Remove:
 - Recoil Starter Mounting Bolts [A]
 - Recoil Starter [B]

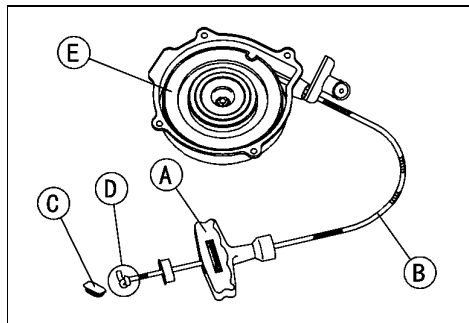


Recoil Starter Installation

- Apply a non-permanent locking agent:
 - Recoil Starter Mounting Bolts
- Tighten:
 - Torque - Recoil Starter Mounting Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**

Recoil Starter Disassembly (KVF650-A1/B1)

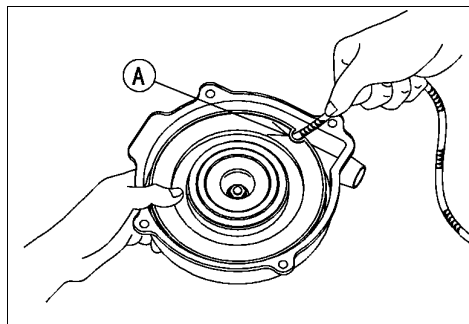
- Remove the recoil starter.
- Pull the handle [A] out 100 ~ 200 mm (3.9 ~ 7.9 in.). Clamp the rope [B] in place with locking pliers.
- Remove the handle cap [C].
- Pry the knot [D] out of the handle and untie it. Pull the handle off the rope.
- Hold the reel [E] in one hand while removing the locking pliers with the other.



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

NOTE

- Do not let the rope wedge between the reel and the housing.
- Slowly allow recoil spring tension to unwind the reel.

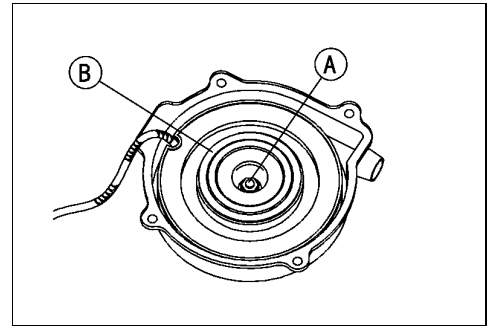


Recoil Starter

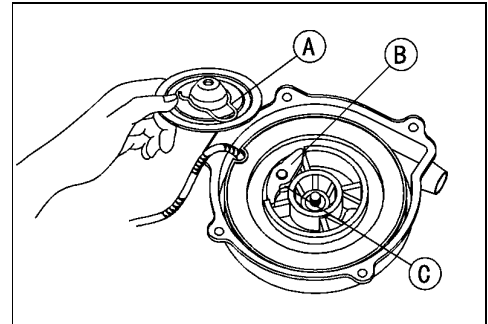
- Remove:
 - Flange Nut [A]
 - Friction Plate [B]

⚠ WARNING

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



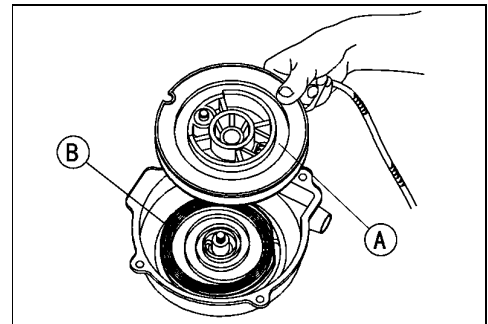
- Remove:
 - Friction Plate Spring [A]
 - Pawl [B]
 - Pawl Spring [C]



- Remove the reel [A] noting the following.

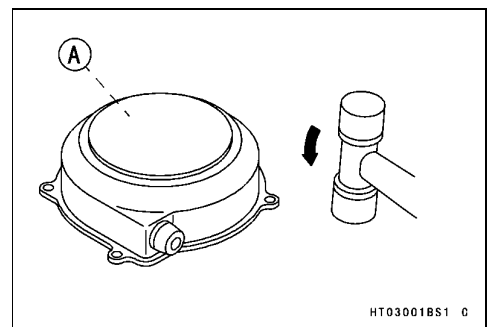
⚠ WARNING

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



NOTE

- There should be no spring tension on the reel when removing the reel. Lift the reel slightly. If tension is felt, push the reel back into place and gently "wiggle" it until the reel may be easily removed.
- If necessary, remove the recoil spring [A] as follows:
 - Place the starter housing facing down on a bench.
 - Strike the bench sharply so safely remove the spring.



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6-6 RECOIL STARTER

Recoil Starter

Recoil Starter Assembly (KVF650-A1/B1)

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

⚠ WARNING

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

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

NOTE

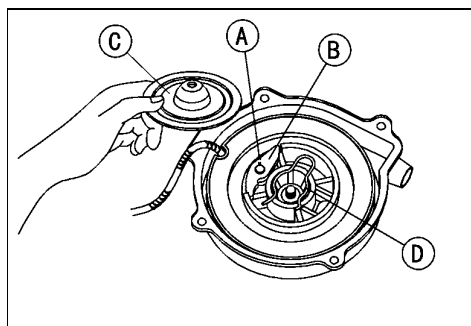
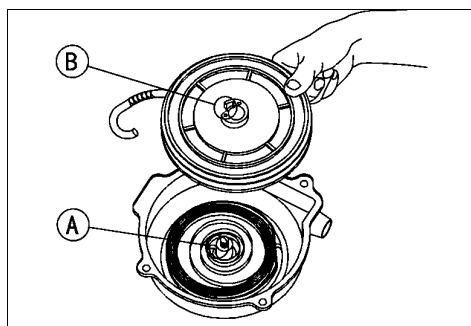
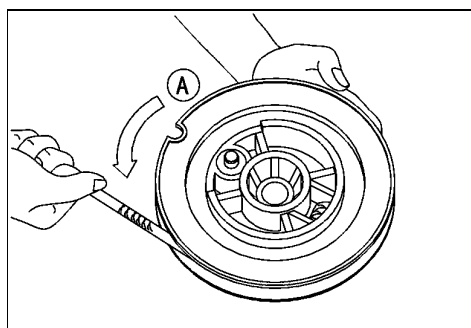
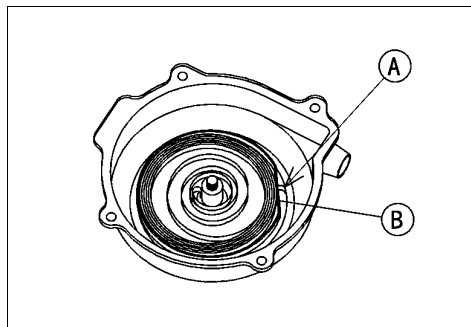
- Push the recoil spring against the housing securely to prevent the spring from slipping off during installation.
- Lightly grease the spring.
- If the rope was unwound from the reel, it must be wound clockwise for correct starter operation.
- Wind the rope **four turns** around the smaller diameter of the reel and **half turn** around the larger diameter.

NOTE

- Turn the reel counterclockwise [A] to wind the rope clockwise. This prevents the rope from twisting.
- Set the reel into the place so that the hook [A] on the spring catches on the tab [B] in the reel.

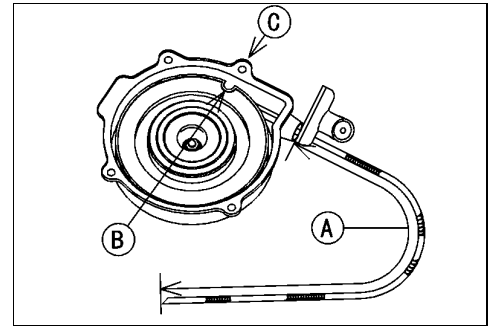
- Grease the pawl spring [A] and pawl [B] and install them as shown.
- Grease the friction plate [C] and install the friction plate and spring [D] being careful of the spring hook position.
- Tighten:

Torque - Recoil Starter Flange Nut: 8.3 N·m (0.85 kgf·m, 74 in·lb)



Recoil Starter

- Turn the reel **three turns clockwise** to preload the spring.
- The rope should protrude about 350 mm (13.8 in.) [A] when the reel notch [B] aligns with the hole [C] as shown.



Recoil Starter Cleaning (KVF650–A1/B1)

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

⚠ WARNING

Clean the starter in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean the starter. A fire or explosion could result.

CAUTION

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

- Use compressed air to dry the cleaned components.

Recoil Starter Inspection (KVF650–A1/B1)

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

Recoil Starter Inspection (KVF650–A2/B2)

- Check the starter rope for excessive wear or fraying.

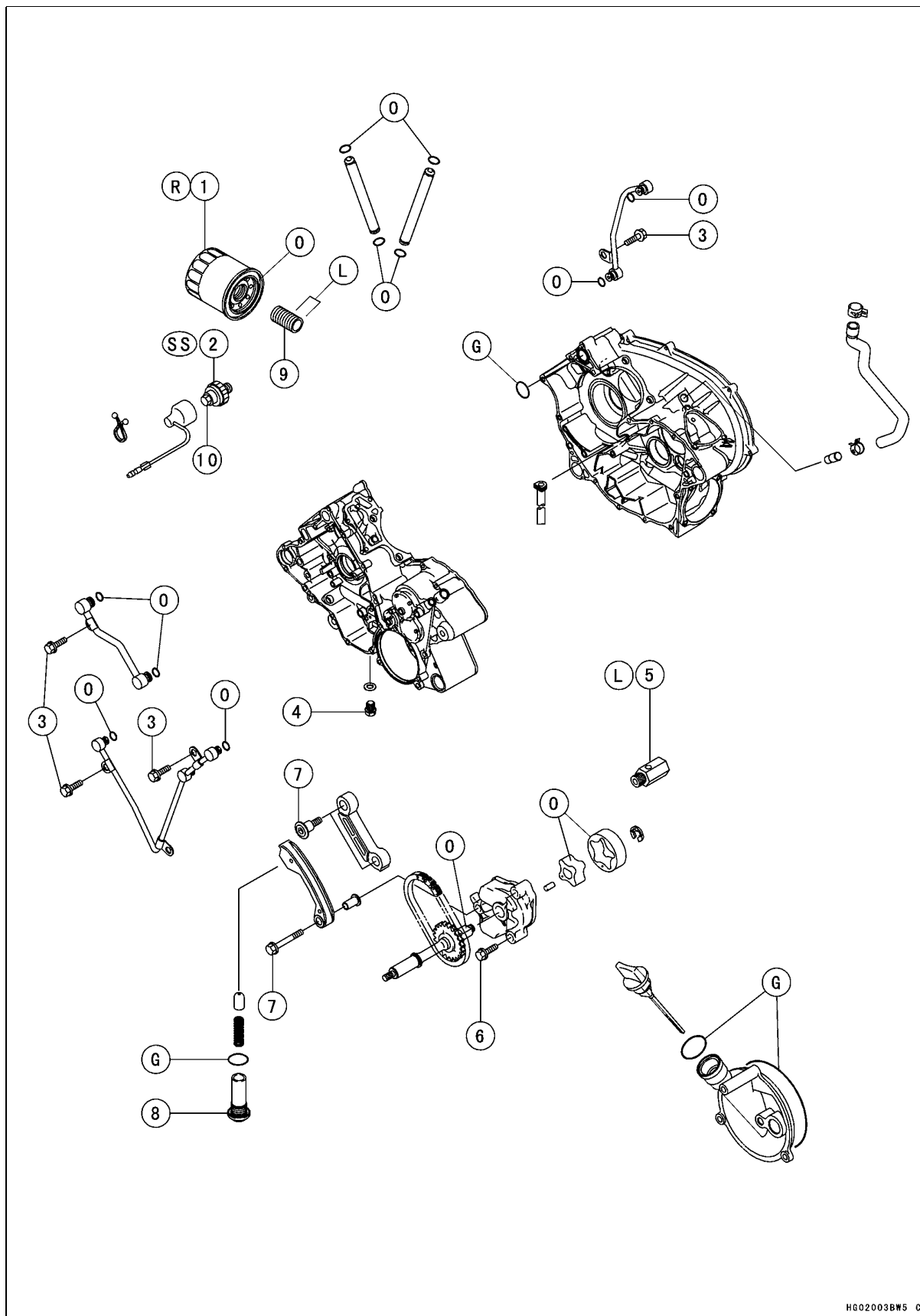
Engine Lubrication System

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7-2 ENGINE LUBRICATION SYSTEM

Exploded View



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ENGINE LUBRICATION SYSTEM 7-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil filter	18	1.8	13	R
2	Oil pressure switch	15	1.5	11	SS
3	Oil pipe bolts	8.8	0.9	78 in·lb	
4	Engine drain plug	20	2.0	14	
5	Oil pressure relief valve	15	1.5	11	L
6	Oil pump bolts	8.8	0.9	78 in·lb	
7	Chain guide bolts	8.8	0.9	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)
10	Oil pressure switch terminal bolt	1.5	0.15	13 in·lb	

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

L: Apply a non-permanent locking agent.

O: Apply engine oil.

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

R: Replacement Parts

7-4 ENGINE LUBRICATION SYSTEM

Specifications

Item	Standard
Engine Oil: Grade Viscosity Capacity	API SF or SG API SH or SJ with JASO MA SAE 10W-40 1.54 L (1.63 US qt) (when filter is not removed) 1.75 L (1.85 US qt) (when filter is removed) 2.05 L (2.17 US qt) (when engine is completely dry)
Oil Pressure Measurement: Oil Pressure @ 4500 r/min (rpm), oil temp. 110°C (230°F)	480 kPa (4.9 kgf/cm ² , 69.7 psi)

Special Tools - Oil Filter Wrench: 57001-1249

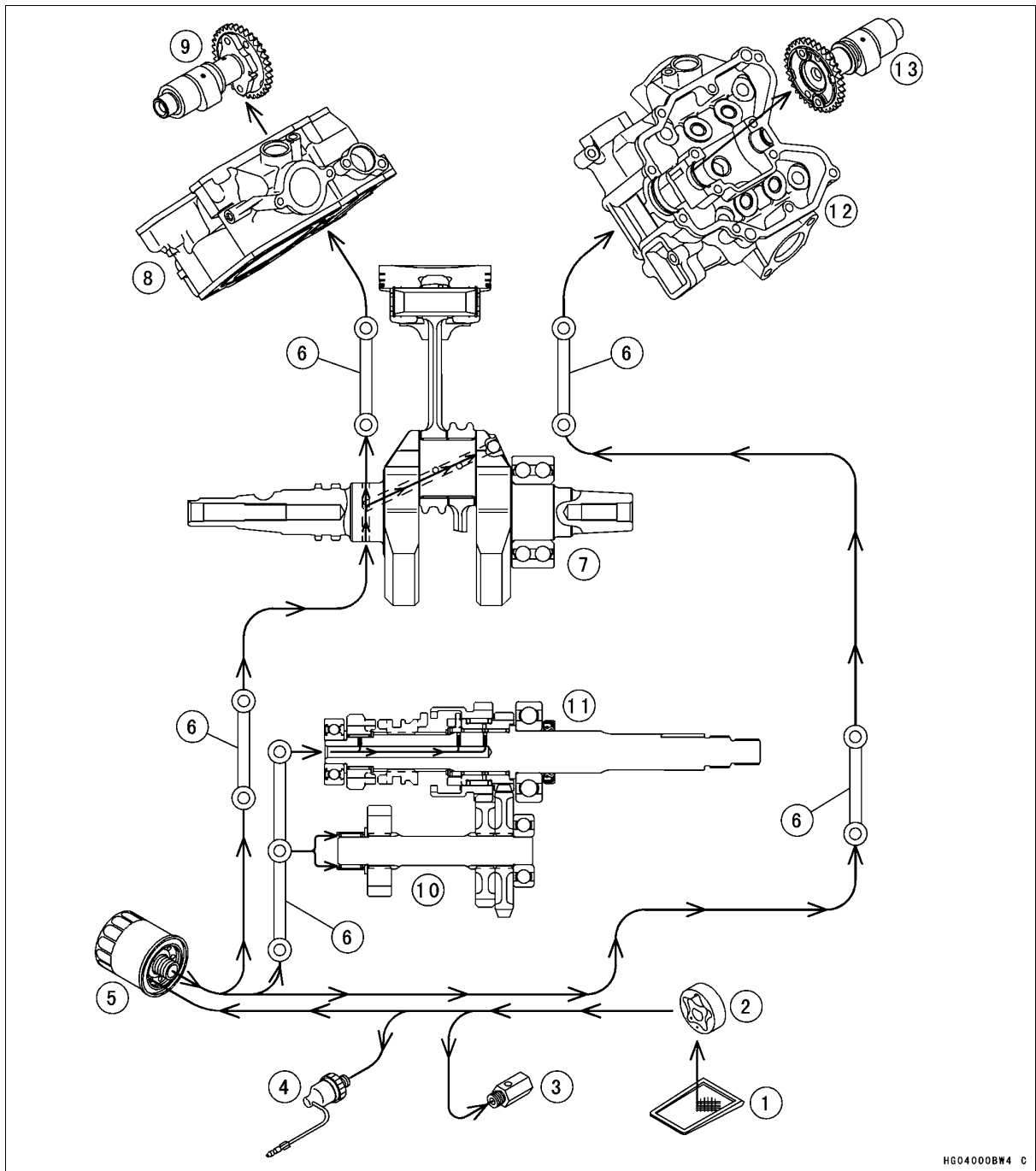
Oil Pressure Gauge, 10 kgf/cm²: 57001-164

Oil Pressure Gauge Adapter: 57001-1033

Sealant - Kawasaki Bond (Silicone Sealant): 57001-120

ENGINE LUBRICATION SYSTEM 7-5

Engine Oil Flow Chart



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- | | | |
|------------------------|-----------------------------|------------------------------|
| 1. Oil Screen | 6. Oil Pipe | 11. Transmission Drive Shaft |
| 2. Oil Pump | 7. Crankshaft | 12. Front Cylinder Head |
| 3. Relief Valve | 8. Rear Cylinder Head | 13. Front Camshaft |
| 4. Oil Pressure Switch | 9. Rear Camshaft | |
| 5. Oil Filter | 10. Transmission Idle Shaft | |

7-6 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

⚠ WARNING

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

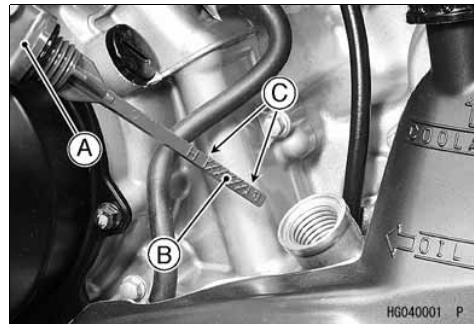
Oil Level Inspection

- Park the vehicle so that it is level, both side-to-side and front-to-rear.
- If the oil has just been changed, start the engine, and run it for several minutes to fill the oil filter.

CAUTION

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

- Support the vehicle so that it is level side to side and front to back after warming up the engine.
- Remove the engine drain plug [A] to drain the oil.
- The oil in the filter can be drained by removing the filter (see Oil Filter Change).
- ★ Replace the drain plug gasket with a new one.
- Tighten:

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

- Pour in the specified type and amount of oil.

Engine Oil

Grade: API SF or SG class

API SH or SJ with JASO MA

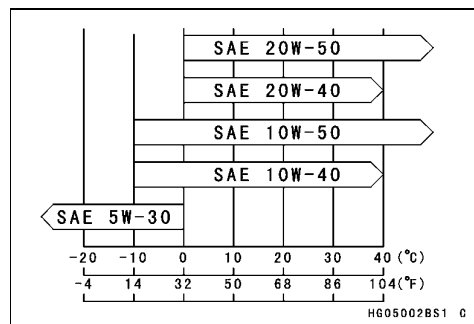
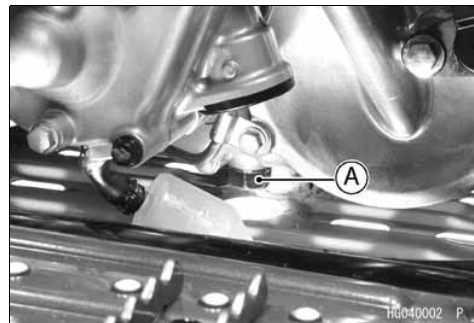
Viscosity: SAE 10W-40

Amount: 1.54 L (1.63 US qt) (When filter is not removed)

1.75 L (1.85 US qt) (When filter is removed)

2.05 L (2.17 US qt) (When engine is completely dry)

- 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.

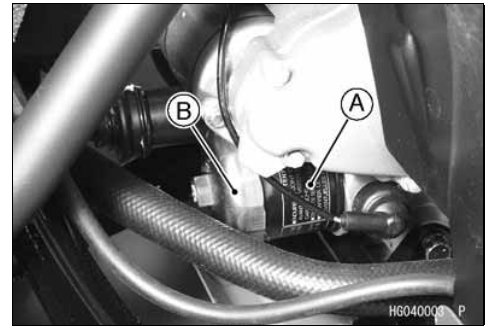


Engine Oil and Oil Filter

Oil Filter Change

- Drain the engine oil.
- Remove the oil filter [A] with the oil filter wrench [B].

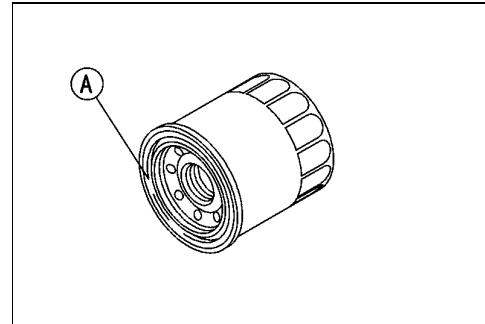
Special Tool - Oil Filter Wrench : 57001-1249



- 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) to the specified torque.

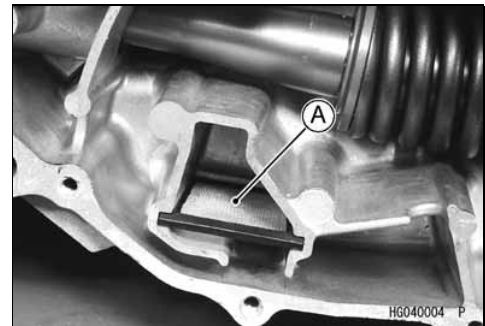
Torque - Oil Filter : 18 N·m (1.8 kgf·m, 13 ft·lb)

- Pour in the specified type and amount of oil.



Oil Screen Removal

- Split the crankcase (see Crankshaft/Transmission chapter).
- Pull the oil screen [A] out of the crankcase.

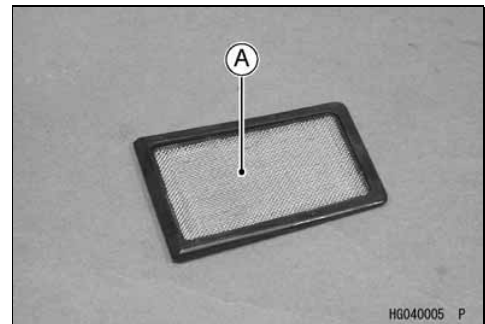


Oil Screen Cleaning

- 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

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



NOTE

- While cleaning the screen, check for any metal particles that might indicate internal engine damage.
- Check the screen carefully for any damage, holes, broken wires, or gasket pulling off.
- ★ If the screen is damaged, replace it.

7-8 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

Oil Pressure Measurement

NOTE

- Measure the oil pressure after the engine is warmed up.
- Remove the oil pressure switch, and attach the oil pressure gauge [A] and adapter [B].

Special Tools - Oil Pressure Gauge, 10 kgf/cm²: 57001-164
Oil Pressure Gauge Adapter: 57001-1033

Oil Pressure

Standard: 480 kPa (4.9 kgf/cm², 69.7 psi) @ 4500 r/min
(rpm), 110°C (230°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.

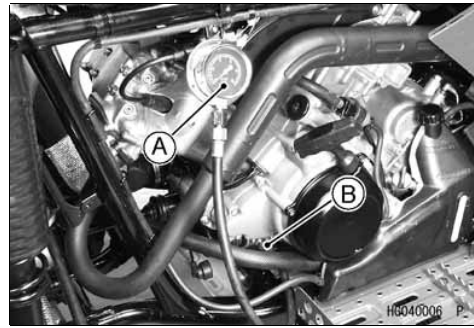
⚠ WARNING

Take care against burns from hot engine oil that will drain through the oil passage when the gauge adapter is removed.

- Apply silicone sealant to the oil pressure switch, and tighten it.

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

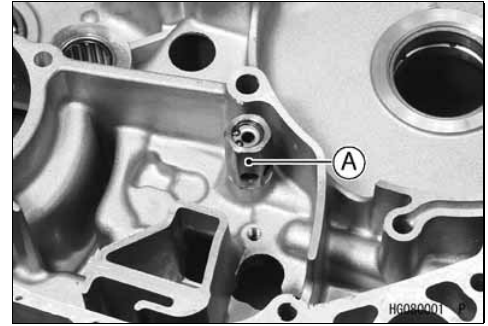
Torque - Oil Pressure Switch: 15 N·m (1.5 kgf·m, 11 ft·lb)



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

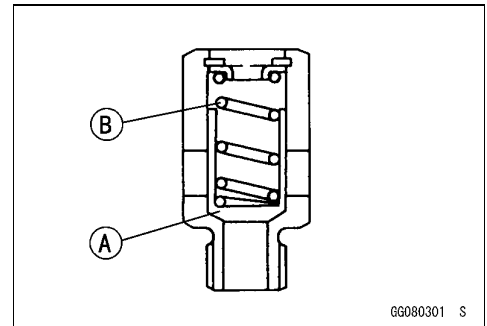
Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft·lb)

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

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

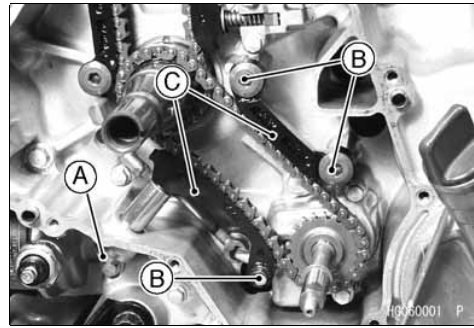
- ★ If the valve does not move smoothly even after washing it, replace the relief valve. The oil pressure relief valve is precision made with no allowance for replacement of individual parts.

7-10 ENGINE LUBRICATION SYSTEM

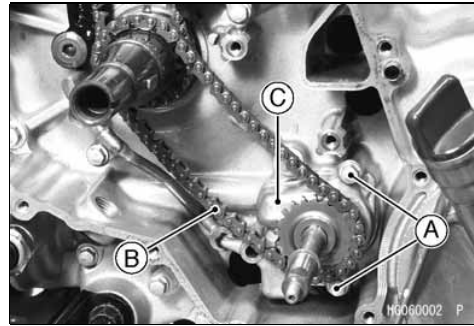
Oil Pump

Oil Pump Removal

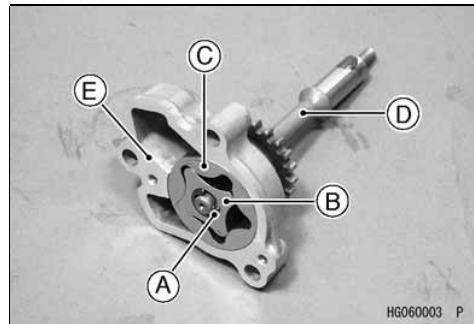
- Remove:
 - Alternator Rotor and Starter Clutch Gear (see Electrical System chapter)
 - Oil Pump Drive Chain Tensioner Bolt [A]
 - Chain Guide Bolts [B] and Collar
 - Chain Guides [C]



- Remove:
 - Oil Pump Bolts [A]
 - Oil Pump Drive Chain [B] and Oil Pump Assembly [C]

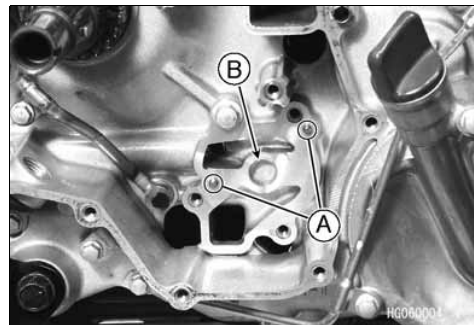


- Remove:
 - Circlip [A]
 - Inner Rotor [B]
 - Outer Rotor [C]
 - Oil Pump Drive Shaft [D]
 - Oil Pump Cover [E]



Oil Pump Installation

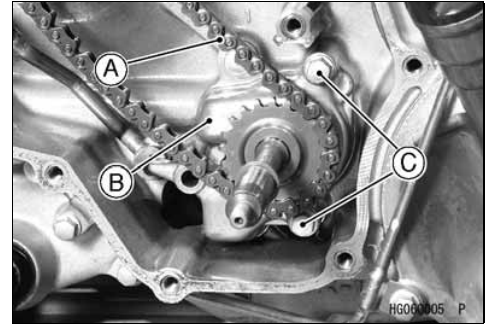
- Apply engine oil:
 - Oil Pump Shaft
 - Inner and Outer Rotors
- Install:
 - Oil Pump Drive Shaft
 - Oil Pump Cover
 - Inner Rotor
 - Outer Rotor
 - New Circlip
- Check to see that the dowel pins [A] are in place.
- Apply engine oil to the oil pump hole [B].



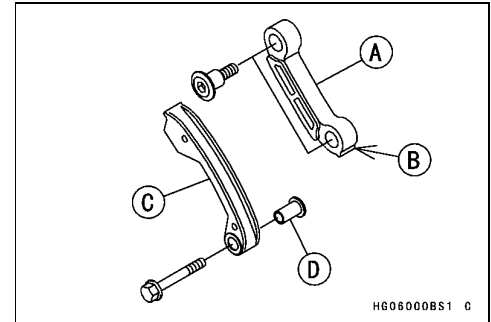
ENGINE LUBRICATION SYSTEM 7-11

Oil Pump

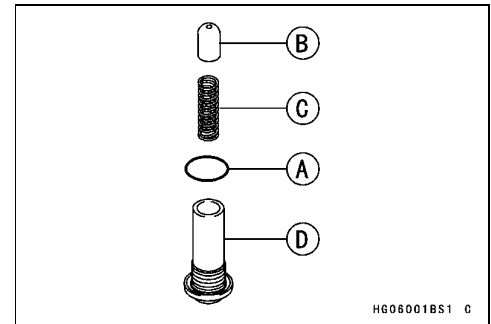
- Install the oil pump drive chain [A] with the oil pump assembly [B].
- Tighten:
Torque - Oil Pump Bolts [C]: 8.8 N·m (0.9 kgf·m, 78 in·lb)



- Install:
Upper Chain Guide [A] (Face the tab [B] downward.)
Lower Chain Guide [C] and Collar [D]
- Tighten:
Torque - Chain Guide Bolts: 8.8 N·m (0.9 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)



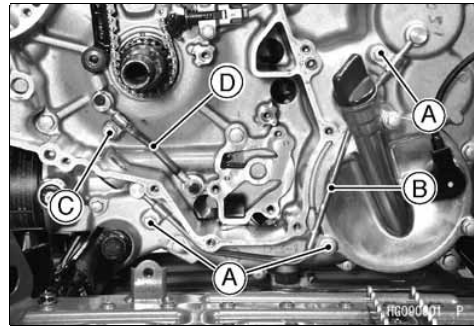
7-12 ENGINE LUBRICATION SYSTEM

Oil Pipe

Oil Pipe Removal

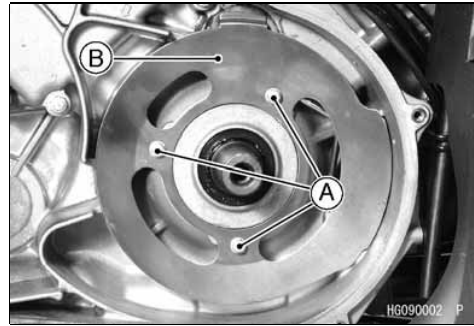
Engine Left Side Oil Pipe:

- Remove:
 - Alternator Cover (see Electrical System chapter)
 - Oil Pipe Bolts [A]
 - Oil Pipe [B]
 - Oil Pump (see Oil Pump Removal)
 - Oil Pipe Bolts [C]
 - Oil Pipe [D]

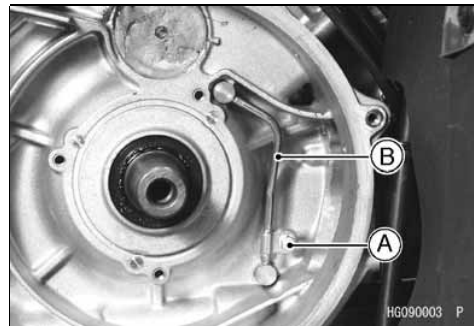


Engine Right Side Oil Pipe:

- Remove:
 - Drive Pulley (see Torque Converter chapter)
 - Plate Bolts [A]
 - Plate [B]

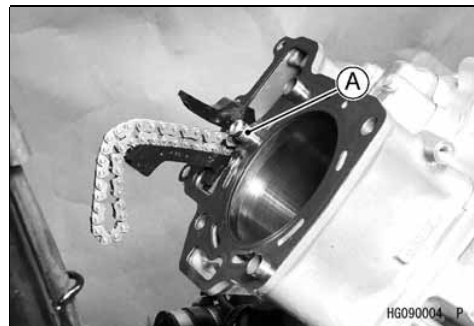


- Remove:
 - Oil Pipe Bolt [A]
 - Oil Pipe [B]



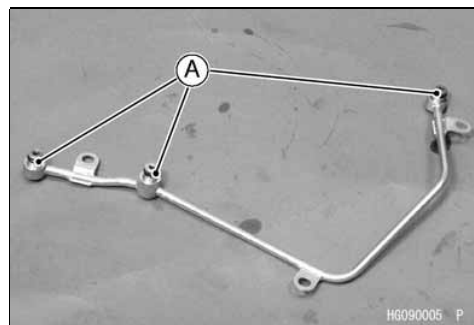
Engine Inside Oil Pipe:

- Remove:
 - Cylinder Head (see Engine Top End chapter)
 - Oil Pipe [A]



Oil Pipe Installation

- Replace the O-ring [A] with new ones if they are damaged.
- Apply engine oil to the O-rings before installation.
- Tighten:
 - Torque - Oil Pipe Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)



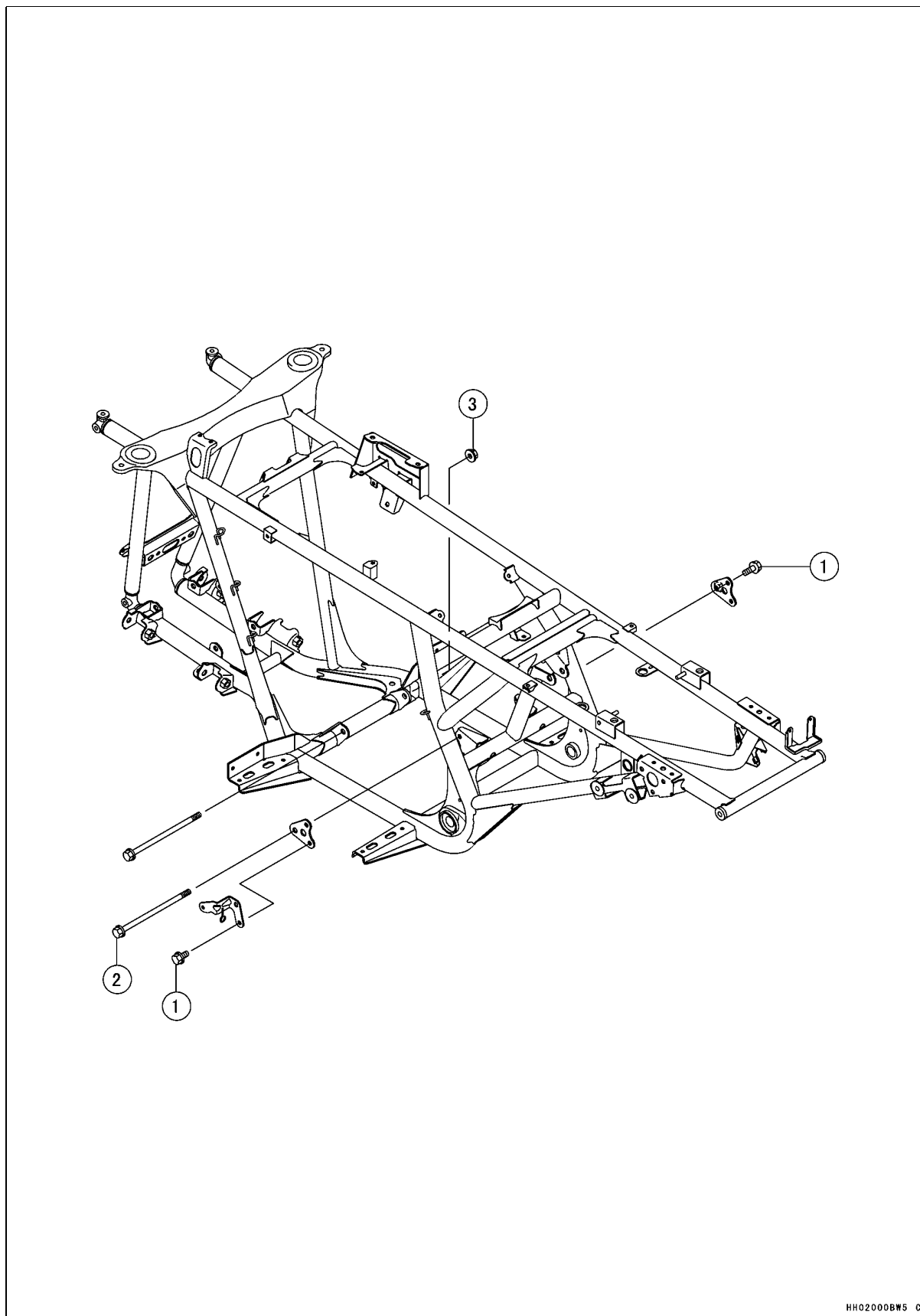
Engine Removal/Installation

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8-2 ENGINE REMOVAL/INSTALLATION

Exploded View



ENGINE REMOVAL/INSTALLATION 8-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine mounting bracket bolts	23	2.3	17	
2	Engine mounting bolt	59	6.0	43	
3	Engine mounting nut	59	6.0	43	

8-4 ENGINE REMOVAL/INSTALLATION

Engine Removal/Installation

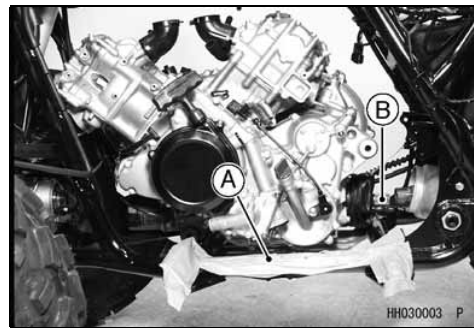
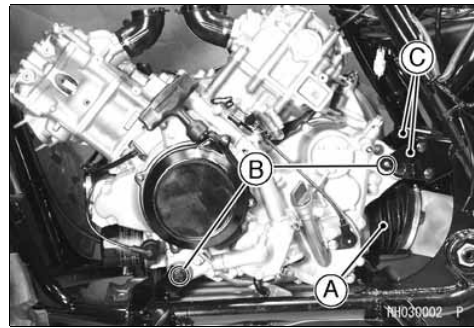
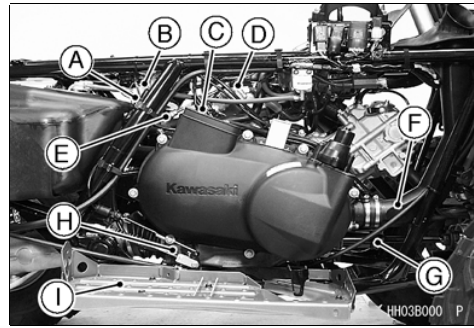
Engine Removal

- Remove:
 - Engine Oil (drain)
 - Coolant (drain)
 - Front Fender and Rear Fender (see Frame chapter)
 - Muffler and Exhaust Pipe (see Engine Top End chapter)
 - Carburetor (see Fuel System chapter)
 - Torque Converter Air Intake Duct
 - Alternator Lead Connector [A]
 - Pickup Coil Lead Connector [B]
 - Engine Brake Actuator Lead Connector [C]
 - Drive Belt Failure Detection Switch Lead Connector [D]
 - Tie-rod (Shift Lever) [E]
 - Air Duct [F]
 - Front Propeller Shaft [G]
 - Speed Sensor Lead Connector [H]
 - Foot Boards [I]
 - Oil Pressure Switch Lead Connector
 - Spark Plug Caps

- Remove:
 - Neutral Switch Lead Connector
 - Reverse Switch Lead Connector
 - Forward/Reverse Detecting Sensor Lead Connector
 - Boot (roll up forward) [A]
 - Engine Mounting Bolts [B]
 - Engine Mounting Bracket [C]

- Put a tape [A] to protect the frame.
- Move the engine forward to remove the drive shaft [B].

- Remove the engine as shown.

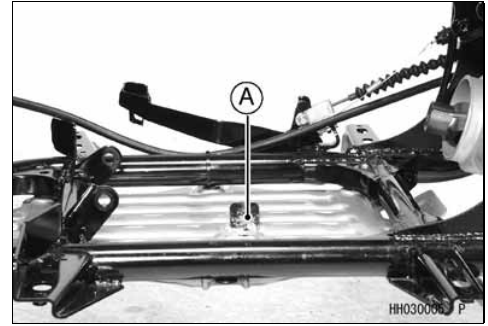


ENGINE REMOVAL/INSTALLATION 8-5

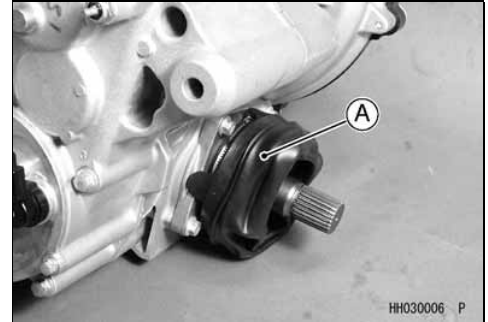
Engine Removal/Installation

Engine Installation

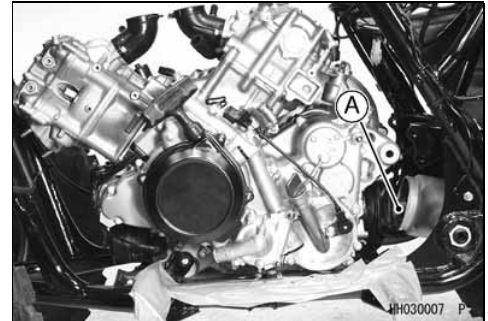
- Be sure the damper [A] is in place.



- Roll up the boot [A] toward the engine.



- Insert the drive shaft in the rear propeller shaft joint [A].
- Tighten:
 - Torque - Engine Mounting Bracket Bolts: 23 N·m (2.3 kgf·m, 17 ft·lb)**
 - Engine Mounting Bolt: 59 N·m (6.0 kgf·m, 43 ft·lb)**
 - Engine Mounting Nut: 59 N·m (6.0 kgf·m, 43 ft·lb)**



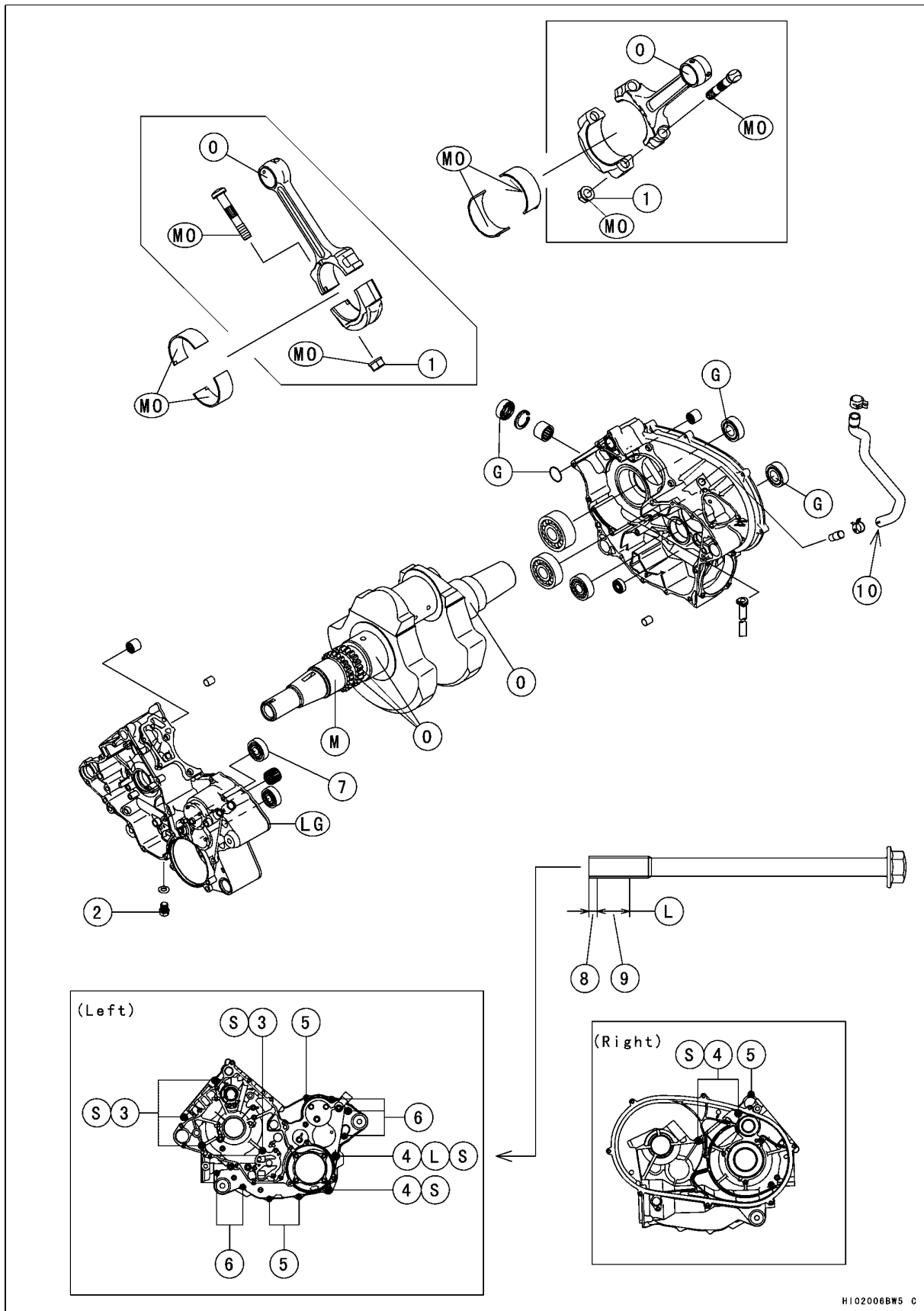
Crankshaft / Transmission

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9-2 CRANKSHAFT / TRANSMISSION

Exploded View



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CRANKSHAFT / TRANSMISSION 9-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Connecting rod big end cap nuts	34	3.5	25	MO
2	Engine drain plug	20	2.0	14	
3	Crankcase bolts (M8) 75 mm (2.95 in.)	20	2.0	14	S
4	Crankcase bolts (M8) 110 mm (4.33 in.)	20	2.0	14	S, L(1)
5	Crankcase bolts (M6) 40 mm (1.57 in.)	9.8	1.0	87 in·lb	
6	Crankcase bolts (M6) 65 mm (2.56 in.)	9.8	1.0	87 in·lb	

7: Face the seal of the bearing to the left side (outward).

8: Do not apply a non-permanent locking agent to this area (2 ~ 3 mm, 0.08 ~ 0.12 in.).

9: About 12 mm (0.47 in.)

10: White Mark: Face the mark backwards and align it with the crankcase mark.

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

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

O: Apply engine oil.

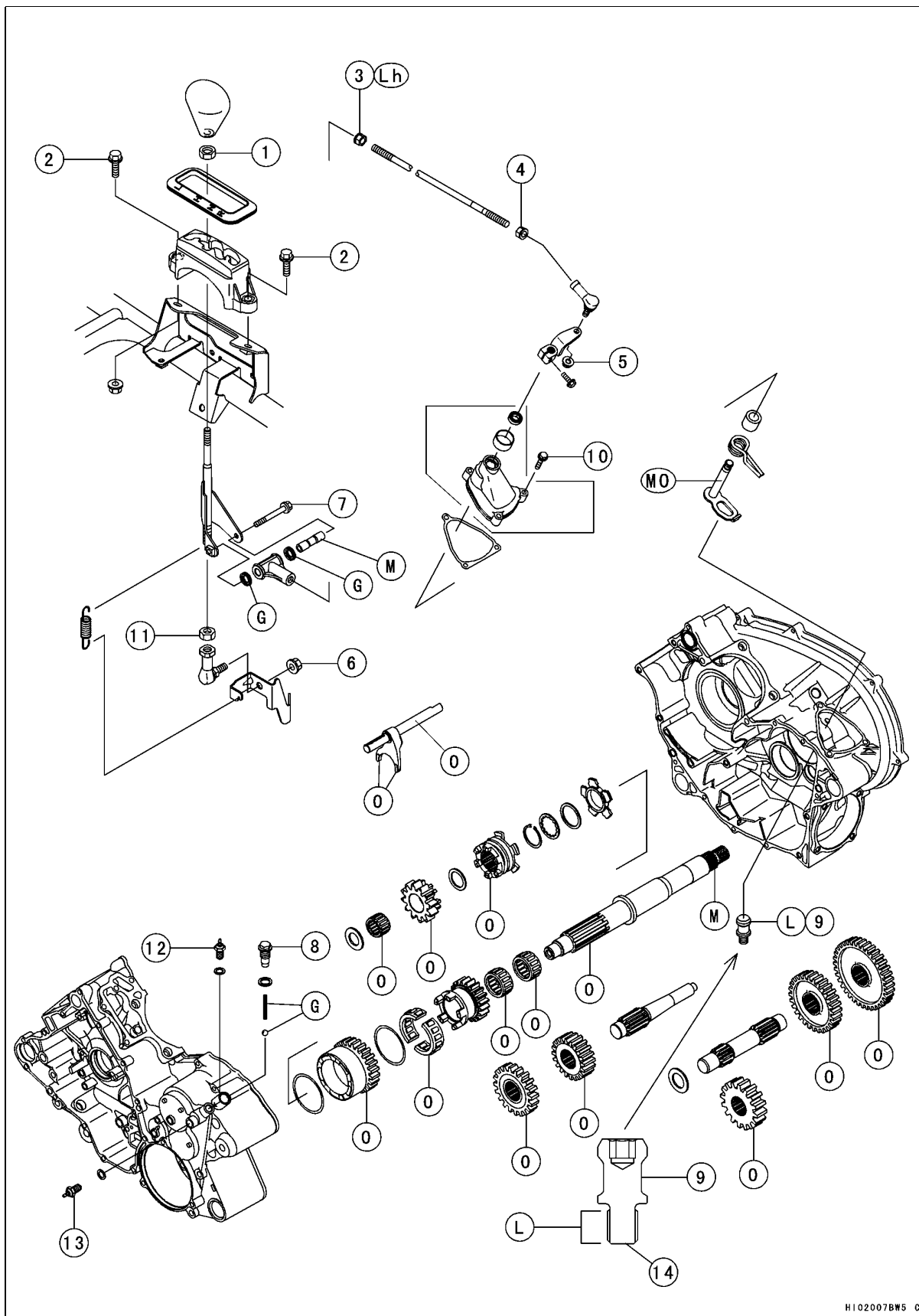
LG: Apply liquid gasket (Three Bond 1215, Gray).

MO: Apply molybdenum disulfide oil.

S: Follow the specific tightening sequence.

9-4 CRANKSHAFT / TRANSMISSION

Exploded View



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CRANKSHAFT / TRANSMISSION 9-5

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Grip hold nut	9.8	1.0	87 in·lb	
2	Shift lever assembly bracket bolts	20	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	20	2.0	14	
6	Shift lever assembly nut	20	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	0.9	78 in·lb	
11	Tie-rod end locknut	20	2.0	14	
12	Neutral position switch	15	1.5	11	
13	Reverse position switch	15	1.5	11	

14: Do not apply a non-permanent locking agent to this end.

- G: Apply grease for oil seal and O-ring.
- L: Apply a non-permanent locking agent.
- M: Apply molybdenum disulfide grease.
- O: Apply engine oil.
- MO: Apply molybdenum disulfide oil.
- Lh: Left-hand Threads

9-6 CRANKSHAFT / TRANSMISSION

Specifications

Item	Standard	Service Limit																							
Crankshaft, Connecting Rods:																									
Connecting rod bend	---	TIR 0.2/100 mm (0.008/3.94 in.)																							
Connecting rod 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 ~ 1.57449 in.)	---																							
○	39.993 ~ 40.000 mm (1.57452 ~ 1.5748 in.)	---																							
Connecting rod big end inside diameter:	43.000 ~ 43.016 mm (1.6929 ~ 1.6939 in.)	---																							
Marking: None	43.000 ~ 43.008 mm (1.6929 ~ 1.69323 in.)	---																							
○	43.009 ~ 43.016 mm (1.69326 ~ 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:																									
<table border="1"> <thead> <tr> <th rowspan="2">Con-rod Big End Bore Diameter Marking</th> <th rowspan="2">Crankpin Diameter Marking</th> <th colspan="2">Bearing Insert</th> </tr> <tr> <th>Size Color</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>None</td> <td>○</td> <td>Brown</td> <td>92028-1963</td> </tr> <tr> <td>None</td> <td>None</td> <td>Yellow</td> <td>92028-1962</td> </tr> <tr> <td>○</td> <td>○</td> <td></td> <td></td> </tr> <tr> <td>○</td> <td>None</td> <td>Green</td> <td>92028-1961</td> </tr> </tbody> </table>				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
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: φ42 Side	41.984 ~ 42.000 mm (1.6529 ~ 1.6535 in.)	41.96 mm (1.652 in.)																							
Crankshaft main bearing bore diameter: φ42 Side	42.025 ~ 42.041 mm (1.6545 ~ 1.6552 in.)	42.08 mm (1.6567 in.)																							
Transmission																									
Shift fork ear thickness	5.9 ~ 6.0 mm (0.2322 ~ 0.2362 in.)	5.8 mm (0.228 in.)																							
Shifter groove width	6.05 ~ 6.15 mm (0.2382 ~ 0.2421 in.)	6.25 mm (0.246 in.)																							

Special Tools - Outside Circlip Pliers: 57001-144

Bearing Driver Set: 57001-1129

Sealant - Three Bond: 1215 (Gray)

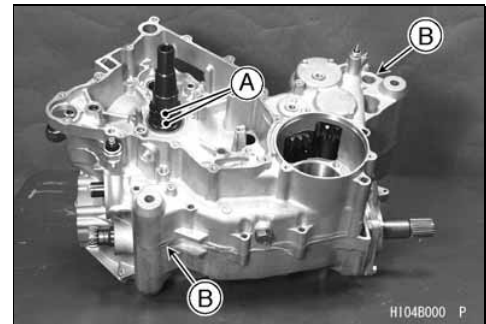
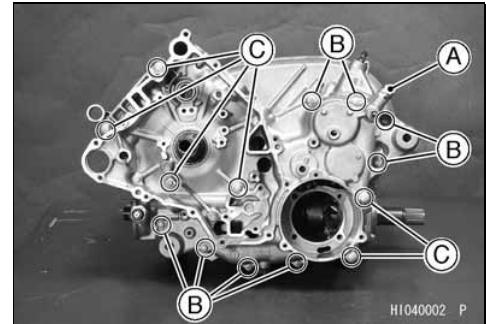
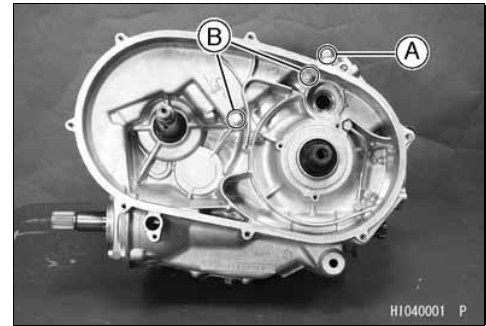
Crankcase

Crankcase Disassembly

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Starter Motor (see Electrical System chapter)
 - Oil Filter
 - Recoil Starter
 - Cylinder Blocks and Pistons (see Engine Top End chapter)
 - Middle Shaft and Chain
 - Right Crankcase Bolts (M6) [A]
 - Right Crankcase Bolts (M8) [B]

- 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 Assembly

CAUTION

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

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

Clean the engine parts in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or low flash-point solvents to clean parts. A fire or explosion could result.

9-8 CRANKSHAFT / TRANSMISSION

Crankcase

- 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:

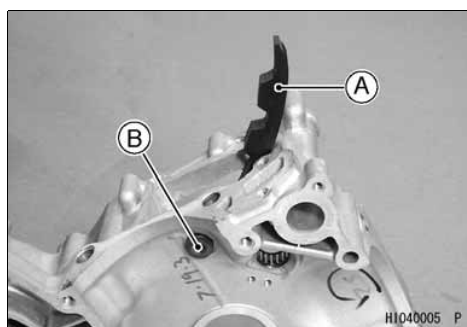
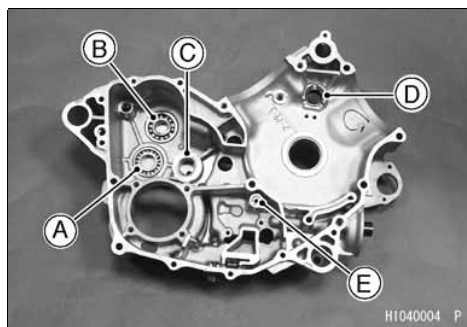
Oil Pressure Relief Valve [E] (see Engine Lubrication System chapter)

- Install:

Rear Cylinder Camshaft Chain Guide [A]

- Tighten:

Torque - Rear Cylinder Camshaft Chain Guide Bolt [B]: 20 N·m (2.0 kgf·m, 14 ft·lb)



- Press and insert the new ball bearings [A] until they are bottomed.

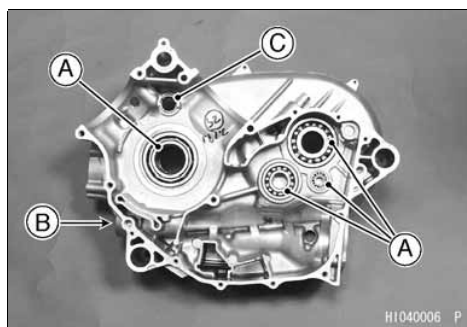
Special Tool - Bearing Driver Set: 57001-1129

- Press and insert the new needle bearings so that the bearing surfaces are flush with the end of the hole.

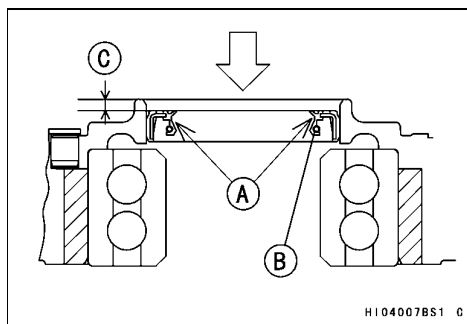
[B] Needle Bearing

[C] Needle Bearing (Insert it from outside.)

- Apply engine oil to the bearings.



- 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.



- Be sure the following parts are in place in the right crankcase half.

Crankshaft

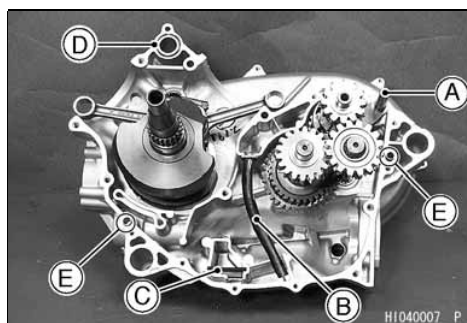
Transmission Shafts and Shift Shaft [A]

Oil Tube [B]

Oil Screen [C]

O-ring (Apply Grease) [D]

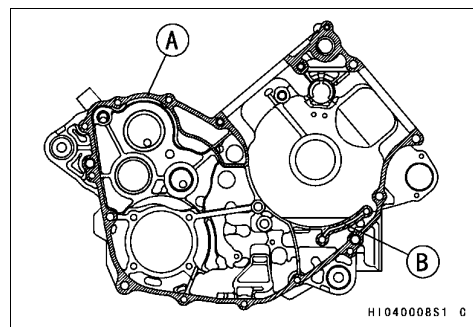
Dowel Pins [E]



CRANKSHAFT / TRANSMISSION 9-9

Crankcase

- Apply liquid gasket [A] to mating surface of the left crankcase half.
Sealant - Three Bond: 1215 (Gray)
- Do not allow liquid gasket to enter the oil passage [B].



- 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].

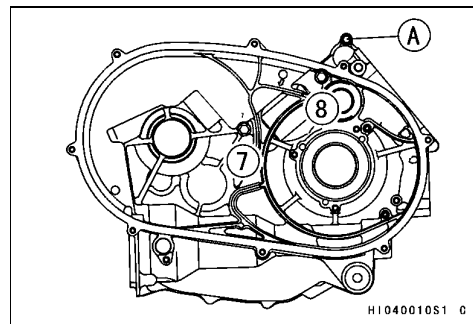
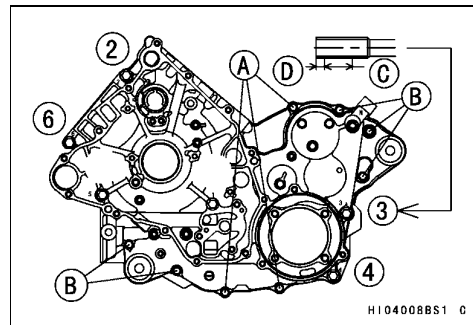
Torque - Crankcase Bolts (M8): 20 N·m (2.0 kgf·m, 14 ft·lb)

[1, 2, 5, 6] L = 75 mm (2.95 in.)
[3, 4, 7, 8] L = 110 mm (4.33 in.)

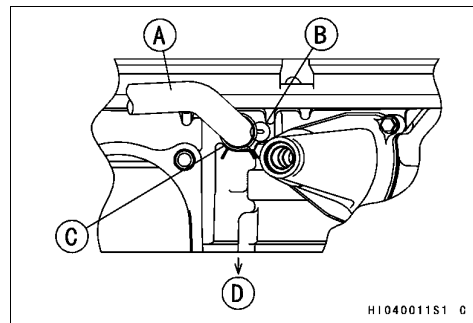
- Tighten:

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.)



- Install the breather tube [A] on the crankcase fitting.
- Align the white line on the tube with the mark [B] on the crankcase.
- Face the open end of the clamp [C] towards the left side [D] as shown.

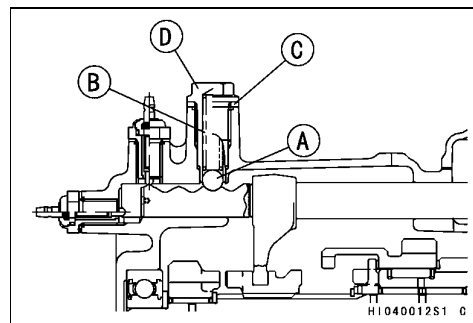


- Apply grease to the steel ball [A] and spring [B].
- Install:
 - Steel Ball
 - Spring
 - Washer [C]
 - Shift Shaft Positioning Bolt [D]
- Tighten:
 - Torque - Shift Shaft Positioning Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Check:

Crankshaft and driven shaft turn freely.

- ★ If any of the shafts do not turn freely, split the crankcase to locate the problem.

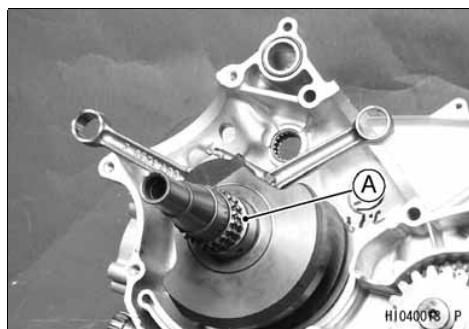


9-10 CRANKSHAFT / TRANSMISSION

Crankshaft/Connection Rod

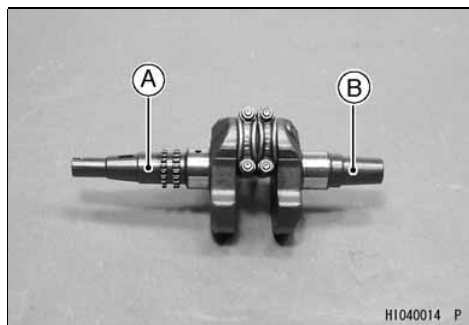
Crankshaft Removal

- 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.

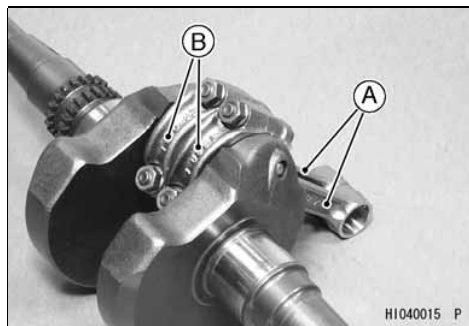


Connecting Rod Removal

- 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.

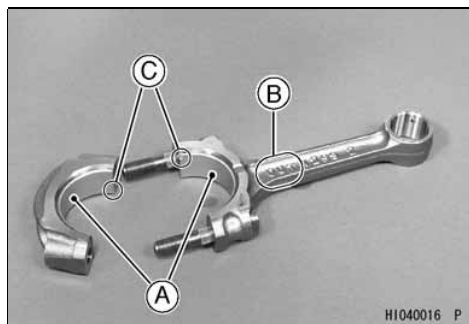


Connecting Rod Installation

CAUTION

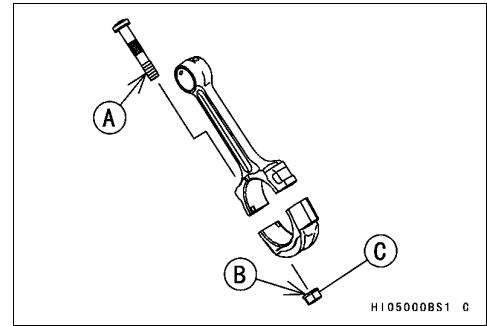
If the connecting rods, bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling the engine to be sure the correct bearing inserts are installed.

- 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 N·m (3.5 kgf·m, 25 ft·lb)**

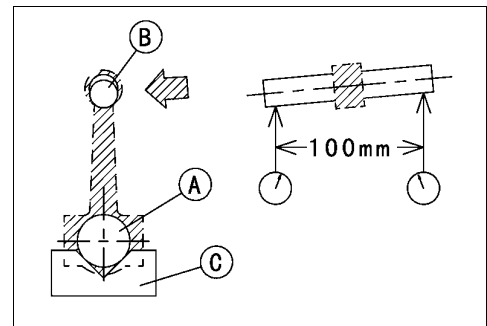


Crankshaft/Connecting Rod Cleaning

- 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

- 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.

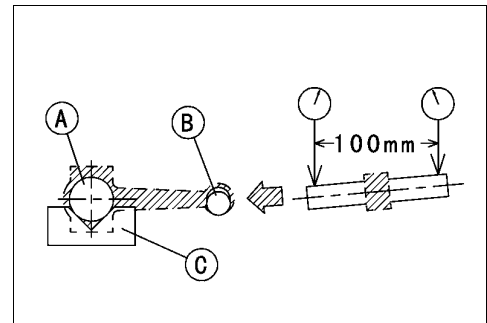


Connecting Rod Bend

Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Twist

- 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.)

Connecting Rod Big End Side Clearance

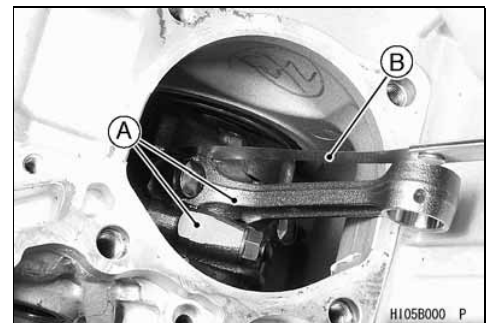
- Measure the side clearance of the connecting rod big end [A].
- Insert a thickness gauge [B] between the big end and either crank web to determine clearance.

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.



9-12 CRANKSHAFT / TRANSMISSION

Crankshaft/Connection Rod

Connecting Rod Big End Bearing/Crankpin Wear

- Measure the bearing insert/crankpin [A] clearance with plastigage [B].
- Tighten the big end nuts to the specified torque.

Torque - Connecting Rod Big End Nuts: 34 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.)

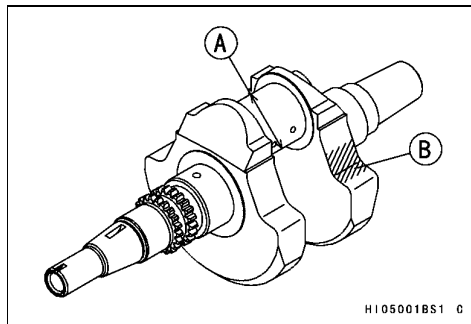
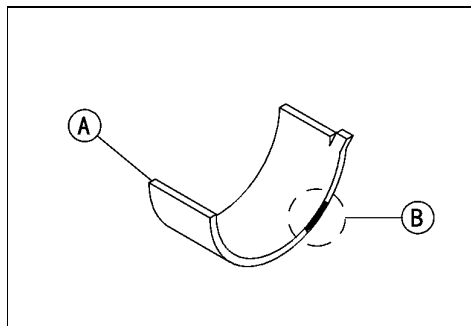
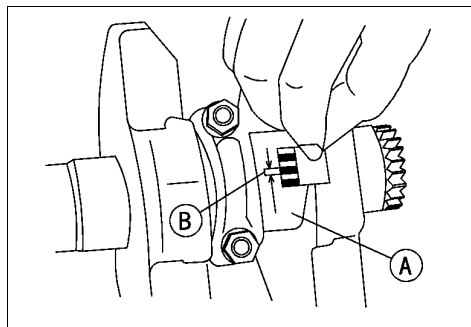
- ★ If the crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameter [A] is not less than the service limit, but does not coincide with the original diameter marking on the crankshaft, make a new mark on it.

Crankpin Diameter Marks

None: 39.984 ~ 39.992 mm (1.5742 ~ 1.57449 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 N·m (3.5 kgf·m, 25 ft·lb)

NOTE

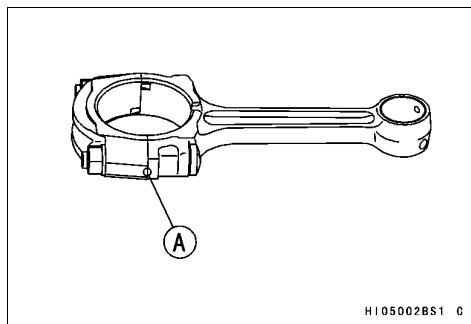
- The mark already on the big end should almost coincide with the measurement because of little wear.

Connecting Rod Big End Inside Diameter Marks

None: 43.000 ~ 43.008 mm (1.6929 ~ 1.69323 in.)

○: 43.009 ~ 43.016 mm (1.69326 ~ 1.6935 in.)

Diameter Mark [A]: "○" or no mark



Crankshaft/Connection Rod

- 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 Marking	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.

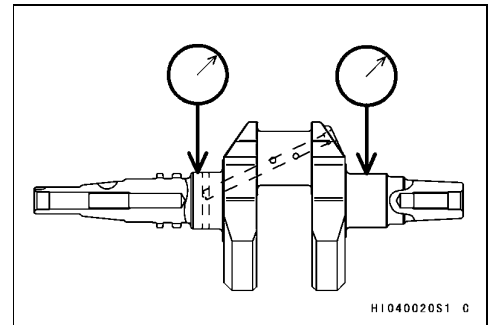
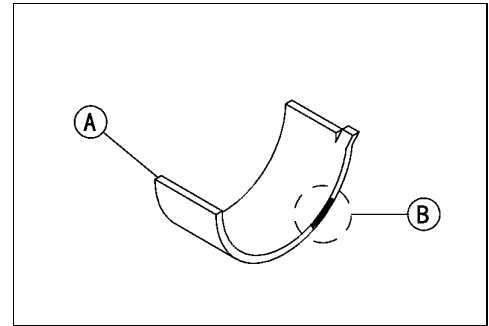
Crankshaft Runout

- 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

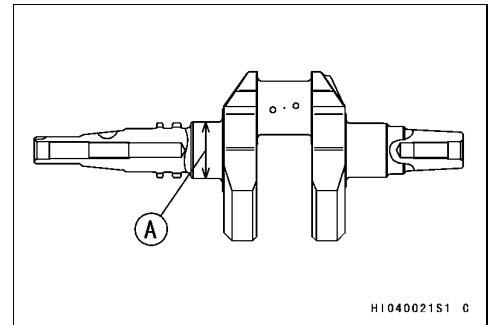
- Measure the diameter [A] of the crankshaft main journal.

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.



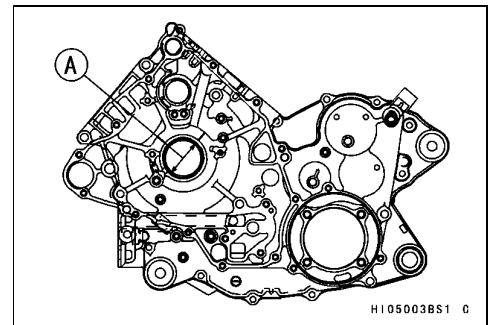
- Measure the main bearing bore diameter [A] in the crankcase halves.

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.

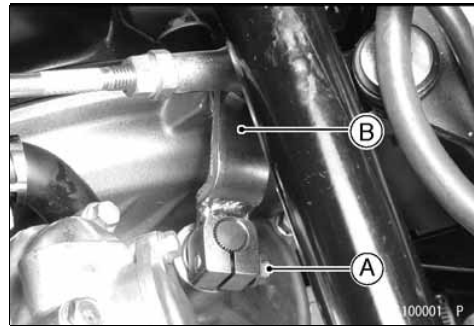


9-14 CRANKSHAFT / TRANSMISSION

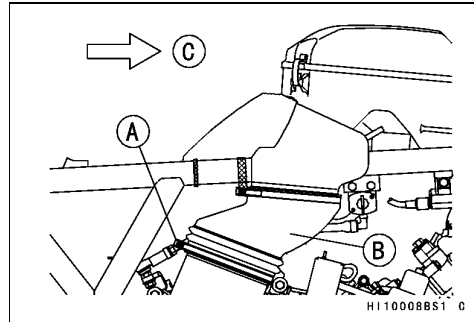
Transmission

Shift Lever Removal

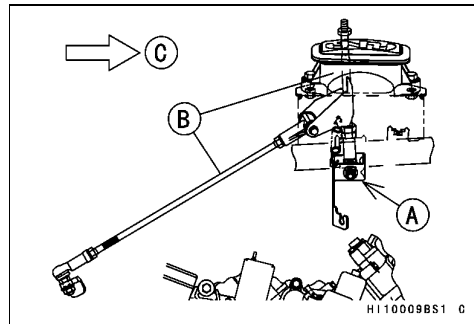
- Set the shift lever in the neutral position.
- Remove:
 - Air Cleaner Cover(see Frame chapter)
 - Shift Shaft Lever Bolt [A]
- Remove the shift shaft lever [B] from the shift shaft.



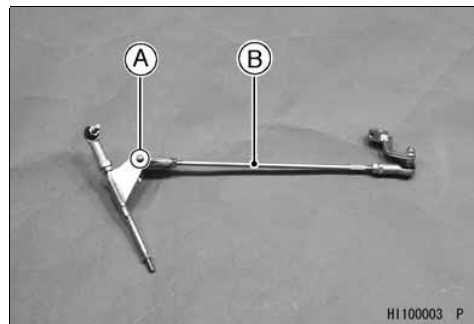
- Loosen the upper and lower clamps [A] and take out the air duct [B].
Front [C]



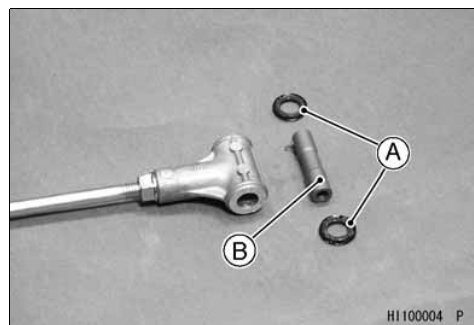
- Remove:
 - Nut [A]
 - Shift Lever Assembly [B]
- Front [C]



- Remove:
 - Tie-Rod End Bolt [A]
 - Tie-Rod [B]



- Remove:
 - Oil Seals [A]
 - Collar [B]

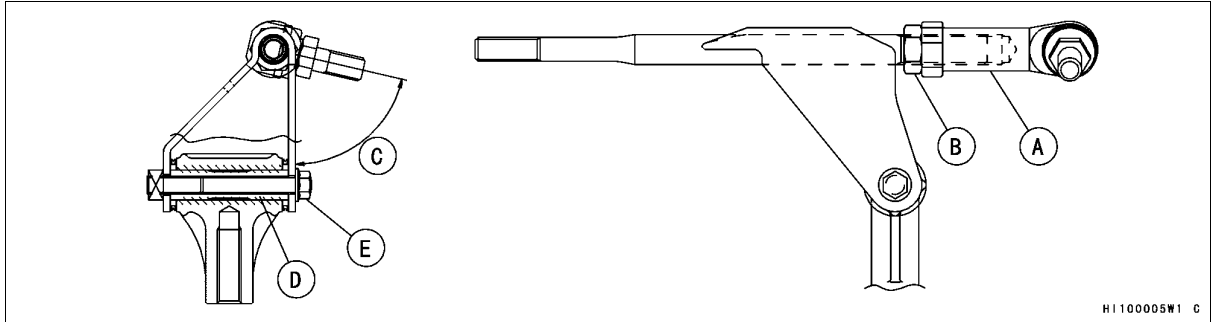


CRANKSHAFT / TRANSMISSION 9-15

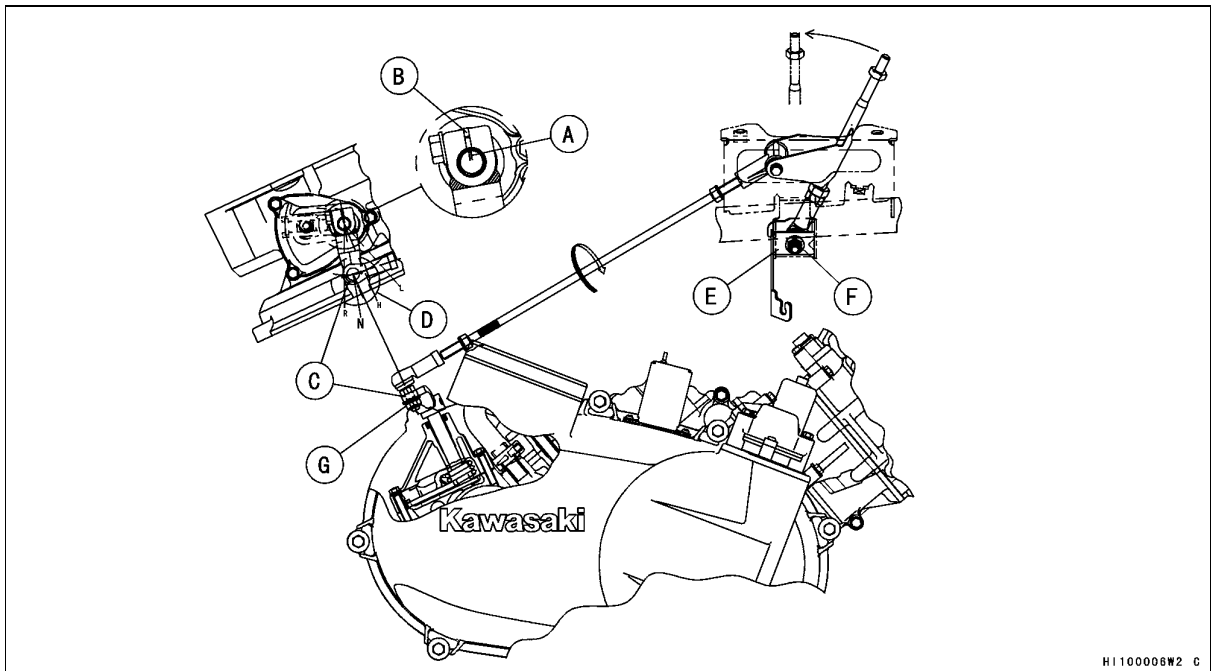
Transmission

Shift Lever Installation

- Twist the tie-rod end [A] and tie-rod locknut [B] to bottom of the screw and then turn back to dimension with $77^\circ \pm 10^\circ$ [C] as shown.
- Tighten the locknut against the tie-rod end:
Torque - Tie-Rod End Locknut: 20 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:
Cable 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]: 20 N·m (2.0 kgf·m, 14 ft·lb)



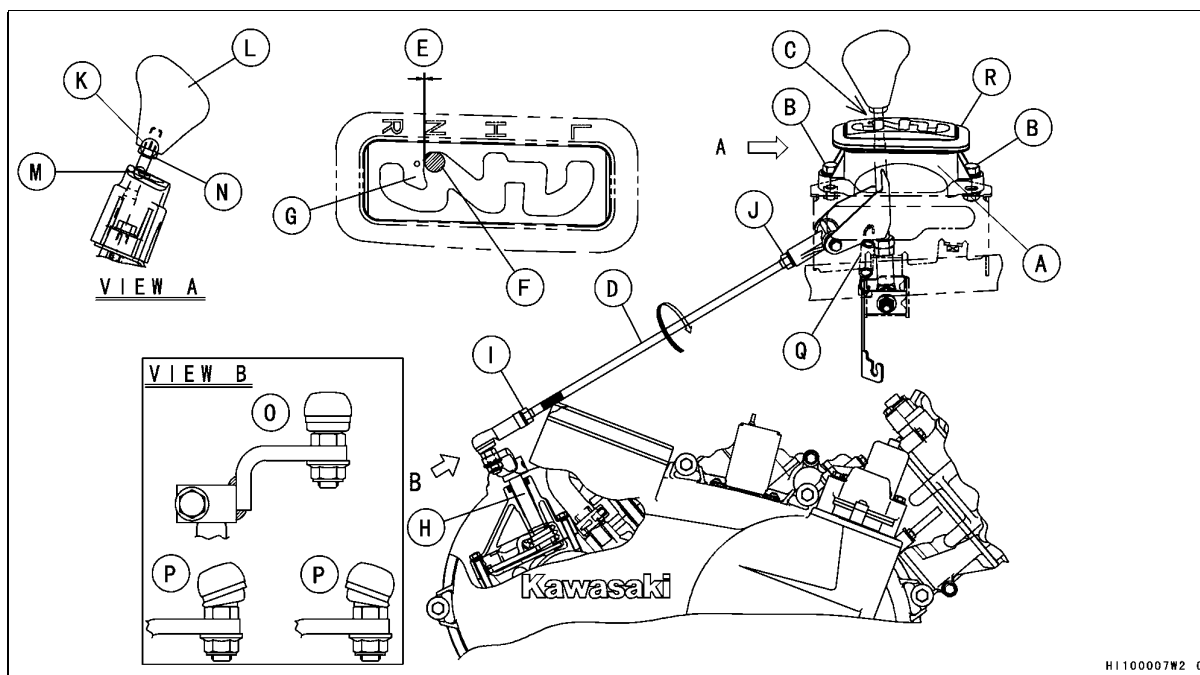
9-16 CRANKSHAFT / TRANSMISSION

Transmission

- Install:
 - Spring [Q]
 - Guide [A]
- Tighten:
 - Torque - Shift Lever Assembly Bracket Bolts [B]: 20 N·m (2.0 kgf·m, 14 ft·lb)**
- Set the lever assembly in the neutral position [C] while turning the tie-rod [D].
- Make sure the gap [E] 0.3 ~ 1.3 mm (0.012 ~ 0.051 in.) between the rod [F] of shift lever assembly and guide [G].
- Do not turn the shift shaft [H] when setting the lever assembly on neutral position.
- Tighten:
 - Torque - Tie-Rod End Rear Locknut [I]: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Holding the rod, and tighten the front locknut [J].
- 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.*
- Align the mark [K] of the grip [L] with the projection [M] on the guide.
- Tighten:
 - Torque - Grip Hold Nut [N]: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- [O] Right
- [P] Wrong
- Install:
 - Trim Seal [R]



CRANKSHAFT / TRANSMISSION 9-17

Transmission

Transmission Removal

- Split the crankcase (see Crankcase Disassembly).
- Remove:
 - Shift Shaft Cover Bolts [A]
 - Shift Shaft Cover [B]

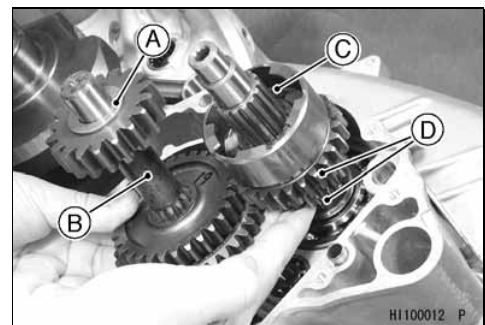
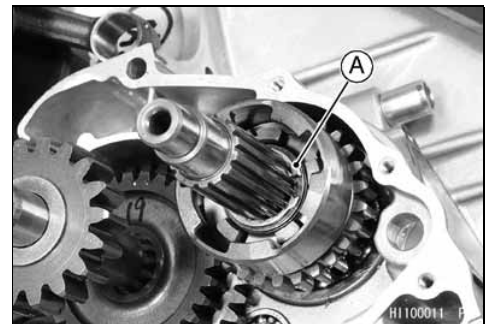
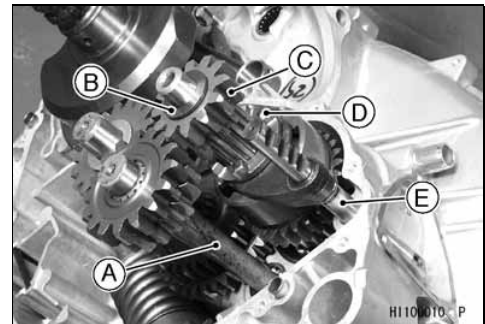
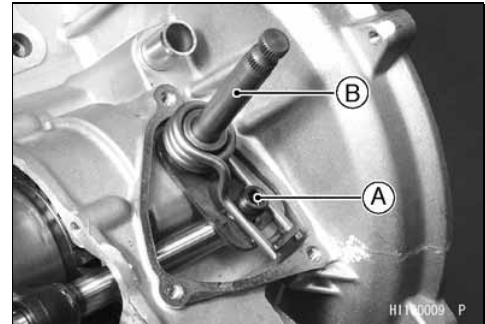
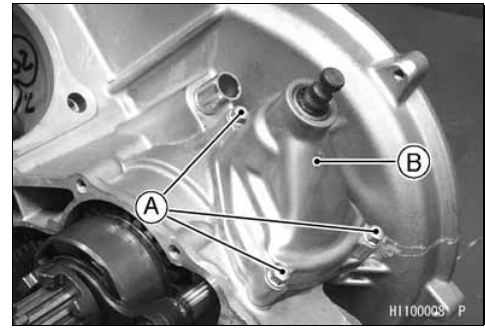
- Remove:
 - Shift Shaft Spring Bolt [A]
 - Shift Shaft [B]

- Remove:
 - Reverse Idle Shaft [A]
 - Spacer [B]
 - Reverse Drive Gear [C], Needle Bearing, and Spacer Shifter [D]
 - Shift Rod [E]

- Remove:
 - Circlip [A]

Special Tool - Outside Circlip Pliers: 57001-144

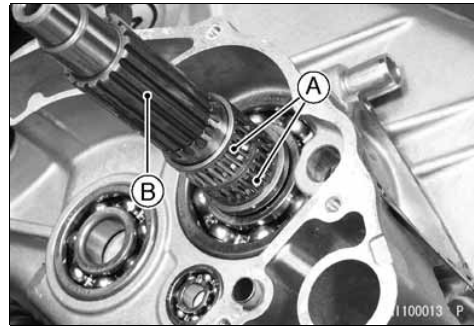
- Remove:
 - Spacer [A]
 - Idle Gear Assembly [B]
 - Washers and Spacer [C]
 - Low and High Gears [D]



9-18 CRANKSHAFT / TRANSMISSION

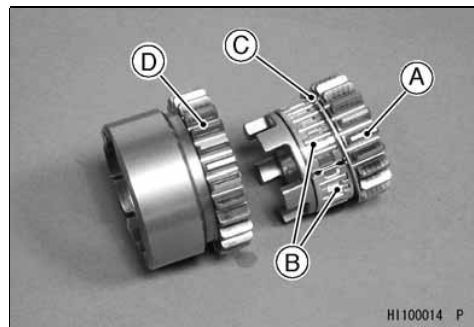
Transmission

- Remove:
 - Needle Bearings [A]
- Remove the driven shaft [B] from the crankcase using a press.

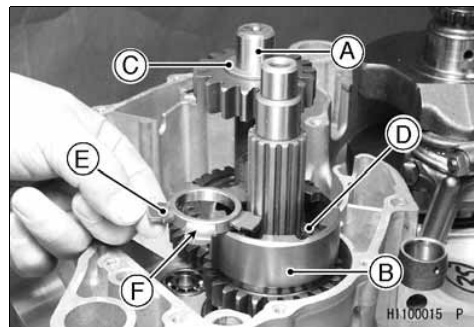


Transmission Installation

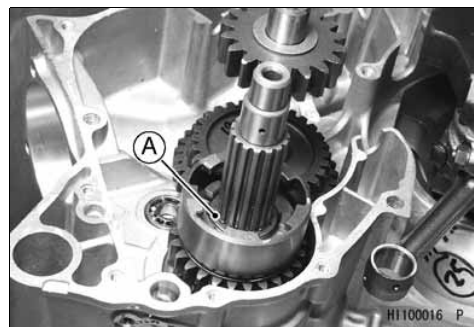
- Insert the driven shaft in the crankcase until it is bottomed using a press.
- Apply engine oil to the needle bearings and install them.
- Install the following parts on the low gear [A].
 - Needle Bearings [B]
 - Spacer [C] (P/No. 92026-1599, 48.2 x 54.3 x 1.0)
 - High Gear [D]



- Install:
 - Idle Shaft [A] with Gear Assembly [B]
 - Spacer [C]
 - Spacer [D] (P/No. 92026-1599, 48.2 x 54.3 x 1.0)
- Install the spacer [E] so that the stepped side [F] faces outward.



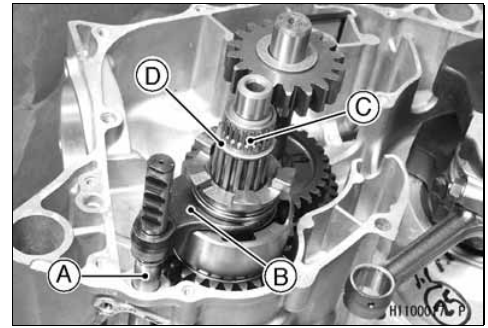
- Install:
 - Spacer
 - Toothed Washer [A]
 - Circlip
- Special Tool - Outside Circlip Pliers: 57001-144**



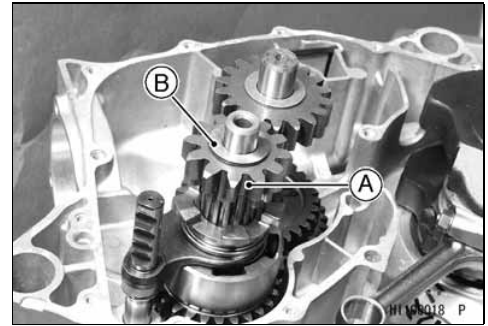
CRANKSHAFT / TRANSMISSION 9-19

Transmission

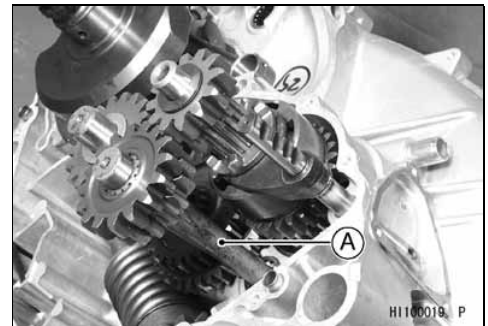
- Apply engine oil:
Shift Rod [A] and Shift Fork Ear [B]
Needle Bearing [C]
- Install:
Shift Rod with Shifter
Spacer [D]
Needle Bearing



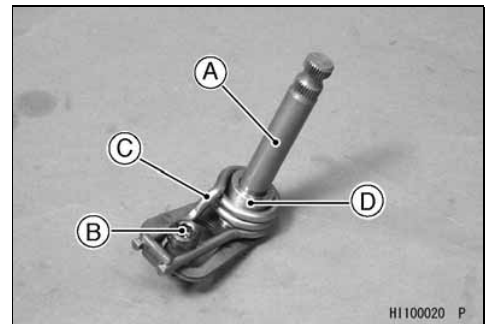
- Install:
Reverse Drive Gear [A]
Spacer [B]



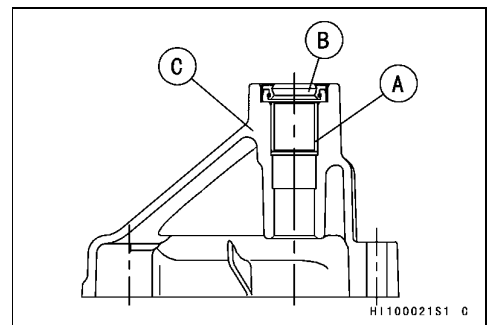
- Install:
Reverse Idle Shaft [A]



- 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 a new bushing [A] and oil seal [B] are installed in the shift shaft cover [C], press and insert the new bushing and oil seal so that their surfaces are flush with the end of the each hole.



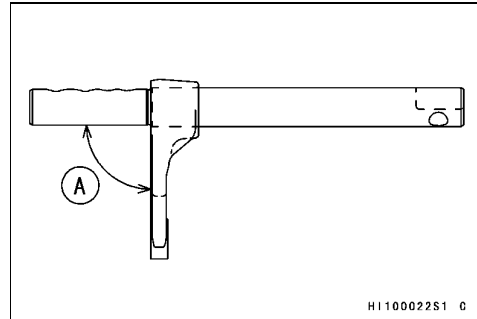
9-20 CRANKSHAFT / TRANSMISSION

Transmission

- Install:
 - Shift Shaft Cover
- Tighten:
 - Torque - Shift Shaft Cover Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

Shift Fork Bending

- 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

- Measure the thickness of the shift fork ears [A], and measure the width [B] of the gear groove and shifter.
- ★ 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 (0.2322 ~ 0.2362 in.)

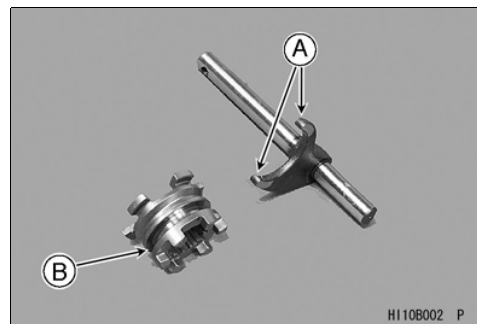
Service Limit: 5.8 mm (0.228 in.)

- ★ If the groove is worn over the service limit, the shifter must be replaced.

Shifter Groove Width

Standard: 6.05 ~ 6.15 mm (0.2382 ~ 0.2421 in.)

Service Limit: 6.25 mm (0.2460 in.)



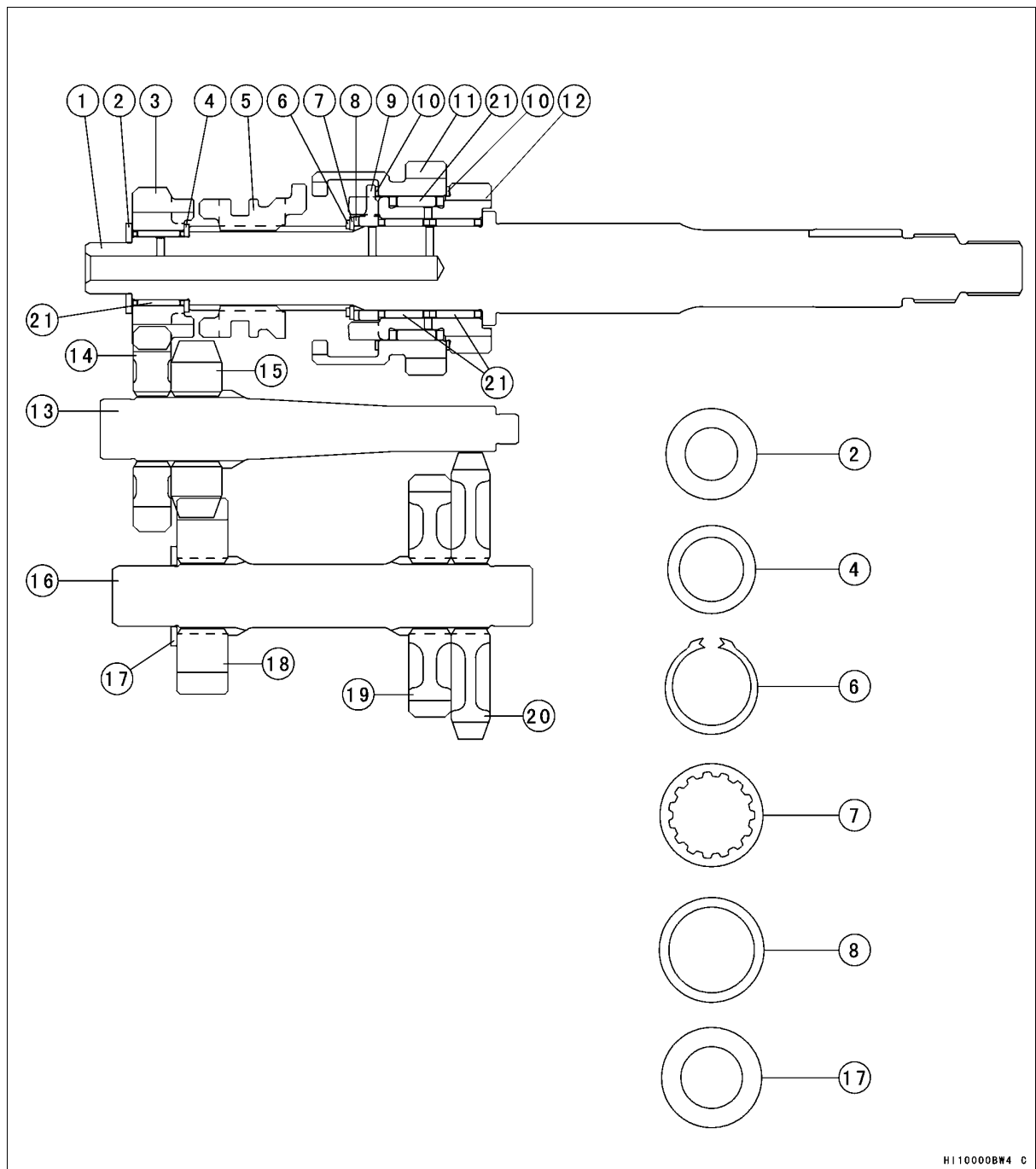
Transmission and Shift Mechanism Inspection

- Visually inspect:
 - Gears
 - Dogs of Gear and Shifter
- ★ If they are damaged or worn excessively, replace them.



CRANKSHAFT / TRANSMISSION 9-21

Transmission



H11000BW4 C

- | | |
|--------------------------------|--------------------------------------|
| 1. Driven Shaft | 12. Drive Low Gear (20T) |
| 2. Spacer (17.3 x 30 x 2.0) | 13. Reverse Idle Shaft |
| 3. Reverse Gear (12T) | 14. Reverse Driven Gear (16T) |
| 4. Spacer (21.2 x 29 x 1.6) | 15. Reverse Driven Output Gear (16T) |
| 5. Shifter | 16. Idle Shaft |
| 6. Snap Ring | 17. Spacer (20.3 x 33 x 2.0) |
| 7. Washer T=1.5 | 18. Driven Output Gear (18T) |
| 8. Spacer (28.2 x 34.5 x 1.6) | 19. Driven Hi Gear (30T) |
| 9. Spacer (Hi and Low) | 20. Driven Low Gear (36T) |
| 10. Spacer (48.2 x 54.3 x 1.0) | 21. Needle Bearing |
| 11. Drive Hi Gear (26T) | |

9-22 CRANKSHAFT / TRANSMISSION

Ball Bearing, Needle Bearing, and Oil Seal

Ball and Needle Bearing Replacement

CAUTION

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

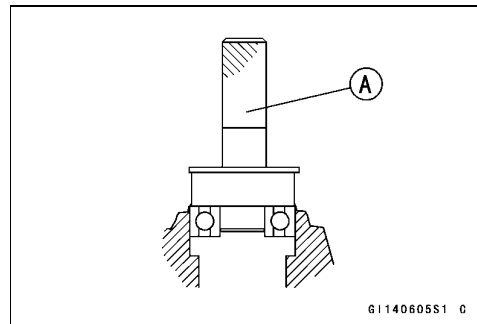
- *In the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.*

CAUTION

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

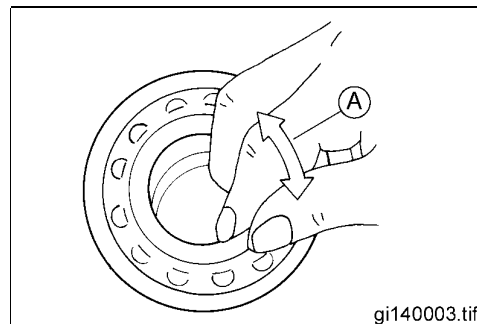
CAUTION

Do not remove the bearings for inspection. Removal may damage them.

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

Oil Seal Inspection

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



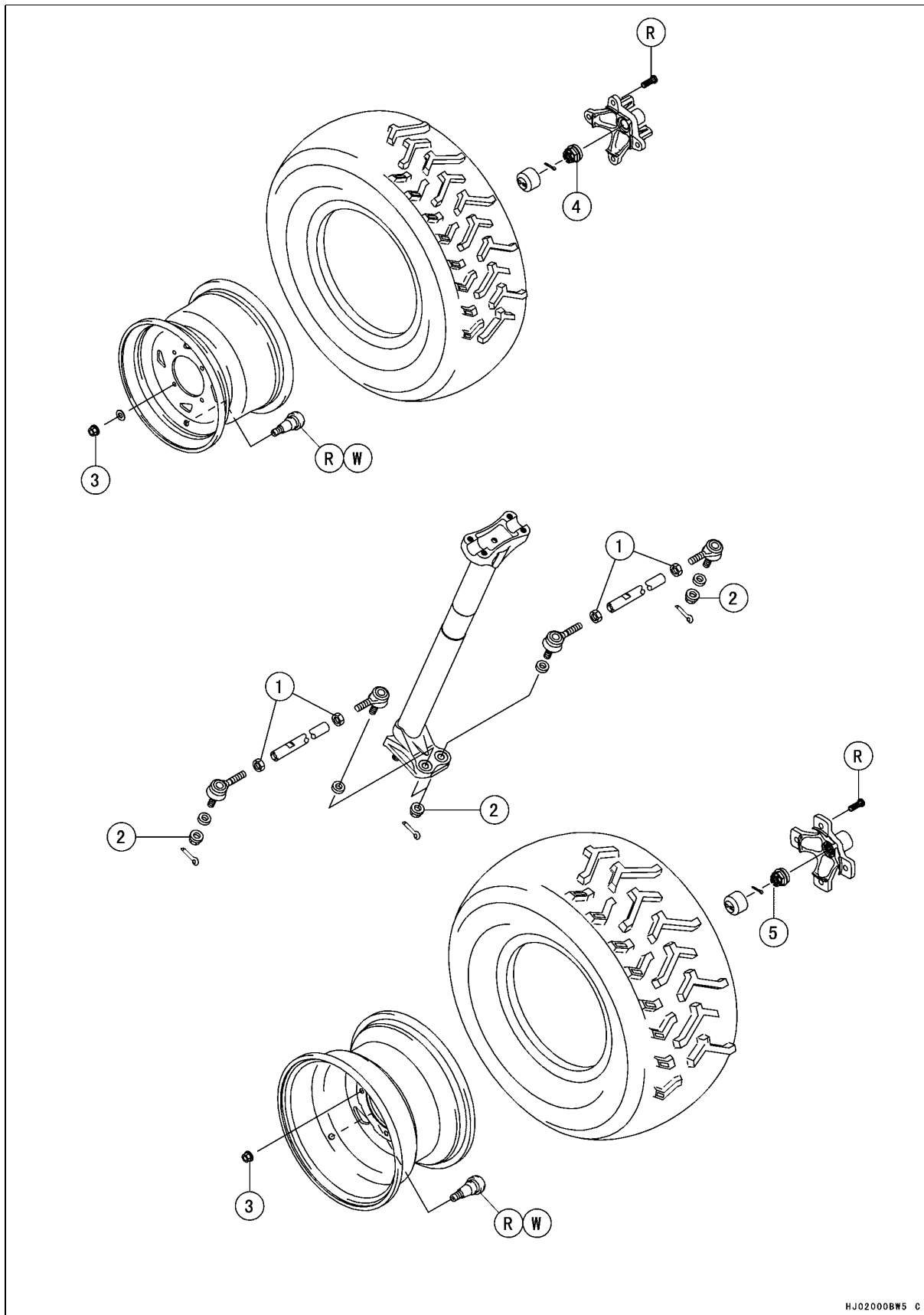
Wheels / Tires

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10-2 WHEELS / TIRES

Exploded View



HJ02000BWS C

WHEELS / TIRES 10-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Tie-rod adjusting sleeve locknuts	27	2.8	20	
2	Tie-rod end nuts	42	4.3	31	
3	Wheel nuts	78	8.0	58	
4	Front axle nuts	197	20	145	
5	Rear axle nuts	265	27	195	

W: Apply water or soap and water solution.

R: Replacement Parts

10-4 WHEELS / TIRES

Specifications

Item	Standard	Service Limit
Wheel Alignment:		
Toe-in of front wheels:	0 ~ 20 mm (0 ~ 0.79 in.) at 1G	---
Tires:		
Standard tire: Front	AT 25 × 8-12 DUNLOP, KT121A, Tubeless	---
Rear	AT 25 × 10-12 DUNLOP, KT127A, Tubeless	---
Tire air pressure (when cold): Front	28 kPa (0.28 kgf/cm ² , 4.0 psi)	---
Rear	35 kPa (0.35 kgf/cm ² , 5.0 psi)	---
Maximun tire air pressure (to seat beads, when cold)	250 kPa (2.5 kgf/cm ² , 36 psi)	---
Tire tread depth: Front	---	3 mm (0.12 in.)
Rear	---	4 mm (0.16 in.)

Special Tool - Jack: 57001-1238

Wheel Alignment

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

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

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

$A \text{ (Rear)} - B \text{ (Front)} = \text{Amount of Toe-in}$

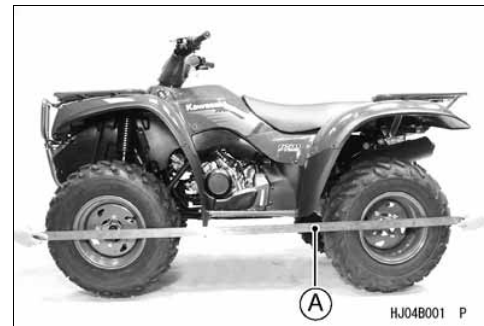
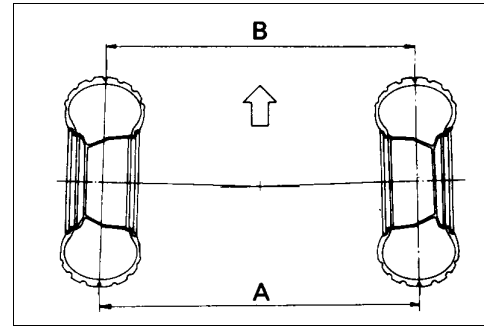
(Distance A and B are measured at axle height with the vehicle sitting on the ground, or at 1G.)

Steering Centering Inspection

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

Steering Centering Adjustment

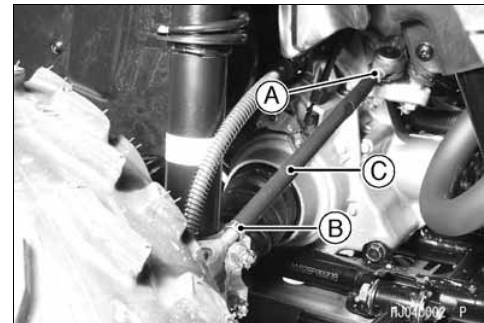
- Hold a straightedge [A] against the rear wheel rim on one side at axle height.



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

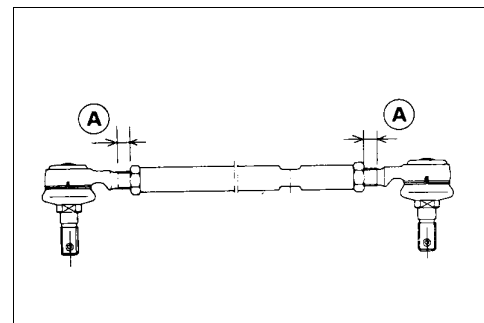
NOTE

- The locknut [B] (White) on the tie-rod has left-hand threads. Turn the wrench clockwise for loosening.



CAUTION

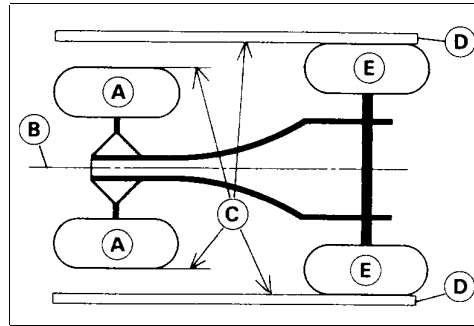
Adjust the tie-rod so that the visible thread length [A] is even on both ends of the tie-rod, or the threads could be damaged.



10-6 WHEELS / TIRES

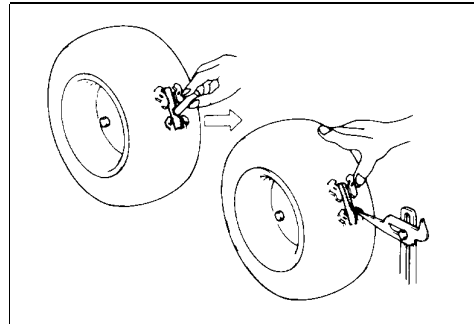
Wheel Alignment

- 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 scribe, make a thin mark near the center of the chalk coating while turning the wheel.



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



Toe-in of Front Wheels

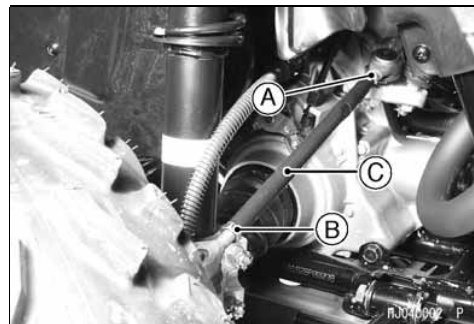
Standard: 0 ~ 20 mm (0 ~ 0.79 in.) at 1G

Toe-in Adjustment

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

NOTE

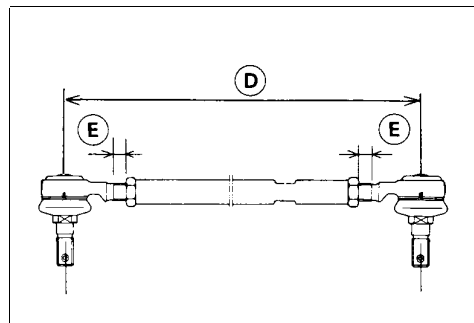
- The locknut [B] (White) on the tie-rod has left-hand threads. Turn the locknut clockwise for loosening.
- The toe-in will be near the specified value, if the tie-rod length [D] is 315 mm (12.4 in.) on each tie-rod.



CAUTION

Adjust the tie-rod length so that the visible thread length [E] 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 Adjusting Sleeve Locknuts: 27 N·m (2.8 kgf·m, 20 ft·lb)
- Test ride the vehicle.



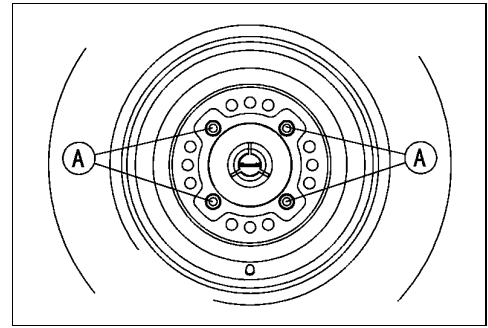
Wheels (Rims)

Wheel Removal

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

Special Tool - Jack: 57001-1238

- Remove:
 - Wheel Nuts
 - Wheel

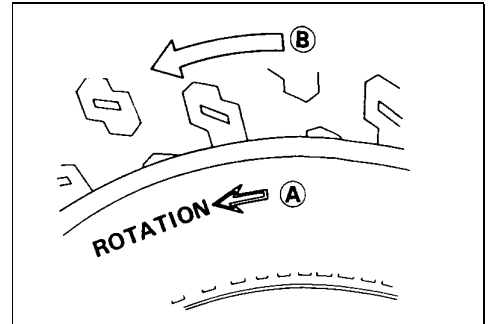


Wheel Installation

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

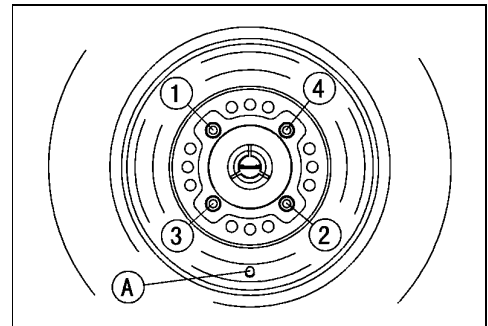
NOTE

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



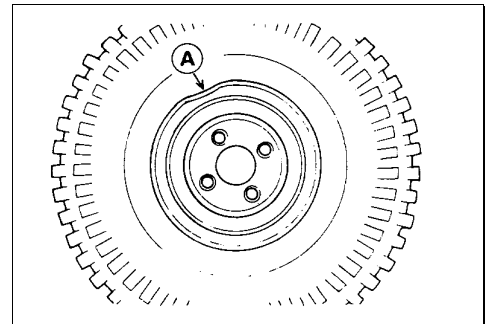
- Position the wheel so that the air valve [A] is toward the outside of the vehicle.
- Tighten the wheel nuts in a criss-cross pattern.

Torque - Wheel Nuts: 78 N·m (8.0 kgf·m, 58 ft·lb)

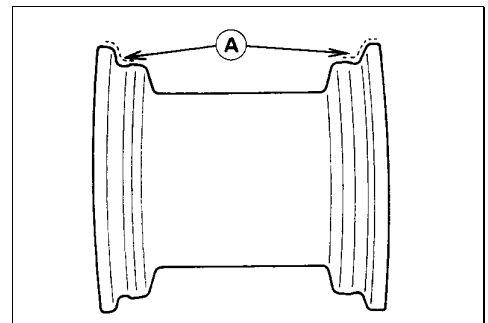


Wheel (Rim) Inspection

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



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



10-8 WHEELS / TIRES

Wheels (Rims)

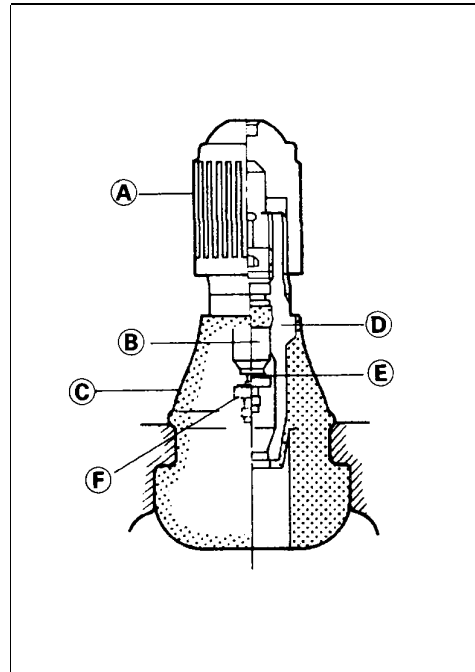
Wheel (Rim) Replacement

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

CAUTION

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

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

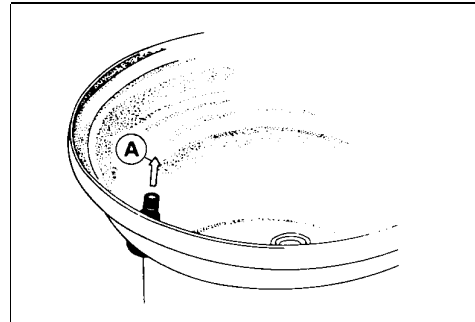


- Install a new air valve in the new rim.
- Remove the valve cap, lubricate the stem with a soap and water solution, and pull the stem [A] through the rim from the inside out until it snaps into place.

CAUTION

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

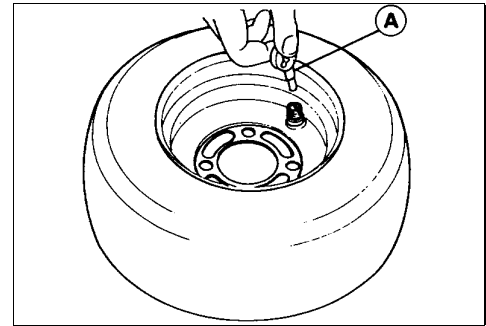
- Mount the tire on the new rim (see Tire Installation).
- Install the wheel (see Wheel Installation).



Tires

Tire Removal

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

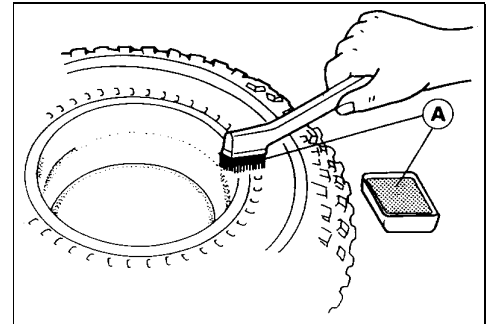


- Lubricate the tire beads and rim flanges on both sides of the wheel with a soap and water solution, or water [A]. This helps the tire beads slip off the rim flanges.

CAUTION

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

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



NOTE

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

Tire Installation

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

CAUTION

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

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

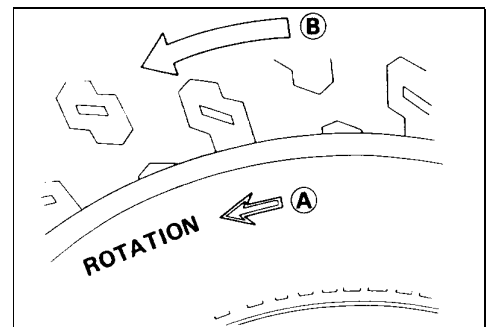
⚠ WARNING

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

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

NOTE

- *The direction of the tire rotation [B] is shown by an arrow on the tire sidewall.*
- Install the tire on the rim using a suitable commercially available tire changer.
- Lubricate the tire beads again and center the tire on the rim.



10-10 WHEELS / TIRES

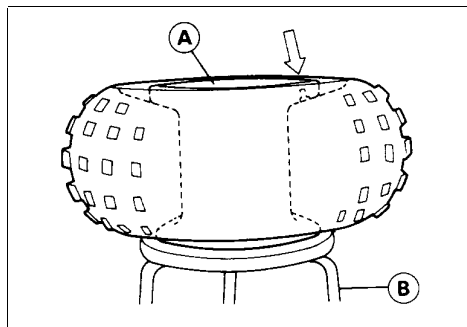
Tires

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

Maximum Tire Air Pressure (to seat beads when cold)
Front and Rear: 250 kPa (2.5 kgf/cm², 36 psi)

⚠ WARNING

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



- 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: 28 kPa (0.28 kgf/cm², 4.0 psi)

Rear: 35 kPa (0.35 kgf/cm², 5.0 psi)

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

⚠ WARNING

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

Tire Inspection

- 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:

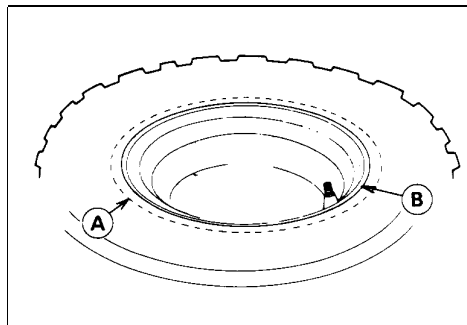
Front 3 mm (0.12 in.)

Rear 4 mm (0.16 in.)

Standard Tire

Front: AT 25 x 8 - 12 DUNLOP KT121A Tubeless

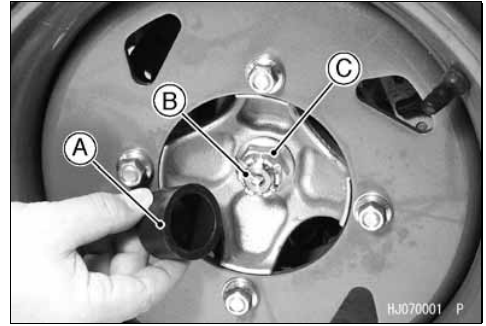
Rear: AT 25 x 10 - 12 DUNLOP KT127A Tubeless



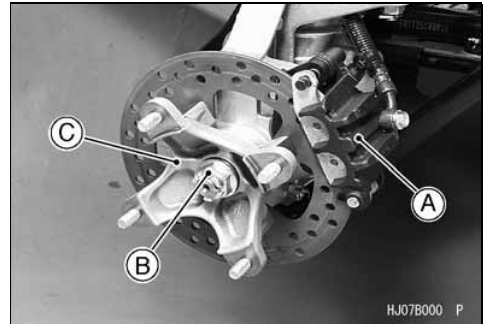
Front Hub

Front Hub Removal

- Remove:
 - Cap [A]
 - Cotter Pin [B]
- Loosen the axle nut [C].



- Remove the wheel (see Wheel Removal).
- Remove the caliper [A] by taking off the mounting bolts, and let the caliper hang free.
- Remove the axle nut [B] and pull off the front hub [C] and brake disc.
- Separate the brake disc from the front hub.

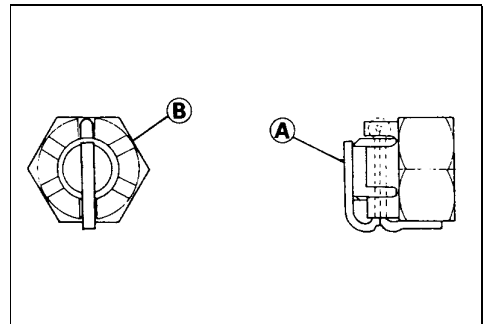


Front Hub Installation

- Install the brake disc (see Brakes chapter).
- Tighten:
 - Torque - Front Axle Nut: 197 N·m (20 kgf·m, 145 ft·lb)**
- Insert a new cotter pin [A] and bend it over the nut [B].

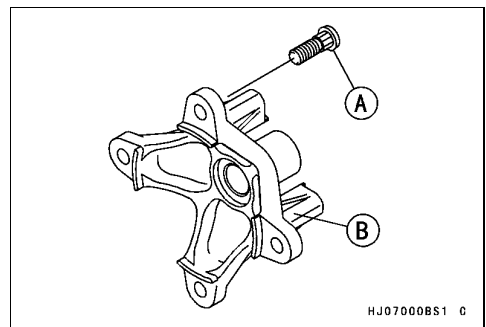
NOTE

- 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 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 Disassembly/Assembly

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

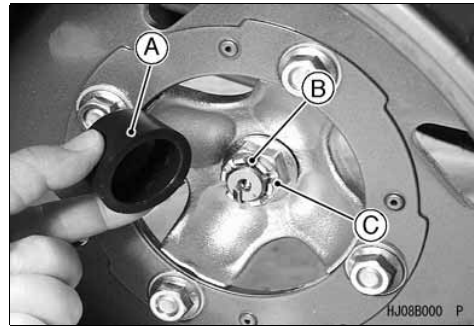


10-12 WHEELS / TIRES

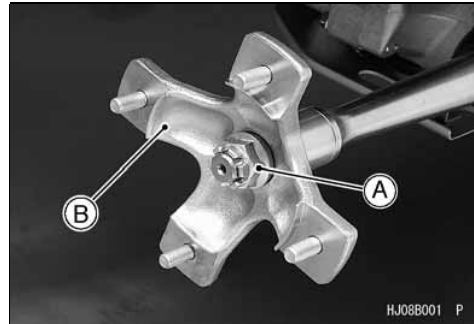
Rear Hub

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]

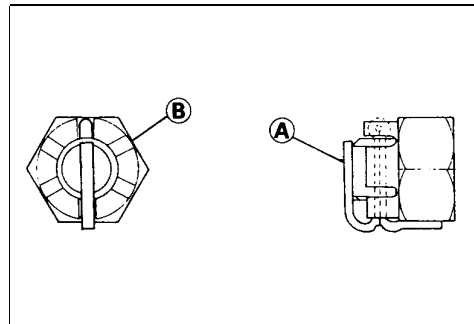


Rear Hub Installation

- Tighten:
 - Torque - Rear Axle Nuts: 265 N·m (27 kgf·m, 195 ft·lb)**
- Insert a new cotter pin [A] and bend it over the nut [B].

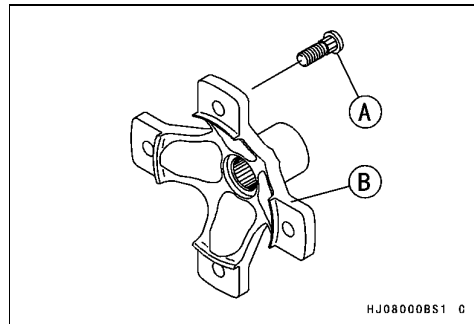
NOTE

- 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 up to next alignment.
- It should be within 30 degree.
- Loosen once and tighten again when the slot goes past the nearest hole.



Rear Hub Disassembly/Assembly

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



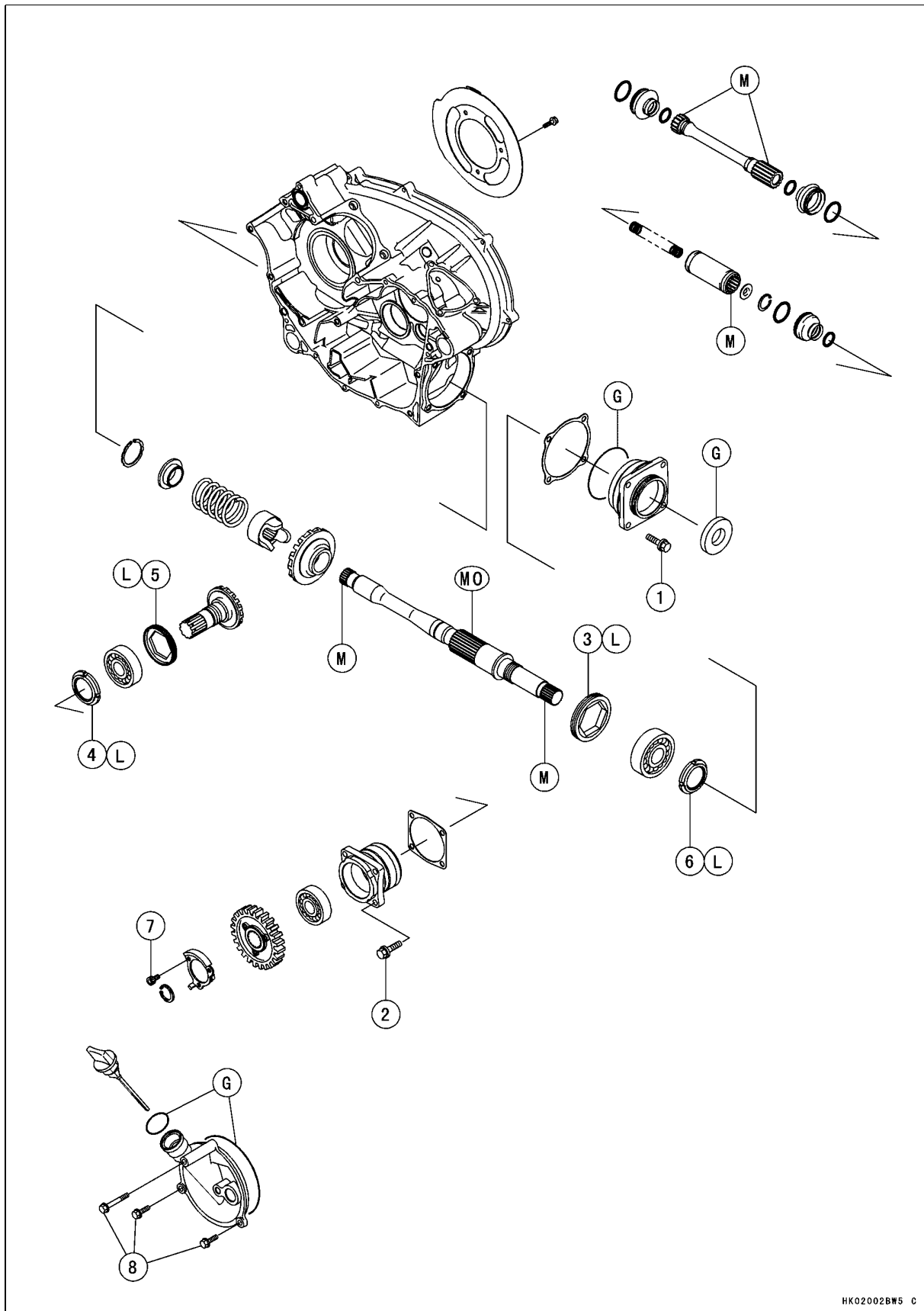
Final Drive

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11-2 FINAL DRIVE

Exploded View



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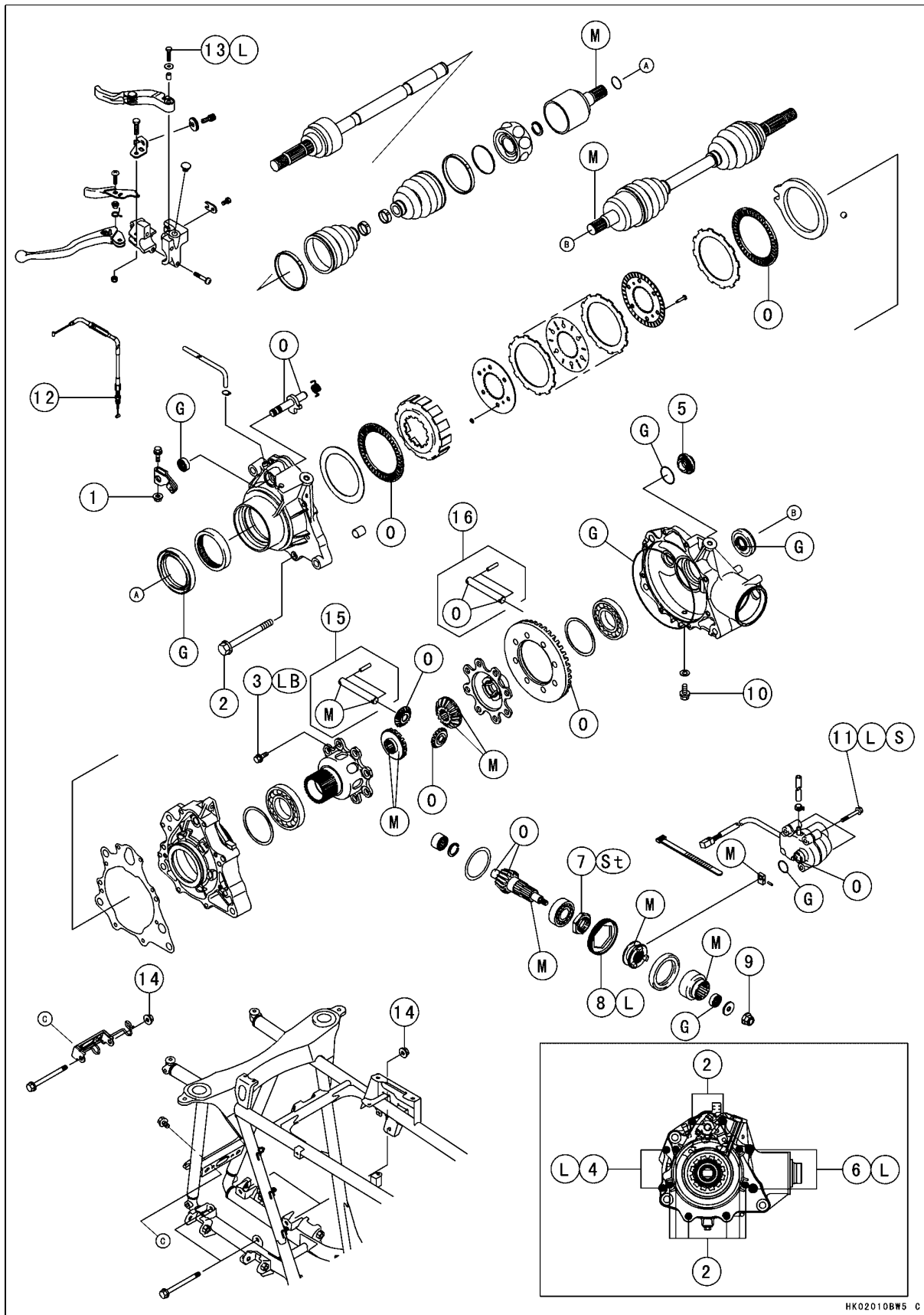
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Output driven bevel gear housing bolts	26	2.7	20	
2	Output drive bevel gear housing bolts	26	2.7	20	
3	Bearing holder	137	14	101	L
4	Bevel gear holder nut	157	16	116	L
5	Bearing holder	118	12	87	L
6	Output shaft holder nut	157	16	116	L
7	Rotor mounting bolts	12	1.2	104 in·lb	
8	Output drive bevel gear cover bolts	8.8	0.9	78 in·lb	

- G: Apply grease for oil seal and O-ring.
- L: Apply a non-permanent locking agent.
- M: Apply molybdenum disulfide grease.
- MO: Apply molybdenum disulfide oil.

11-4 FINAL DRIVE

Exploded View



HK02010BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Variable front differential control shift shaft lever bolt	8.8	0.9	78 in·lb	
2	Front final gear case left cover bolts (M8)	9.8	1.0	87 in·lb	
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	Oil filler cap	29	3.0	22	
6	Front final gear case center cover bolts (M8)	24	2.4	17	L
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 (A1, B1-M8)	20	2.0	14	
9	Front final gear case coupling nut (A2, B2-M10)	25	2.5	18	
10	Oil drain plug	24	2.4	17	
11	2WD/4WD actuator mounting bolts	9.8	1.0	87 in·lb	L, S
12	Variable differential control cable locknut	17	1.7	12	
13	Variable differential control lever bolt	–	–	–	L
14	Front final gear case bolts and nuts	59	6.0	43	

15: A1, B1 Models

16: A2, B2 Models

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

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

O: Apply engine oil.

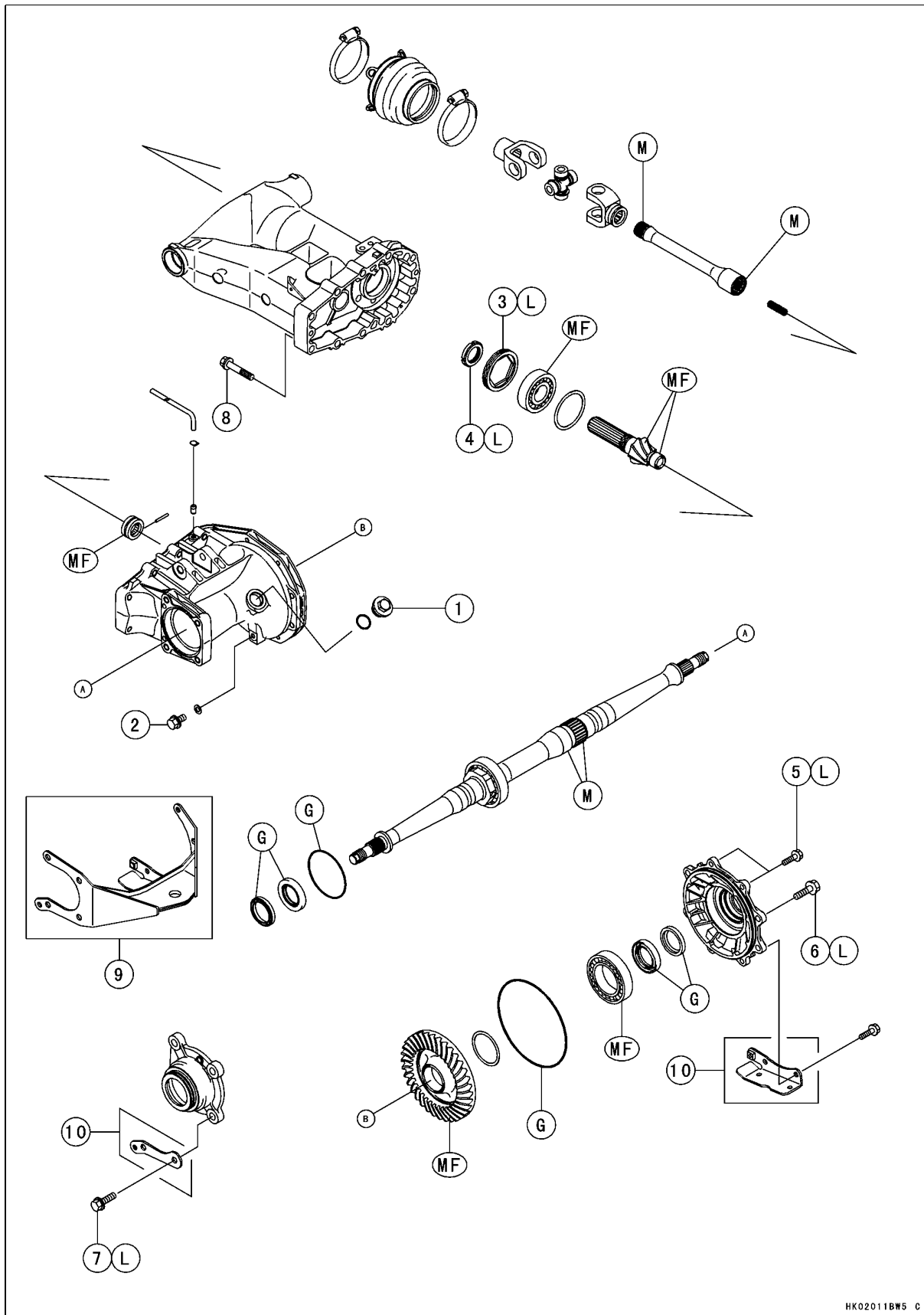
LB: Apply a non-permanent locking agent (Three Bond TB2471 Blue).

S: Follow the specific tightening sequence.

St: Stake the fasteners to prevent loosening.

11-6 FINAL DRIVE

Exploded View



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Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil filler cap	29	3.0	22	
2	Oil drain plug	24	2.4	17	
3	Pinion gear bearing holder	137	14	101	L
4	Pinion gear bearing holder nut	157	16	116	L
5	Rear final gear case right cover bolts (M8)	24	2.4	17	L
6	Rear final gear case right cover bolts (M10)	49	5.0	36	L
7	Rear final gear case left cover bolts	49	5.0	36	L
8	Rear final gear case bolts	42	4.3	31	L

9: Trailer hitch bracket is installed on the A1 (GB and EUR models only) and A2, B2 models.

10: The brackets are installed on the A1 (except GB and EUR models), B1 models.

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

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MF: Apply MOBIL FLUID 424 or equivalent oil.

GB: United Kingdom model

EUR: Europe model

11-8 FINAL DRIVE

Specifications

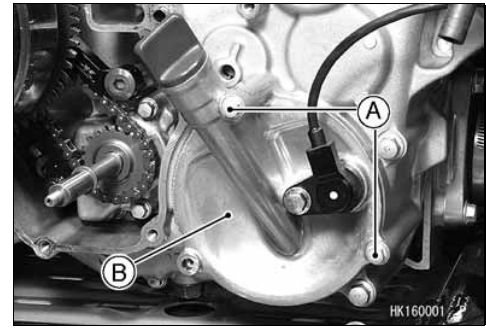
Item	Standard	Service Limit
Output Bevel Gear Case Output bevel gear backlash	0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.) (at output drive shaft spline)	---
Front Final Gear Case: Gear case oil (same engine oil): Type: Viscosity Oil level Capacity LSD clutch torque: (when variable differential control lever is released.) (when variable differential control lever is pulled in.) Bevel gear backlash	API SF or SG API SH or SJ with JASO MA class SAE 10W-40 Filler opening bottom 430 mL (0.45 US qt) 15 ~ 20 N·m (1.5 ~ 2.0 kgf·m, 11 ~ 14 ft·lb) 157 N·m (16 kgf·m, 116 ft·lb) or more 0.10 ~ 0.20 mm (0.004 ~ 0.008 in.) (at pinion gear spline)	--- --- --- --- --- --- ---
Rear Axle Shaft Rear axle shaft runout	TIR 1 mm (0.04 in.) or less	TIR 2 mm (0.08 in.)
Rear Final Gear Case: Gear case oil: Type: A1, B1 A2, B2 Oil level Capacity Rear final bevel gear backlash	MOBIL Fluid 424 MOBIL Fluid 424 or CITGO TRANSGARD TRACTOR HYDRAULIC FLUID Filler opening bottom 900 mL (0.95 US qt) 0.07 ~ 0.14 mm (0.003 ~ 0.006 in.) (at pinion gear spline)	--- --- --- --- ---

Special Tools - Bearing Puller: 57001-135
Inside Circlip Pliers: 57001-143
Outside Circlip Pliers: 57001-144
Circlip Pliers: 57001-154
Oil Seal & Bearing Remover: 57001-1058
Bearing Driver Set: 57001-1129, This includes Driver Holder, 57001-1132.
Socket Wrench: 57001-1363
Damper Spring Compressor Set: 57001-1475
Holder & Guide Arbor: 57001-1476
Socket Wrench, Hex 50: 57001-1478
Output Shaft Holder & Spacer: 57001-1479
Pinion Gear Holder: 57001-1480
Nut Holding Bolts: 57001-1481
Socket Wrench: 57001-1482
Socket Wrench, Hex 41: 57001-1484
Pinion Gear Holder: 57001-1485
Oil Seal Driver: 57001-1487
Gear Holder & Socket Wrench, Hex 24: 57001-1489
Hexagon Wrench, Hex 41: 57001-1491
Oil Seal Driver, ϕ 18: 57001-1505
Oil Seal Driver, ϕ 48: 57001-1506

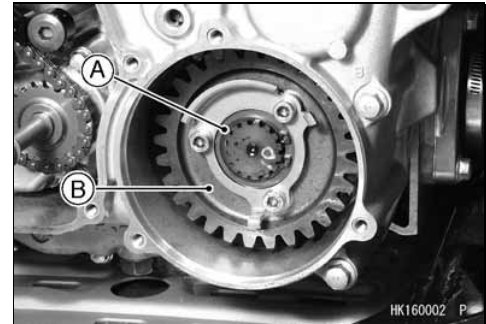
Output Bevel Gears

Output Drive Bevel Gear Removal

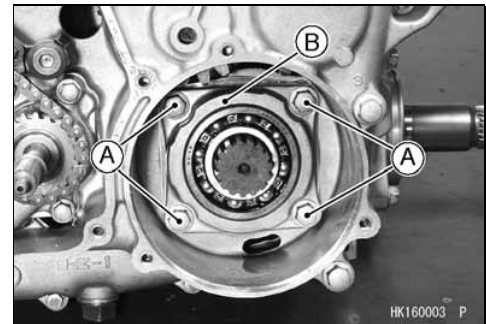
- Remove:
 - Oil Pipe
 - Output Drive Bevel Gear Cover Bolts [A]
 - Output Drive Bevel Gear Cover [B]



- Remove:
 - Circlip [A]**Special Tool - Outside Circlip Pliers: 57001-144**
- Remove:
 - Output Drive Idle Gear [B]

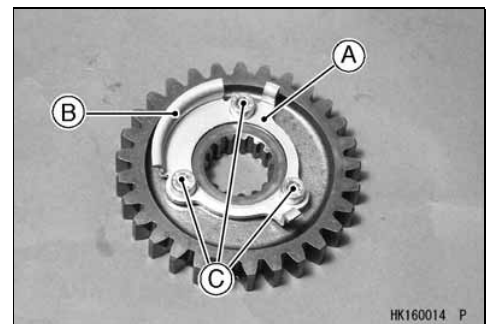


- Remove:
 - Output Drive Bevel Gear Housing Bolts [A]
 - Output Drive Bevel Gear Housing [B]



Output Drive Bevel Gear Installation

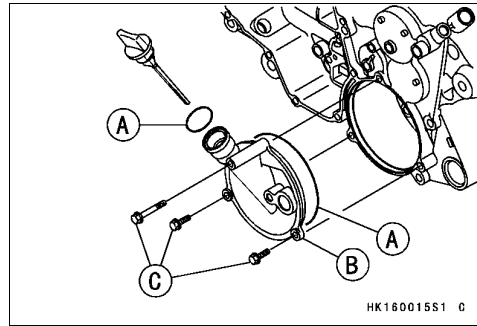
- Install the output drive bevel gear housing.
- Tighten:
 - Torque - Output Drive Bevel Gear Housing Bolts: 26 N·m (2.7 kgf·m, 20 ft·lb)**
- Install the rotor [A] so that the projections [B] face outward.
- Tighten:
 - Torque - Rotor Mounting Bolts [C]: 12 N·m (1.2 kgf·m, 104 in·lb)**
- Install:
 - Output Drive Idle Gear
 - New Circlip
- Special Tool - Outside Circlip Pliers: 57001-144**



11-10 FINAL DRIVE

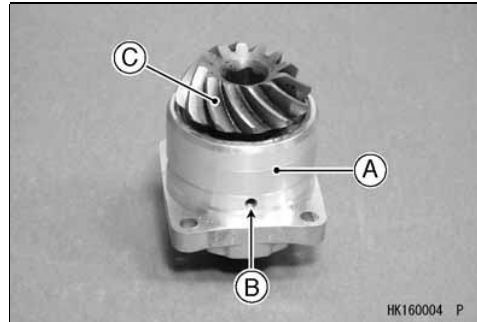
Output Bevel Gears

- Apply grease:
 - O-rings [A]
- Install:
 - Output Drive Bevel Gear Cover [B]
- Tighten:
 - Torque - Output Drive Bevel Gear Cover Bolts [C]: 8.8 N·m (0.9 kgf·m, 78 in·lb)



Output Drive Bevel Gear Disassembly

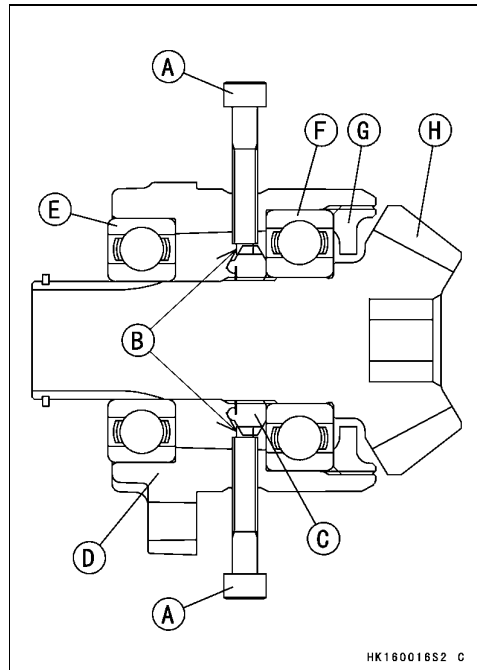
- Remove:
 - Output Drive Bevel Gear Housing [A] (see Output Drive Bevel Gear Removal)
- Look through the hole [B] in the housing.
- Turn the bevel gear [C] until the groove of the output drive bevel gear holder nut is seen.



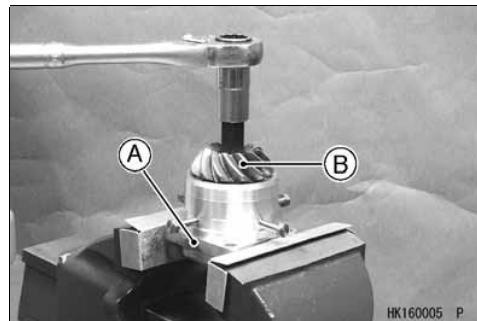
- Tighten the nut holding bolts [A] (4) securely into the grooves [B] of the bevel gear holder nut [C] in the output drive bevel gear housing.

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



- 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.

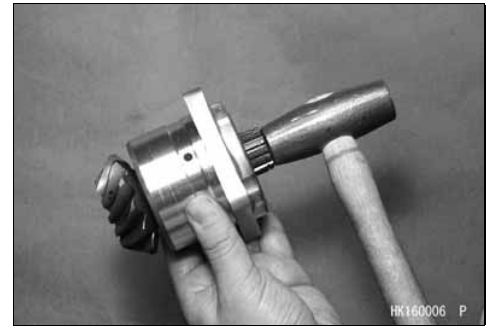


Output Bevel Gears

- 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

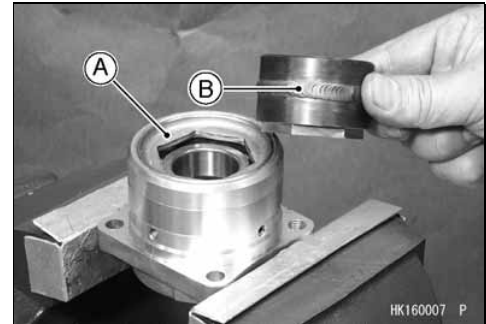
- Repeat the above procedure, and remove the bevel gear from the housing.



- Remove the bearing holder [A] using the hexagon wrench [B].

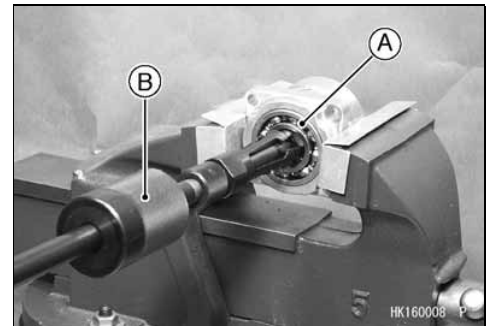
Special Tool - Hexagon Wrench, Hex 41: 57001-1491

- If the holder seems too difficult to break free, apply heat to softer the locking agent.



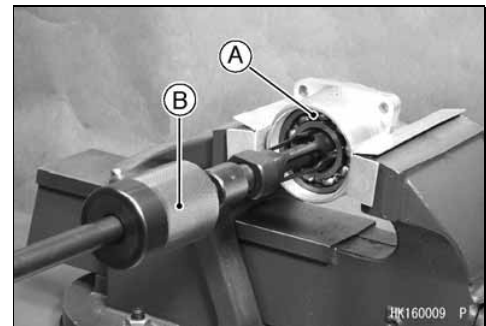
- Remove:
Outer Ball Bearing [A]

Special Tool - Oil Seal & Bearing Remover [B]: 57001-1058



- Remove:
Output Drive Bevel Gear Holder Nut
Inner Ball Bearing [A]

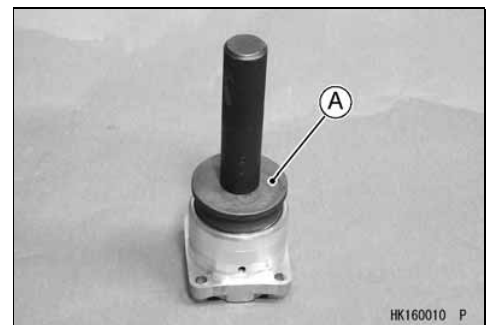
Special Tool - Oil Seal & Bearing Remover [B]: 57001-1058



Output Drive Bevel Gear Assembly

- Press the new inner ball bearing until it is bottomed.

Special Tool - Bearing Driver Set [A]: 57001-1129



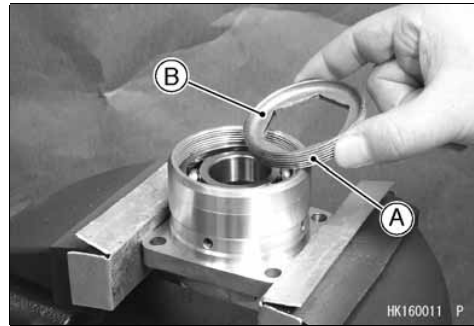
11-12 FINAL DRIVE

Output Bevel Gears

- 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: 118 N·m (12 kgf·m, 87 ft·lb)

- Press the output drive bevel gear until it is bottomed.

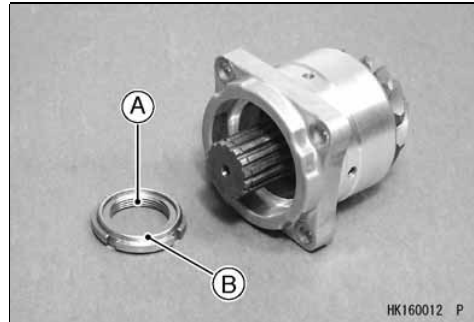


- Apply a non-permanent locking agent to the threads of the bevel gear holder nut [A] and tighten it so that the projection side [B] faces outward.

Special Tool - Socket Wrench: 57001-1482 [C]

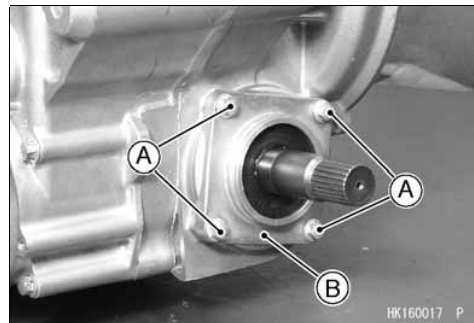
Torque - Bevel Gear Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)

- Press the new outer ball bearing until it is bottomed.

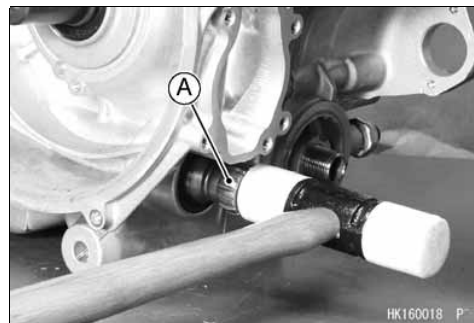


Output Driven Bevel Gear Removal

- Remove:
 - Swingarm (see Suspension chapter) and Front Propeller Shaft (see this chapter) or Engine (see Engine Removal/Installation chapter)
 - Output Driven Bevel Gear Housing Bolts [A]
 - Output Driven Bevel Gear Housing [B]



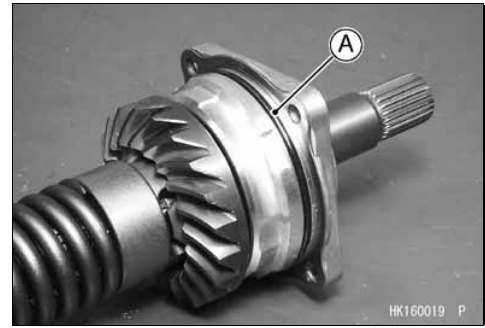
- Tap lightly the front end [A] of the output driven bevel gear shaft using a plastic mallet.
- The output driven bevel gear shaft assembly comes off with the housing.



Output Bevel Gears

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 (2.7 kgf·m, 20 ft·lb)

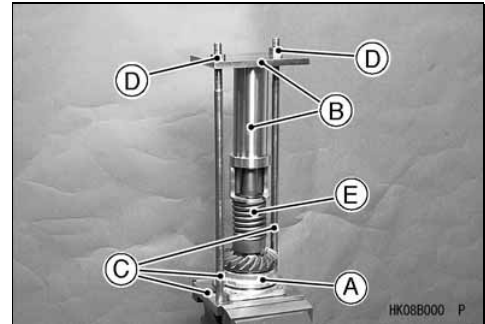


Output Driven Bevel Gear Disassembly

- Remove:
 - Output Driven Bevel Gear Housing Assembly (see Output Driven Bevel Gear Removal)
- Hold the holder in a vise, and set the housing assembly [A] on the holder.

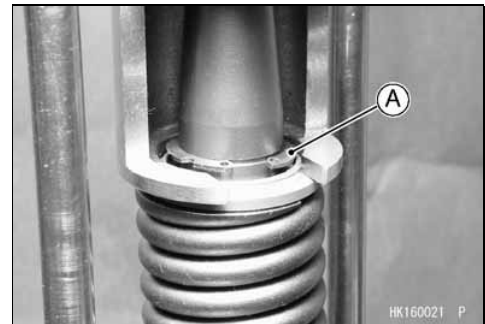
**Special Tools - Damper Spring Compressor Set [B]: 57001-1475
Holder & Guide Arbor [C]: 57001-1476**

- Tighten the nuts [D] and compress the damper spring [E].

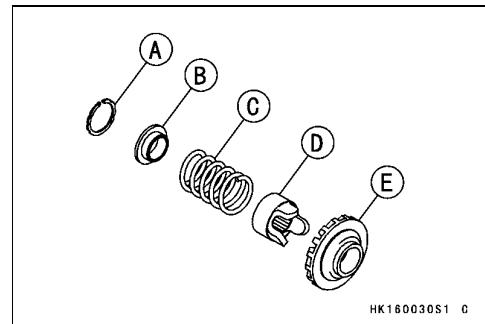


- Remove:
 - Circlip [A]

Special Tool - Circlip Pliers: 57001-154



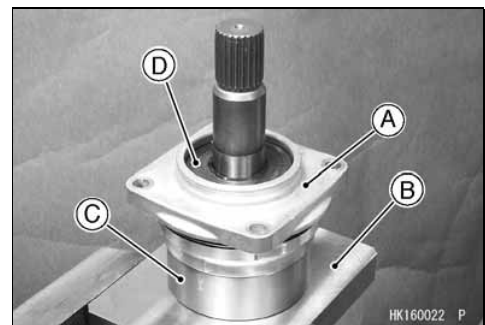
- Remove:
 - Circlip [A]
 - Spring Holder [B]
 - Spring [C]
 - Cam Damper [D]
 - Output Driven Bevel Gear [E]



- Hold the housing assembly [A] with the output shaft holder [B] & spacer [C] in a vise.

Special Tool - Output Shaft Holder & Spacer: 57001-1479

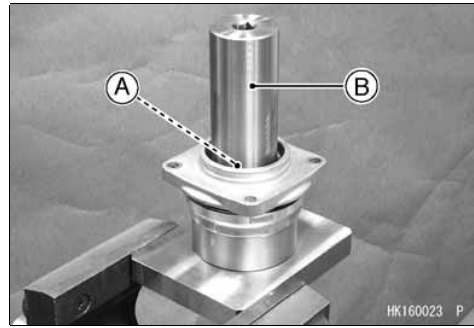
- Remove:
 - Oil Seal [D]



11-14 FINAL DRIVE

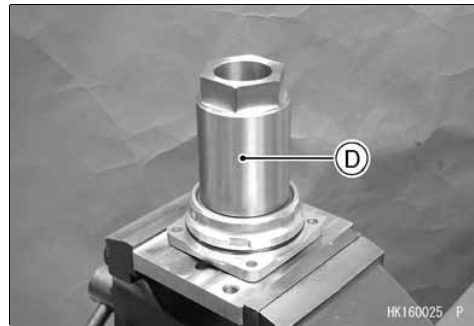
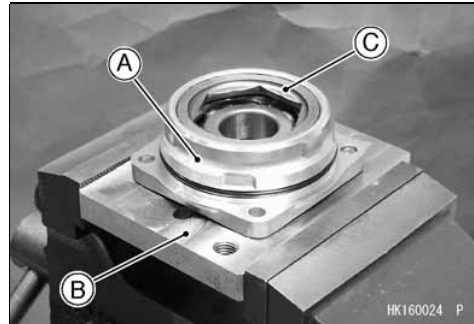
Output Bevel Gears

- Remove:
Output Shaft Holder Nut [A]
Special Tool - Socket Wrench [B]: 57001-1482



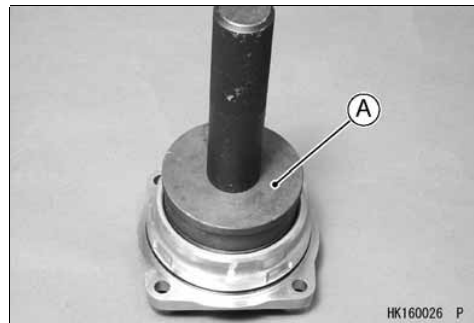
- Hold the housing assembly [A] with the holder [B] in a vise.
Special Tool - Holder & Guide Arbor : 57001-1476

- Remove:
Bearing Holder [C]
Special Tool - Socket Wrench [D], Hex 50: 57001-1478
- If the holder seems too difficult to break free, apply heat to soften the locking agent.
- Remove:
Ball Bearing
Special Tool - Oil Seal & Bearing Remover: 57001-1058

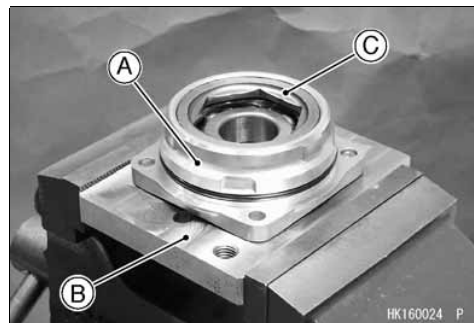


Output Driven Bevel Gear Assembly

- 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
- Apply a non-permanent locking agent to the threads of the bearing holder [C] and tighten it.
Special Tool - Socket Wrench, Hex 50: 57001-1478
Torque - Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)



Output Bevel Gears

- Hold the housing assembly [A] with the output shaft holder [B] & spacer [C] in a vise.

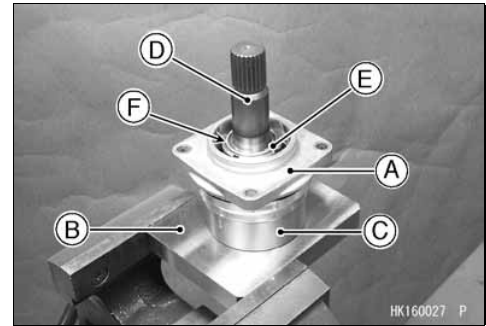
Special Tool - Output Shaft Holder & Spacer: 57001-1479

- Insert the output shaft [D] in the housing.
- Apply a non-permanent locking agent to the threads of the output shaft holder nut [E] and tighten it so that the projection side [F] faces outward.

Special Tool - Socket Wrench: 57001-1482

Torque - Output Shaft Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)

- Apply grease to the oil seal and press it.



- Hold the holder [A] in a vise, and set the housing assembly [B] on the holder.

Special Tool - Holder & Guide Arbor: 57001-1476

- Install:

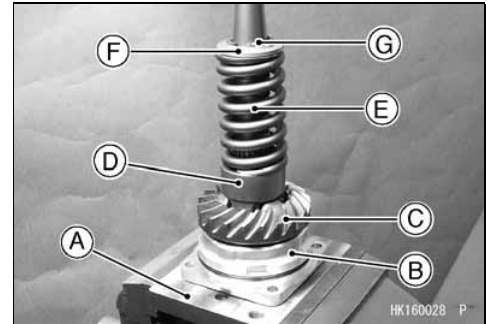
Output Driven Bevel Gear [C]

Cam Damper [D]

Spring [E]

Spring Holder [F]

Circlip [G]



- Install:

Guide Bars [A]

Damper Spring Compressor Set [B]

Special Tools - Holder & Guide Arbor: 57001-1476

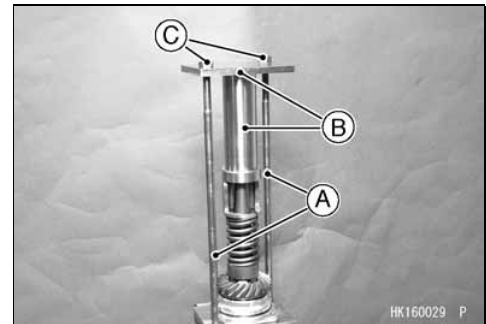
Damper Spring Compressor Set: 57001-1475

- Tighten the nuts [C] and compress the damper spring.

- Install:

Circlip

Special Tool - Circlip Pliers: 57001-154



11-16 FINAL DRIVE

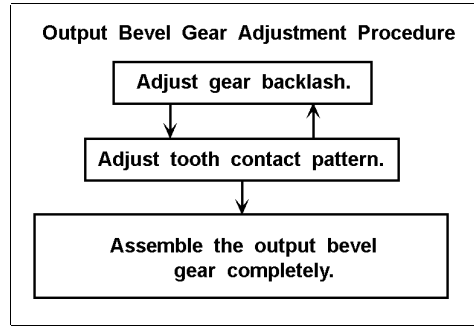
Output Bevel Gears

Output Bevel Gears Adjustment

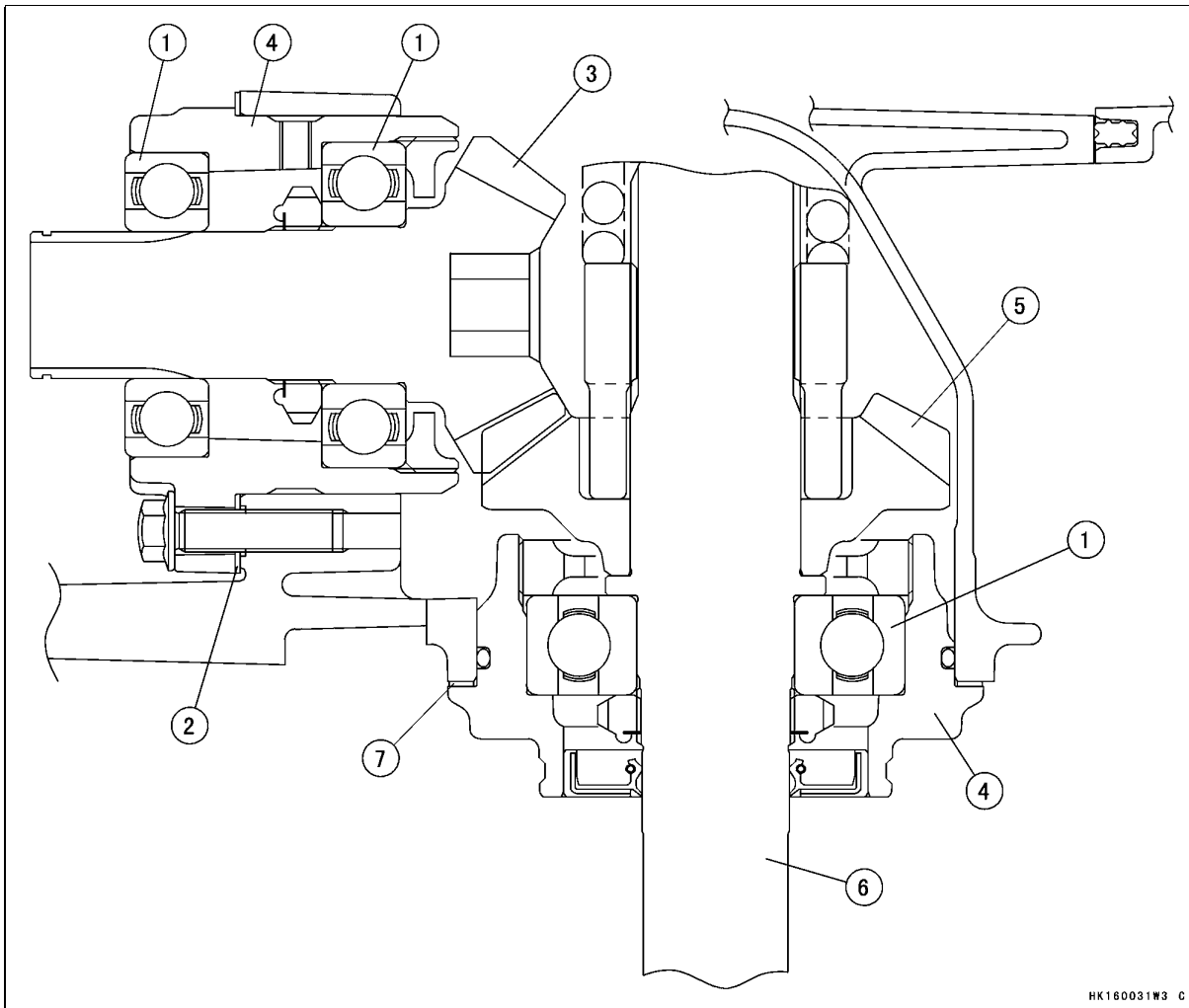
The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

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 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

Output Bevel Gears

Drive Bevel Gear Shims for Tooth Contact Adjustment

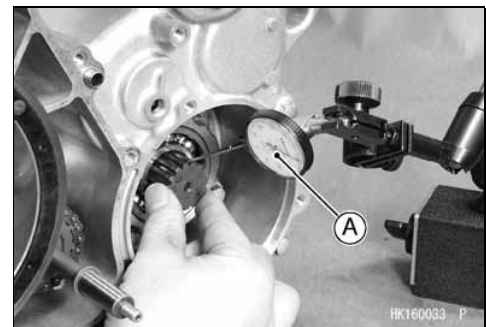
Thickness	Part Number
0.15 mm (0.006 in.)	92180-1311
0.2 mm (0.008 in.)	92180-1312
0.5 mm (0.020 in.)	92180-1313
0.8 mm (0.031 in.)	92180-1314
1.0 mm (0.039 in.)	92180-1351
1.2 mm (0.047 in.)	92180-1352

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

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)

11-18 FINAL DRIVE

Output Bevel Gears

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.

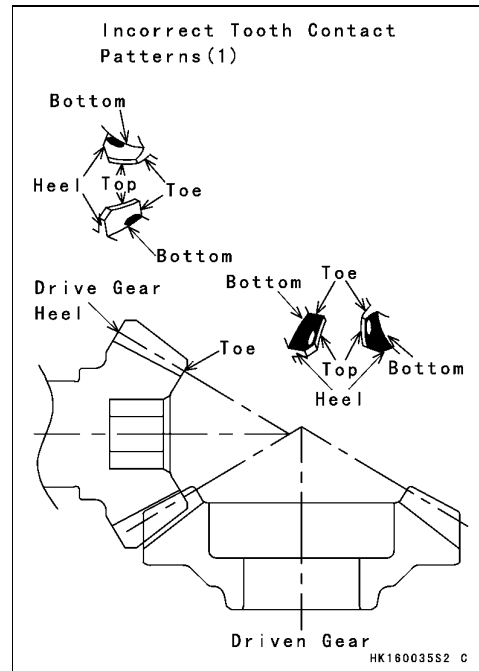
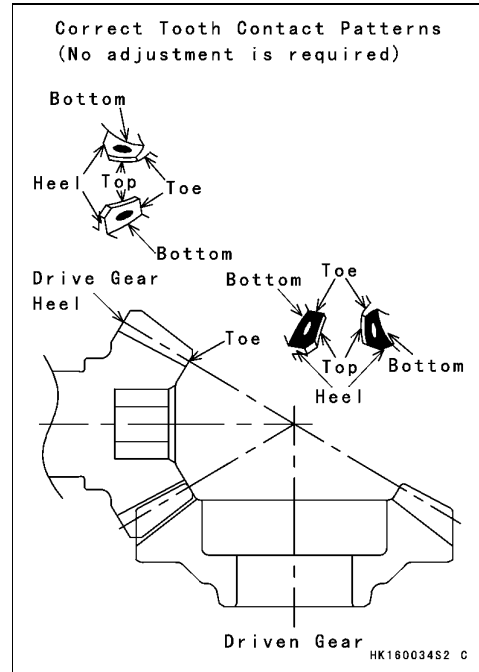
NOTE

- 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

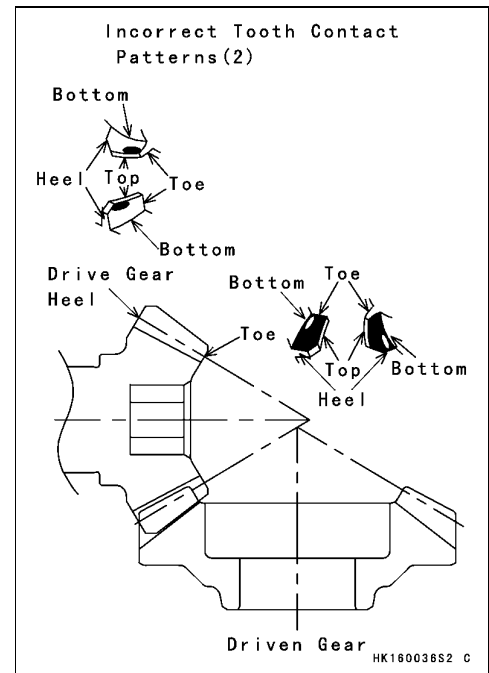
- If the backlash is out of the standard range after changing shims, correct the backlash before checking the tooth contact pattern.

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.



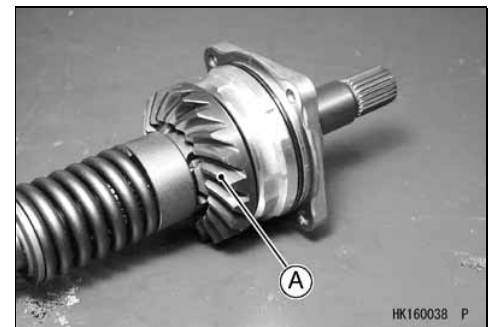
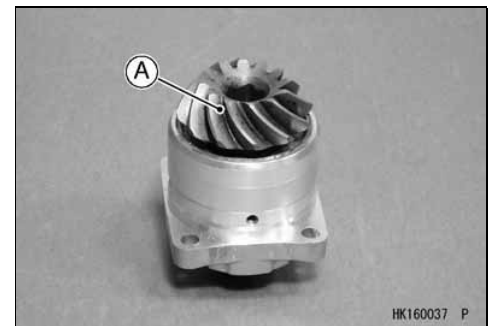
Output Bevel Gears

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.



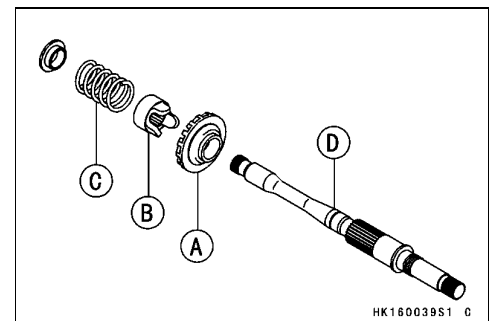
Bevel Gears Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.



Cam Damper Inspection

- Visually inspect:
 - Bevel Gear Cam [A]
 - Cam Follower [B]
 - Spring [C]
 - Shaft [D]
- ★ Replace any part if it appears damaged.

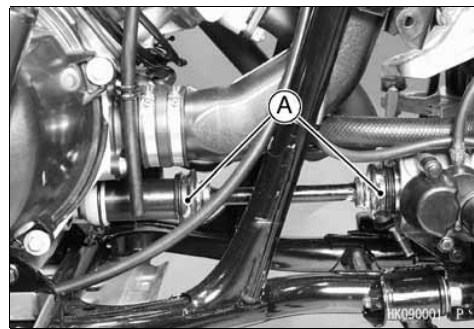


11-20 FINAL DRIVE

Front Propeller Shaft

Front Propeller Shaft Removal

- Slip the O-ring clamps off the grooves on the small rubber boots [A], and then pull the boot.



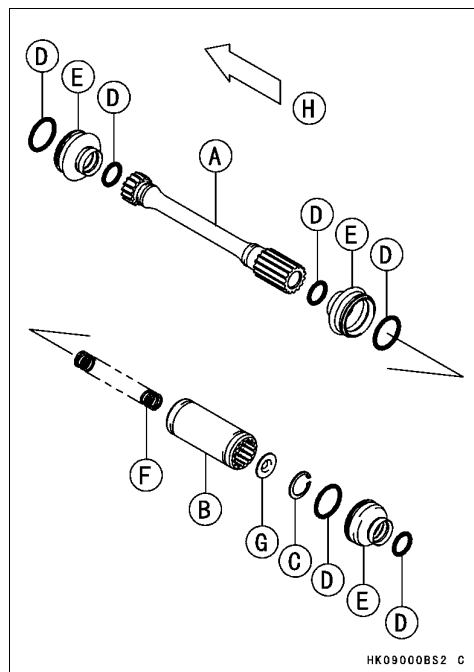
- Push the front propeller shaft [A] rearward, and remove the front end [B] from the front final gear case.
- Remove the front propeller shaft from the vehicle.



Front Propeller Shaft Installation

- Wipe any old grease off 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 on the output bevel gear 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.

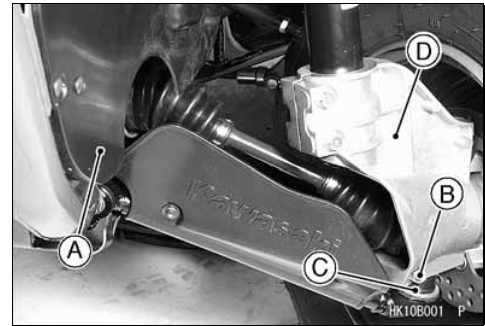
- O-ring [D]
- Boots [E]
- Spring [F]
- Spring Seat [G]
- Front [H]



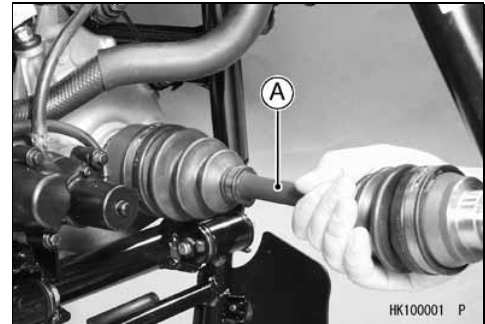
Front Axle

Front Axle Removal

- Drain the front final gear case oil (see Front Final Gear Case Oil Change).
- Remove:
 - Front Wheel (see Wheels/Tires chapter)
 - Inner Cover [A] (see Frame chapter)
 - Knuckle Joint Bolt [B]
- Remove the knuckle joint [C] from the knuckle [D].

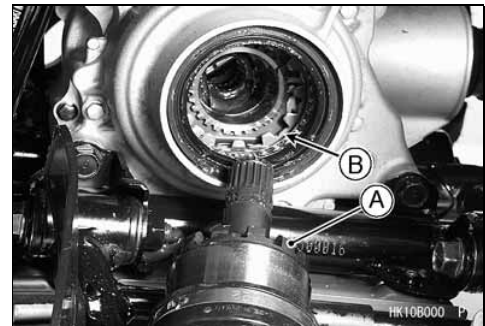


- Pull the front axle [A] in a straight line out of the front final gear case.



Front Axle Installation

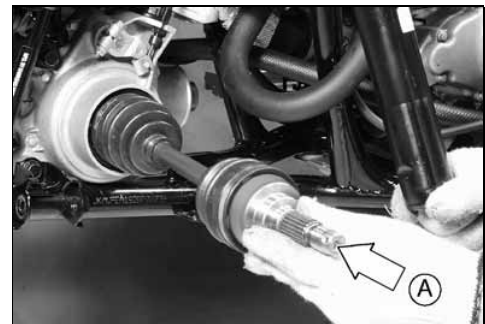
- Wipe the old grease off the splines of the axle and the gear case oil seal.
- Visually inspect the splines of the axle.
- ★ If they are badly worn or chipped, replace the axle with a new one.
- Apply molybdenum disulfide grease to the axle splines and the gear case oil seal.
- Insert the left axle so that the teeth [A] fit in the grooves [B].



- Tap [A] the end of the front axle lightly and install the front axle.

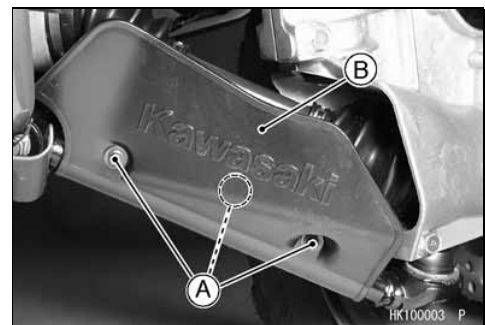
NOTE

- The axle shaft must not come off easily.



Front Axle Joint Boot Inspection

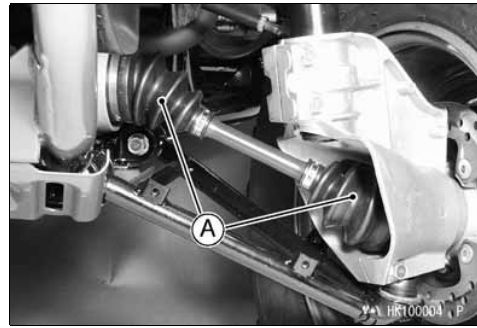
- Visually inspect the front axle joint boots in accordance with the Periodic Maintenance Chart (see General Information chapter) or if the axles are noisy during operation.
- Remove:
 - Bolts [A] and Washer Guard [B]



11-22 FINAL DRIVE

Front Axle

- Visually inspect the joint boots [A].
- ★ If the joint boot is torn, worn, deteriorated, or leaks grease, replace the front axle assembly.



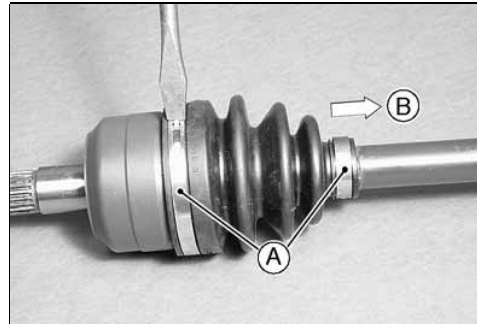
Front Axle Joint Boot Replacement

NOTE

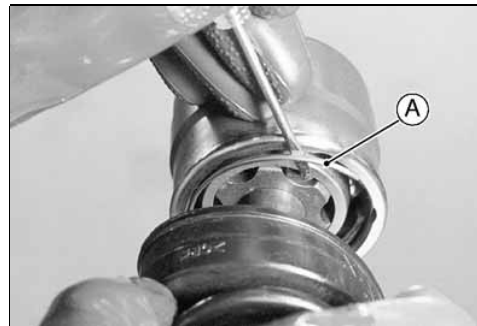
- Only the inboard joint can be disassembled, so replacement of either the inboard or outboard joint boots always begins at the inboard end.

Inboard Joint Boot Removal:

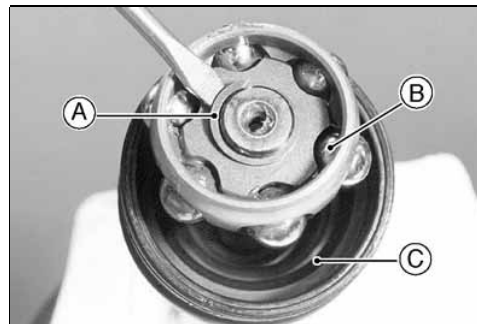
- Remove the front axle (See Front Axle Removal)
- Remove the boot bands [A] of inside joint boot.
- Scrap the removed boot bands.
- Slide the joint boot towards the center [B] of the axle.



- Remove the retaining ring [A].
- Separate to the axle shaft.



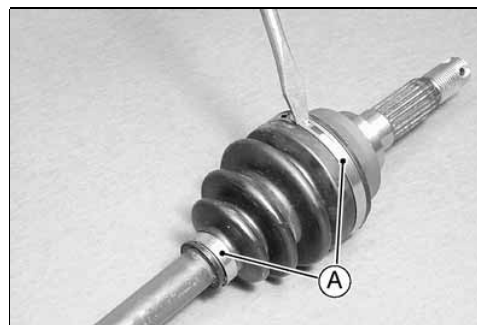
- Remove:
 - Circlip [A]
 - Ball bearing [B]
 - Inside joint boot [C]



Outboard Joint Boot Replacement:

NOTE

- If inspections of the outboard joint and boot reveal no problems, do not remove the outboard boot. Move on to Inboard Joint Boot Assembly.
- Remove the boot bands of outside joint boot.
- Scrap the removed boot bands [A].



Front Axle

- The out side joint [A] cannot be disassembled.
- Inspect the outside joint [B].
- ★ If the joint does not move smoothly due to wear or corrosion, replace the front axle because the joint bearing is damaged.
- Inspect whether the axle shaft spline is damaged or not.
- ★ If there is clear damage or wear on the spline, replace the axle shaft.
- Clean the axle shaft by wiping off the used grease on it.

CAUTION

Do not clean the boot with the mineral oil or gasoline because they damage the boot.

- Wind the tape [A] on the inside splines of the axle shaft in order to protect the joint boot.
- Apply the special grease slightly on the inside of the boot small diameter, and install the joint boot on the groove of the shaft.

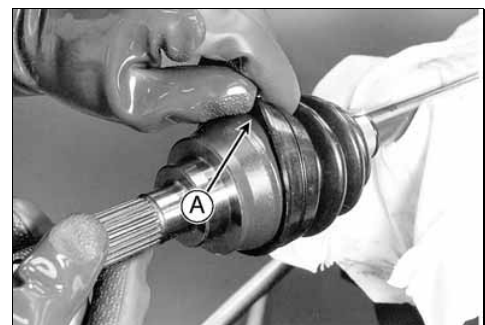
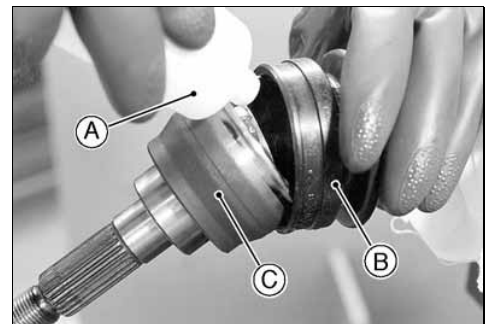
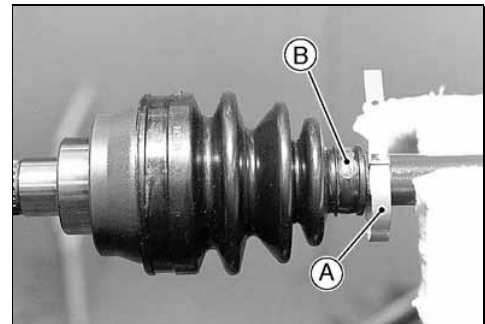
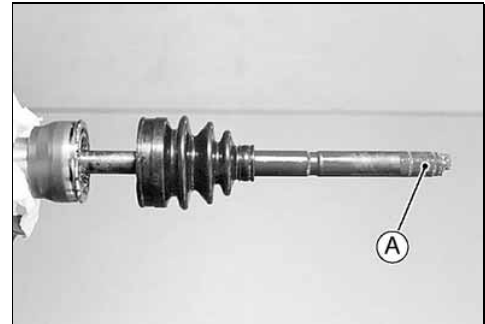
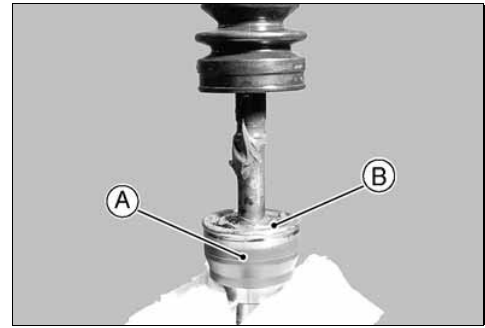
CAUTION

Only the special grease which is included with the boot kit can be applied to the boots.

- Apply the special grease [B] slightly on the part of band installation in order to make easy to install the band [A].
- Install the small band first.

- Squeeze all of the special grease [A] (about 70 grams) into the outboard boot [B], and slide the boot onto the outside joint [C].

- Open the edge [A] of the boot in order to equalize the air pressures.

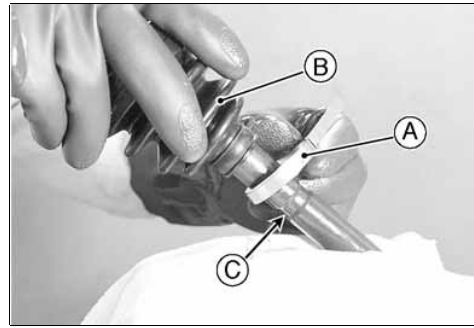


11-24 FINAL DRIVE

Front Axle

Inboard Joint Boot Assembly:

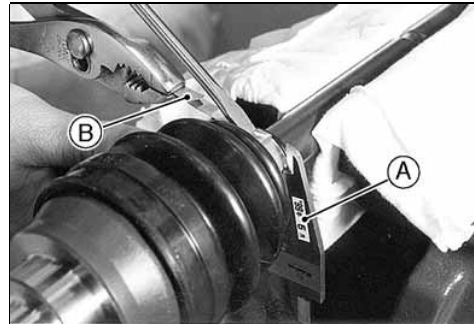
- Slide the small band [A] onto the shaft, and then slide the boot [B] into the groove [C] on the shaft.



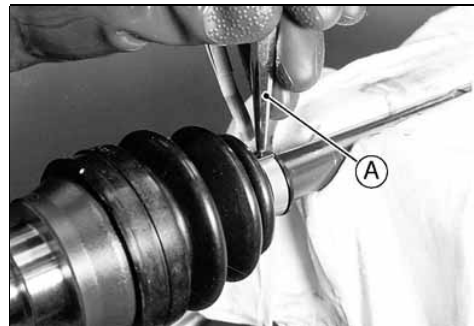
- Tighten the band, pulling the tip of band [B] with a plier and a driver, while measuring the outside diameter of the band.

Outside Diameter of Band: 26.1 ± 0.3 mm (1.028 ± 0.012 in.)
(After tightening the outside small diameter)

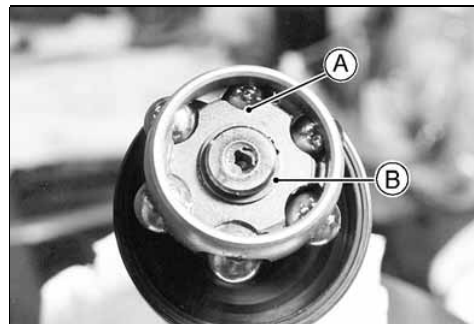
[A] Vernier Calipers



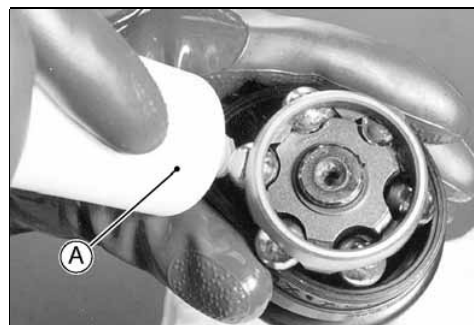
- When the outside diameter of the band comes to the specified value, bend the tip of band about 90 degrees.
- After bending the tip of band, stake it with a chisel [A] so that it does not loosen.
- After staking it, cut off the extra tip of the band, and bend it securely.



- Install the ball bearing [A] and new circlip [B].

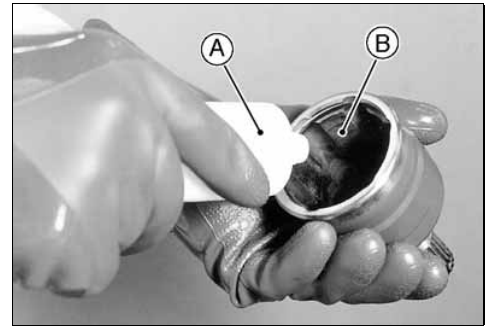


- Squeeze about half a tube (35 grams) of the special grease [A] into the inboard joint boot.



Front Axle

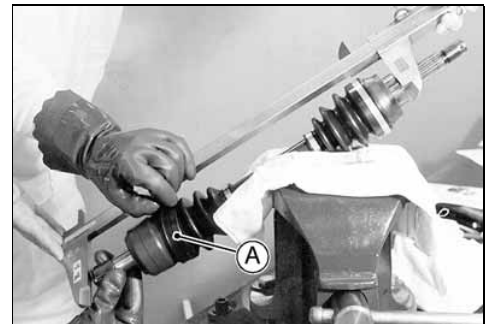
- Squeeze the remaining special grease [A] into the bearing cup [B].



- Install the inside shaft, and install the new retaining ring [A].

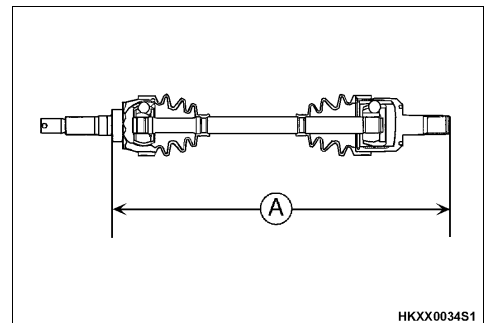


- Compress the axle assembly to the specified length while relieving the air pressure inside the inboard boot [A].
- Hold the axle at this setting.

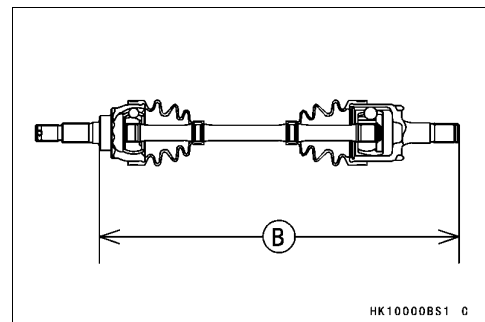


Standard Length of Assembling:

Right Front Axle: 395 mm (15.55 in.) [A]



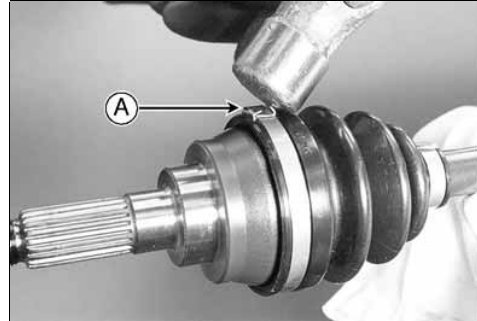
Left Front Axle: 403 mm (15.87 in.) [B]



11-26 FINAL DRIVE

Front Axle

- Install the large board.
- Assemble it the same as the small band, noting this setting;
Outside Diameter of Band: 69.0 ± 0.3 mm (2.717 ± 0.012 in.)
(After tightening the outside large diameter)
- While the band is held at the diameter above, tap down the wings 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.

CAUTION

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 is in place, and tighten the filler cap.
- Apply grease to the O-ring.

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

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 front side cover (see Frame chapter).
- Place an oil pan beneath the front final gear case and remove the drain plug [A].

⚠ WARNING

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

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

Torque - Oil Drain Plug: 24 N·m (2.4 kgf·m, 17 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 SF or SG
API SH or SJ with JASO MA class

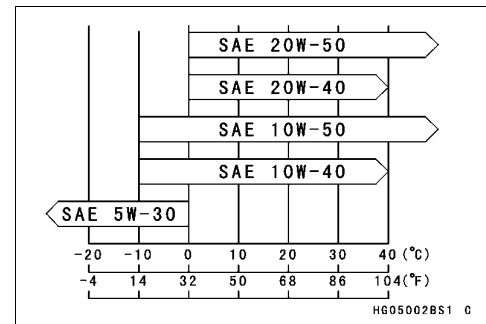
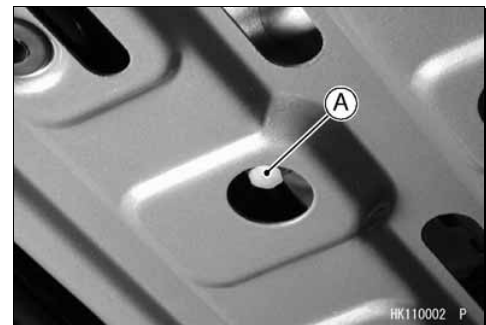
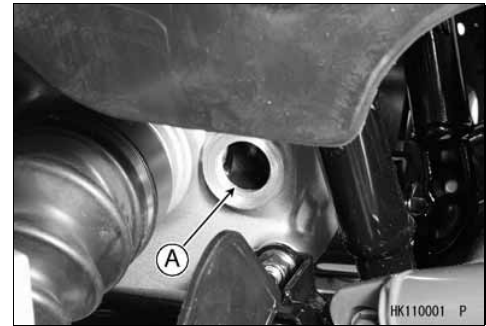
Viscosity: SAE 10W-40

Capacity: 430 mL (0.45 US qt)

NOTE

- Depending on the atmospheric temperature of your riding area, the engine oil viscosity should be changed according to the chart.
- Be sure the O-ring is in place, and tighten the filler cap.
- Apply grease to the O-ring.

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



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11-28 FINAL DRIVE

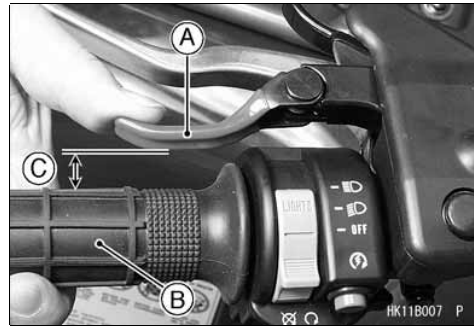
Front Final Gear Case

Variable Differential Control Lever Position Inspection

- Pull the variable differential control lever [A] towards the handlebar grip [B] with a spring scale until it reads 3.0 kg (7 lb) of force.
 - The clearance [C] between the control lever and grip should be 15 ~ 25 mm (0.6 ~ 1.0 in.).
- ★ If the clearance is not within the specified range, adjust the cable.

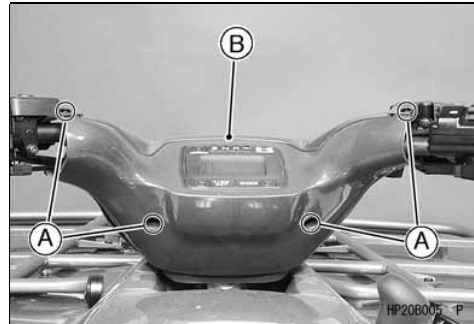
Differential Control Lever Position

Standard: 15 ~ 25 mm (0.6 ~ 1.0 in.)

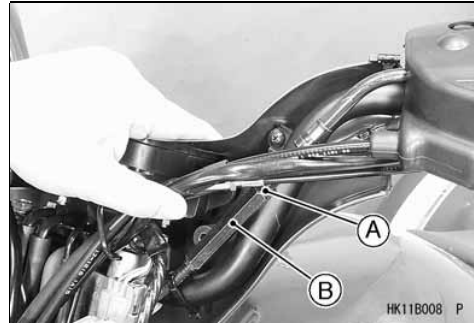


Variable Differential Control Lever Position Adjustment

- Remove:
 - Handle Cover Screws [A]
 - Handle Cover Front [B]

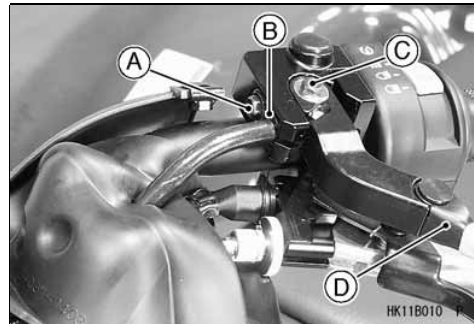


- Loosen the locknut [A] of the differential control cable.
- Turn the adjuster [B] until the cable has proper amount of play.
- Tighten the locknut securely.



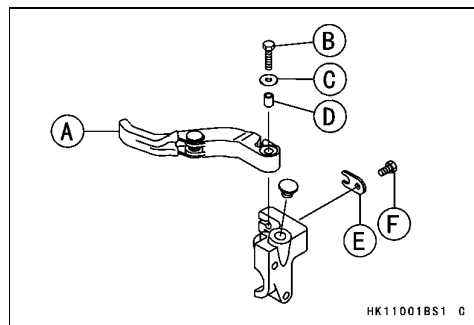
Variable Differential Control Lever Removal

- Remove:
 - 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



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].
- Install:
 - Variable Differential Control Lever Bolt, Washer [C] and Collar [D]
 - Cable Stopper Plate [E]
 - Plate Bolt [F]
- Check the variable differential control lever position (see Variable Differential Control Lever Position Inspection).



Front Final Gear Case

Variable Differential Control Cable Installation

- Lubricate the variable differential control cable before installation.
- Route the cable correctly according to the General Information chapter.

⚠ WARNING

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

- Tighten:
 - Torque - Variable Differential Control Cable Locknut [A]: 17 N·m (1.7 kgf·m, 12 ft·lb)
- Check the variable differential control lever position (see Variable Differential Control Lever Position Inspection).

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 rust inhibitor through the pressure cable luber.

Variable Differential Control Cable Inspection

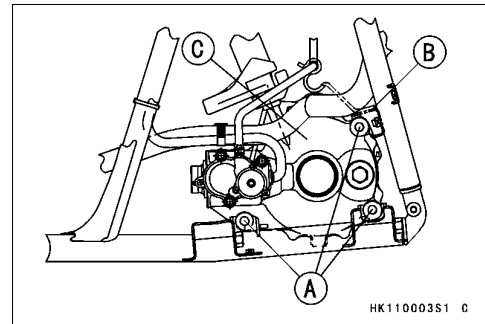
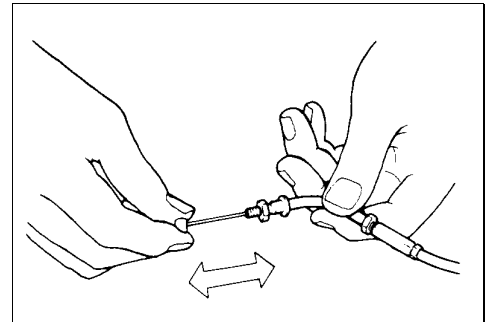
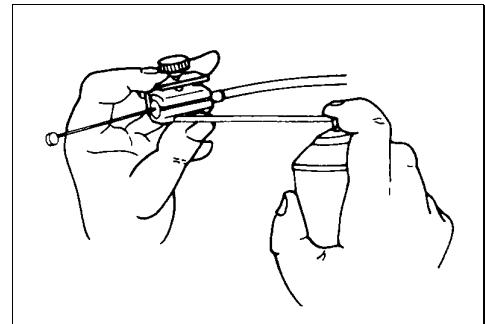
- With the variable differential control cable disconnected at both ends, the cable should move freely within the cable housing.
- ★ If the cable does not move freely after lubricating, if the cable is frayed, or if the housing is kinked, replace the cable.

Front Final Gear Case Removal

- Drain the gear case oil (see Front Final Gear Case Oil Change).
- Remove :
 - Front Propeller Shaft (see Front Propeller Shaft Removal)
 - Left Suspension Arm (see Suspension chapter)
 - Right and Left Front Axles (see Front Axle Removal)
 - Actuator Wire Connector
 - Vent Hoses (Gear Case and Actuator)
 - Variable Front Differential Control Cable Lower End
 - Front Final Gear Case Bolts [A] and Nuts
 - Bracket [B]
- Pull out the front final gear case [C].

Front Final Gear Case Installation

- Install the gear case bolts from the vehicle left side.
 - Torque - Front Final Gear Case Bolts and Nuts: 59 N·m (6.0 kgf·m, 43 ft·lb)
- Install the removed parts.
- Fill the front final gear case with the specified oil (see Front Final Gear Case Oil Change).

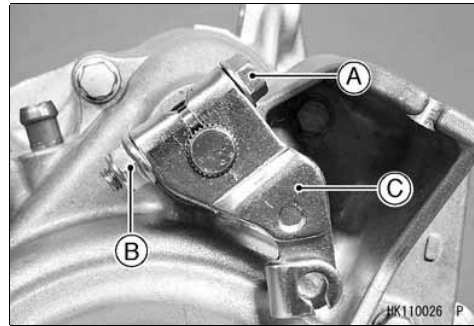


11-30 FINAL DRIVE

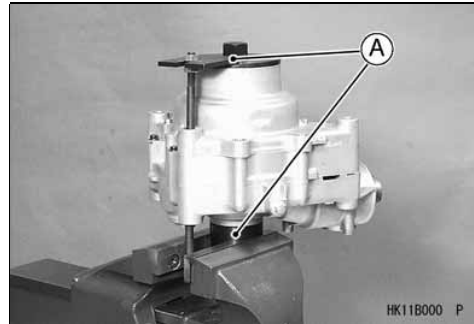
Front Final Gear Case

Front Final Gear Case Disassembly

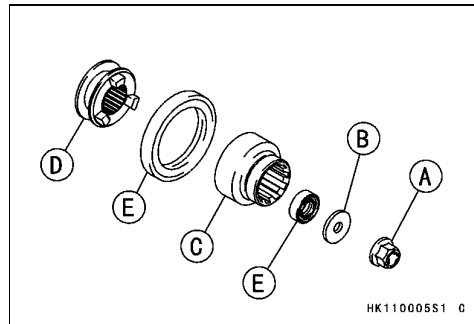
- Remove:
 - Front Final Gear Case (see Front Final Gear Case Removal)
 - Variable Front Differential Control Shift Shaft Lever Bolt [A] and Nut [B]
 - Variable Front Differential Control Shift Shaft Lever [C]
 - 2WD/4WD Actuator (see Electrical System chapter)



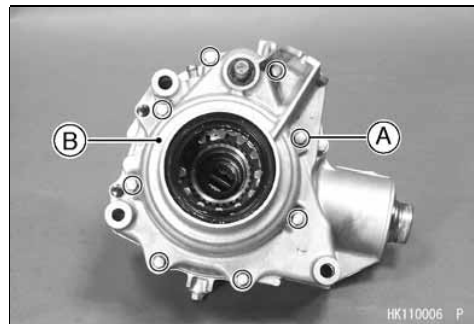
- Hold the front final gear case with the gear holder & socket wrench [A] in a vise.
- Special Tool - Gear Holder & Socket Wrench, Hex 24: 57001-1489**



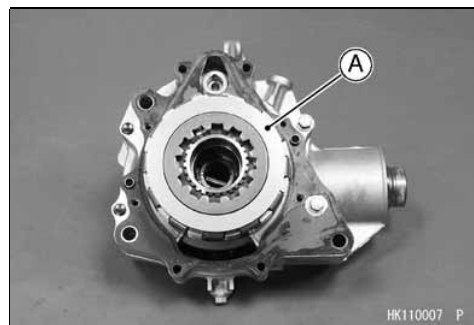
- Remove:
 - Front Final Gear Case Coupling Nut [A]
 - Washer [B]
 - Front Final Gear Case Coupling [C]
 - Shifter [D]
 - Oil Seals [E]



- Remove:
 - Front Final Gear Case Left Cover Bolts [A]
 - Front Final Gear Case Left Cover [B]
 - Variable Front Differential Control Shift Shaft Spring

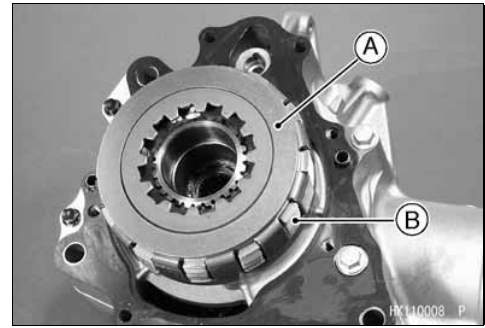


- Remove:
 - Outer Disc [A]
 - Needle Bearing



Front Final Gear Case

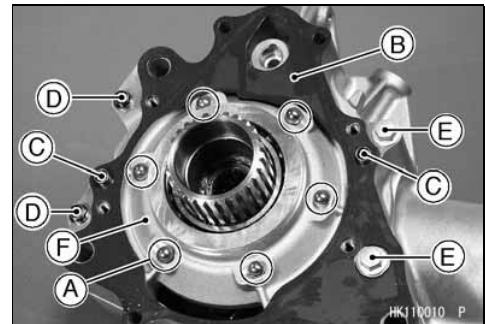
- Remove:
Housing [A] and Differential Disc Assembly [B]
Inner Disc
Needle Bearing



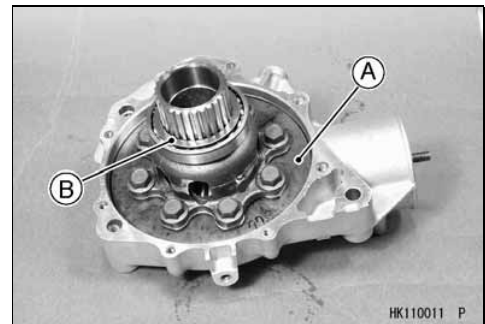
- Remove:
Cam Plate [A]



- 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]

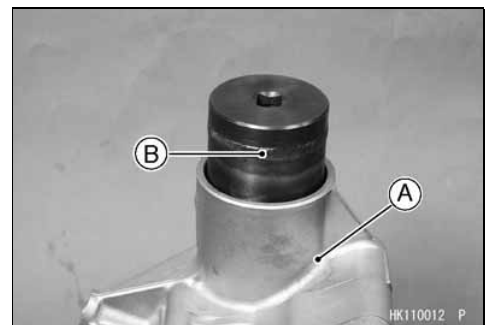


- Hold the front final gear case left cover [A] in a vise, and remove the bearing holder using the socket wrench [B].

Special Tool - Socket Wrench, Hex 41: 57001-1484

- If the holder seems too difficult to break free, apply heat to softer the locking agent.

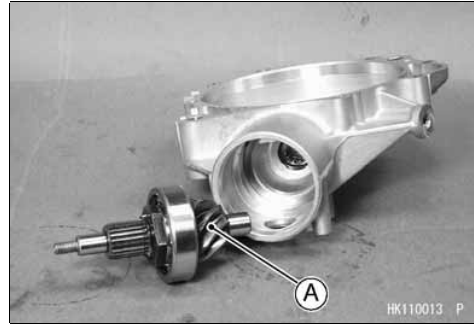
- Remove:
Pinion Gear Bearing Holder



11-32 FINAL DRIVE

Front Final Gear Case

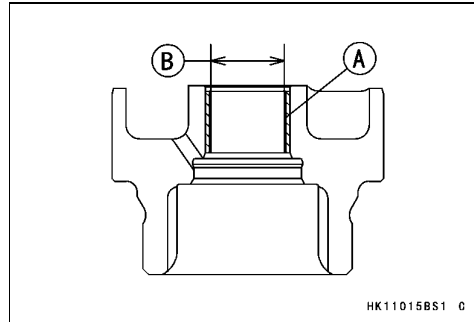
- Remove:
 - Pinion Gear Unit [A]
 - Shim(s)



Front Final Gear Case Coupling Inspection

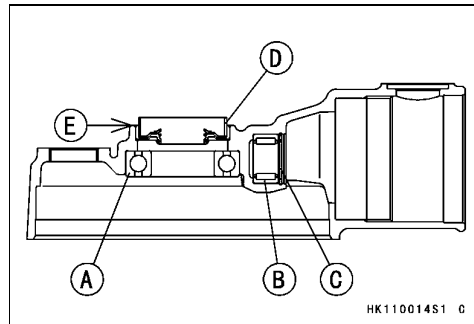
- ★ If the coupling bushing [A] is damaged or worn, replace the front final gear case coupling.

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

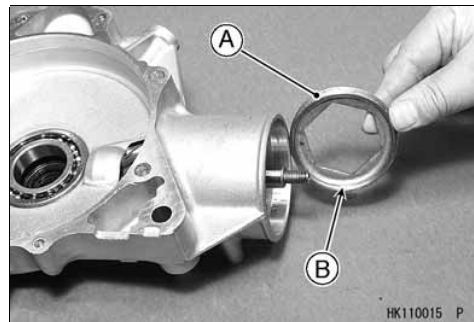
- Install:
 - Ball Bearing [A]
 - Needle Bearing [B]
 - Circlip [C]
- Special Tool - Inside Circlip Pliers: 57001-143**
- Install:
 - Oil Seal [D]
- Insert the oil seal so that the rubber surface is flush [E] with the end of hole.
- Apply grease to the oil seal lip.



- 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.
- Apply a non-permanent locking agent to the pinion gear bearing holder [A], and tighten it so that the deep recess [B] faces outward.

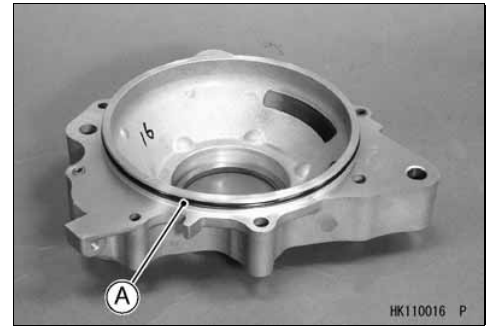
Special Tool - Socket Wrench, Hex 41: 57001-1484

Torque - Pinion Gear Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)



Front Final Gear Case

- Install:
Ring Gear Assembly
- Apply grease to the O-ring [A] on the front final gear case center cover.

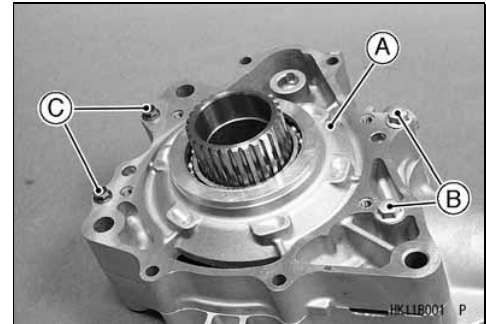


- Install:
Front Final Gear Case Center Cover [A]
Front Final Gear Case Center Cover Bolts (M8) [B]
Front Final Gear Case Center Cover Bolts (M6) [C]
- Apply a non-permanent locking agent to the front final gear case center bolts (M8 and M6) and tighten them.

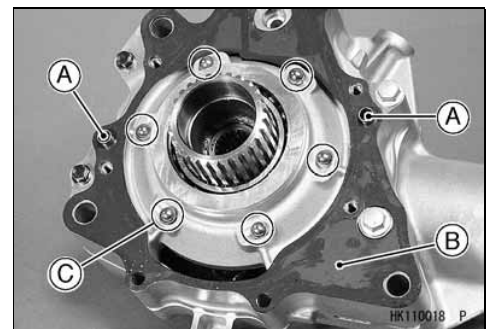
Torque - Front Final Gear Case Center Cover Bolts (M8): 24 N·m (2.4 kgf·m, 17 ft·lb)

Front Final Gear Case Center Cover Bolts (M6): 9.8 N·m (1.0 kgf·m, 87 in·lb)

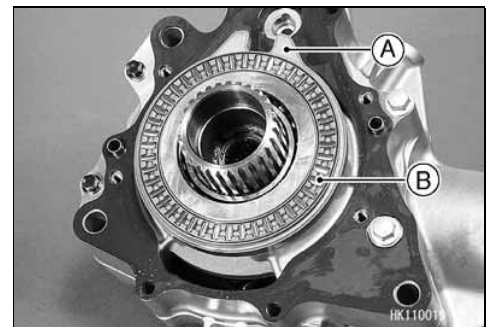
- Adjust the gear backlash and tooth contact pattern (see Front Final Bevel Gear Adjustment).



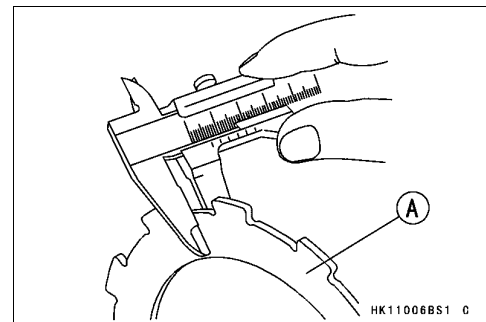
- Install:
Dowel Pins [A]
New Gasket [B]
Steel Balls [C]



- 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].



11-34 FINAL DRIVE

Front Final Gear Case

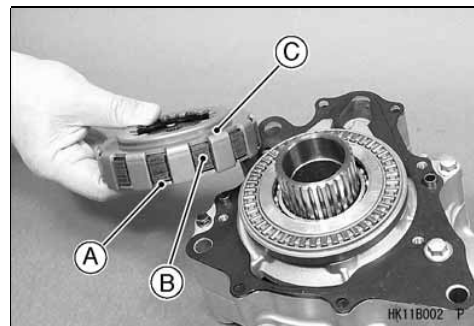
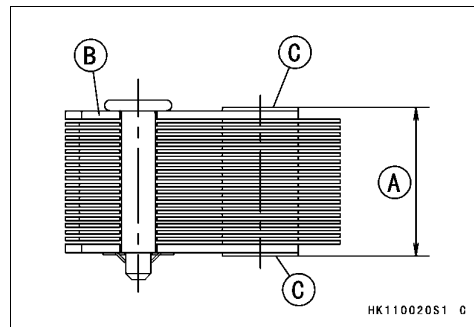
- Select the width [A] of the disc assembly [B] in accordance with the thickness of the inner disc, refer to the below table.

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.)

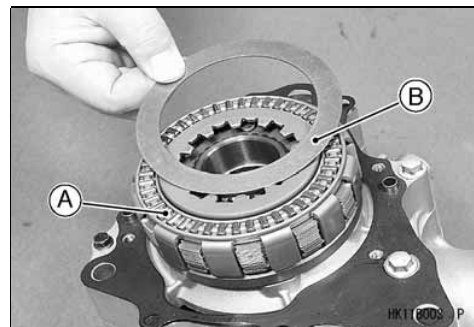
- Measure the width of the disc assembly at three locations, and calculate average for three points.

NOTE

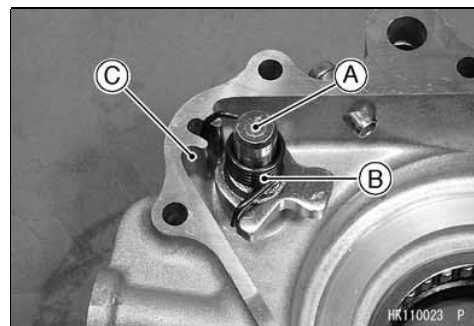
- Be careful not to damage the facing surface [C] on the outer plates.
- ★ If the width is within the specified range, install the inner disc and disc assembly.
- ★ If the width is not within the specified range, replace the disc assembly.
- Install:
 - Inner Disc [A]
 - Disc Assembly [B] and Housing [C]



- Apply engine oil to the needle bearing [A].
- Install:
 - Needle Bearing
 - Outer Disc [B]

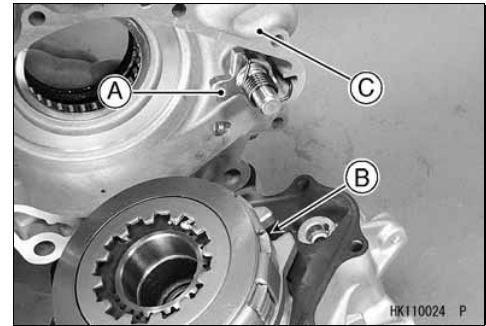


- Apply engine oil to the variable front differential control shaft [A].
- Install the shaft and spring [B] in the front final gear case left cover [C] as shown.



Front Final Gear Case

- 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]
- Tighten:
Torque - Front Final Gear Case Left Cover Bolts (M8): 9.8 N·m (1.0 kgf·m, 87 in·lb)

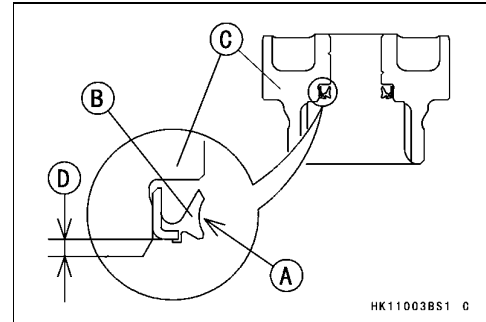


- Apply grease to the oil seal lip [A].
- Press the oil seal [B] in the coupling [C] to the specified position as shown.
[D] 1 mm (0.04 in.)

Special Tool - Oil Seal Driver, ϕ 18: 57001-1505
Driver Holder: 57001-1132

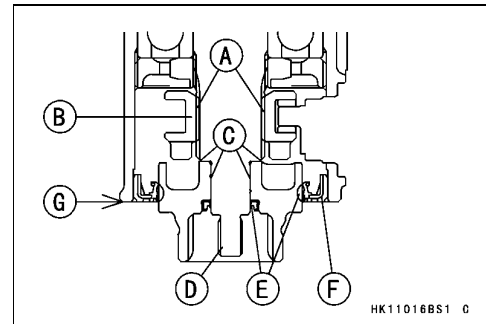
NOTE

- 57001-1132 is included in Bearing Driver Set, 57001-1129.



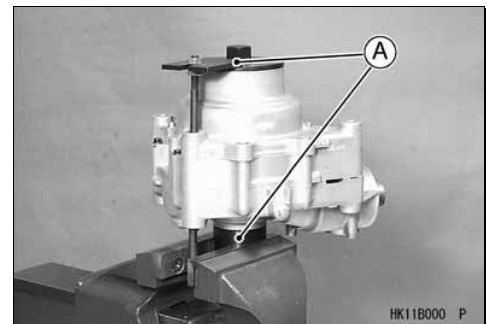
- Apply molybdenum disulfide grease to the spline [A] in the shifter [B] and inner surface [C] of the coupling.
- Install the shifter and coupling on the pinion gear shaft [D].
- Apply grease to the oil seal lip [E].
- Press the oil seal [F] in the front final gear case so that the oil seal surface is flush [G] with the case end.

Special Tool - Oil Seal Driver, ϕ 48: 57001-1506



- Hold the front final gear case with the gear holder & socket wrench [A] in a vise.

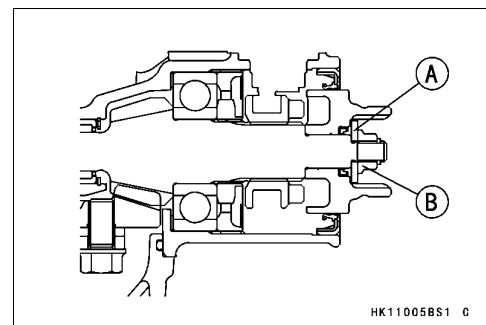
Special Tool - Gear Holder & Socket Wrench: 57001-1489



- Install:
Washer [A]
Front Final Gear Case Coupling Nut [B]
- Tighten:

Torque - Front Final Gear Case Coupling Nut (A1, B1-M8): 20 N·m (2.0 kgf·m, 14 ft·lb)

Front Final Gear Case Coupling Nut (A2, B2-M10): 25 N·m (2.5 kgf·m, 18 ft·lb)



11-36 FINAL DRIVE

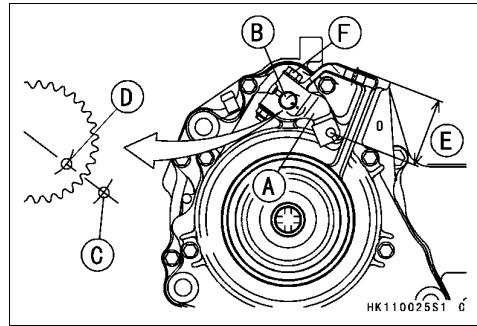
Front Final Gear Case

- Install the variable front differential control 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 shaft as shown.

[E] 45.8 ~ 50.4 mm (1.803 ~ 1.984 in.)

- Tighten:

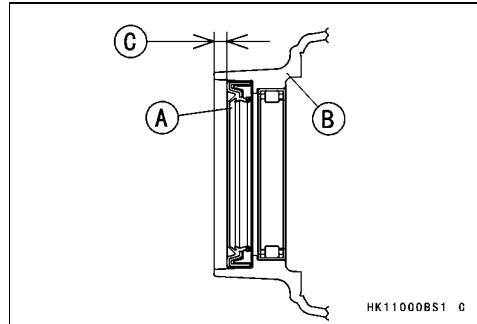
Torque - Variable Front Differential Control Shift Shaft Lever Bolt [F]:
8.8 N·m (0.9 kgf·m, 78 in·lb)



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.)



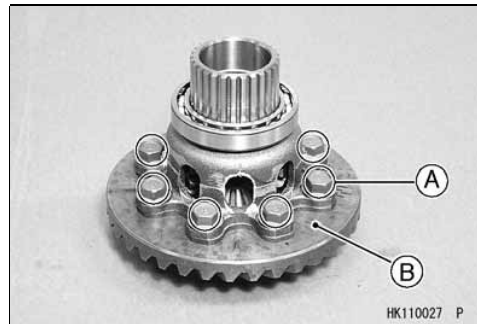
Ring Gear Disassembly

- Remove:

Ring Gear Assembly (see Front Final Gear Case Disassembly)

Ring Gear Bolts [A]

Ring Gear [B]



- Remove:

Differential Gear Cover [A]

Right Side Gear (16T) [B]

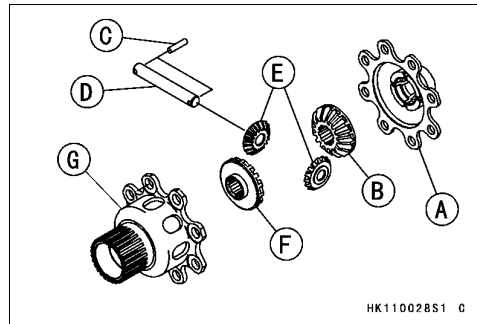
Pins [C]

Spider Gear Shaft [D]

Spider Gears (10T) [E]

Left Side Gear (16T) [F]

Left Differential Gear Case [G]



Ring Gear Assembly

○ The following procedure corresponds to the **A1** and **B1** models.

- Press the bearing [A] on the left differential gear case [B] until it is bottomed.

- Apply engine oil [C] to the spider gears.

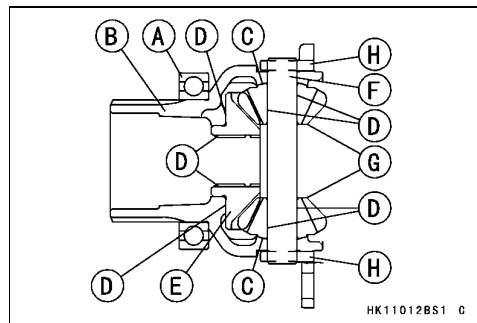
- Apply molybdenum disulfide grease [D] to the side gear (16T) [E] and the spider gear shaft [F].

- Install:

Left Side Gear (16T)

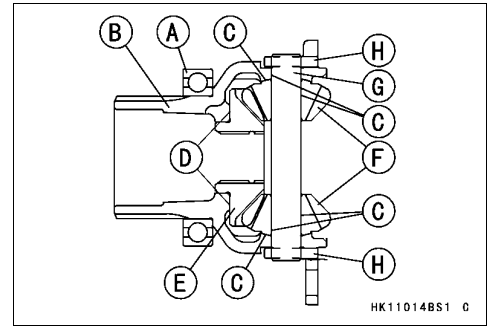
Spider Gears (10T) [G]

Spider Gear Shaft [F] and Pins [H]

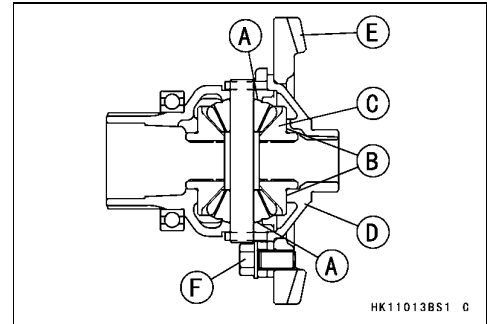


Front Final Gear Case

- The following procedure corresponds to the **A2** and **B2** models.
- 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 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 side gear (16T) [C].
 - Install:
 - 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.

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 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.

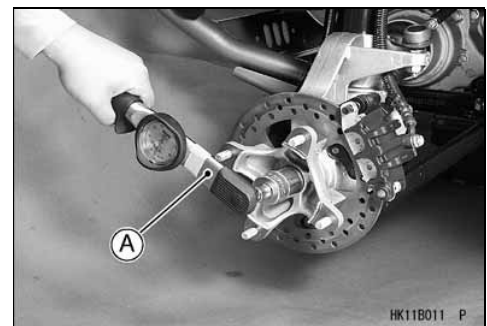
LSD Clutch Torque (When variable differential control lever is released.)
Standard: 15 ~ 20 N·m (1.5 ~ 2.0 kgf·m, 11 ~ 14 ft·lb)

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.

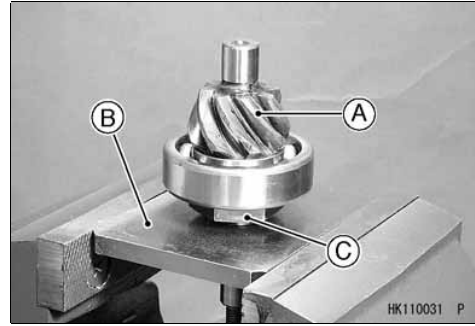


11-38 FINAL DRIVE

Front Final Gear Case

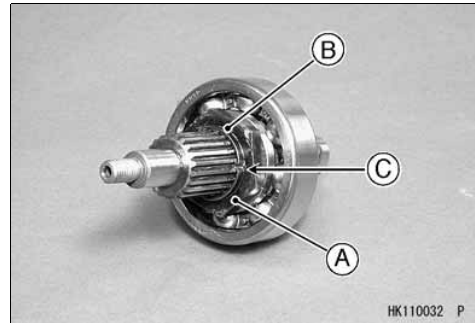
Pinion Gear Unit Disassembly

- 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: 57001-1485
- Remove the ball bearing only if required.
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 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: 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.



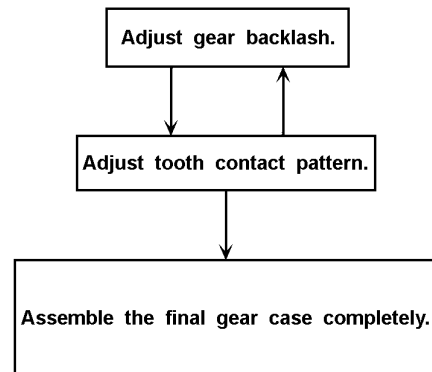
Front Final Bevel Gear Adjustment

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.

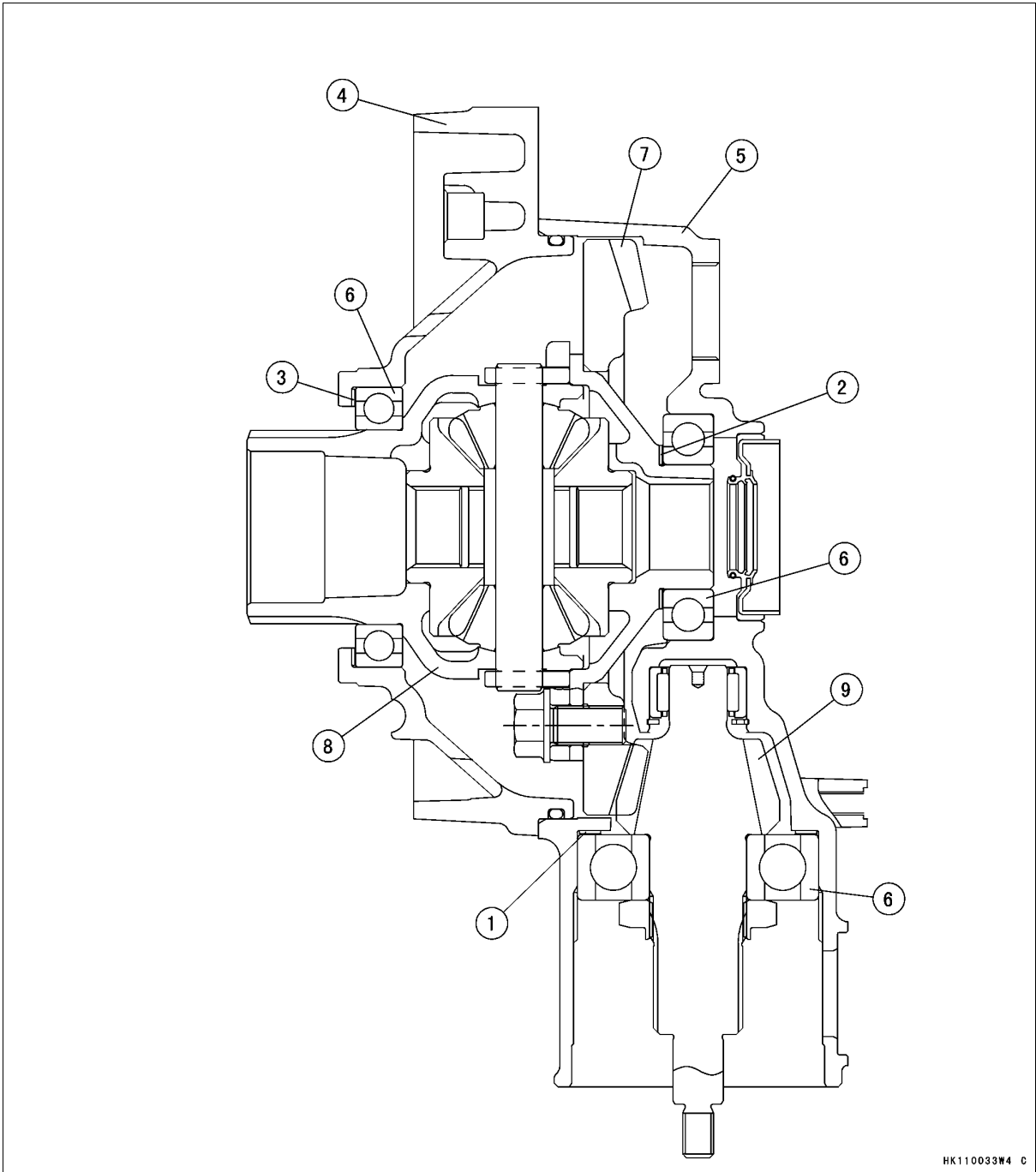
- When any one of the backlash-related parts are replaced, check and adjust the bevel gear backlash, and tooth contact by replacing shims.
- The amount of backlash is influenced by the ring gear position more than by the pinion gear position.
- Tooth contact location is influenced by the pinion gear position more than by the ring gear position.

Front Final Bevel Gear Adjustment Procedure



Front Final Gear Case

Front Final Gear Case (Backlash-related Parts)



HK110033W4 C

- | | | |
|----------------------------|---------------------------------------|-----------------------|
| 1. Pinion Gear Shim(s) | 4. Front Final Gear Case Center Cover | 6. Ball Bearings |
| 2. Ring Gear Right Shim(s) | 5. Front Final Gear Case Right Cover | 7. Ring Gear |
| 3. Ring Gear Left Shim(s) | | 8. Ring Gear Assembly |
| | | 9. Pinion Gear |

11-40 FINAL DRIVE

Front Final Gear Case

1. Pinion Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1325
0.2 mm (0.008 in.)	92180-1327
0.5 mm (0.020 in.)	92180-1326
0.7 mm (0.028 in.)	92180-1384
0.8 mm (0.031 in.)	92180-1328
0.9 mm (0.035 in.)	92180-1385
1.0 mm (0.039 in.)	92180-1337
1.1 mm (0.043 in.)	92180-1386
1.2 mm (0.047 in.)	92180-1338

2. Ring Gear Right Shims for Tooth Contact Adjustment

Thickness	Parts Number
0.15 mm (0.006 in.)	92180-1331
0.2 mm (0.008 in.)	92180-1332
0.5 mm (0.020 in.)	92180-1329
0.7 mm (0.028 in.)	92180-1381
0.8 mm (0.031 in.)	92180-1330
0.9 mm (0.035 in.)	92180-1382
1.0 mm (0.039 in.)	92180-1339
1.1 mm (0.043 in.)	92180-1383
1.2 mm (0.047 in.)	92180-1340

3. Ring Gear Left Shims for Tooth Contact Adjustment

Thickness	Parts Number
0.15 mm (0.006 in.)	92180-1334
0.2 mm (0.008 in.)	92180-1336
0.5 mm (0.020 in.)	92180-1335
0.7 mm (0.028 in.)	92180-1387
0.8 mm (0.031 in.)	92180-1333
0.9 mm (0.035 in.)	92180-1388
1.0 mm (0.039 in.)	92180-1341
1.1 mm (0.043 in.)	92180-1389
1.2 mm (0.047 in.)	92180-1342

Front Final Gear Case

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.
- 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)

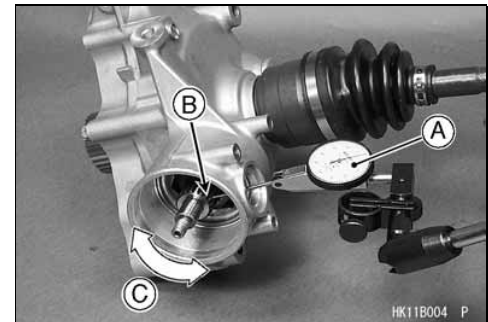
- ★ If the backlash is not within the limit, replace the pinion gear shims. To increase backlash, increase the thickness of the shim(s). To decrease backlash, decrease the thickness of the shim(s).
- Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.

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.



11-42 FINAL DRIVE

Front Final Gear Case

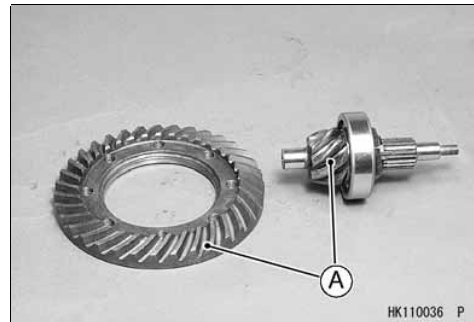
- The tooth contact patterns of both (drive and coast) sides should be centrally located between the top and bottom of the tooth. The drive pattern can be a little closer to the toe and the coast pattern can be a somewhat longer and closer to the toe.
- ★ If the tooth contact pattern is incorrect, replace 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.

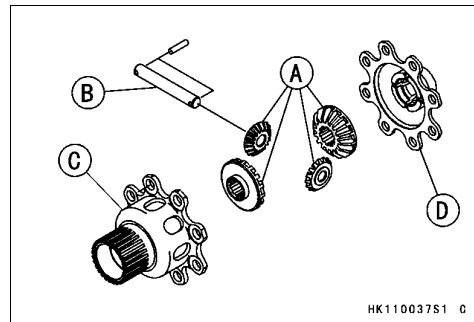
Bevel Gear Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.



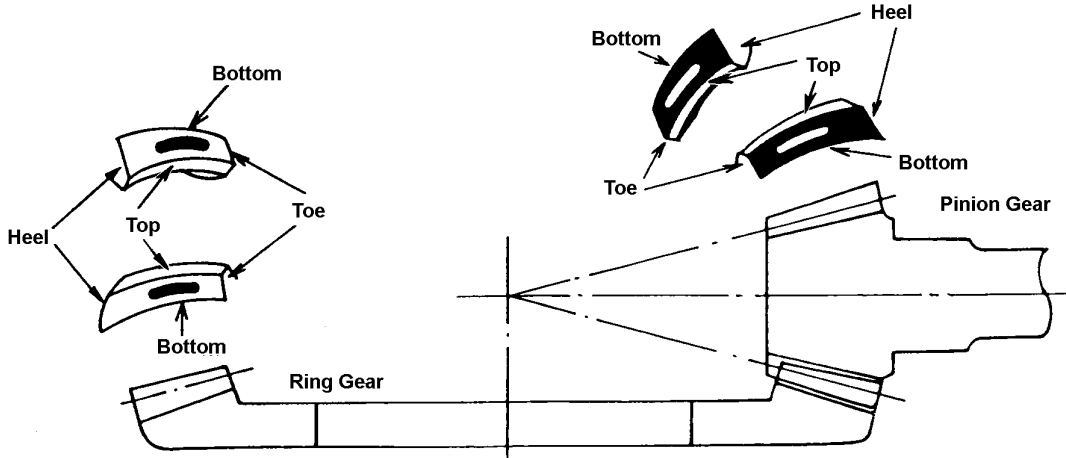
Differential Gear Inspection

- 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.



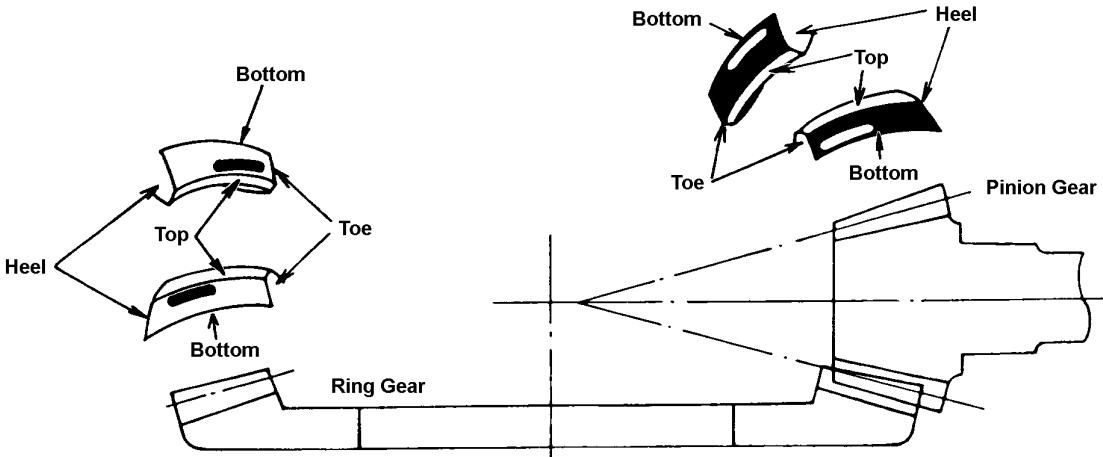
Front Final Gear Case

Correct Tooth Contact Pattern: No adjustment is required.

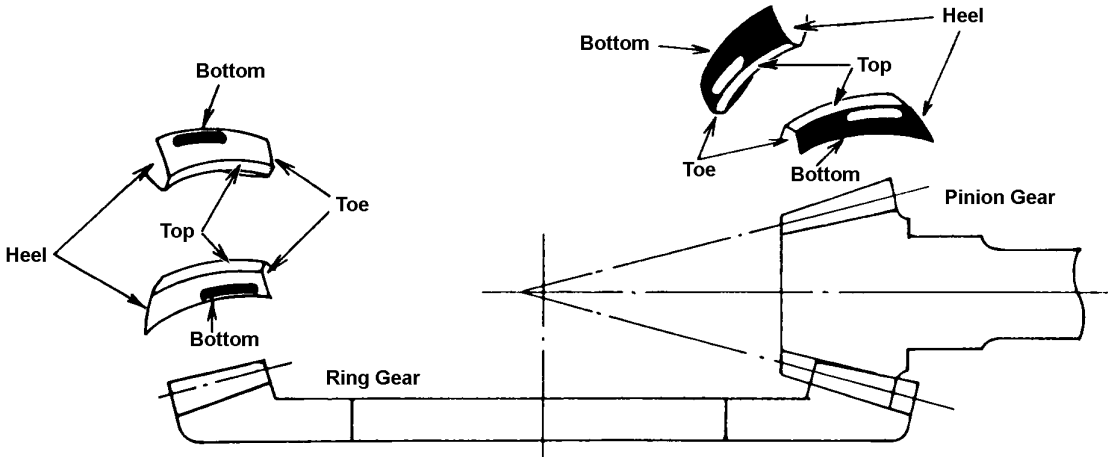


Incorrect Tooth Contact Patterns

Example 1 : Decrease the thickness of the ring 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 ring 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.

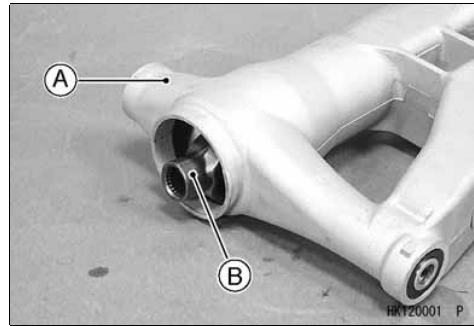


11-44 FINAL DRIVE

Rear Propeller Shaft

Rear Propeller Shaft Removal

- Drain the rear final gear case oil (see Rear Final Gear Case Oil Change).
- Remove:
 - Swingarm [A] (see Suspension chapter)
 - Rear Propeller Shaft [B]

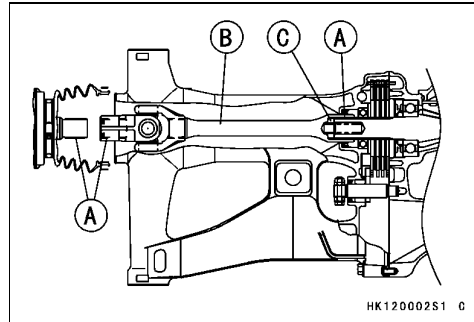


Rear Propeller Shaft Installation

- Wipe the old grease off the front and rear end splines [A] of the rear propeller shaft [B] and apply new grease in those.

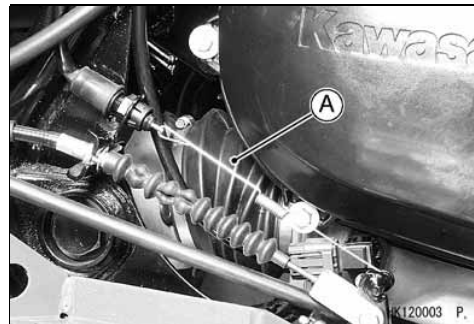
Grease - Molybdenum Disulfide Grease

- Be sure to install the spring [C] on the pinion gear nut of the rear final gear case.
- Install the rear propeller shaft while aligning the splines.



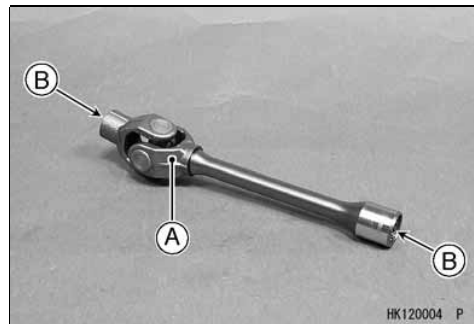
Rear Propeller Shaft Joint Boot Inspection

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



Rear Propeller Shaft Inspection

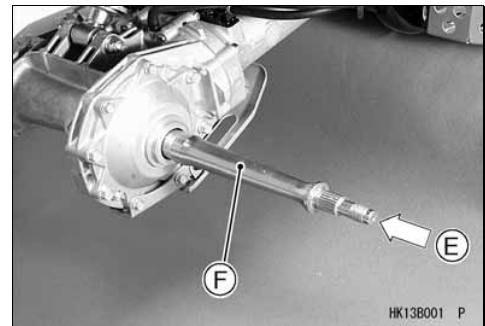
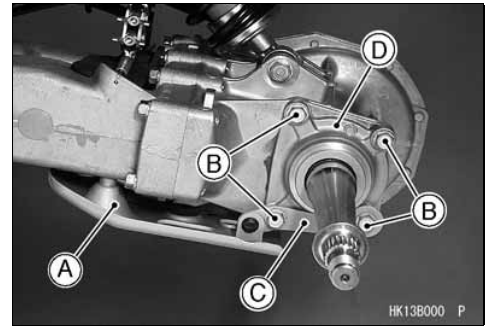
- Remove the rear propeller shaft (see Rear Propeller Shaft Removal).
- Check that the universal joint [A] works smoothly without rattling or sticking.
- ★ If it does rattle or stick, the universal joint is damaged. Replace the propeller shaft with a new one.
- Visually inspect the splines [B] on the 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 joint in the final gear case.
- ★ If splines are badly worn, chipped, or loose, replace the output shaft and the pinion gear joint.



Rear Axle (A1, B1)

Rear Axle Removal

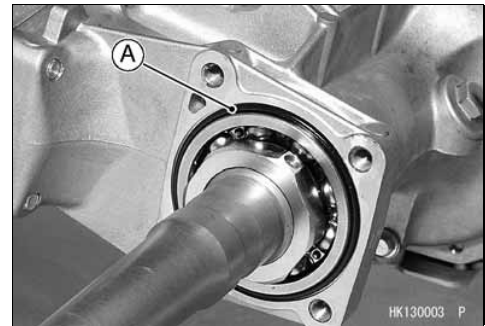
- Drain the rear final gear case oil (see Rear Final Gear Case Oil Change).
- Remove:
 - Rear Wheels (see Wheels/Tires chapter)
 - Rear Hub (see Wheels/Tires chapter)
 - Rear Bottom Guard [A] (see Frame chapter)
 - Rear Final Gear Case Left Cover Bolts [B]
 - Bracket [C]
 - Rear Final Gear Case Left Cover [D]
- Tap [E] the right end of the rear axle [F] and pull it out from the left.
- The left axle bearing comes off with the axle.



Rear Axle Installation

- Install the rear axle from the left side with the left bearing installed, while aligning the splines.
- Apply grease:
 - O-ring [A]
 - Oil Seal Lips in Rear Final Gear Case Left Cover
- Apply a non-permanent locking agent to the rear final gear case left cover bolts and tighten them.

Torque - Rear Final Gear Case Left Cover Bolts: 49 N·m (5.0 kgf·m, 36 ft·lb)

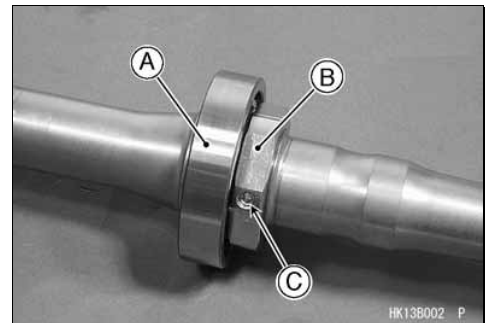


Ball Bearing Wear

CAUTION

Do not remove the bearing [A] for inspection. Removal may damage it.

- Check the ball bearing.
- Since the ball bearing is made to extremely close tolerances, the wear must be judged by feel rather than measurement.
- Spin the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace the rear axle shaft.

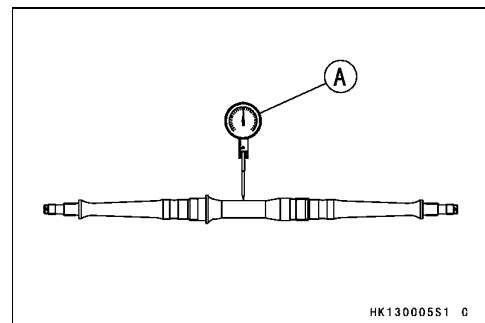


Rear Axle Runout Inspection

- Visually inspect the axle for damage.
- ★ If the axle is damaged or bent, replace it.
- Set the rear axle in an alignment jig or on V blocks, and place a dial gauge [A] against the middle point.
- Turn the axle slowly. The difference between the highest and lowest dial gauge readings is the axle runout (TIR).
- ★ If the runout exceeds the service limit, replace the axle.

Rear Axle Shaft Runout

Standard: TIR 1 mm (0.04 in.) or less
Service Limit: TIR 2 mm (0.08 in.)

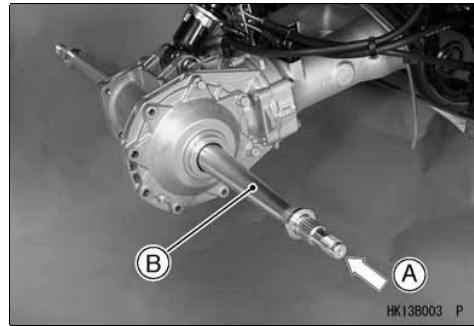


11-46 FINAL DRIVE

Rear Axle (A2, B2)

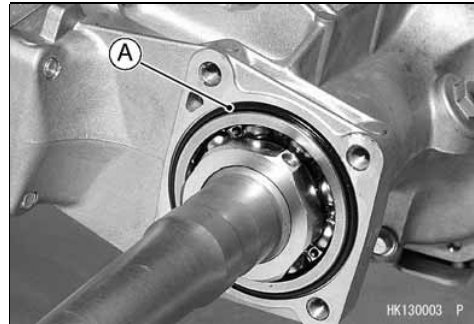
Rear Axle Removal

- Drain the rear final gear case oil (see Rear Final Gear Case Oil Change).
- Remove:
 - Rear Wheels (see Wheels/Tires chapter)
 - Rear Hub (see Wheels/Tires chapter)
 - Rear Bottom Guard (see Frame chapter)
 - Trailer Hitch Bracket (see Frame chapter)
 - Rear Final Gear Case Left Cover
- Tap [A] the right end of the rear axle [B] and pull it out from the left.
- The left axle bearing comes off with the axle.

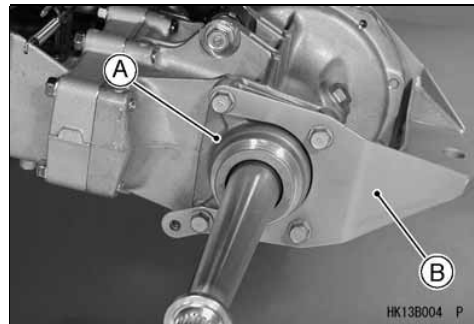


Rear Axle Installation

- Install the rear axle from the left side with the left bearing installed, while aligning the splines.
- Apply grease:
 - O-ring [A]
 - Oil Seal Lips in Rear Final Gear Case Left Cover



- Install:
 - Rear Final Gear Case Left Cover [A]
 - Trailer Hitch Bracket [B] (see Frame chapter)

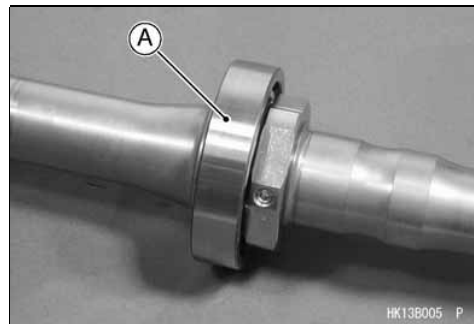


Ball Bearing Wear

CAUTION

Do not remove the bearing [A] for inspection. Removal may damage it.

- Check the ball bearing.
 - Since the ball bearing is made to extremely close tolerances, the wear must be judged by feel rather than measurement.
 - Spin the bearing by hand to check its condition.
 - ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace the rear axle shaft.

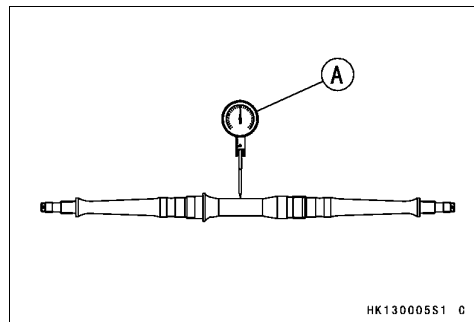


Rear Axle Runout Inspection

- Visually inspect the axle for damage.
 - ★ If the axle is damaged or bent, replace it.
- Set the rear axle in an alignment jig or on V blocks, and place a dial gauge [A] against the middle point.
- Turn the axle slowly. The difference between the highest and lowest dial gauge readings is the axle runout (TIR).
- ★ If the runout exceeds the service limit, replace the axle.

Rear Axle Shaft Runout

Standard: TIR 1 mm (0.04 in.) or less
Service Limit: TIR 2 mm (0.08 in.)



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.

CAUTION

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.
- Be sure the O-ring is in place.

Torque - 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 drain plug [A].

CAUTION

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

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

Torque - Oil Drain Plug: 24 N·m (2.4 kgf·m, 17 ft·lb)

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

Rear Final Gear Case Oil

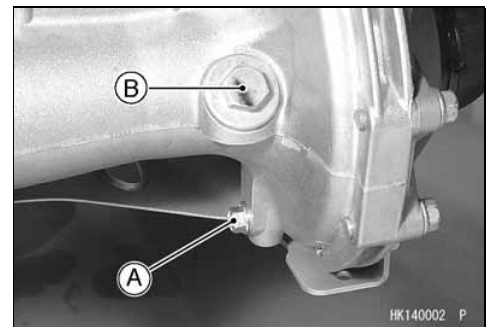
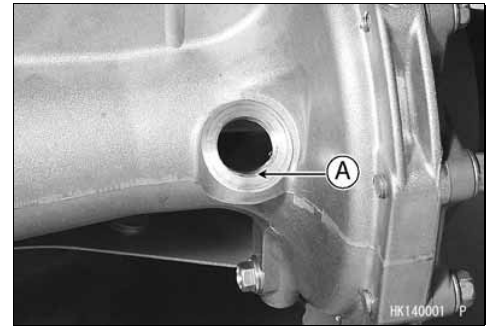
Type:

A1, B1: MOBIL Fluid 424
 A2, B2: MOBIL Fluid 424 or GITGO
 TRANSGARD TRACTOR HYDRAULIC FLUID

Capacity: 900 mL (0.95 US qt)

- Be sure the O-ring is in place.

Torque - Oil Filler Cap [B]: 29 N·m (3.0 kgf·m, 22 ft·lb)

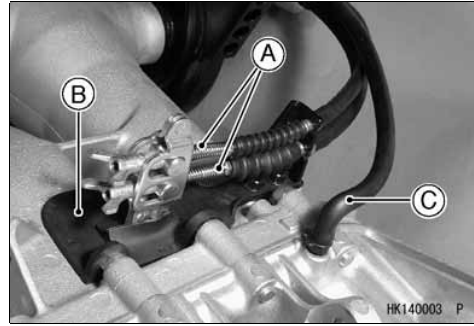


11-48 FINAL DRIVE

Rear Final Gear Case

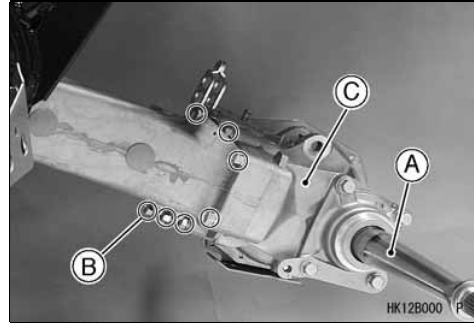
Rear Final Gear Case Removal

- Remove:
 - Rear Wheels (see Wheels/Tires chapter)
 - Rear Shock Absorber (see Suspension chapter)
 - Rear Brake Cable Ends [A]
 - Bracket [B]
 - Vent Hose [C]



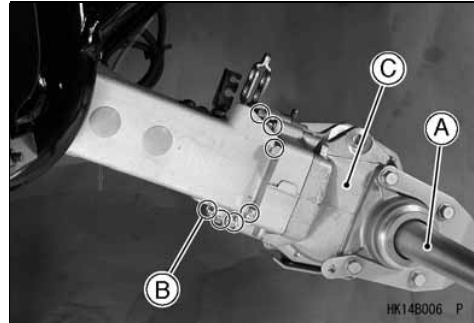
- The following procedure corresponds to the **A1** and **B1** models.

- Remove:
 - Rear Bottom Guard (see Frame chapter)
 - Rear Axle [A] (see Rear Axle Removal)
 - Rear Final Gear Case Bolts [B] (10)
 - Rear Final Gear Case [C]



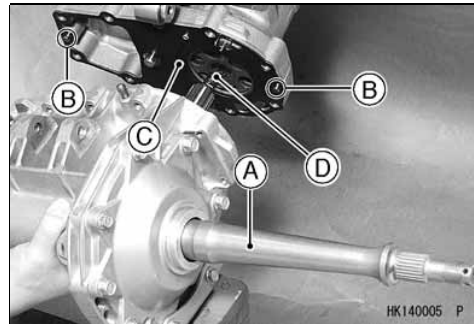
- The following procedure corresponds to the **A2** and **B2** models.

- Remove:
 - Rear Axle [A] (see Rear Axle Removal)
 - Rear Final Gear Case Bolts [B] (10)
 - Rear Final Gear Case [C]



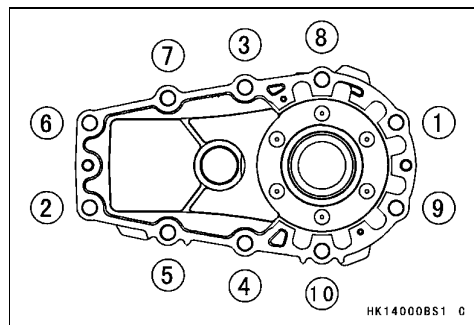
Rear Final Gear Case Installation

- Install:
 - Rear Axle Shaft [A]
 - Dowel Pins [B]
 - New Gasket [C] (see Brake System chapter)
 - Spring [D]
- Insert the pinion gear shaft of the rear final gear case in the plate assembly.
- Align the splines by rotating the axle shaft.



- Tighten the rear final gear case bolts following the tightening sequence [1 ~ 10].

Torque - Rear Final Gear Case Bolts: 42 N·m (4.3 kgf·m, 31 ft·lb)

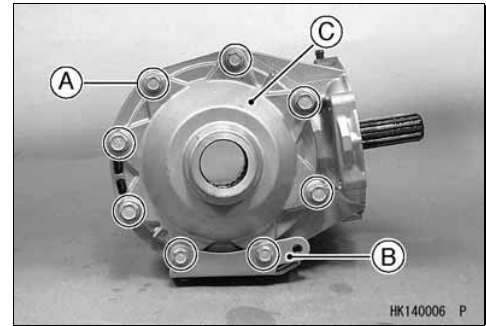


Rear Final Gear Case

Rear Final Gear Case Disassembly

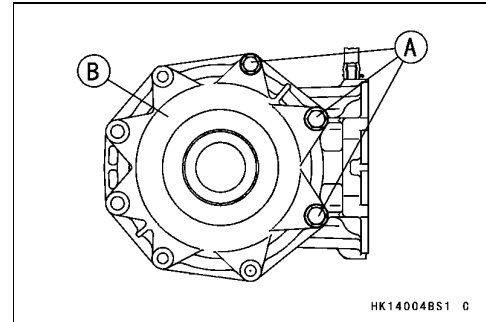
○ The following procedure corresponds to the **A1** and **B1** models.

- Remove:
 - Rear Final Gear Case (see Rear Final Gear Case Removal)
 - Rear Final Gear Case Right Cover Bolts [A]
 - Bracket [B]
 - Rear Final Gear Case Right Cover [C]

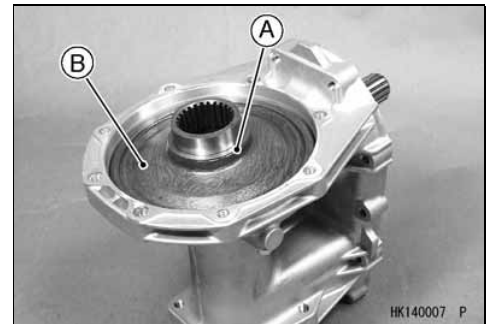


○ The following procedure corresponds to the **A2** and **B2** models.

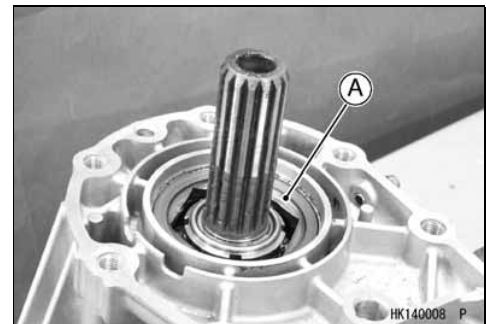
- Remove:
 - Rear Final Gear Case (see Rear Final Gear Case Removal)
 - Rear Final Gear Case Right Cover Bolts [A]
 - Rear Final Gear Case Right Cover [B]



- Remove:
 - Shim(s) [A]
 - Ring Gear [B]



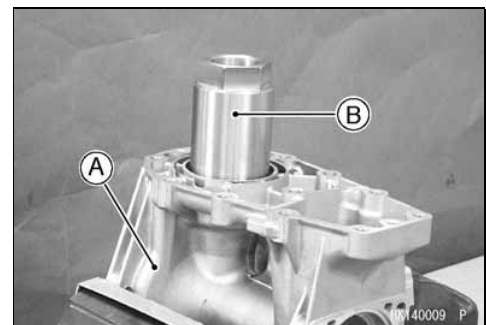
- Remove:
 - Pinion Gear Bearing Holder [A]



○ 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

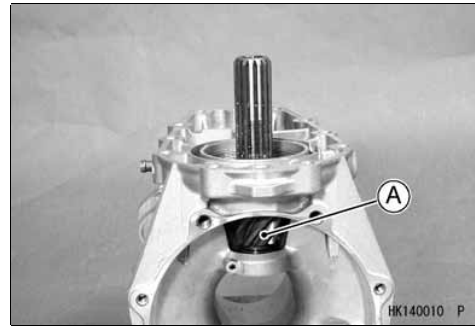
○ If the holder seems too difficult to break free, apply heat to softer the locking agent.



11-50 FINAL DRIVE

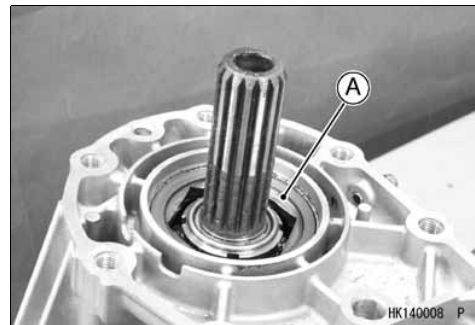
Rear Final Gear Case

- Remove:
 - Pinion Gear Unit [A]
 - Shim(s)

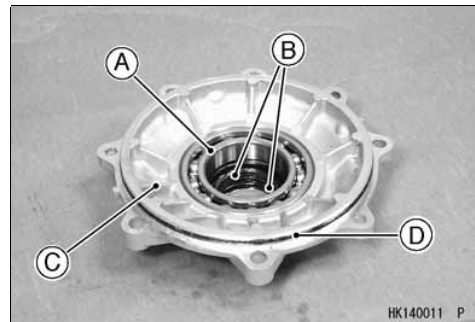


Rear Final Gear Case Assembly

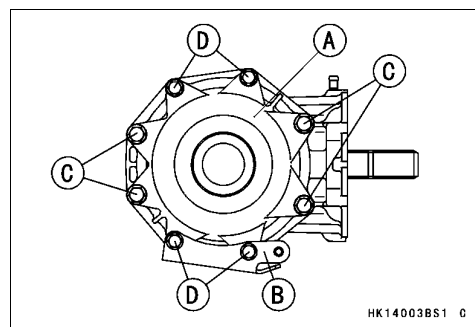
- Visually check the pinion gear and ring gear for scoring, chipping, or other damage.
 - ★ Replace the bevel gear as a set if either gear is damaged since they are lapped as a set in the factory to get the best tooth contact.
 - Install:
 - Shim(s)
 - Pinion Gear Unit
 - Be sure to check and adjust the bevel gear backlash and tooth contact when any of the backlash-related parts are replaced (see Rear Final Bevel Gear Adjustment).
 - Apply a non-permanent locking agent to the pinion gear bearing holder [A], 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)**



- Inspect:
 - Ball Bearing [A] (see Bearing and Oil Seal section)
 - Oil Seals [B] (see Bearing and Oil Seal section)
- ★ If they are damaged, replace the rear final gear case right cover [C].
- Apply grease to the oil seal lips and O-ring [D].



- The following procedure corresponds to the **A1** and **B1** models.
 - Install:
 - Rear Final Gear Case Right Cover [A]
 - Bracket [B]
 - Apply a non-permanent locking agent to the cover bolts, and tighten them.
- Torque - Rear Final Gear Case Right Cover Bolts (M10) [C]: 49 N·m (5.0 kgf·m, 36 ft·lb)**
- Rear Final Gear Case Right Cover Bolts (M8) [D]: 24 N·m (2.4 kgf·m, 17 ft·lb)**



Rear Final Gear Case

○ The following procedure corresponds to the **A2** and **B2** models.

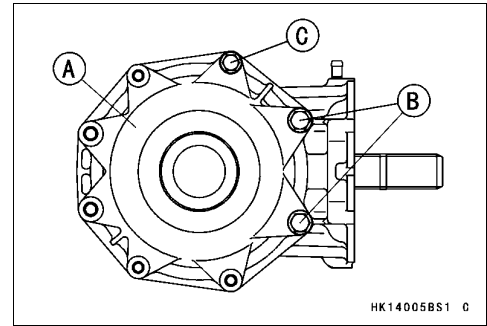
● **Install:**

Rear Final Gear Case Right Cover [A]

- Apply a non-permanent locking agent to the cover bolts, and tighten them.

Torque - 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, 17 ft·lb)



Oil Seal Installation

- Press the oil seals in the right and left covers to the specified positions as shown.

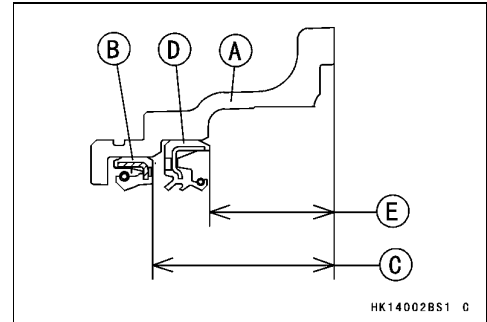
[A] Left Cover

[B] Outside Oil Seal

[C] 31.5 ~ 32.5 mm (1.24 ~ 1.28 in.)

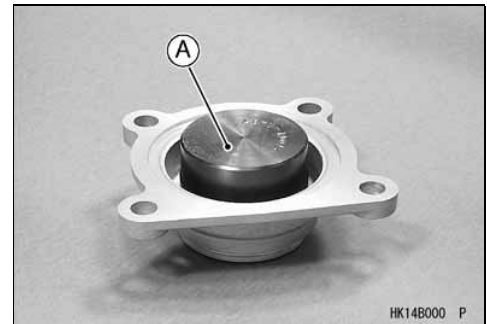
[D] Inside Oil Seal

[E] 21.3 ~ 22.3 mm (0.84 ~ 0.88 in.)



- Use the oil seal driver [A] for the outside oil seals of the right and left covers.

Special Tool - Oil Seal Driver: 57001-1487



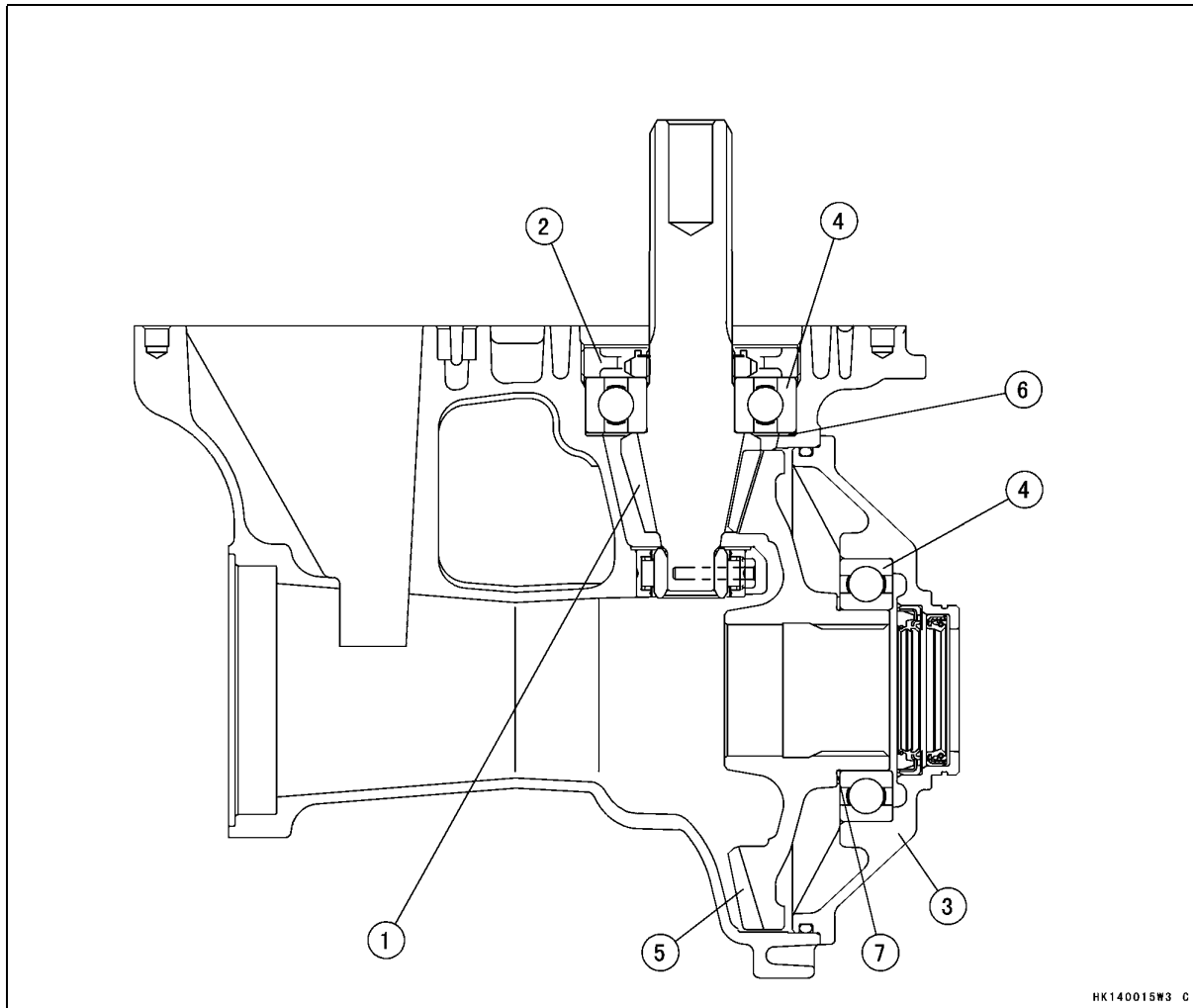
11-52 FINAL DRIVE

Rear Final Gear Case

Rear Final Bevel Gear Adjustment

- The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.
- After replacing any of the backlash-related parts, be sure to check and adjust the backlash and tooth contact of the bevel gears. First, adjust backlash, and then tooth contact by replacing shims.
- The amount of backlash is influenced by the ring gear position more than by the pinion gear position.
- Tooth contact locations is influenced by the pinion gear position more than by the ring gear position.

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)

HK140015W3 C

Rear Final Gear Case

6. Pinion Gear Shims for Tooth Contact Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1320
0.2 mm (0.008 in.)	92180-1319
0.5 mm (0.020 in.)	92180-1321
0.8 mm (0.031 in.)	92180-1322
1.0 mm (0.039 in.)	92180-1345
1.2 mm (0.047 in.)	92180-1346

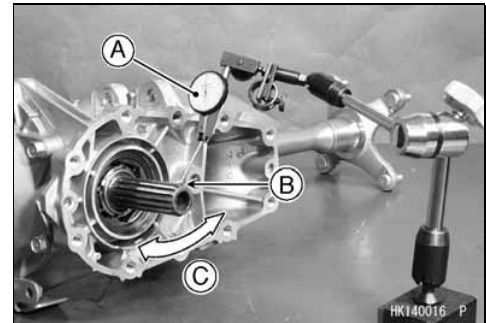
7. Ring Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1318
0.2 mm (0.008 in.)	92180-1316
0.5 mm (0.020 in.)	92180-1317
0.8 mm (0.031 in.)	92180-1315
1.0 mm (0.039 in.)	92180-1343
1.2 mm (0.047 in.)	92180-1344

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 shim **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 : 0.07 ~ 0.14 mm (0.003 ~ 0.006 in.) at pinion gear spline



- ★ If the backlash is not within the limit, replace the ring gear shim(s). To increase backlash, decrease the thickness of the shim(s). To decrease backlash, increase the thickness of the shim(s).
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.

Tooth Contact Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth of the pinion gear.

NOTE

- Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- The checking compound must be smooth and firm, with the consistency of tooth paste.
- Special compounds are available at automotive supply stores for the purpose of checking differential gear tooth patterns and contact.

11-54 FINAL DRIVE

Rear Final Gear Case

- 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.

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: 57001-1480

- Remove the ball bearing [E] as necessary.

Special Tool - Bearing Puller: 57001-135

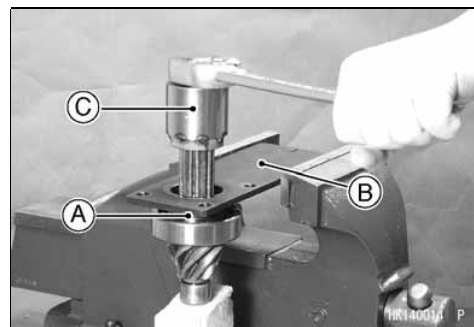
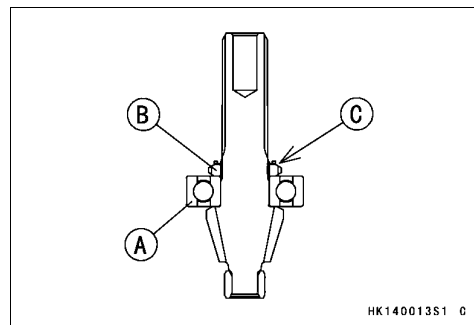
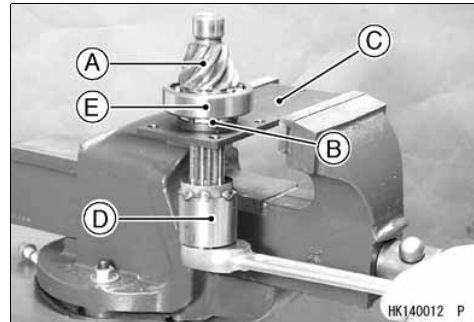
Pinion Gear Unit Assembly

- 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 [C]: 57001-1480

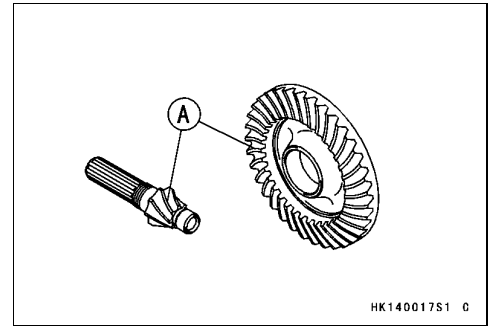
Torque - Pinion Gear Bearing Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)



Rear Final Gear Case

Bevel Gear Inspection

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.



11-56 FINAL DRIVE

Bearing and Oil Seal

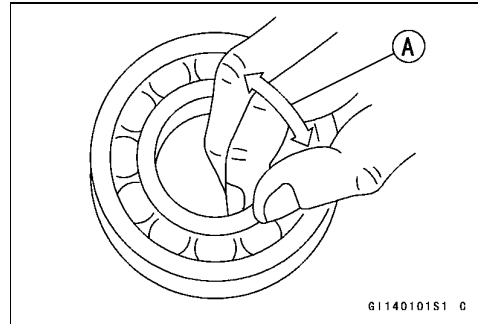
Ball or Needle Bearing Inspection

Since the bearings are made to extremely close tolerances, the clearance cannot normally be measured.

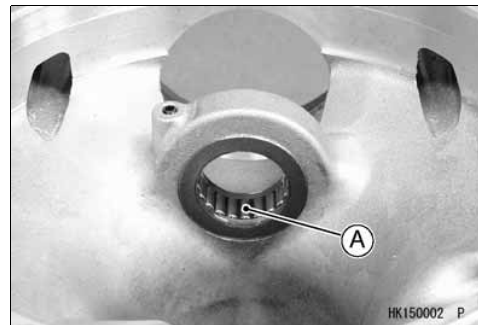
CAUTION

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.



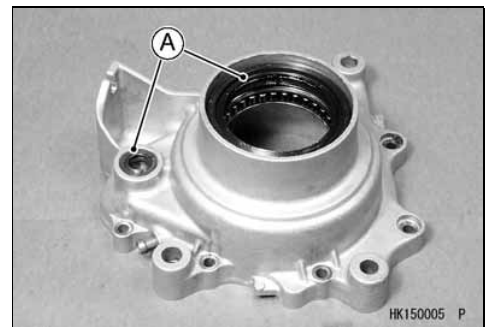
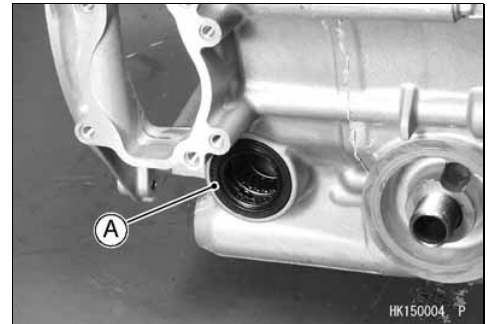
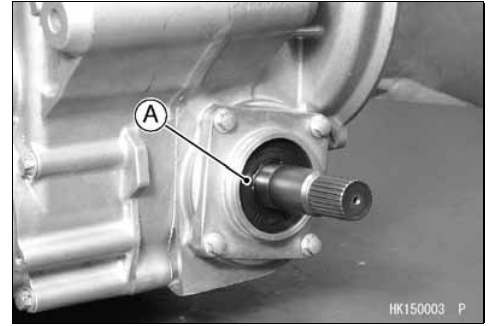
- Check the needle bearings [A] in the rear final gear case.
- The rollers in the needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
- ★ If the bearing is damaged, replace the rear final gear case.



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.



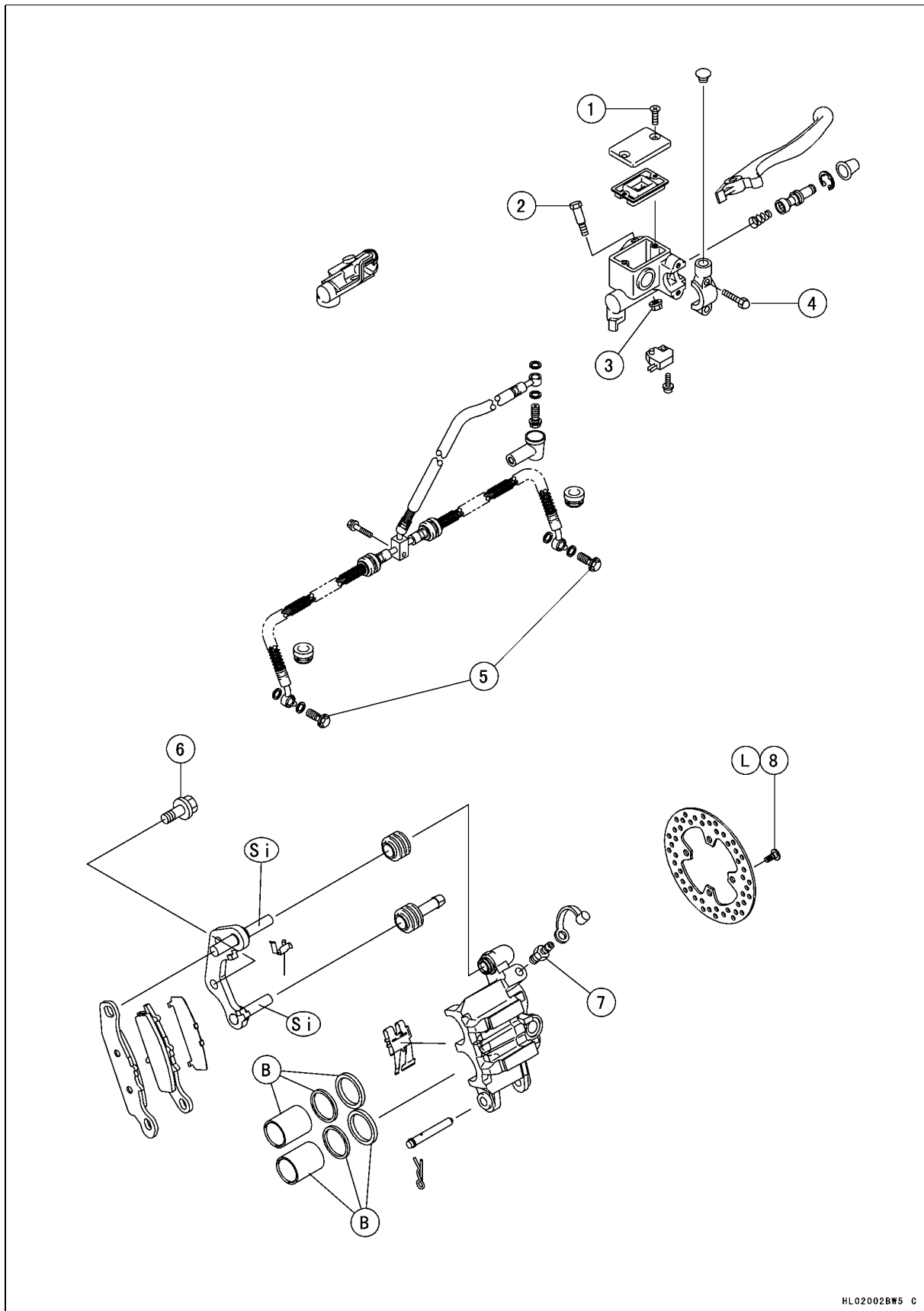
Brakes

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12-2 BRAKES

Exploded View



HL02002BW5 C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Reservoir cap screws	1.5	0.15	13 in·lb	
2	Brake lever pivot bolt	5.9	0.6	52 in·lb	
3	Brake lever pivot bolt locknut	5.9	0.6	52 in·lb	
4	Master cylinder clamp bolts	11	1.1	95 in·lb	
5	Brake hose banjo bolt	25	2.5	18	
6	Caliper mounting bolts	25	2.5	18	
7	Bleed valves	7.9	0.8	69 in·lb	
8	Disc mounting bolts	37	3.8	27	L

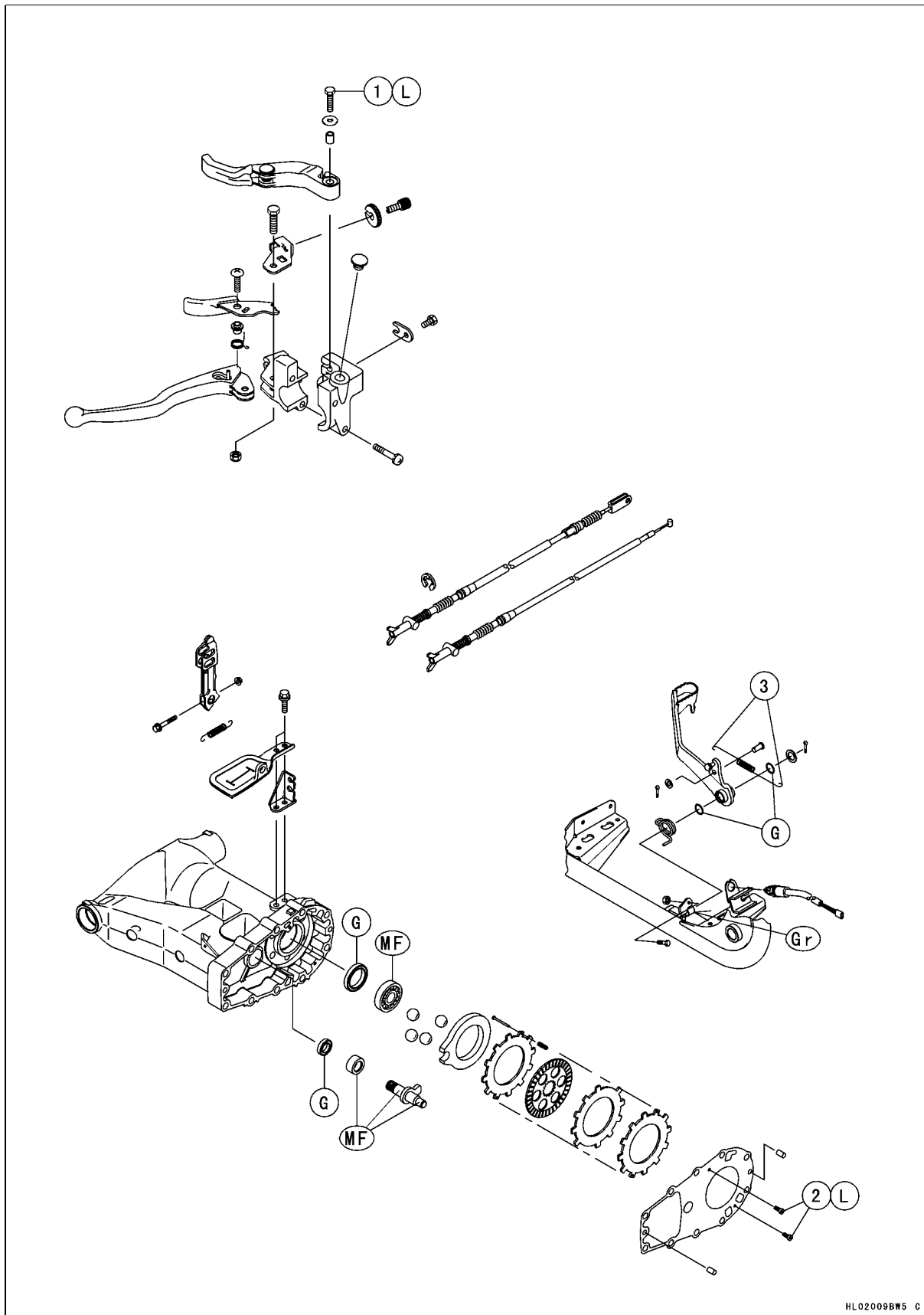
B: Apply brake fluid.

L: Apply a non-permanent locking agent.

Si: Apply silicone grease.

12-4 BRAKES

Exploded View



HL02009BW5 C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Variable differential control lever bolt	–	–	–	L
2	Gasket screws	–	–	–	L

- 3: Bend both hooks after installing the spring.
- G: Apply grease for oil seal and O-ring.
- L: Apply a non-permanent locking agent.
- Gr: Apply grease.
- MF: Apply MOBIL FLUID 424 or equivalent oil.

12-6 BRAKES

Specifications

Item	Standard	Service Limit
Brake Fluid: Type	DOT 3 or DOT 4	---
Front Disc Brake: Pad lining thickness	4.0 mm (0.16 in.)	1 mm (0.04 in.)
Disc thickness	3.3 ~ 3.7 mm (0.130 ~ 0.146 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	55 ~ 60 mm (2.2 ~ 2.4 in.) above footboard	---
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 Pullers: 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.**

Brake Fluid Recommendation

Use extra heavy-duty brake fluid only from a container marked DOT3 or DOT4.

Recommended Disc Brake Fluid

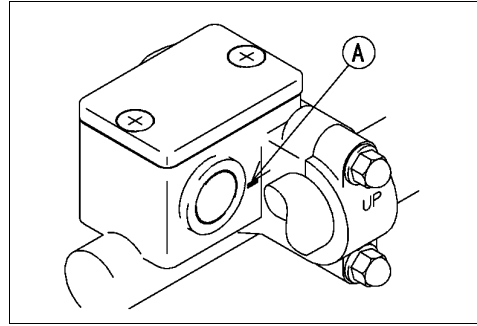
Type : DOT 3 or DOT 4

12-8 BRAKES

Brake Fluid

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.

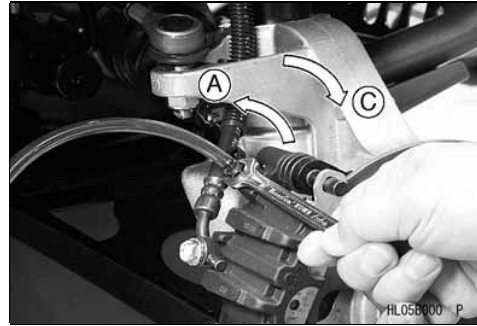
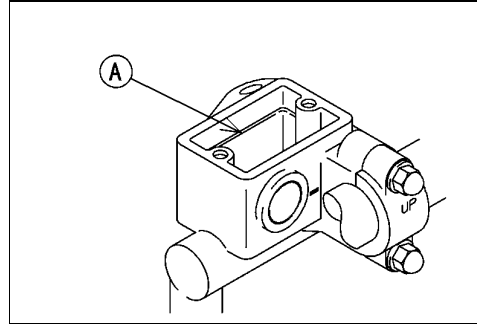
⚠ WARNING

Change the fluid in the brake line completely if the fluid must be refilled but the type and brand of the 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)

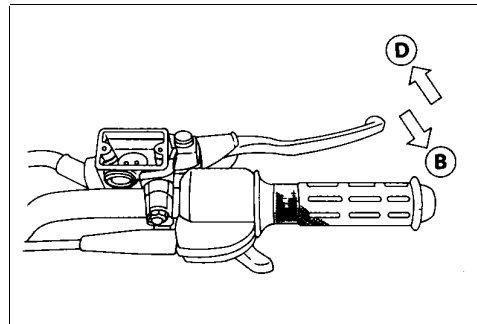
Brake Fluid Change

- Remove the front wheels (see Wheels/Tires chapter).
- 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

Do not mix two brands of fluid. Change the brake fluid in the brake line completely if the brake fluid must be refilled but the type and brand of the brake fluid that is already in the reservoir are not known.

- Tighten:
Torque - Bleed Valves: 7.9 N·m (0.8 kgf·m, 69 in·lb)

Brake Fluid

- Install the front wheels (see Wheels/Tires chapter).
- Apply the brake lever forcefully for a few seconds, and check for fluid leakage around the fittings.

⚠ WARNING

If the brake lever has a soft or "spongy feeling" when it is applied, there might be air in the brake line or the brake may be defective. Since it is dangerous to operate the vehicle under such conditions, bleed the air from the brake line immediately.

Brake Line Air Bleeding

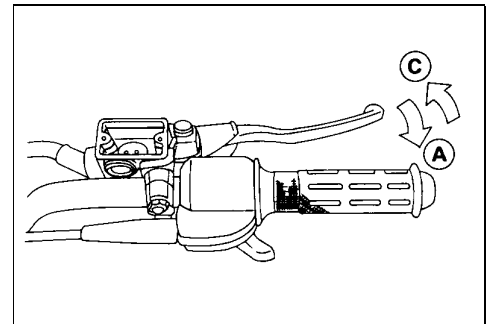
- Remove the front wheels (see Wheels/Tires chapter).
- Bleed the air whenever brake parts are replaced or reassembled.
- Remove the reservoir cap and fill the reservoir with new brake fluid.
- Slowly pump the brake lever several times until no air bubbles can be seen rising up through the fluid from 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 : 7.9 N·m (0.8 kgf·m, 69 in·lb)**
- Install the front wheels (see Wheels/Tires chapter).
- Apply the brake lever forcefully for a few seconds, and check for fluid leakage around the fittings.



12-10 BRAKES

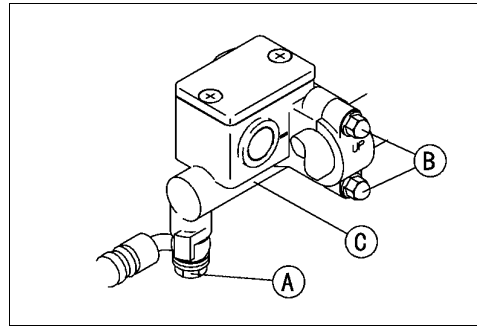
Master Cylinder

Master Cylinder Removal

- Remove:
 - Brake Hose Banjo Bolt [A]
 - Master Cylinder Clamp Bolts [B]
 - Master Cylinder [C]

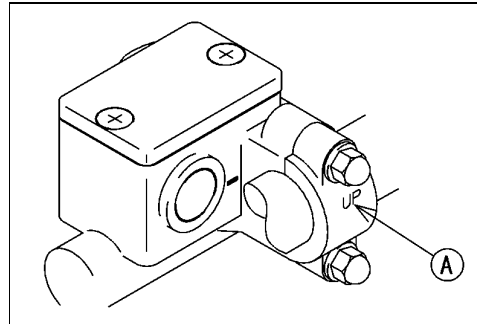
CAUTION

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



Master Cylinder Installation

- 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 - Master Cylinder Clamp Bolts: 11 N·m (1.1 kgf·m, 95 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 Brake Line Air Bleeding).
- Check the brake for good braking power, no braking brag, and no fluid leakage.



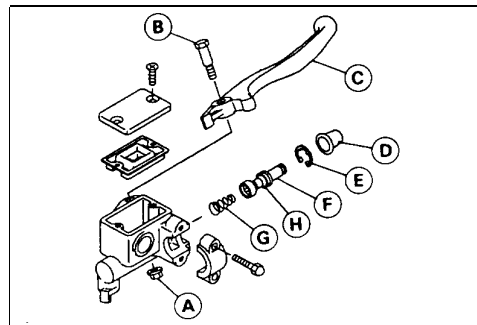
WARNING

Do not attempt to drive the vehicle until a firm brake lever can be obtained by pumping the brake lever until the pads are against each disc. The brakes will not function on the first application of the lever if this is not done.

Master Cylinder Disassembly

- Remove:
 - Master Cylinder (see Master Cylinder Removal)
 - Brake Lever Pivot Nut [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



CAUTION

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

Master Cylinder

Master Cylinder Assembly

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

CAUTION

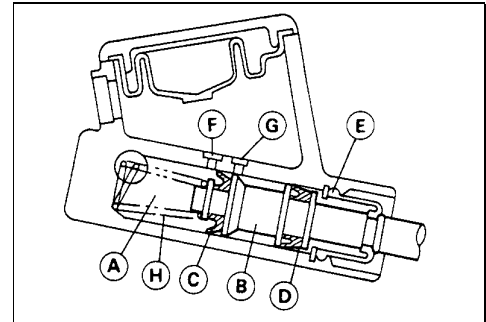
Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part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

- 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 - Brake Lever Pivot Bolt: 5.9 N·m (0.6 kgf·m, 52 in·lb)
Brake Lever Pivot Bolt Locknut: 5.9 N·m (0.6 kgf·m, 52 in·lb)

Master Cylinder Inspection (Visual Inspection)

- Disassemble the master cylinder (see 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.

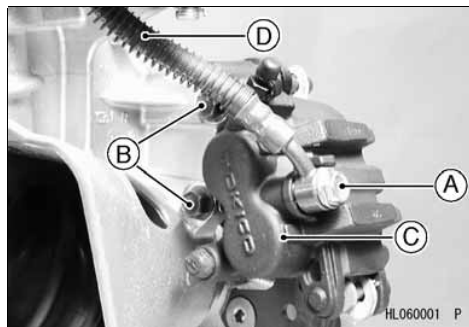


12-12 BRAKES

Calipers

Caliper Removal

- Remove the front wheel (see 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.



CAUTION

Immediately wash away any brake fluid that spills.

NOTE

- If the caliper is to be disassembled after removal and if compressed air is not available, disassemble the caliper before the brake hose is removed (see Caliper Disassembly).

Caliper Installation

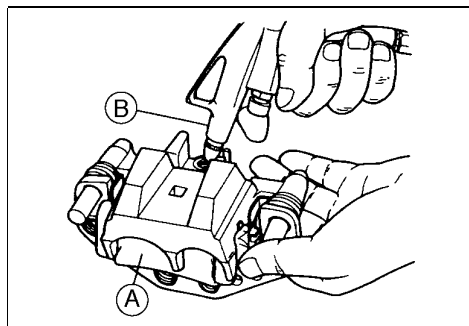
- Install the caliper and brake hose lower end.
- Replace the washers that are on each side of hose fitting with new ones.
- Tighten:
 - Torque - Caliper Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)
 - Brake Hose Banjo Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)
- Check the fluid level in the brake reservoir.
- Bleed the brake line (see Brake Line Air Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.

WARNING

Do not attempt to drive the vehicle until a firm brake lever can be obtained by pumping the brake lever until the pads are against each disc. The brakes will not function on the first application of the lever if this is not done.

Caliper Disassembly

- Remove:
 - Caliper (see Caliper Removal)
 - Pads and Anti-rattle Spring (see Brake Pad Removal)
- 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

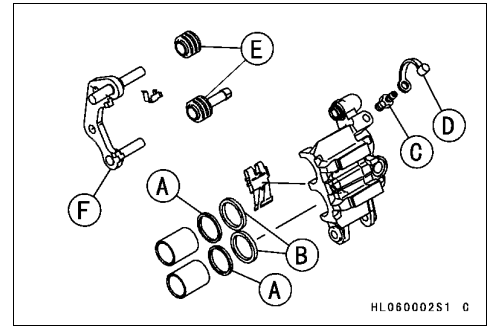
To avoid serious injury, never place your fingers or palm inside the caliper opening. If you apply compressed air into the caliper, the piston may crush your hand or fingers.

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 and spring (see Brake Pad Removal).
- Pump the brake lever to remove the caliper piston.

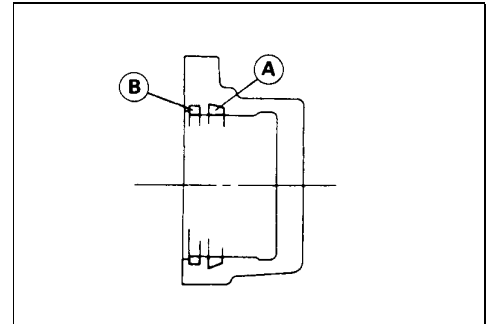
Calipers

- Remove:
 - Dust Seal [A]
 - Fluid Seal [B]
 - Bleed Valve [C] and Rubber Cap [D]
 - Boots [E] and Caliper Holder [F]



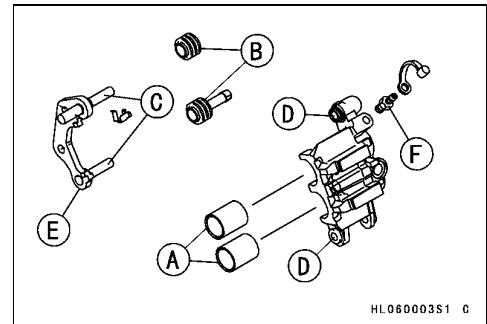
Caliper Assembly

- 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.

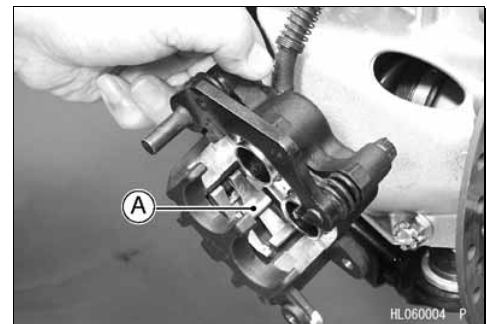


- Apply brake fluid to the outside of the pistons [A], and push them into the cylinder by hand. Take care that neither the cylinder nor the piston skirt gets scratched.
- Replace the rubber boots [B] if they are damaged.
- Apply a thin coat of silicone grease to the caliper holder shafts [C] and holder holes [D] (Silicone grease is a special high temperature, water-resistant grease).
- Install:
 - Caliper Holder [E]
 - Bleed Valve [F] and Rubber Cap

Torque - Bleed Valve: 7.9 N·m (0.8 kgf·m, 69 in·lb)



- Install the anti-rattle spring [A] in the caliper as shown.
- Install the pads (see Brake Pad Installation).



12-14 BRAKES

Calipers

Fluid Seal Damage

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 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.

Dust Seal and Friction Boot Damage

- Check that the dust seals [B] and friction boots [C] are not cracked, worn swollen, or otherwise damaged.
- ★ If they show any damage, replace them.

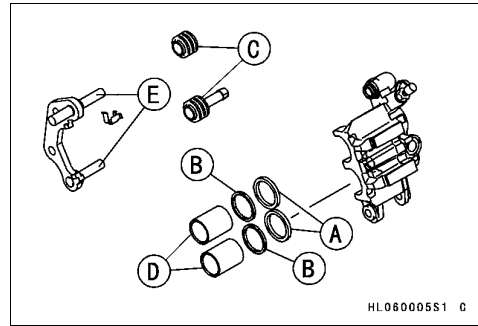
Piston and Cylinder Damage

- Visually inspect the piston [D] and cylinder surfaces.
- ★ Replace the caliper if the cylinder and piston are badly scored or rusty.

Caliper Holder Shaft Wear Inspection

The caliper body must slide smoothly on the caliper holder shafts [E]. If the body does not slide smoothly, one pad will wear more than the other, pad wear will increase, and constant drag on the disc will raise brake and brake fluid temperature.

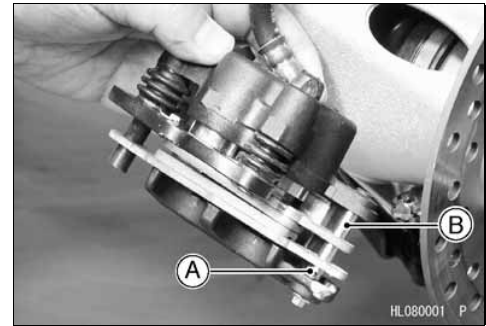
- Check to see that the caliper holder shafts are not badly worn or stepped, and that the rubber friction boots are not damaged.
- ★ If the rubber friction boot is damaged, replace the rubber friction boot.
- ★ If caliper holder shaft is damaged, replace the caliper holder shaft and rubber friction boot as a unit.



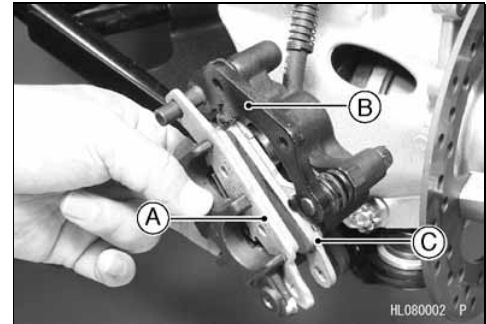
Brake Pads

Brake Pad Removal

- Detach the caliper from the disc (see Caliper Removal).
- Draw out the clip [A], and remove the pad holder pin [B]



- Remove the pad [A] on the outside.
- Push the holder [B] towards the piston, and remove the pad [C] on the piston side.



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 Holder Pin and Clip
- The clip must be "outside" of the pads.

⚠ WARNING

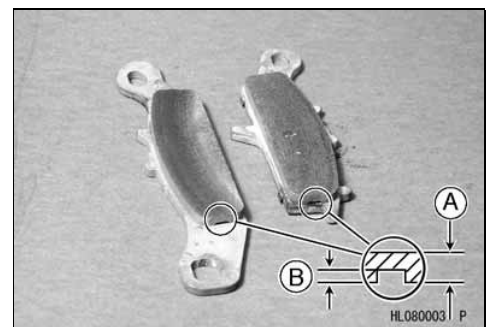
Do not attempt to drive the vehicle until a firm brake lever can be obtained by pumping the brake lever until the pads are against each disc. The brake will not function on the first application if this is not done.

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:	4.0 mm (0.16 in.)
Service Limit:	1 mm (0.04 in.)



12-16 BRAKES

Brake Discs

Disc Cleaning

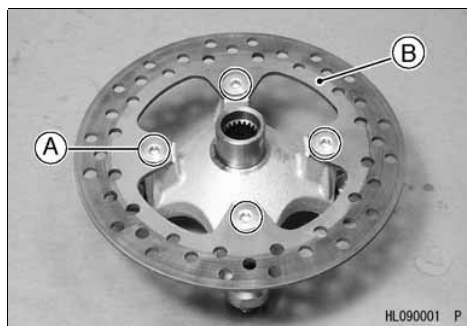
Poor braking can be caused by oil on a disc. Oil on a disc must be cleaned off with an oilless cleaning fluid such as trichloroethylene or acetone.

⚠ WARNING

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

Disc Removal

- Remove:
 - Front Hub (see Wheels/Tires chapter)
 - Brake Disc Mounting Bolts [A]
 - Brake Disc [B]



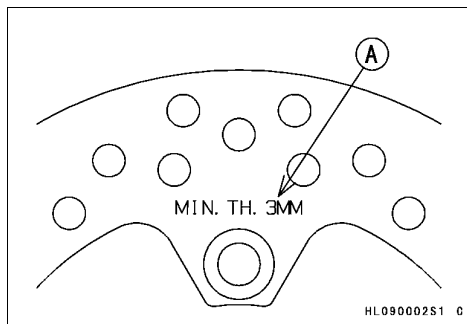
Disc Installation

- The disc must be installed with the marked side [A] facing toward the steering knuckle.
- Tighten:

Non-permanent Locking Agent — Disc Mounting Bolts

Torque - 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.

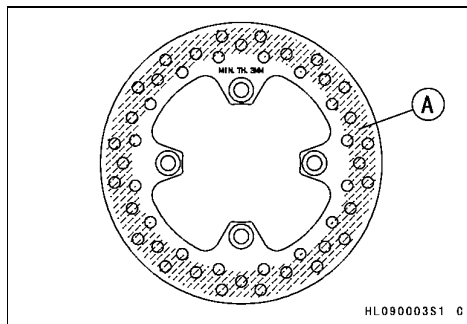


Disc Wear

- 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 (0.130 ~ 0.146 in.)
Service Limit: 3 mm (0.12 in.)

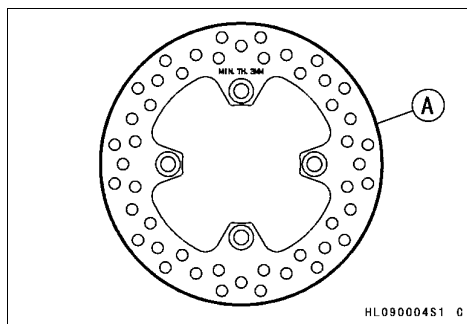


Disc Runout

- 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

Brake Hose Inspection

- The high pressure inside the brake line can cause fluid to leak or the hose to burst if the line is not properly maintained. Bend and twist the rubber hose while examining it.
- ★ Replace it if any cracks or bulges are noticed.

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.

CAUTION
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 (see General Information chapter), and tighten the banjo bolts.

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

12-18 BRAKES

Rear Brake Lever, Pedal and Cables

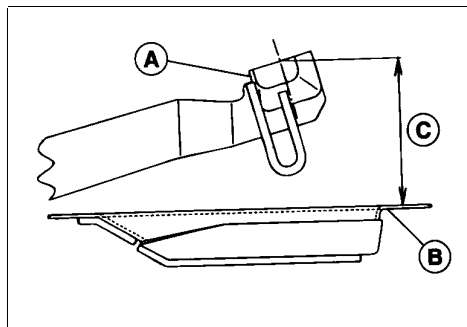
Brake Pedal Position Inspection

- Check that the brake pedal [A] is in the correct position as shown.
[B] Footboard

Pedal Position [C]

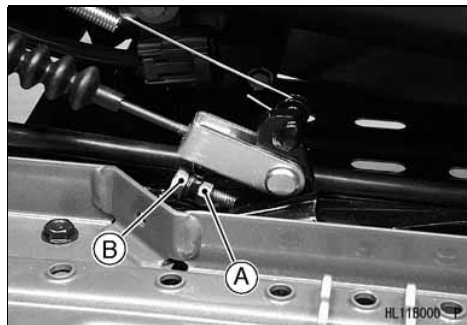
Standard: 55 ~ 60 mm (2.2 ~ 2.4 in.) above footboard

- ★ If it is incorrect, adjust the brake pedal position.



Brake Pedal Position Adjustment

- 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 Brake Pedal Free Play Inspection).

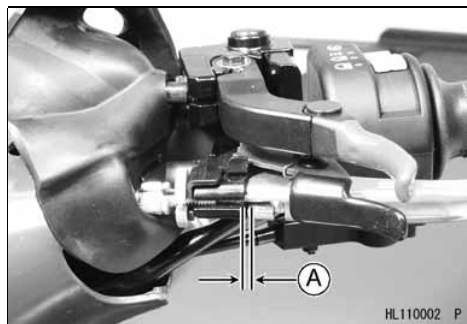


Rear Brake Lever Free Play Inspection

- 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.)

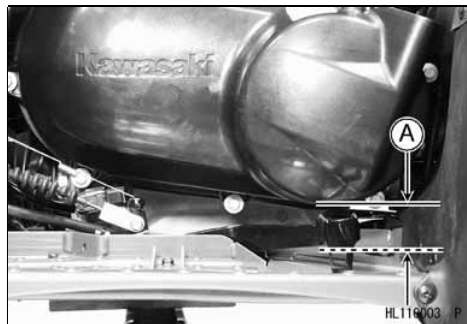


Brake Pedal Free Play Inspection

- 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.

Pedal Free Play

Standard: 15 ~ 25 mm (0.6 ~ 1.0 in.)



Rear Brake Lever, Pedal and Cables

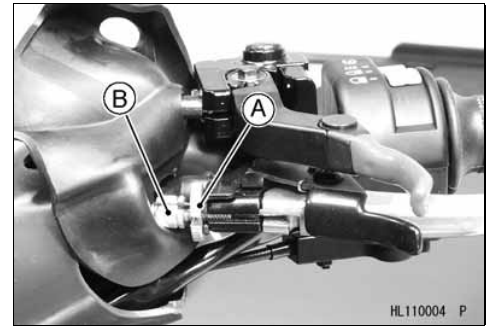
Rear Brake Lever and Pedal Free Play Adjustment

NOTE

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

Rear Brake Lever:

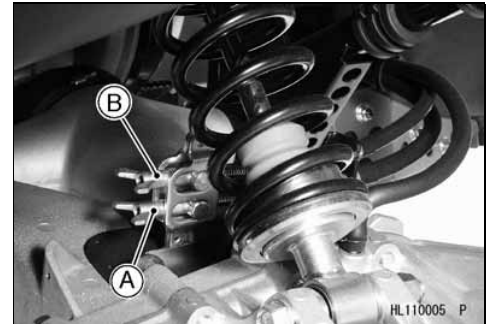
- Loosen the knurled locknut [A] and turn the adjuster [B] at the rear brake lever in as far as it will go.
- Tighten the locknut.



- 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.

Brake Pedal:

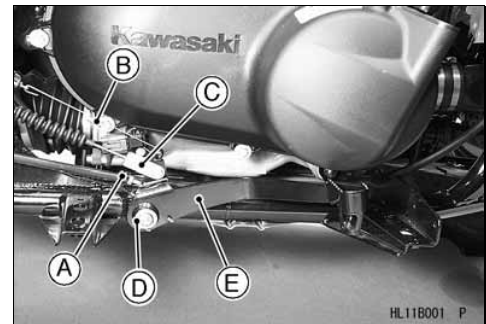
- Turn the brake pedal adjuster [B] at the rear end of the brake cable until the brake pedal has the correct amount of play.



- 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.

Brake Pedal Removal

- Remove:
 - Right Footboard (see Frame chapter)
- Loosen the locknut and the adjusting bolt [A].
- Remove:
 - Brake Switch Spring [B]
 - Cotter Pin, Washer, Pin and Brake Cable Joint [C]
 - Cotter Pin and Washer [D]
 - O-ring and Brake Pedal [E]
 - Spring

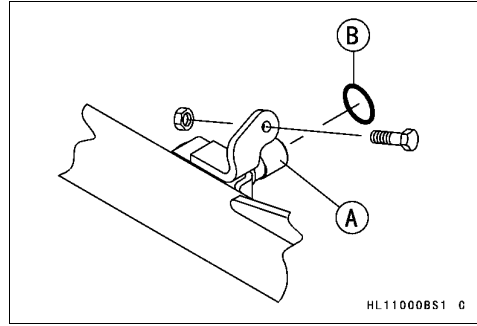


12-20 BRAKES

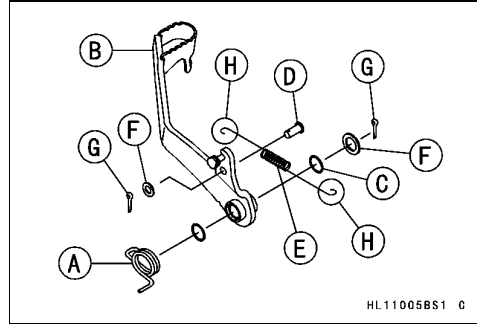
Rear Brake Lever, Pedal and Cables

Brake Pedal Installation

- Apply grease:
 - Brake Pedal Pivot [A]
 - O-ring [B]

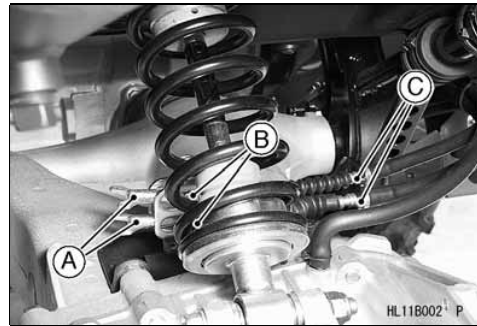


- Install:
 - Spring [A]
 - Brake Pedal [B]
- Apply grease:
 - O-ring [C]
- Install:
 - Brake Cable Joint and Pin [D]
 - Brake Switch Spring [E]
 - Washers [F]
- Replace the cotter pins [G] with new ones.
- Bend both side hooks [H] of switch spring [E] after installing the spring.
- Adjust the brake pedal position (see Brake Pedal Position).

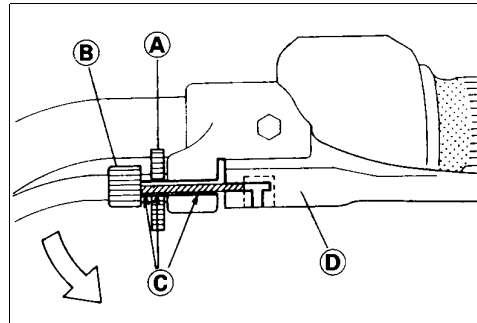


Brake Cable Removal

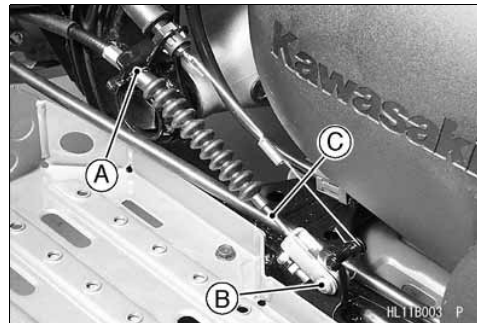
- Remove:
 - Right Rear Flap (see Frame chapter)
- Unscrew the adjusters [A] at the rear ends of the cables, and pull the cables out of the joints [B] and cable mounts [C].



- Loosen the knurled locknut [A] at the rear brake lever and screw in the adjuster [B].
- Line up the slots [C] in the brake lever, knurled locknut, and adjuster, and then free the cable from the lever [D].
- Remove the brake lever cable from the frame.



- Remove:
 - Circlip [A]
 - Cotter Pin, Washer and Pin [B]
 - Brake Pedal Cable [C]



Rear Brake Lever, Pedal and Cables

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 General Information chapter.
- Adjust the brake pedal and rear brake lever.

Brake Cable Lubrication

Whenever the brake cable is removed, lubricate the cable as follows:

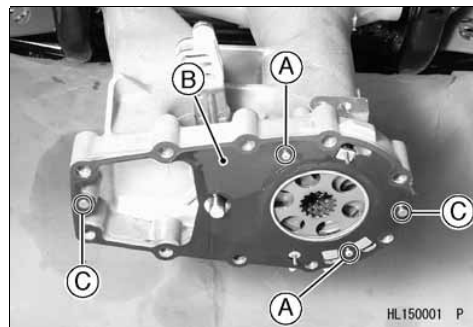
- Lubricate the cable with a penetrating rust inhibitor.

12-22 BRAKES

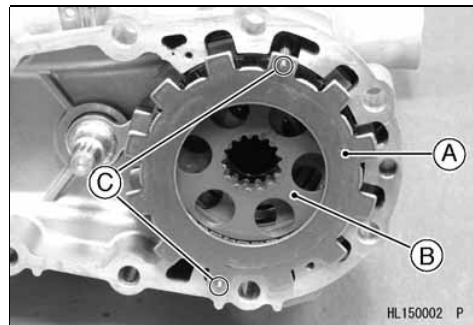
Internal Wet Brake

Internal Wet Brake Disassembly

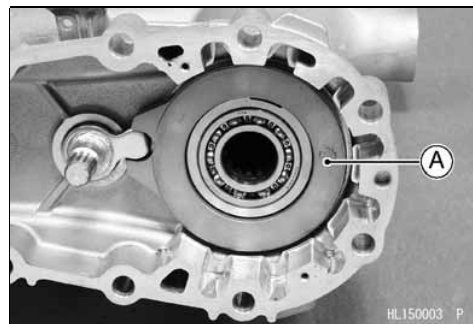
- Remove:
 - Rear Final Gear Case (see Final Drive chapter)
 - Gasket Screws [A]
 - Gasket [B]
 - Dowel Pins [C]



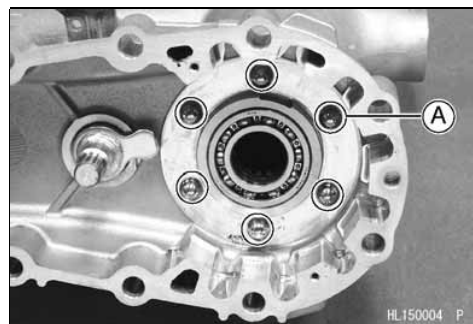
- Remove:
 - Steel Plates [A]
 - Friction Plates [B]
 - Pins [C] and Springs



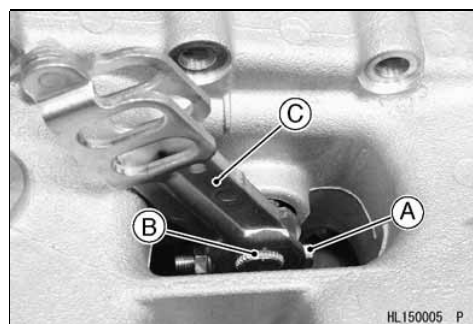
- Remove:
 - Cam Plate [A]



- Remove:
 - Steel Balls [A]



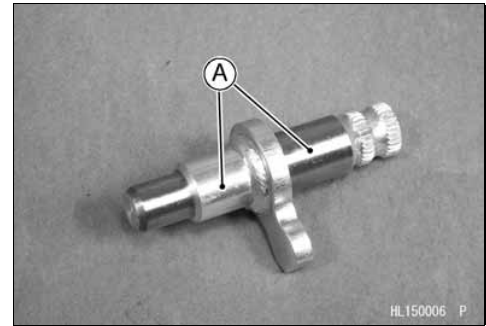
- Remove:
 - Brake Cam Lever Bolt and Nut [A]
 - Brake Camshaft [B]
 - Brake Cam Lever [C]



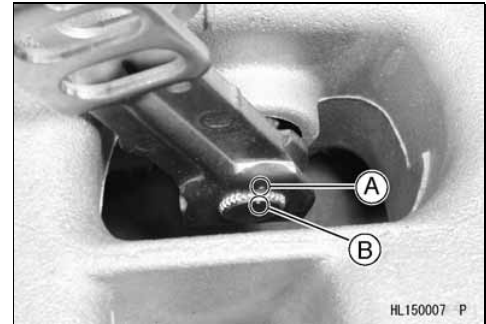
Internal Wet Brake

Internal Wet Brake Assembly

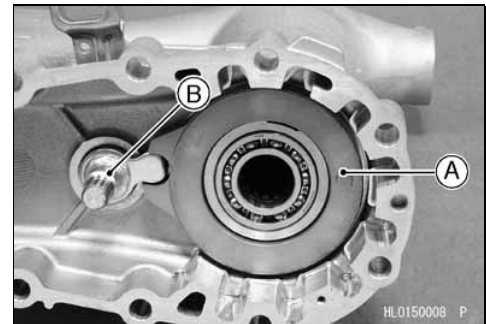
- Apply [A] MOBIL FLUID 424 or equivalent oil to the brake camshaft and the inside of the collar.
- Insert the camshaft in the swingarm.



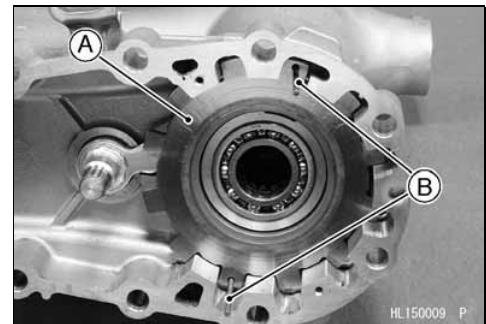
- Align the punch mark [A] on the brake cam lever with the punch mark [B] on the brake camshaft.



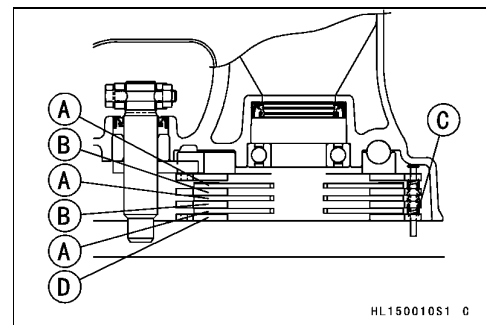
- Install:
 - Steel Balls
 - Brake Cam Plate [A]
- Fit the cam plate and brake camshaft [B] as shown.



- Install:
 - Steel Pressure Plate [A] and Pins [B] (as shown)



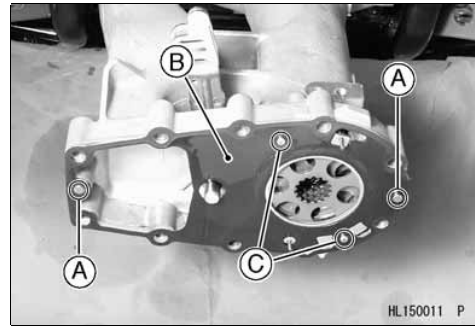
- Install:
 - Friction Plates [A]
 - Steel Plates [B]
 - Springs [C]
 - Steel Pressure Plate [D]



12-24 BRAKES

Internal Wet Brake

- Install:
 - Dowel Pins [A]
 - New Gasket [B]
- Apply a non-permanent locking agent to the gasket screws [C], and tighten them.
- Install:
 - Rear Final Gear Case (see Final Drive chapter)



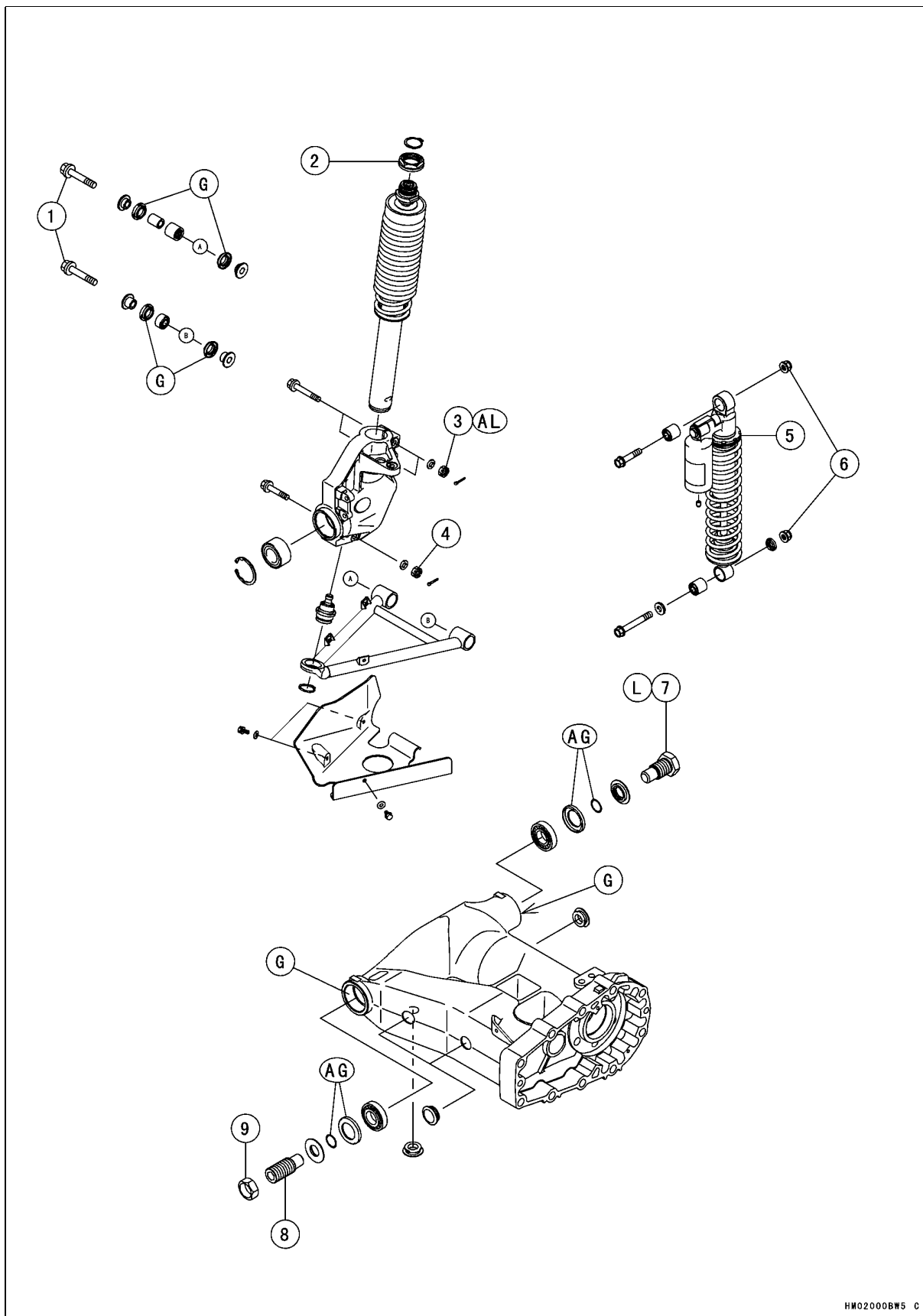
Suspension

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13-2 SUSPENSION

Exploded View



HW0200BWS C

SUSPENSION 13-3

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Suspension arm pivot bolts	88	9.0	65	
2	Front shock absorber mounting nuts	74	7.5	54	
3	Front shock absorber clamp bolts and nuts	42	4.3	31	AL
4	Steering knuckle joint nut	42	4.3	31	
5	Rear shock absorber spring locknut	88	9.0	65	
6	Rear shock absorber mounting nuts	62	6.3	46	
7	Swingarm pivot right shaft	152	15.5	112	L
8	Swingarm pivot left shaft	20	2.0	14	
9	Swingarm pivot left nut	152	15.5	112	

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

L: Apply a non-permanent locking agent.

AG: Apply grease (Amoco rykon premium grease No. 2 EP Green).

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

13-4 SUSPENSION

Specifications

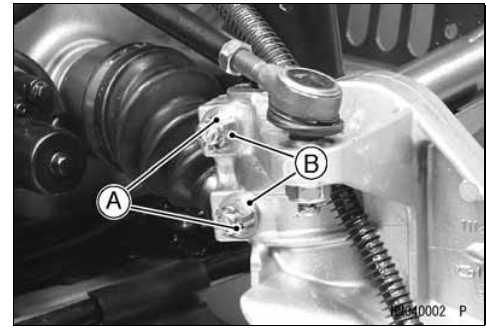
Item	Standard	Service Limit (Usable Range)
Shock Absorbers: Spring preload setting position (Rear)	Spring free length minus 29.9 mm (1.18 in.)	Spring free length minus 22.9 mm (0.90 in.) to 36.9 mm (1.45 in.)

Special Tools - Outside Circlip Pliers: 57001-144
Oil Seal & Bearing Remover: 57001-1058
Bearing Driver Set: 57001-1129
Jack: 57001-1238
Holder & Guide Arbor: 57001-1476
Spacer & Holder: 57001-1477

Shock Absorbers

Front Shock Absorber Removal

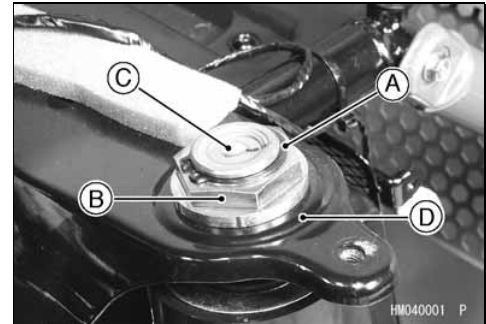
- Remove:
 - Front Fender (see Frame chapter)
 - Cotter Pins [A]
 - Front Shock Absorber Clamp Bolts and Nuts [B]



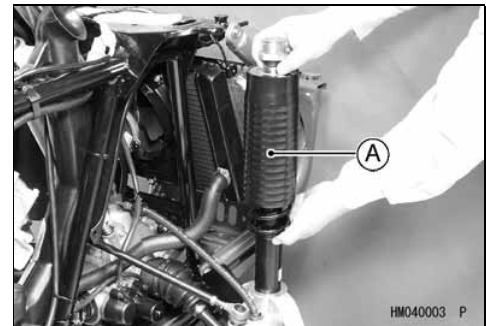
- Remove:
 - Circlip [A]

Special Tool - Outside Circlip Pliers: 57001-144
- While supporting the vehicle with a jack, loosen the nut [B].

Special Tool - Jack: 57001-1238
- Remove the ball joint [C] of the shock absorber from the frame bracket [D].



- Remove:
 - Front Shock Absorber [A]

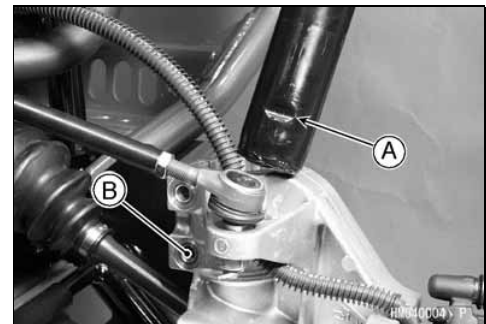


Front Shock Absorber Installation

- Insert the shock absorber into the knuckle, and align its recess [A] and the lower bolt hole [B] in the knuckle.
- Tighten:
 - Torque - Front Shock Absorber Clamp Bolts and Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)**

NOTE

- Tighten the two clamp bolts alternately two times to ensure even tightening torque.



- Insert the ball joint into the frame bracket.
- Tighten the nut.
 - Torque - Front Shock Absorber Mounting Nut: 74 N·m (7.5 kgf·m, 54 ft·lb)**
- Replace the circlip with a new one.

Special Tool - Outside Circlip Pliers: 57001-144
- Lower the vehicle and remove the jack.

Front Shock Absorber Inspection

Since the front shock absorbers are sealed units which cannot be disassembled, only external checks are necessary.

- ★ If one unit is damaged, replace both shock absorbers as a set. If only one unit is replaced and the two are not balanced, vehicle instability at high speed may result.

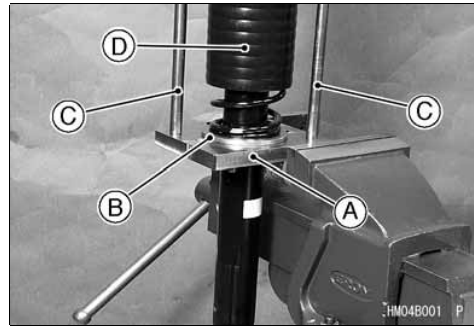
13-6 SUSPENSION

Shock Absorbers

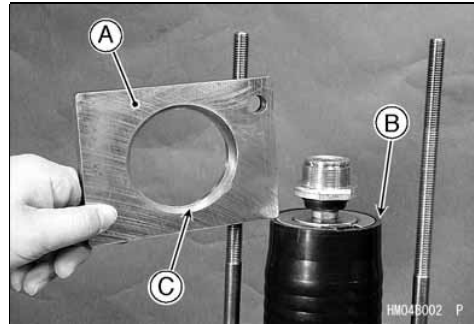
Front Shock Absorber Spring Replacement

- Remove:
Front Shock Absorber (see Front Shock Absorber Removal)
- Hold the holder [A] (57001-1476) and spacer [B] (57001-1477) in a vice as shown.
- Install the guide arbors [C] (57001-1476) on the holder.
- Insert the front shock absorber [D] into the center of the spacer and holder.

Special Tools - Holder & Guide Arbor: 57001-1476
Holder & Spacer: 57001-1477



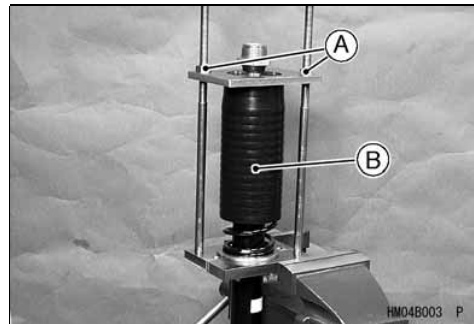
- Put the upper holder [A] (57001-1477) on upper ends of the spring cover [B] and arbors so that the recess side [C] downward.



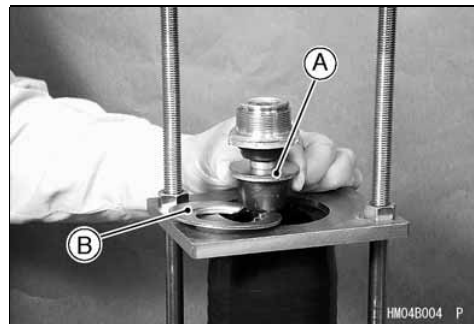
- Tighten the nuts [A] and press the spring until the spring seat stopper is free.

NOTE

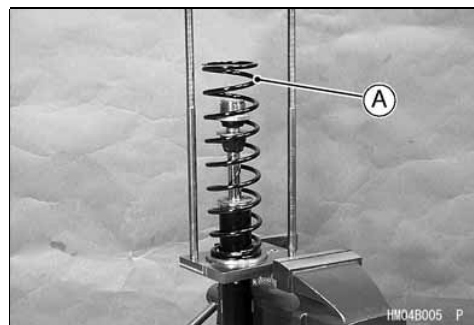
- Do not press until the spring cover [B] is bottomed.



- Pull up the spring seat [A] and remove the spring seat stopper [B].

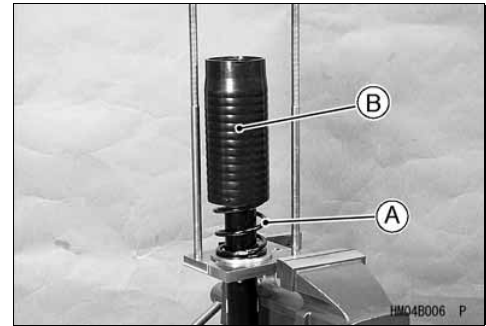


- Remove:
Nuts and Upper Holder
Spring Cover
Spring [A]



Shock Absorbers

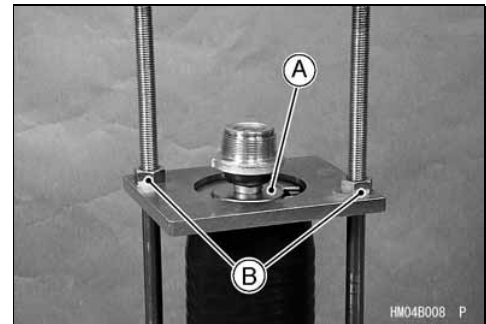
- Install the replaced spring [A] with the smaller end facing downward on the lower spring seat.
- Install the spring cover [B] with the smaller end (recess side) facing upward.



- Install the spring seat stopper [A] by the reverse of removal.



- Fit the spring seat stopper under the spring seat [A].
- Remove:
 - Nuts [B]
 - Upper Holder
 - Front Shock Absorber

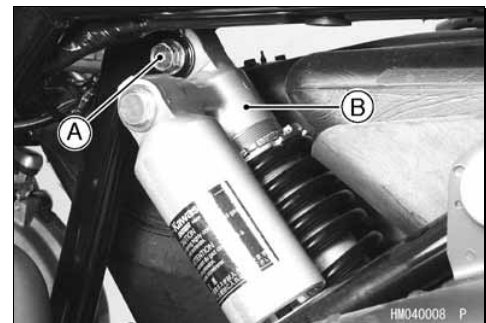
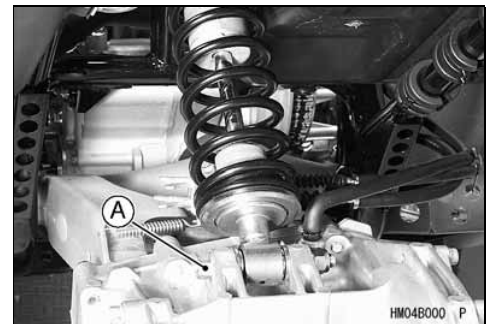


Rear Shock Absorber Removal

- Remove:
 - Rear Fender (see Frame chapter)
- 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].

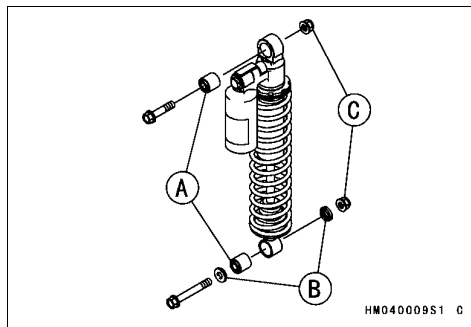


13-8 SUSPENSION

Shock Absorbers

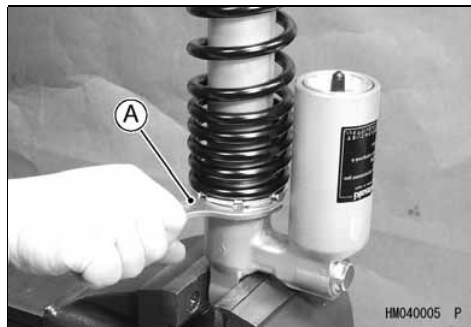
Rear Shock Absorber Installation

- Install:
 - Rubber Bushings [A]
 - Collars [B]
- Tighten:
 - Torque - Rear Shock Absorber Mounting Nuts [C]: 62 N·m (6.3 kgf·m, 46 ft·lb)**



Rear Shock Absorber Preload Adjustment

- Remove:
 - Rear Shock Absorber (see Rear Shock Absorber Removal)
- Loosen the locknut and turn out the adjusting nut to free the spring.
 - Owner's Tool - Hook Wrench [A]: 92210-1173**

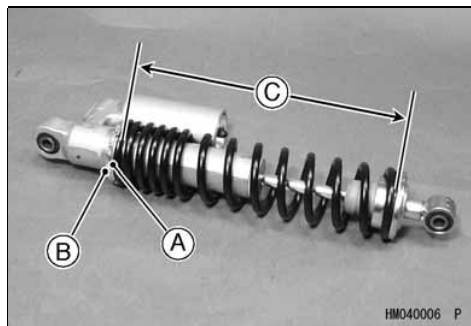


- Measure the spring free length.
- To adjust the spring preload, turn in the adjusting nut [A] to the desired position and tighten the locknut [B].
 - [C] Spring Length

Spring Preload Setting Position

- Standard:** Spring free length minus 29.9 mm (1.18 in.)
- Usable Range:** Spring free length minus 22.9 mm (0.90 in.) to 36.9 mm (1.45 in.)

Torque - Rear Shock Absorber Spring Locknut: 88 N·m (9.0 kgf·m, 65 ft·lb)



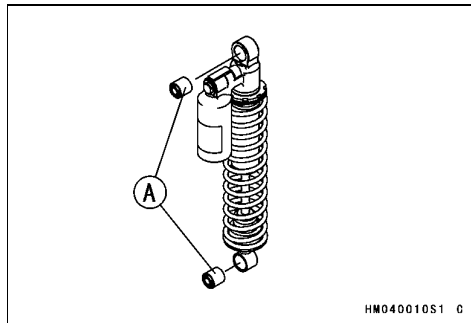
★ If the spring action feels too soft or too stiff, adjust it in accordance with the following table.

Spring Action

Position	Spring Force	Setting	Load	Terrain	Speed
22.9 mm (0.90 in.)	Weak	Soft	Light	Smooth	Low
↑	↑	↑	↑	↑	↑
↓	↓	↓	↓	↓	↓
36.9 mm (1.45 in.)	Stronger	Hard	Heavy	Rough	High

Rear Shock Absorber Inspection

- Check the rubber bushings [A] in the upper and lower pivots.
- ★ If bushings are worn, cracked, hardened, or otherwise damaged, replace them.



Shock Absorbers

Rear Shock Absorber Scrapping

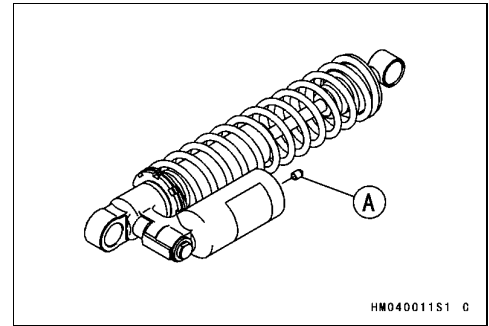
⚠ WARNING

Since the reservoir tank of the rear shock absorber contains nitrogen gas, do not incinerate the reservoir tank without first releasing the gas or it may explode.

- Remove the shock absorber (see Rear Shock Absorber Removal).
- Remove the valve cap [A] and release the nitrogen gas completely from the gas reservoir.
- Remove the valve.

⚠ WARNING

Since the high pressure gas is dangerous, do not point the valve toward your face or body.



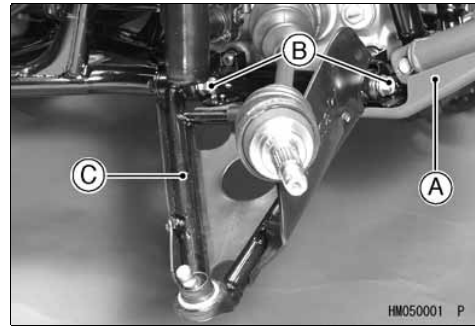
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13-10 SUSPENSION

Suspension Arms

Suspension Arm Removal

- Remove:
 - Front Wheel (see Wheels/Tires chapter)
 - Front Hub (see Wheels/Tires chapter)
 - Steering Knuckle (see Steering chapter)
 - Front Lower Guard [A]
 - Suspension Arm Pivot Bolts [B]
 - Suspension Arm [C]
 - Shim (if installed)

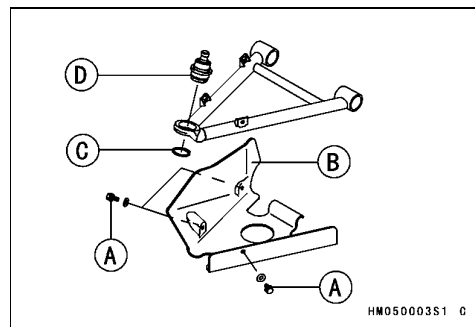


Suspension Arm Installation

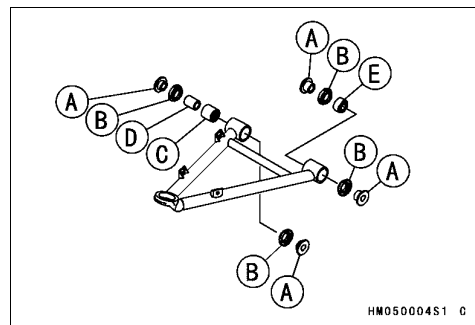
- Tighten:
 - Torque - Suspension Arm Pivot Bolts: 88 N·m (9.0 kgf·m, 65 ft·lb)**

Suspension Arm Disassembly

- Remove:
 - Axle Guard Bolts [A] and Washers
 - Axle Guard [B]
 - Circlip [C]
- Press out the knuckle joint [D].



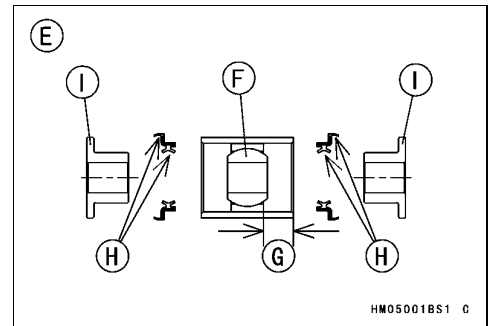
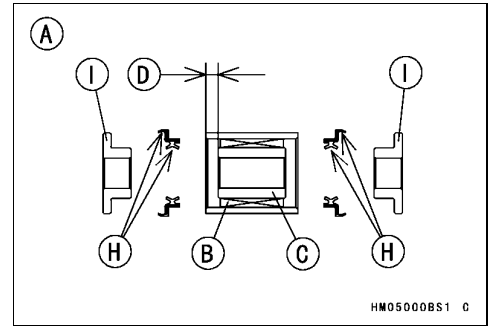
- Remove:
 - Collars [A]
 - Oil Seals [B]
 - Needle Bearing [C] (front side)
 - Sleeve [D] (front side)
 - Ball Joint Bearing [E] (rear side)



Suspension Arms

Suspension Arm Assembly

- Install the following parts as shown.
 - Front Side [A]:
 - Needle Bearing [B]
 - Sleeve [C]
 - [D] = 6.9 ± 0.1 mm (0.272 ± 0.004 in.)
 - Rear Side [E]:
 - Ball Joint Bearing [F]
 - [G] = 12.9 ± 0.1 mm (0.508 ± 0.004 in.)
- Apply grease [H] to all oil seals.
- Install:
 - Collars [I]



13-12 SUSPENSION

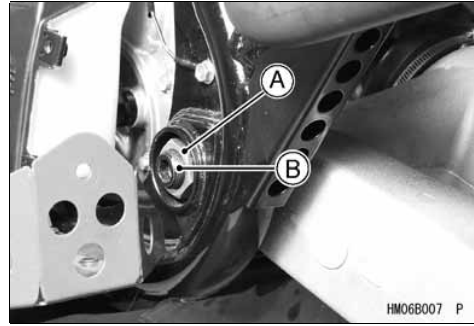
Swingarm

Swingarm Removal

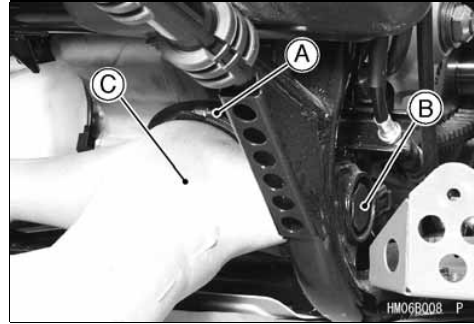
- Support the vehicle on a stand or a jack so that the rear wheels are off the ground.

Special Tool - Jack: 57001-1238

- Remove:
 - Rear Final Gear Case (see Final Drive chapter)
 - Swingarm Pivot Left Nut [A]
 - Swingarm Pivot Left Shaft [B]

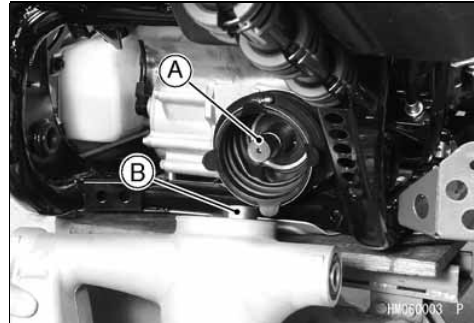


- Loosen:
 - Boot Clamp Screw [A]
- Remove:
 - Boot
 - Swingarm Pivot Right Shaft [B]
 - Swingarm [C]

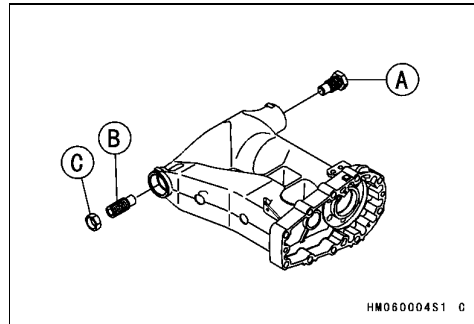


Swingarm Installation

- Apply molybdenum disulfide grease to the spline of the output shaft [A].
- Fit the propeller shaft [B] on the output shaft.

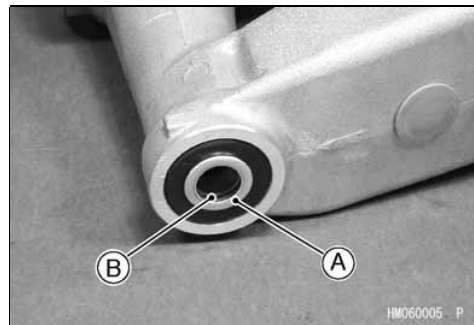


- Apply a non-permanent locking agent:
 - Swingarm Pivot Right Shaft [A]
- Tighten:
 - Torque - Swingarm Pivot Right Shaft: 152 N·m (15.5 kgf·m, 112 ft·lb)**
- Tighten:
 - Torque - Swingarm Pivot Left Shaft [B]: 20 N·m (2.0 kgf·m, 14 ft·lb)**
 - Swingarm Pivot Left Nut [C]: 152 N·m (15.5 kgf·m, 112 ft·lb)**
- Fit the boot on the swingarm, and tighten the clamp screw.



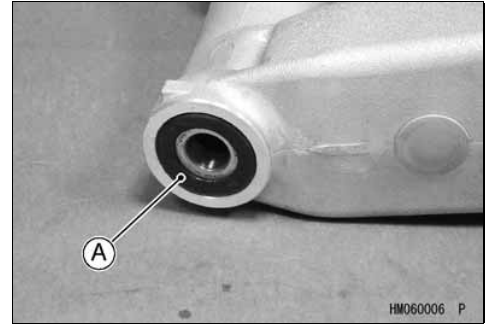
Swingarm Disassembly

- Remove:
 - Collars [A]
 - O-ring [B]

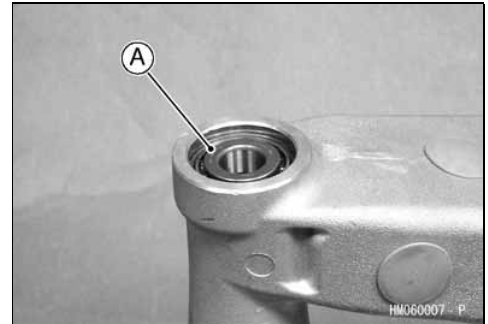


Swingarm

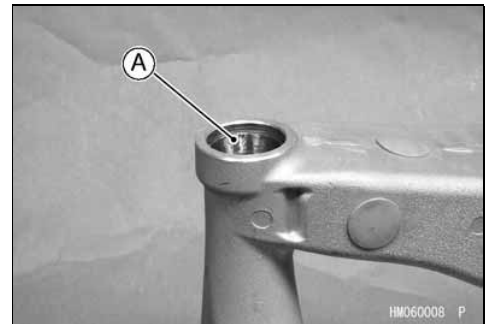
- Remove:
Oil Seal [A]



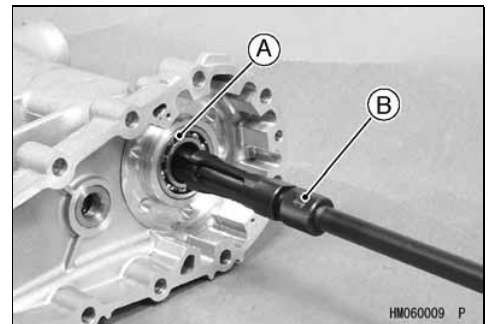
- Remove:
Tapered Roller Bearing [A]



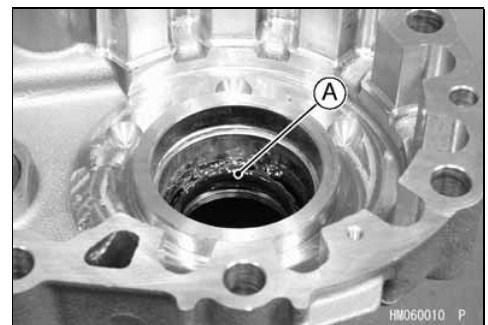
- Remove:
Outer Race [A]



- Remove:
Ball Bearing [A]
Special Tool - Oil Seal & Bearing Remover [B]: 57001-1058



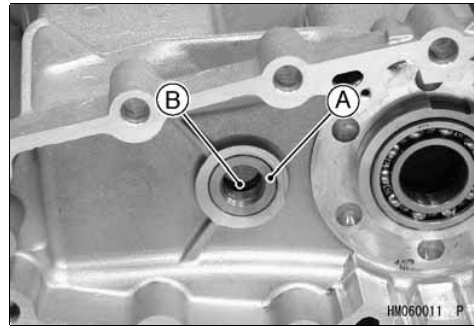
- Remove:
Oil Seal [A]



13-14 SUSPENSION

Swingarm

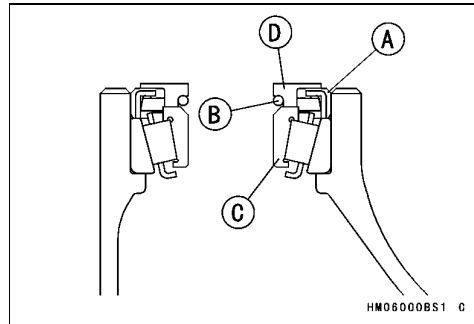
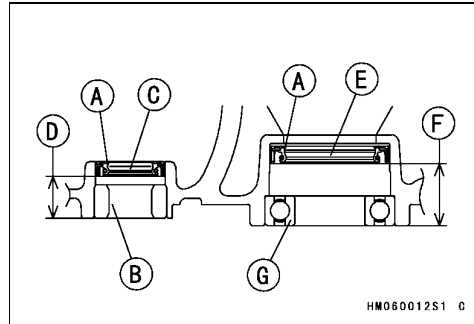
- Remove:
 - Collar [A]
 - Oil Seal [B]



Swingarm Assembly

- Apply grease:
 - Inside [A] of Oil Seals
- Apply MOBIL FLUID 424 or Equivalent:
 - Surface of Collar [B]
- Install the following parts as shown.
 - Brake Lever Oil Seal [C]
[D] = 14.5 ± 0.1 mm (0.571 ± 0.004 mm)
 - Collar (level with surface)
 - Propeller Shaft Oil Seal [E]
[F] = 25 ± 0.1 mm (0.984 ± 0.004 mm)
 - Ball Bearing [G] (level with surface)
- Apply Amoco Rykon Premium Grease No.2 EP Green:
 - Inside of Oil Seals [A]
 - O-rings [B]
- Install the following parts as shown.
 - Tapered Roller Bearing [C]
 - Oil Seal (level with surface)
 - O-ring
 - Collar [D]

Special Tool - Bearing Driver Set: 57001-1129

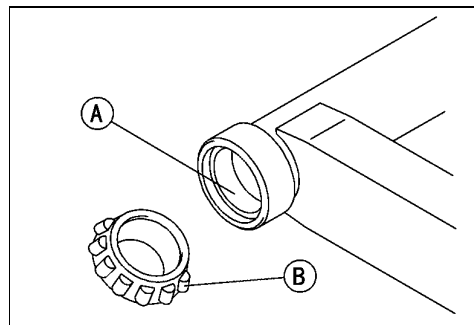


Swingarm Bearing Inspection

- Remove the rear final gear case (see Final Drive chapter).
- Move the swingarm up and down to check for abnormal friction, and push and pull it back and forth to check for bearing play.
- ★ If abnormal friction is felt, the bearings are damaged. Replace the oil seals and both left and right bearings.
- The play developed during use may indicate bearing damage. In this case, remove the swingarm and inspect the bearings. Replace both left and right bearings, if either of the bearings is damaged.

Swingarm Bearing Lubrication

- Remove the swingarm.
- Using a high flash-point solvent, wash the bearings clean of grease, and dry them.
- Inspect the bearings and oil seals for abrasion, color change, or other damage.
- Apply grease to the outer races [A], and pack the tapered roller bearings [B] with the same grease.
- Apply Amoco Rykon Premium Grease No. 2 EP (green) to the inside of the oil seals.
- Install the swingarm (see Swingarm Installation).



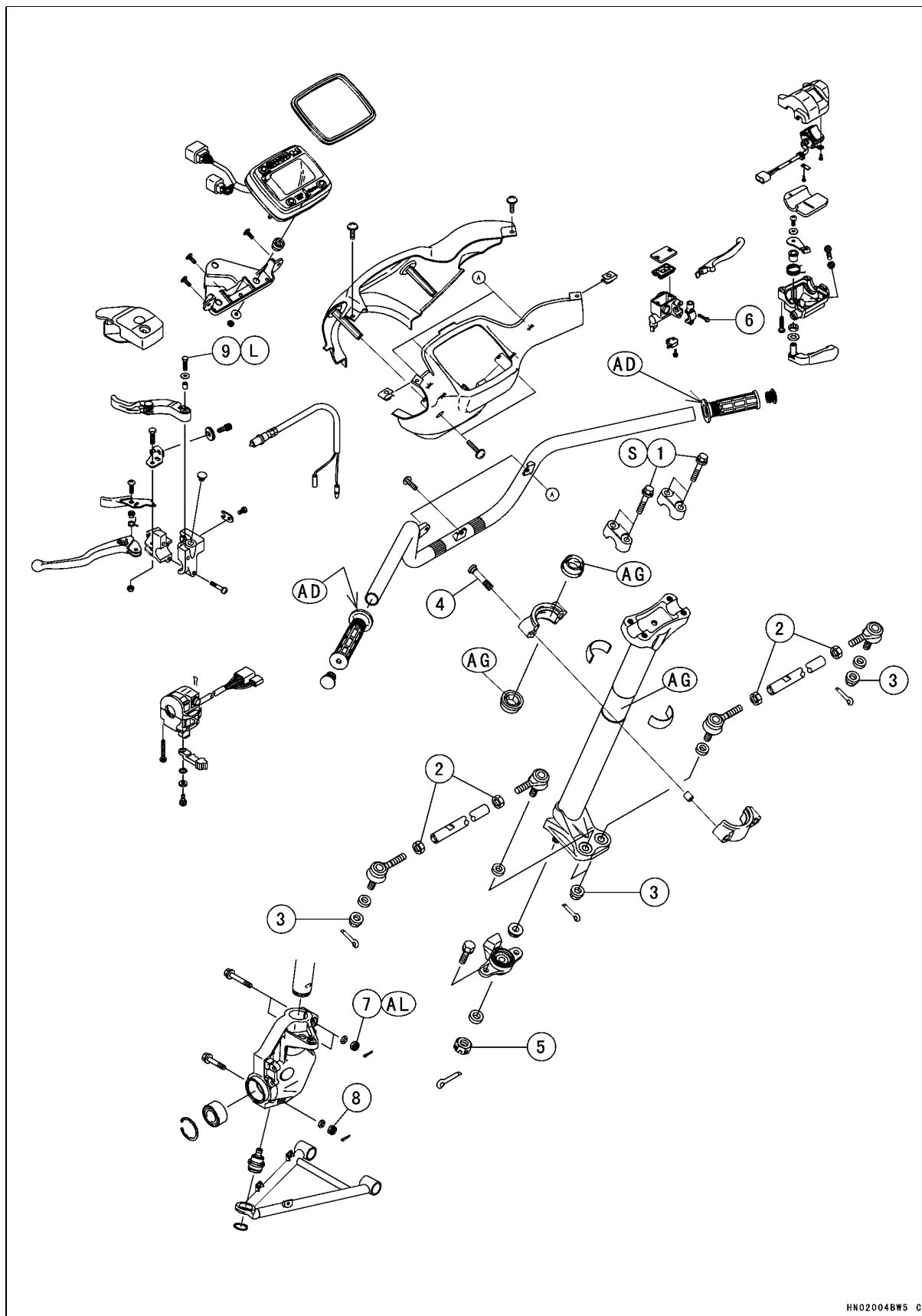
Steering

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14-2 STEERING

Exploded View



HN02004BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar holder bolts	29	3.0	22	S
2	Tie-rod adjusting sleeve locknuts	27	2.8	20	
3	Tie-rod end nuts	42	4.3	31	
4	Steering stem clamp bolts	25	2.5	18	
5	Steering stem bottom end nut	64	6.5	47	
6	Master cylinder clamp bolts	11	1.1	95 in-lb	
7	Front shock absorber clamp bolts and nuts	42	4.3	31	AL
8	Steering knuckle joint nut	42	4.3	31	
9	Variable differential control lever bolt	–	–	–	L

L: Apply a non-permanent locking agent.

AD: Apply adhesive agent.

AG: Apply grease (Amoco rykon premium grease No. 2 EP Green).

S: Follow the specific tightening sequence.

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

14-4 STEERING

Specifications

Item	Standard	Service Limit
Tie-Rods: Tie-Rod Length	315 mm (12.4 in.)	---

Special Tools - Inside Circlip Pliers: 57001-143

Bearing Driver Set: 57001-1129

Steering

Steering Stem Removal

- Remove:
 - Front Fender (see Frame chapter)
 - Front Side Covers (see Frame chapter)
 - Cotter Pins [A]
 - Tie-Rod End Nuts [B]
 - Steering Stem Bearing Housing Bolts [C] (right and left)

CAUTION

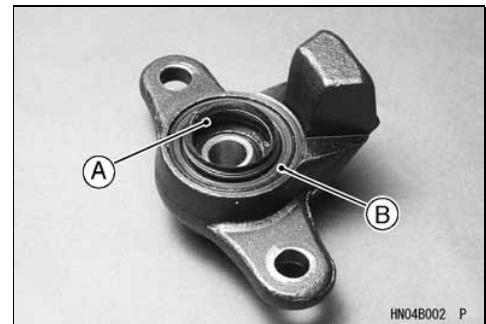
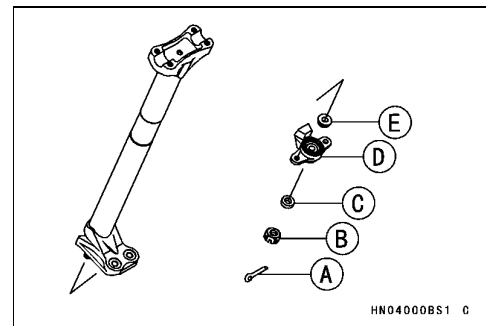
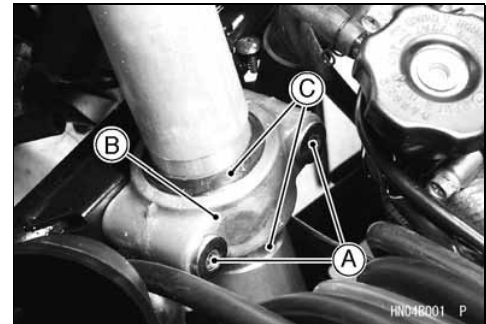
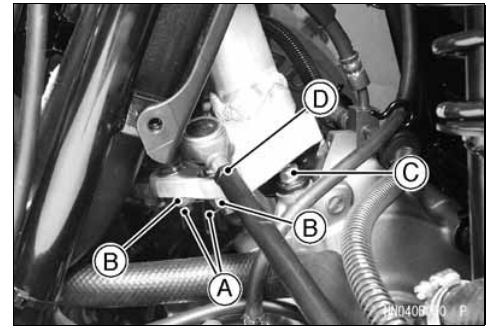
Do not loosen the locknuts [D] at the ends of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.

- Remove:
 - Handlebar (see Handlebar Removal)
 - Steering Clamp Bolts [A]
 - Steering Clamps [B]
 - Grease Seals [C]
 - Bearing Sleeves

- Pull the steering stem out of the frame.
- Remove:
 - Cotter Pin [A]
 - Steering Stem Bottom End Nut [B]
 - Lower Collar [C]
 - Steering Stem Bearing [D]
 - Upper Collar [E]

Steering Stem Installation

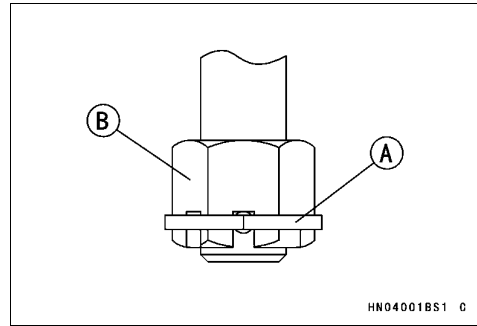
- Full grease up the seal grooves [A] in the steering stem bearing [B].
- Install:
 - Upper Collar
 - Lower Collar
- Tighten:
 - Torque - Steering Stem Bottom End Nut: 64 N·m (6.5 kgf·m, 47 ft·lb)**



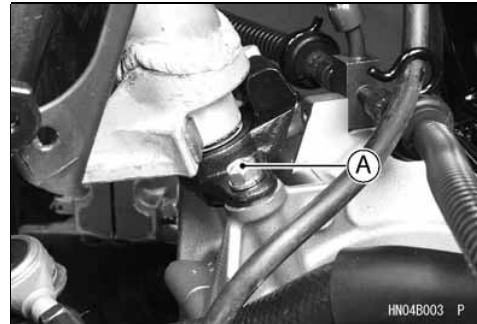
14-6 STEERING

Steering

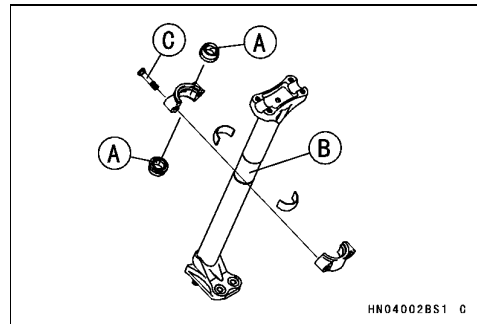
- Bend both ends of the cotter pin [A] as shown.
Steering Stem Bottom End Nut [B]



- Apply a non-permanent locking agent:
Steering Stem Bearing Joint Bolts [A]



- Apply Amoco Rykon Premium Grease No.2 EP (Green):
Inside of Grease Seals [A]
Steering Stem [B]
- Tighten:
Torque - Steering Stem Clamp Bolts [C]: 25 N·m (2.5 kgf·m, 18 ft·lb)
Tie-Rod End Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)
- Inspect the toe-in (see Wheels/Tires chapter).



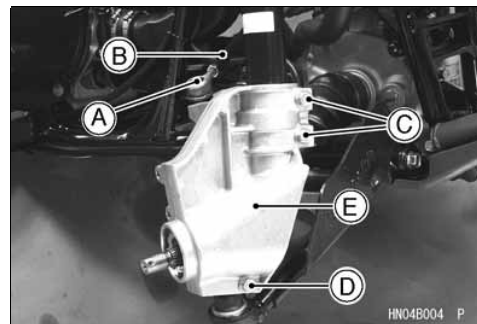
Steering Knuckle Removal

- Remove:
Front Wheel and Hub (see Wheel/Tires chapter)
Brake Caliper (see Brakes chapter)
Tie-Rod End Nut and Tie-Rod End [A]

CAUTION

Do not loosen the locknuts at the ends of the tie-rod adjusting sleeve [B], or the toe-in of the front wheels will be changed.

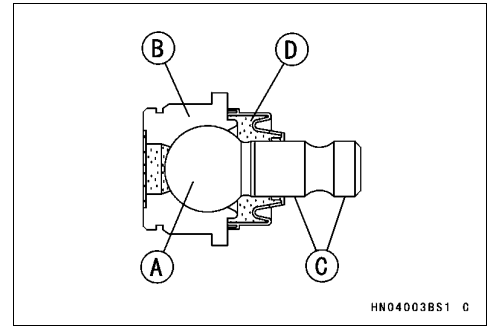
- Remove:
Front Shock Absorber Clamp Bolts [C] and Nuts
Knuckle Joint Bolt [D] and Nut
- Remove the steering knuckle [E] from the front axle and front shock absorber.



Steering

Steering Knuckle Installation

- Inspect the spherical bearing [A].
- ★ If roughness, excessive play, or seizure is found, replace the knuckle joint [B].
- Clean the shanks [C] of the knuckle joint.
- Check that the joint boot [D] is not torn, worn, deteriorated, or is leaking grease.
- Tighten:
 - Torque - **Steering Knuckle Joint Nut: 42 N·m (4.3 kgf·m, 31 ft·lb)**
 - Front Shock Absorber Clamp Nut: 42 N·m (4.3 kgf·m, 31 ft·lb)**
 - Tie-Rod End Nut: 42 N·m (4.3 kgf·m, 31 ft·lb)**

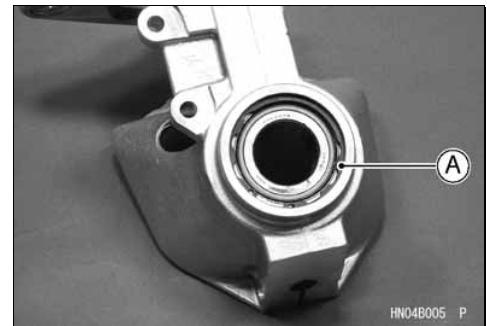


NOTE

- Tighten the two front shock absorber clamp nuts alternately two times to ensure even tightening torque.

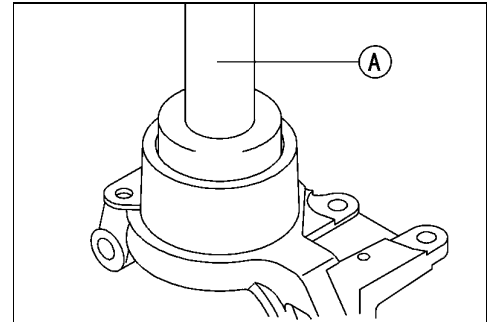
Steering Knuckle Bearing Removal

- Remove:
 - Steering Knuckle (see Steering Knuckle Removal)
 - Circlip [A]
 - Drive the bearing out using a suitable bearing driver from the bearing driver set.
- Special Tool - Inside Circlip Pliers: 57001-143**
- Special Tool - Bearing Driver Set: 57001-1129**



Steering Knuckle Bearing Installation

- The marked side of the bearing faces outward.
 - Press in the bearing until it is bottomed.
- Special Tool - Bearing Driver Set: 57001-1129 [A]**
- Replace the circlip with a new one.
- Special Tool - Inside Circlip Pliers: 57001-143**

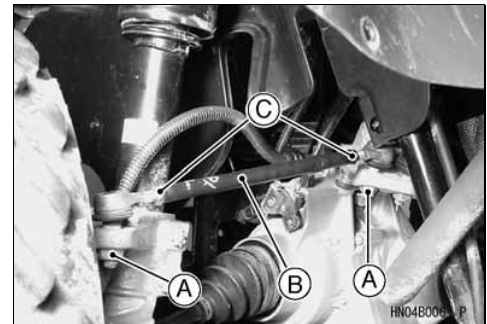


Tie-Rod Removal

- Remove:
 - Front Side Cover (see Frame chapter)
 - Cotter Pin and Tie-Rod End Nuts [A]
 - Tie-Rod [B]

CAUTION

When removing the tie-rod, be careful not to bend it. Do not loosen the locknuts [C] at the end of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.



Tie-Rod Installation

- The right and left tie-rods are identical.
- Tighten:
 - Torque - **Tie-Rod End Nuts: 42 N·m (4.3 kgf·m, 31 ft·lb)**
- Inspect the toe-in (see Wheels/Tires chapter).

14-8 STEERING

Steering

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 white locknut on the tie-rod has left-hand threads. Turn the wrench clockwise (as viewed from the joint end) for loosening.

CAUTION

Do not remove the grease seal. It is packed with grease.

Tie-Rod End Installation

- Check that the seal lip [A] is on the shank [B].

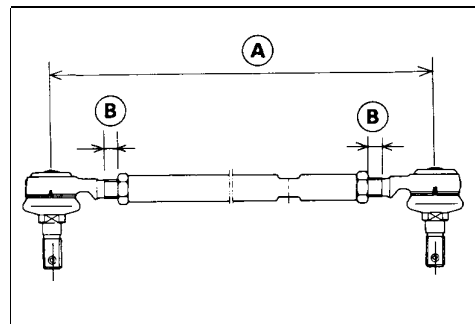
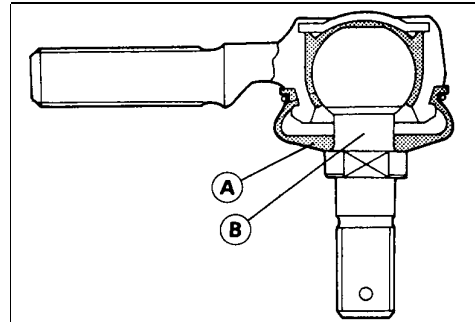
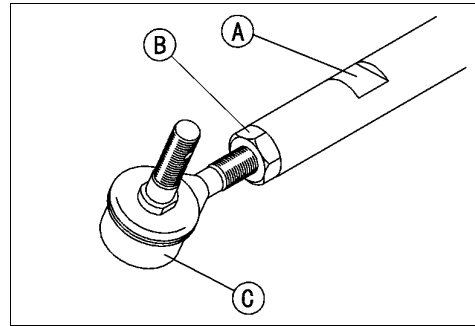
- Install the tie-rod ends so that the tie-rod has the correct length [A], and both visible thread lengths [B] are equal.

Tie-Rod Length

Standard: 315 mm (12.4 in.)

- Tighten:

Torque - Tie-Rod Adjusting Sleeve Locknuts: 27 N·m (2.8 kgf·m, 20 ft·lb)



Steering Maintenance

Steering Inspection

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

NOTE

- The cables and wires will have some effect on the steering action which must be taken into account.
- Check the steering action again.
- ★ If steering stem bearing lubrication does not remedy the problem, inspect the steering stem for straightness, steering stem clamps, and tie-rod bearings.
- ★ If you feel looseness, or if the steering rattles as it turns, check the tightness of the steering bolts and nuts.
- Tighten loose bolts and nuts to the specified torque (see Exploded View), and check the steering action again.
- ★ If the steering action does not change by tightening the bolts and nuts, inspect the steering stem clamps, steering stem bearings, tie-rod bearings, and steering knuckle joints.

Steering Stopper Inspection

- Inspect the crack or damage on the steering stopper [A].
- ★ If there is damage on it, replace the steering stem.

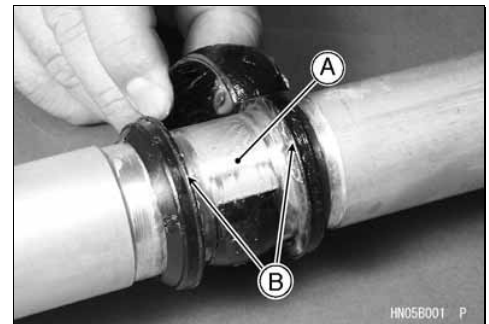


Steering Stem Straightness

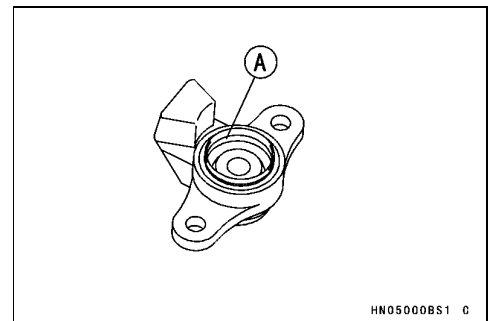
- Remove the steering stem (see Steering Stem Removal).
- Check the steering stem for straightness.
- Use a straightedge along the stem.
- ★ If the steering stem is bent, replace the steering stem.

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 Amoco Rykon Premium Grease No. 2 EP (Green) to the steering stem [A] and the inside [B] of the grease seal.



- Lubricate the steering stem bearing [A].
- Remove the steering stem bearing.
- Pack the grease seal lips with grease.

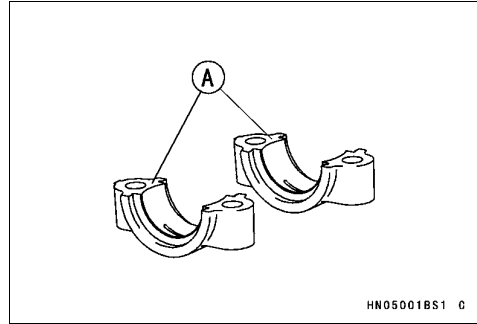


14-10 STEERING

Steering Maintenance

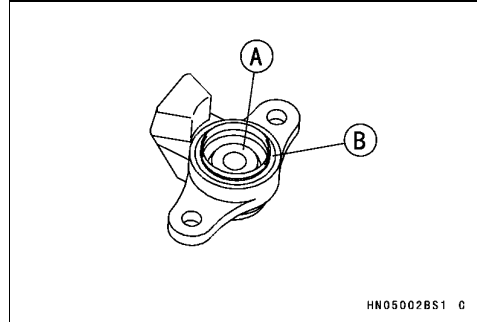
Steering Stem Clamp Inspection

- 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.

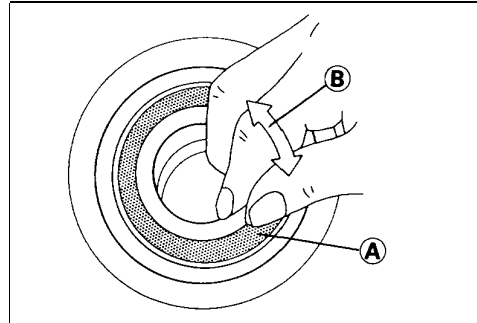


Steering Knuckle Bearing Inspection

CAUTION

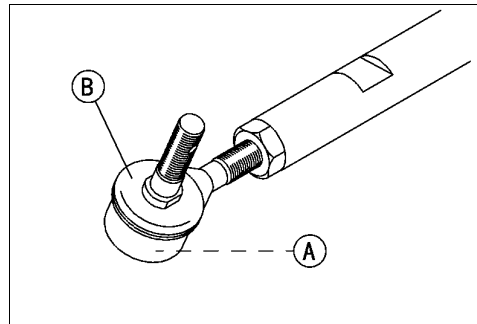
Do not remove any bearings for inspection.

- Remove the steering knuckle (see Steering Knuckle Removal).
- Examine the bearing seal [A] for tears or leakage.
- ★ If the seal is torn or is leaking, replace the bearing.
- Turn [B] the bearing back and forth while checking for roughness or binding.
- ★ If roughness or binding is found, replace the bearing.



Tie-Rod End and Steering Knuckle Joint Inspection

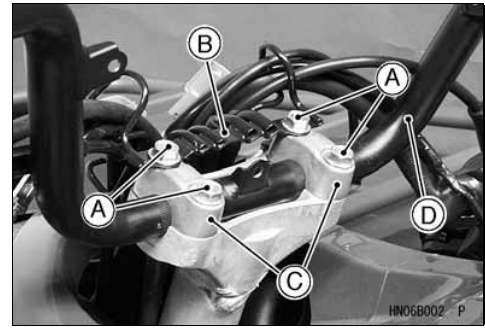
- Inspect each spherical bearing [A].
- ★ If roughness, excessive play, or seizure is found, replace the tie-rod end, or steering knuckle joint.
- Inspect each grease seal [B].
- ★ If damage, wear or deterioration is found, replace the tie-rod end, or steering knuckle joint.



Handlebar

Handlebar Removal

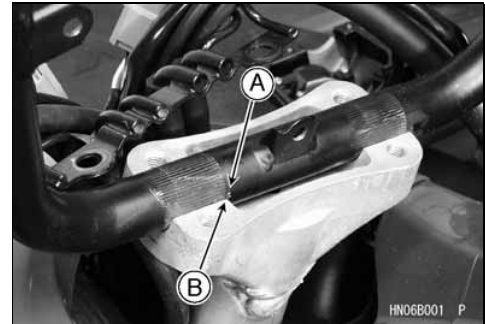
- Remove:
 - Throttle Case
 - Front Brake Master Cylinder
 - Left-hand Switch Housing
 - Rear Brake Lever Assembly
 - Handlebar Holder Bolts [A] and Bracket [B]
 - Handlebar Holders [C]
 - Handlebar [D]



Handlebar Installation

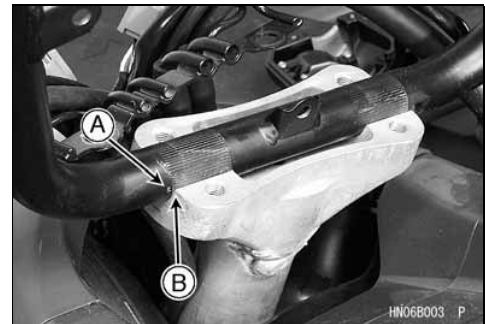
Early Model:

- Align the punch mark [A] on the handlebar with the mating surface end [B] of the steering stem.

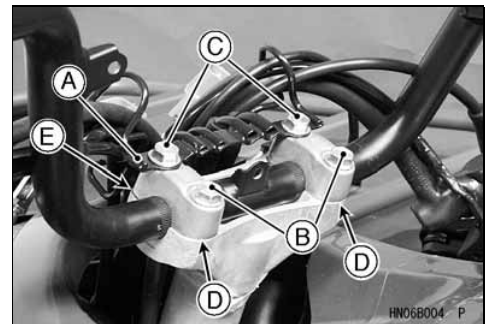


Late Model:

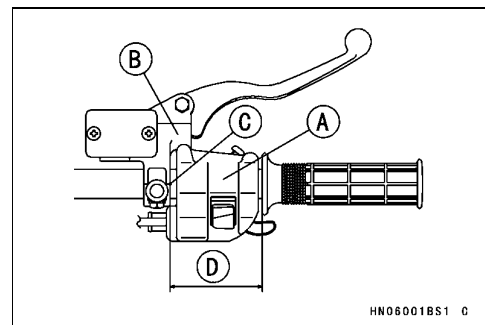
- Align the punch mark [A] on the handlebar with the mating surface end [B] of the steering stem.



- Install the bracket [A].
- Tighten the holder rear bolts [B] first and then the front bolts [C].
- Torque - Handlebar Holder Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)**
- If the holder is correctly installed, there will be no gap [D] at the rear and an even gap [E] at the front after tightening.



- Install:
 - Right Switch Housing (Throttle Case) [A]
 - Front Brake Lever (Master Cylinder) [B]
 - Punch Mark [C]
 - [D] = 70 mm (2.76 in.)

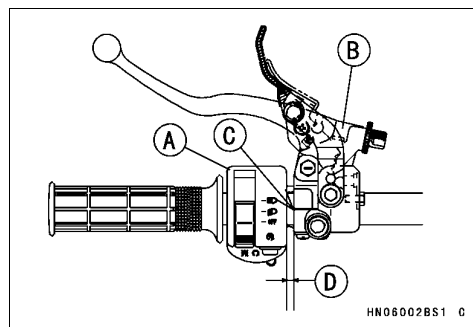


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14-12 STEERING

Handlebar

- Install:
 - Left Switch Housing [A]
 - Rear Brake Lever Assembly [B]
 - Punch Mark [C]
 - [D] = 6 mm (0.24 in.)



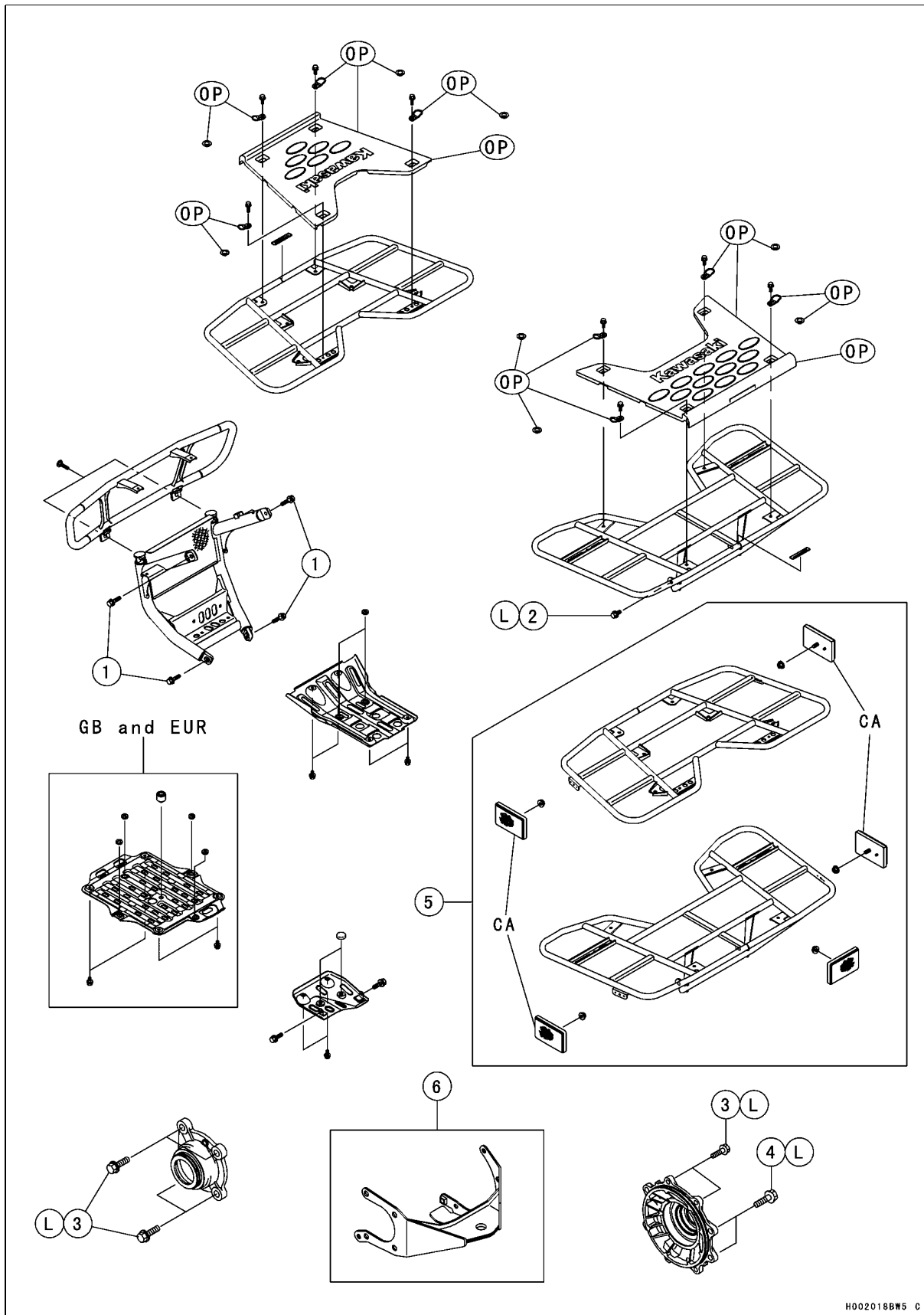
Frame

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15-2 FRAME

Exploded View



H002018BW5 C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front lower guard bolts	29	3.0	22	
2	Rear carrier lower bolts	54	5.5	40	L
3	Trailer hitch bracket bolts (M8)	24	2.45	17	L
4	Trailer hitch bracket bolts (M10)	49	5.0	36	L

5: Canada, United Kingdom and Europe models

6. Trailer hitch bracket is installed on the A1 (United Kingdom and European models only) and A2, B2 models.

L: Apply a non-permanent locking agent.

OP: Optional Parts

CA: Canada model

GB: Optional parts for United Kingdom A1 model.

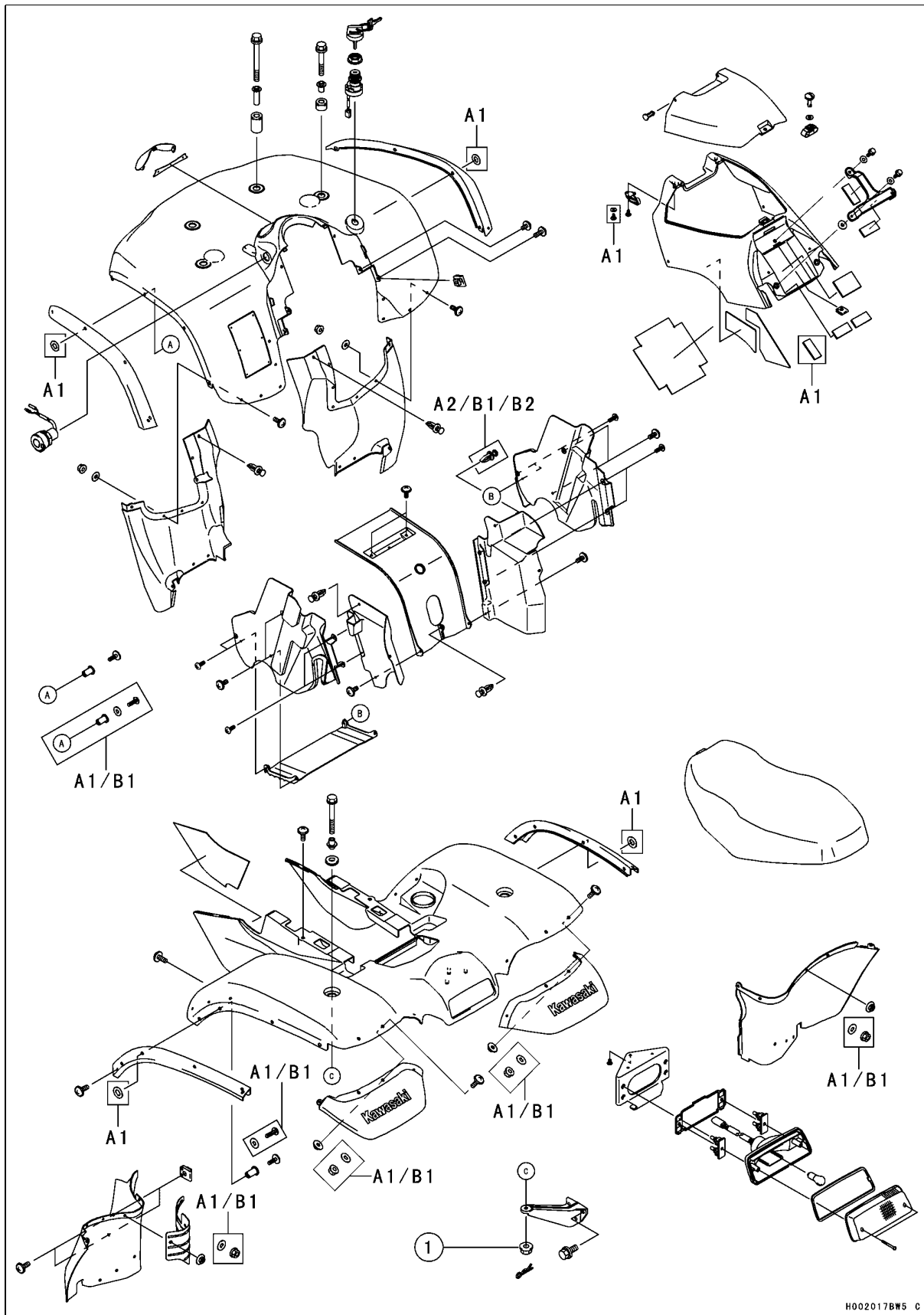
For A2 model is standard parts.

EUR: Optional parts for Europe A1 model.

For A2 model is standard parts.

15-4 FRAME

Exploded View



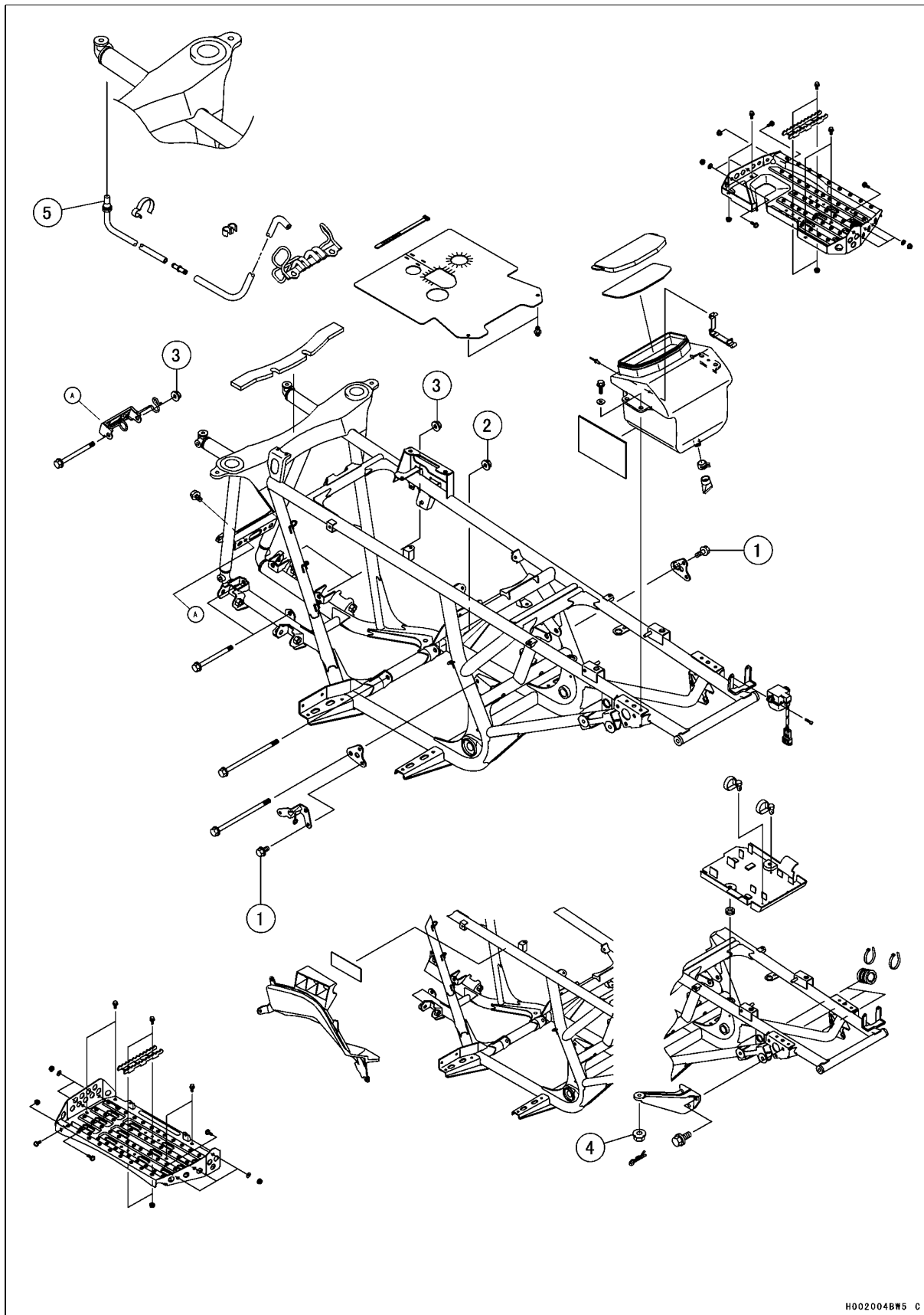
H002017BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear carrier upper bolts and nuts	37	3.8	27	

15-6 FRAME

Exploded View



H002004BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine mounting bracket bolts	23	2.3	17	
2	Engine mounting nuts	59	6.0	43	
3	Front final gear case bolts and nuts	59	6.0	43	
4	Rear carrier upper bolts and nut	37	3.8	27	

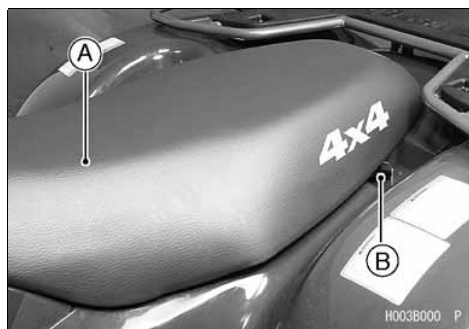
5: Insert the breather tube end into the frame hole.

15-8 FRAME

Seat

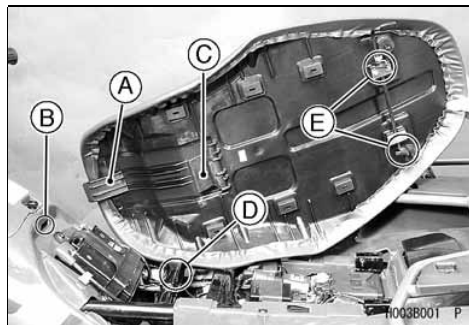
Seat Removal

- Remove the seat [A] by pulling the latch lever [B] and then pulling the seat up to the rear.



Seat Installation

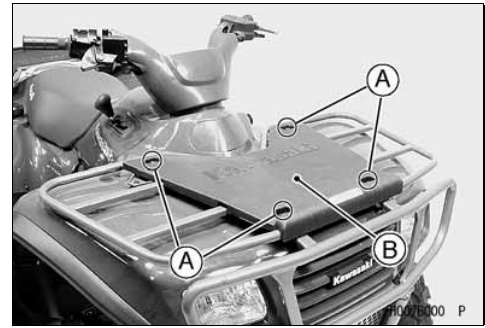
- Insert the front seat hook [A] into the hole [B] in the air cleaner cover and the center hook [C] into the receiver [D] on the frame, and slide the seat all the way forward pushing the seat end.
- Push down the rear part of the seat until the locks [E] with a click.



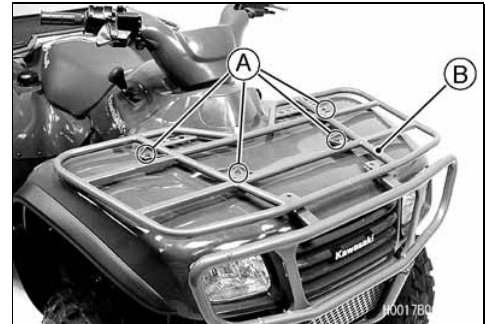
Carriers

Front Carrier Removal

- Remove:
 - Carrier Bolts [A]
 - Front Carrier Cover (optional part) [B]

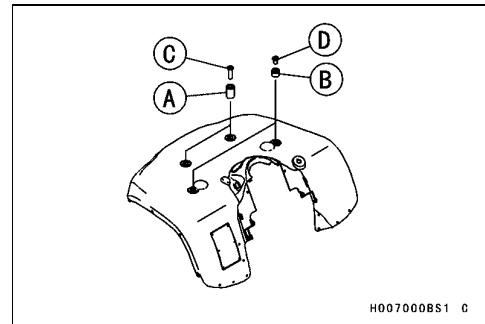


- Remove:
 - Carrier Bolts [A]
 - Collars
 - Front Carrier [B]

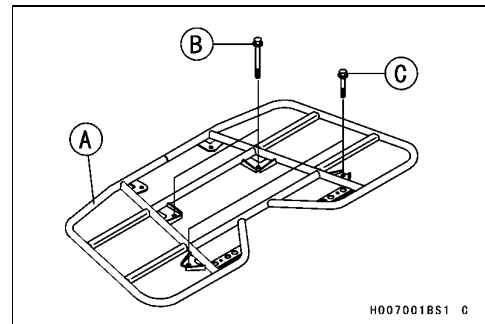


Front Carrier Installation

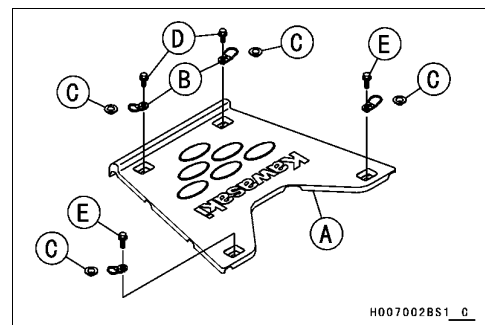
- Install:
 - Long Damper, L = 58.5 mm (2.30 in.) [A]
 - Short Damper, L = 25.5 mm (1.00 in.) [B]
 - Long Collar, L = 65 mm (2.56 in.) [C]
 - Short Collar, L = 33.7 mm (1.33 in.) [D]



- Install:
 - Front Carrier [A]
 - Carrier Bolts, L = 80 mm (3.15 in.) [B]
 - Carrier Bolts, L = 50 mm (1.97 in.) [C]



- Install:
 - Front Carrier Cover (optional part) [A]
 - Hooks [B] or Collars [C] (optional parts)
 - Carrier Bolts, L = 20 mm (0.79 in.) [D]
 - Carrier Bolts, L = 25 mm (0.98 in.) [E]

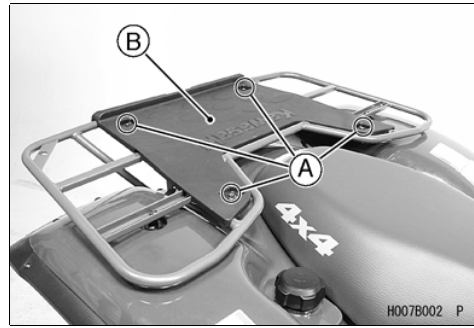


15-10 FRAME

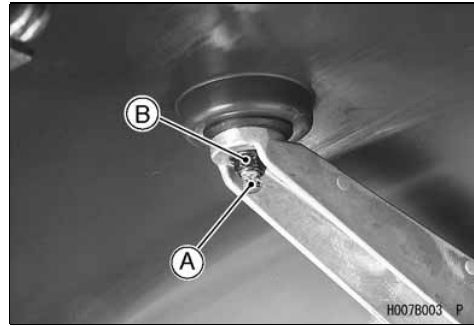
Carriers

Rear Carrier Removal

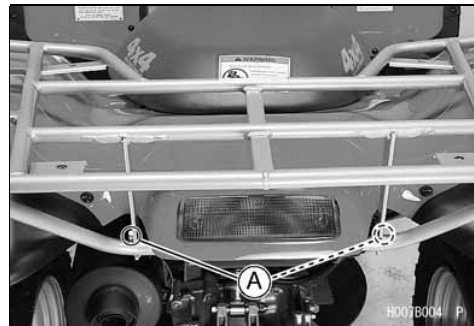
- Remove:
 - Carrier Bolts [A]
 - Hooks or Collars (optional parts)
 - Rear Carrier Cover (optional part) [B]



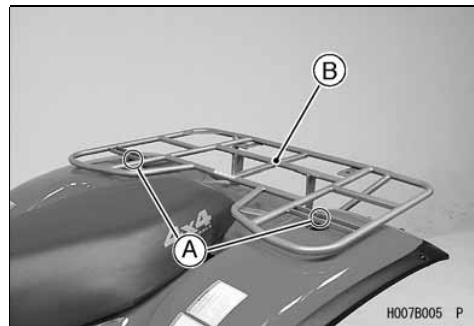
- Remove:
 - Snap Pins [A] (both sides)
 - Nuts [B] (both sides)



- Remove:
 - Rear Carrier Lower Bolts [A]

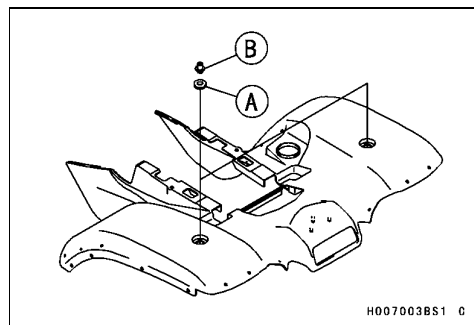


- Remove:
 - Rear Carrier Upper Bolts [A]
 - Rear Carrier [B]



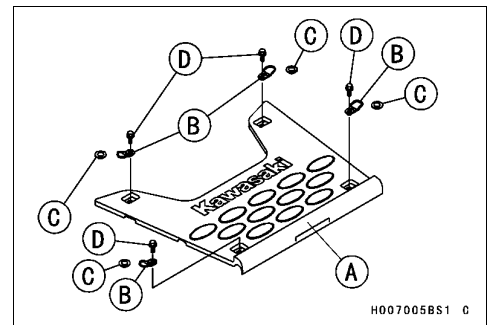
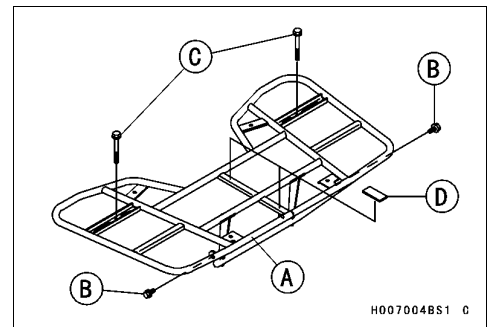
Rear Carrier Installation

- Install:
 - Damper [A]
 - Collar [B]



Carriers

- Install:
 - Rear Carrier [A]
- Apply a non-permanent locking agent:
 - Rear Carrier Lower Bolts [B]
- Tighten:
 - Torque - Rear Carrier Upper Bolts and Nuts [C]: 37 N·m (3.8 kgf·m, 27 ft·lb)**
 - Rear Carrier Lower Bolts: 54 N·m (5.5 kgf·m, 40 ft·lb)**
- Install:
 - Snap Pins
- Confirm:
 - Dampers [D] (optional parts)
- Install:
 - Rear Carrier Cover [A] (optional part)
 - Hooks [B] or Collars [C] (optional parts)
 - Carrier Bolts [D]

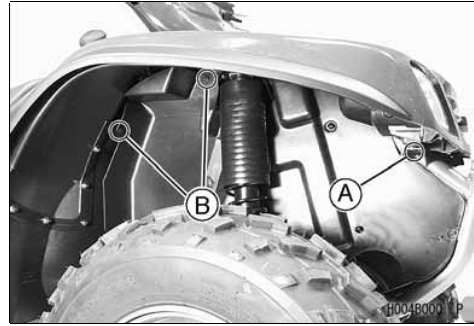


15-12 FRAME

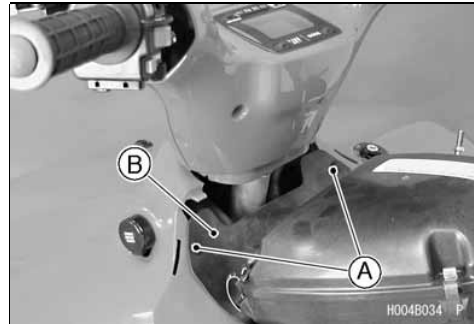
Fenders

Front Fender Removal

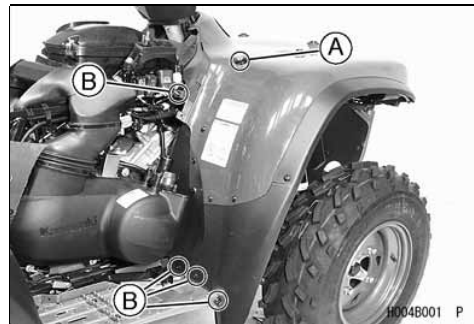
- Remove:
 - Seat (see Seat Removal)
 - Air Cleaner Cover (see Air Cleaner Cover Removal)
 - Front Carrier (see Front Carrier Removal)
 - Headlight Mounting Screws [A]
 - Quick Rivets [B]



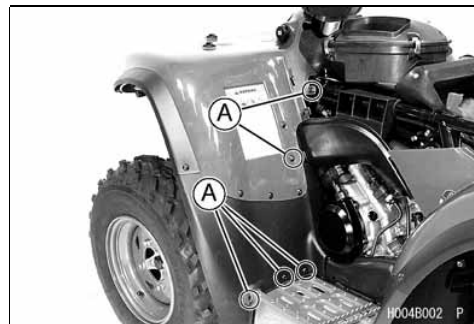
- Remove:
 - Quick Rivets [A]
 - Rubber Cover [B]



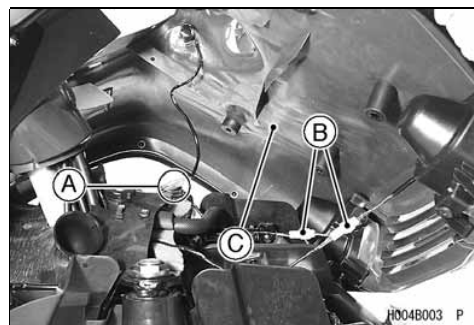
- Remove:
 - Ignition Switch Nut [A]
 - Screws [B]



- Remove:
 - Screws [A]



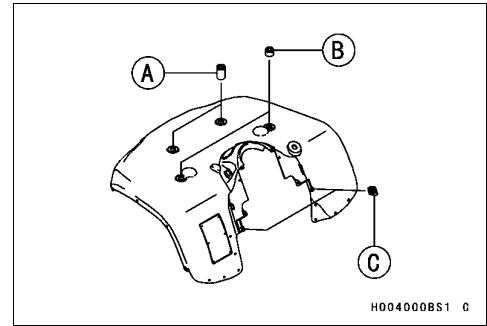
- Disconnect:
 - Power Outlet Connector Wires [A]
 - Headlight Wire Connectors [B]
- Remove:
 - Front Fender [C]



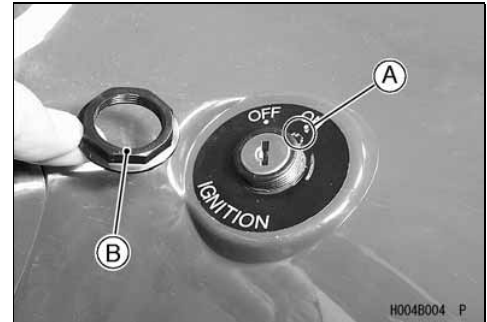
Fenders

Front Fender Installation

- Connect:
 - Power Outlet Connector Wires
 - Headlight Wire Connectors
- Install:
 - Long Damper, L = 58.5 mm (2.30 in.) [A]
 - Short Damper, L = 25.5 mm (1.00 in.) [B]
 - Clamp Nuts [C]

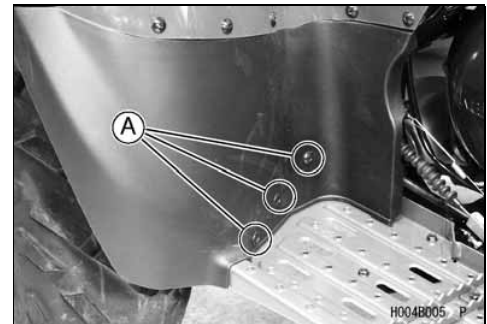


- Fit the projection [A] on the ignition switch into the recess in the front fender.
- Tighten the nut [B] securely.
- Install:
 - Front Carrier (see Front Carrier Installation)

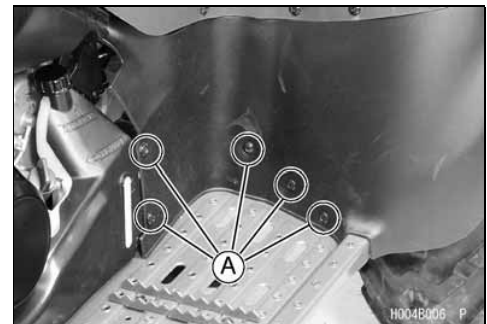


Rear Fender Removal

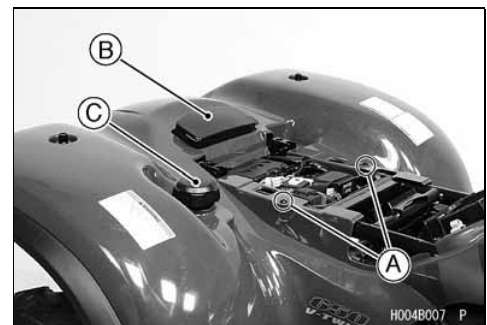
- Remove:
 - Seat (see Seat Removal)
 - Rear Carrier (see Rear Carrier Removal)
 - Rear Right Flap Screws [A]



- Remove:
 - Rear Left Flap Screws [A]



- Remove:
 - Screws [A]
 - Storage Case Lid [B]
 - Fuel Tank Cap [C]



15-14 FRAME

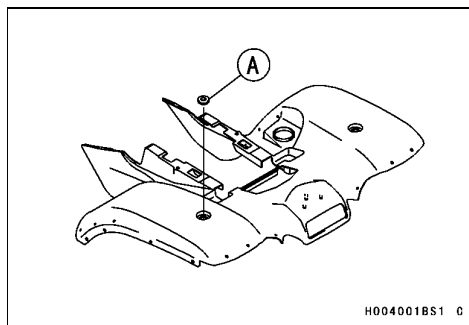
Fenders

- Disconnect:
 - Tail/Brake Light Wire Connector [A]
- Remove:
 - Rear Fender [B]
- Install the fuel tank cap after removing the rear fender.



Rear Fender Installation

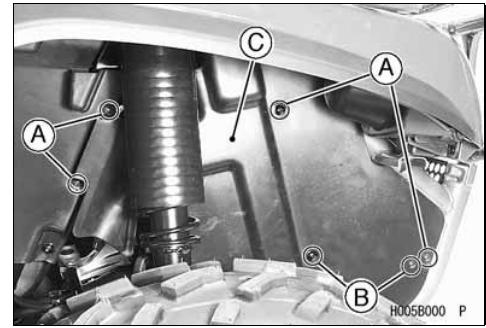
- Connect:
 - Tail/Brake Light Wire Connector
- Install:
 - Dampers [A]
 - Rear Carrier (see Rear Carrier Installation)
- Tighten:
 - Torque - Rear Carrier Upper Bolts and Nuts: 37 N·m (3.8 kgf·m, 27 ft·lb)



Covers

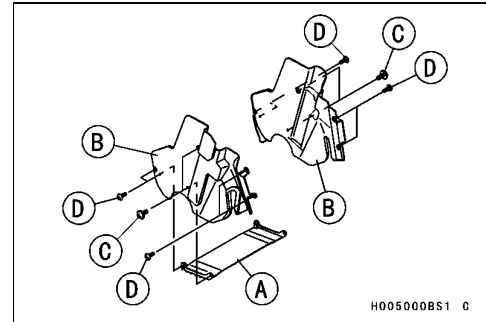
Inner Cover Front and Front Lower Shroud Removal

- Remove:
 - Screws [A]
 - Front Lower Shroud Screws [B]
 - Inner Cover Front [C]
 - Front Lower Shroud



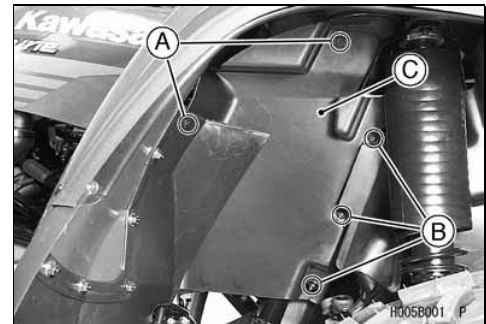
Inner Cover Front and Front Lower Shroud Installation

- Install:
 - Front Lower Shroud [A]
 - Inner Cover Front [B]
 - Screws [C]
 - Tapping Screws [D]



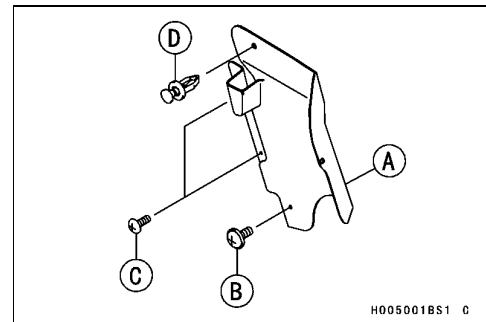
Inner Cover Rear Removal

- Remove:
 - Quick Rivets [A]
 - Screws [B]
 - Inner Cover Rear [C]



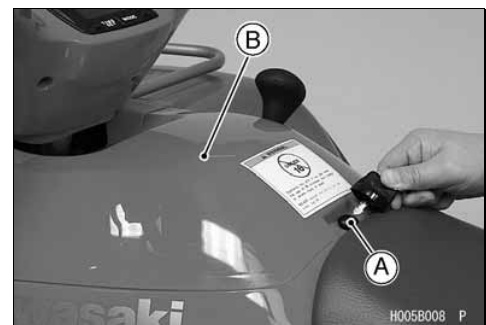
Inner Cover Rear Installation

- Install:
 - Inner Cover Rear [A]
 - Screws [B]
 - Tapping Screws [C]
 - Quick Rivets [D]



Air Cleaner Upper Cover Removal

- Turn the knob [A] with the ignition key and pull the air cleaner upper cover [B] rearward, and remove the cover.

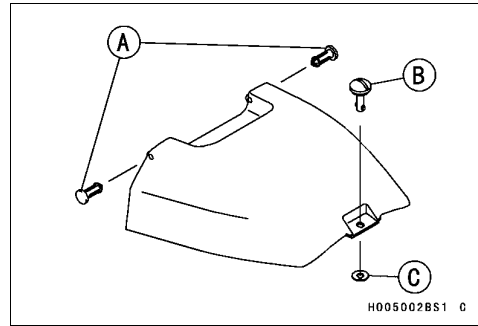


15-16 FRAME

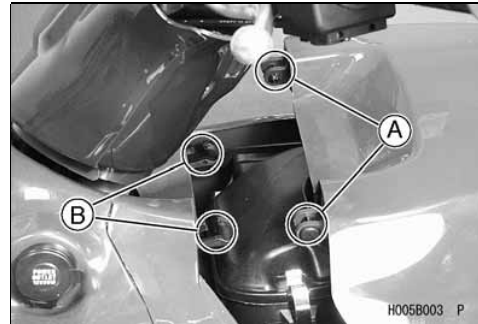
Covers

Air Cleaner Upper Cover Installation

- Confirm:
 - Hinge Pins [A]
 - Knob [B]
 - Washer [C]



- Insert the hinge pins [A] in the hinges [B], and install the air cleaner upper cover.
- Turn the knob with the ignition key to lock it.



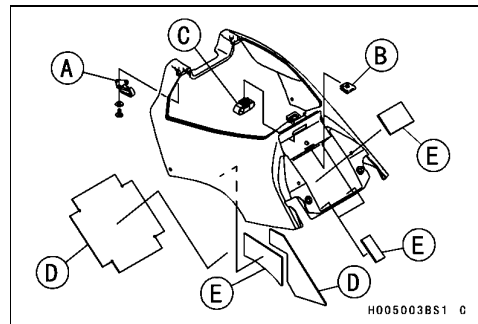
Air Cleaner Cover Removal

- Remove:
 - Seat (see Seat Removal)
 - Battery (see Electrical System chapter)
 - Shift Lever Knob [A]
 - Screws [B] (both sides)
 - Air Cleaner Cover [C]



Air Cleaner Cover Installation

- Confirm:
 - Hinge [A], Washer and Tapping Screw
 - Clamp Screw [B]
 - Latch [C]
 - Mats [D]
 - Dampers [E]



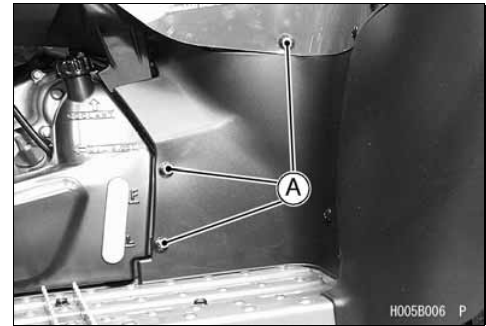
- Inset the tabs [A] of the cover into the recesses.



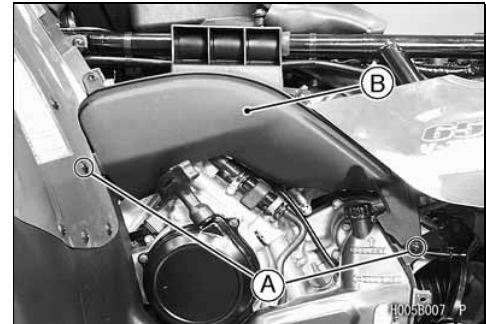
Covers

Left Side Cover Removal

- Remove:
 - Air Cleaner Cover (see Air Cleaner Cover Removal)
 - Rear Left Flap Screws [A]

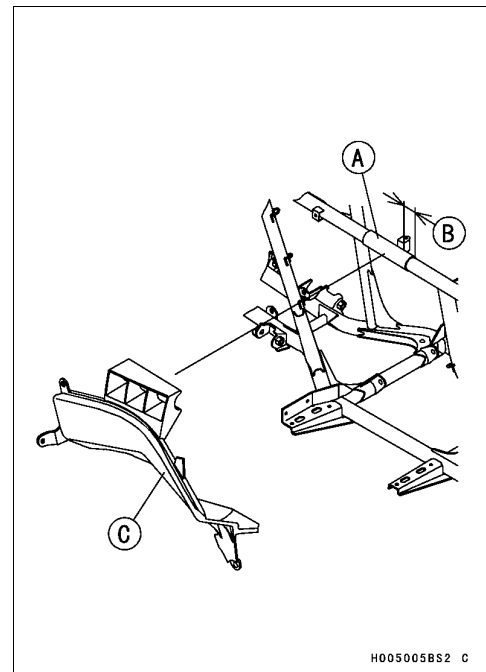


- Remove:
 - Screws [A]
 - Left Side Cover [B]



Left Side Cover Installation

- Confirm:
 - Damper [A]
 - [B] = 25 ~ 35 mm (0.98 ~ 1.38 in.)
- Install:
 - Left Side Cover [C]



15-18 FRAME

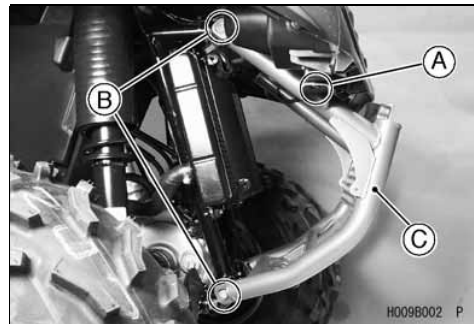
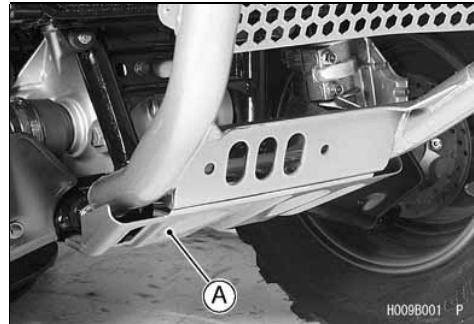
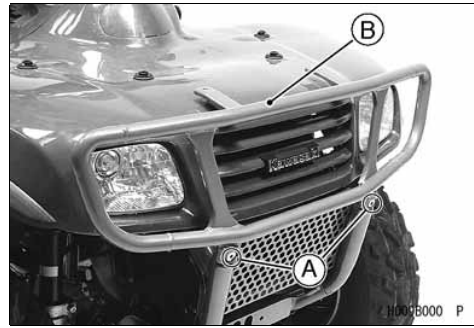
Guards

Front Guard Removal

- Remove:
 - Front Carrier (see Front Carrier Removal)
 - Front Upper Guard Bolts [A]
 - Front Upper Guard [B]

- Remove:
 - Inner Cover Front (see Inner Cover Front Removal)
 - Front Bottom Guard Bolts (four)
 - Front Bottom Guard [A]

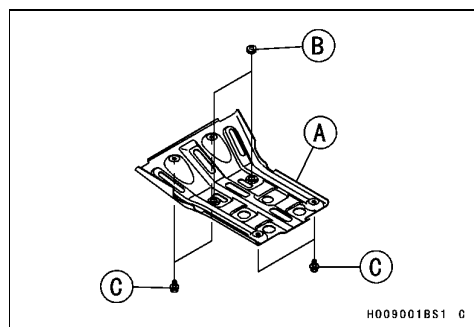
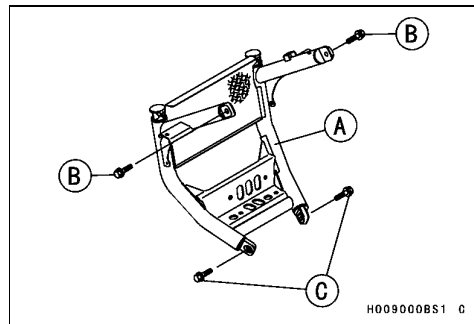
- Remove:
 - Headlight Mounting Screws [A]
 - Front Lower Guard Bolts [B]
 - Front Lower Guard [C]



Front Guards Installation

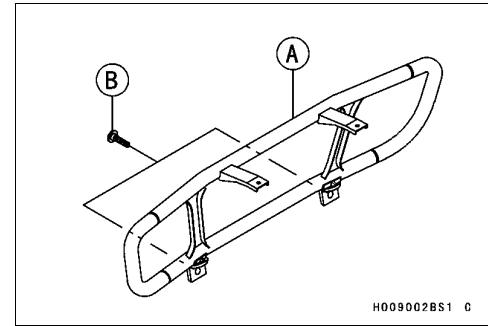
- Install:
 - Front Lower Guard [A]
 - Front Lower Guard Bolts (yellow) [B]
 - Front Lower Guard Bolts (white) [C]
- Torque - Front Lower Guard Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)**
- Install:
 - Headlight Mounting Screws

- Install:
 - Front Bottom Guard [A]
 - Dampers [B]
 - Front Bottom Guard Bolts [C]



Guards

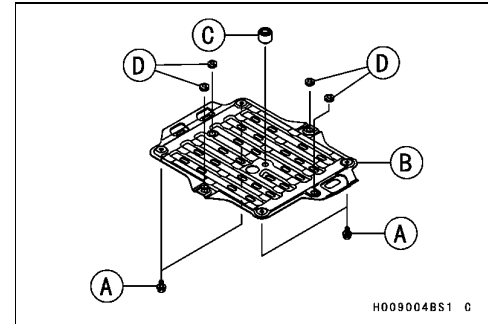
- Install:
 - Front Upper Guard [A]
 - Front Upper Guard Bolts [B]



Engine Bottom Guard Removal

NOTE

- The guard is an optional part for European A1 model, and a standard part for other models.
- Remove:
 - Bolts [A]
 - Engine Bottom Guard [B]



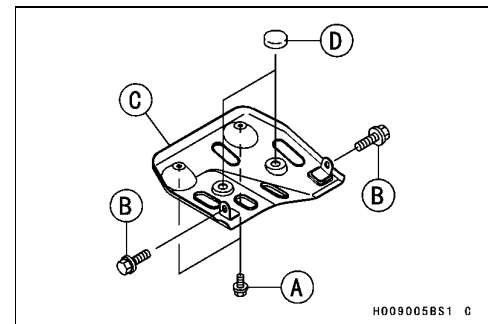
Engine Bottom Guard Installation

NOTE

- The guard is an optional part for European A1 model, and a standard part for other models.
- Confirm:
 - Damper [C] (for Engine)
 - Dampers [D] (for Frame)
- Install:
 - Engine Bottom Guard
 - Bolts

Rear Bottom Guard Removal

- Remove:
 - Bolts (M6) [A]
 - Bolts (M8) [B]
 - Rear Bottom Guard [C]



Rear Bottom Guard Installation

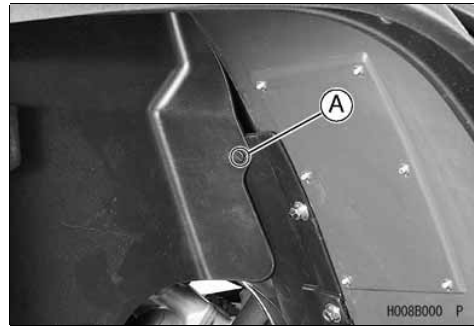
- Confirm:
 - Dampers [D]
- Install:
 - Rear Bottom Guards
 - Bolts (M8)
 - Bolts (M6)

15-20 FRAME

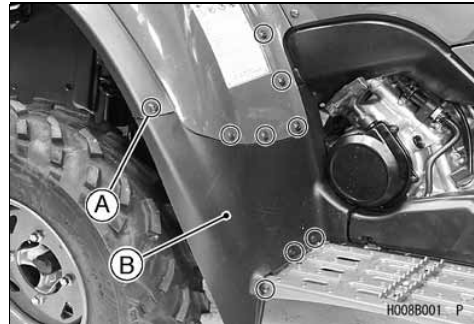
Flaps and Footboards

Front Flap Removal

- Remove:
Quick Rivet [A]



- Remove:
Screws [A], Washers, and Nuts
Front Flap [B]

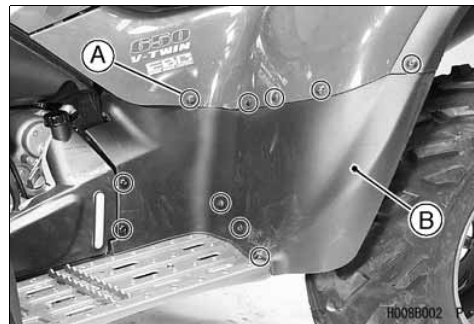


Front Flap Installation

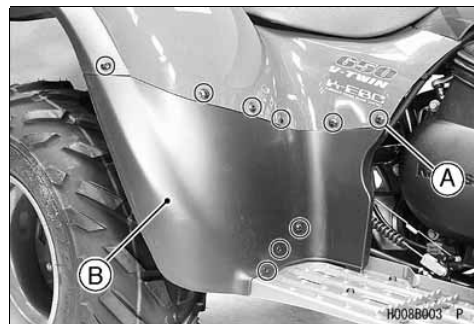
- Installation is the reverse of removal.

Rear Flap Removal

- Remove:
Screws [A], Washers, and Nuts
Heat Guard Plate
Rear Left Flap [B]



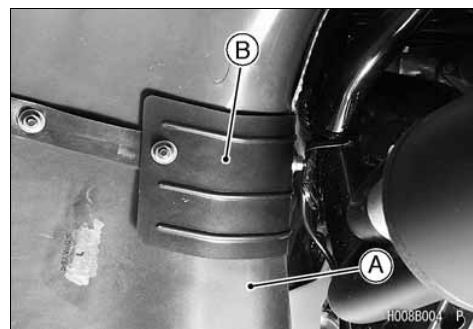
- Remove:
Screws [A], Washers, and Nuts
Rear Right Flap [B]



Flaps and Footboards

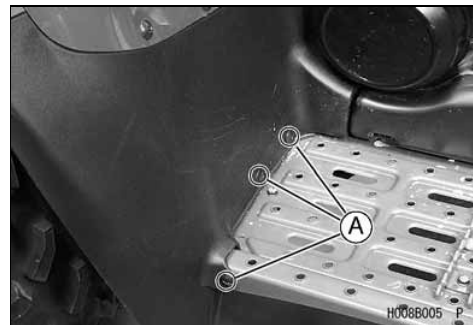
Rear Flap Installation

- Install:
 - Rear Left Flap [A]
 - Heat Guard Plate [B]
 - Screws, Washers, and Nuts

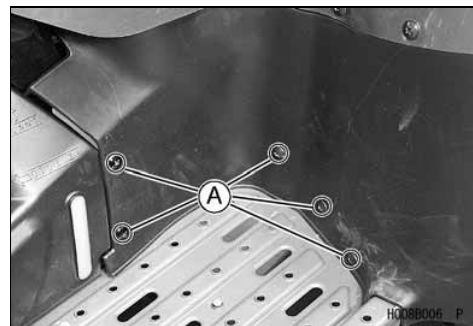


Footboard Removal

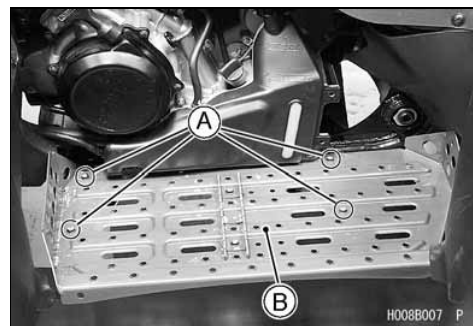
- Remove:
 - Screws [A], Washers, and Nuts



- Remove:
 - Screws [A], Washers, and Nuts

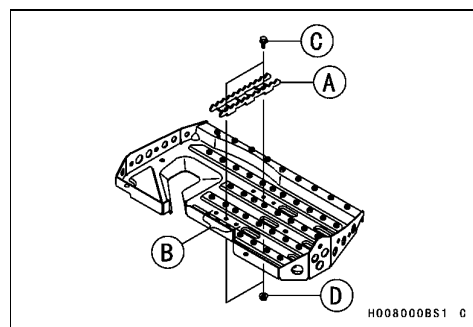


- Remove:
 - Bolts [A]
 - Footboard [B]



Footboard Installation

- Confirm:
 - Footrest [A]
 - Center Holes of Three Holes [B] (both side)
 - Bolts [C] and Nuts [D]
- Install:
 - Footboard
 - Bolts
 - Screws, Washers, and Nuts

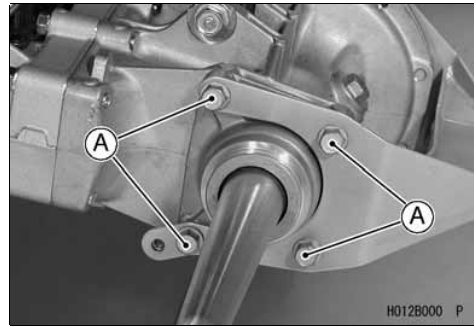


15-22 FRAME

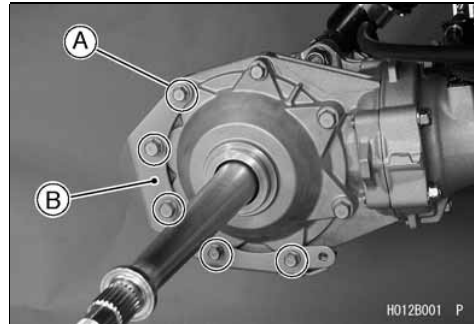
Trailer Hitch Bracket

Trailer Hitch Bracket Removal

- Drain:
 - Rear Final Gear case Oil (see Rear Final Gear Case Oil Change section in Final Drive chapter)
- Remove:
 - Rear Bottom Guard (see Rear Bottom Guard Removal)
 - Trailer Hitch Bracket Bolts (M8) [A]

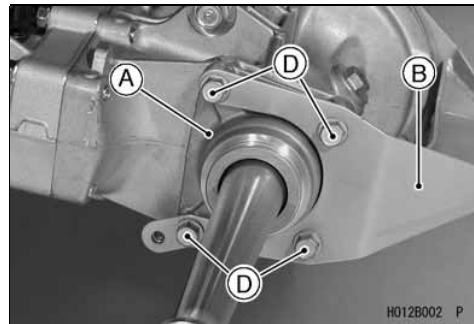


- Remove:
 - Trailer Hitch Bracket Bolts [A]
 - Trailer Hitch Bracket [B]

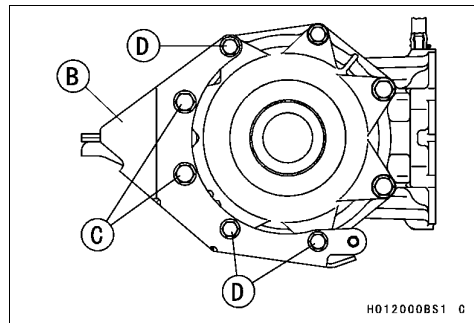


Trailer Hitch Bracket Installation

- Install:
 - Rear Final Gear Case Left Cover [A] (see Rear Axle Installation section in Final Drive chapter)
 - Trailer Hitch Bracket [B]
- Apply a non-permanent locking agent to the trailer hitch bracket bolts.
- Tighten:
 - Torque - Trailer Hitch Bracket Bolts (M10) [C]: 49 N·m (5.0 kgf·m, 36 ft·lb)
 - Trailer Hitch Bracket Bolts (M8) [D]: 24 N·m (2.4 kgf·m, 17 ft·lb)



- Install:
 - Rear Bottom Guard (see Rear Bottom Guard Installation)
- Fill the final gear case up to the bottom of filler opening with the specified oil (see Rear Final Gear Case Oil Change section in Final Drive chapter).



Electrical System

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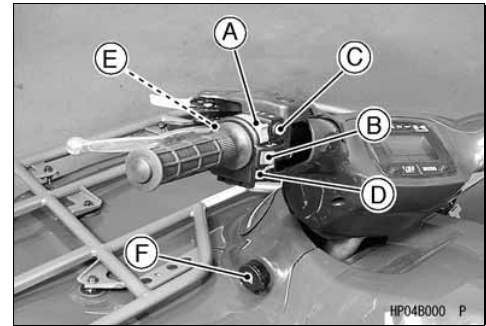
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16-2 ELECTRICAL SYSTEM

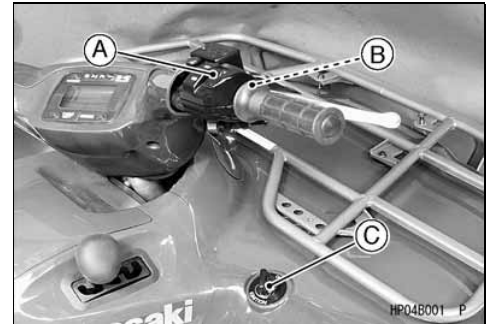
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Parts Location

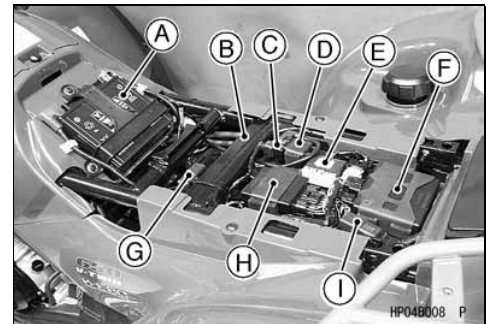
Light/Dimmer Switch [A]
 Engine Stop Switch [B]
 Starter Button [C]
 Reverse Power Assist Switch (Override) [D]
 Rear Brake Light Switch [E]
 Power Outlet Connector [F]



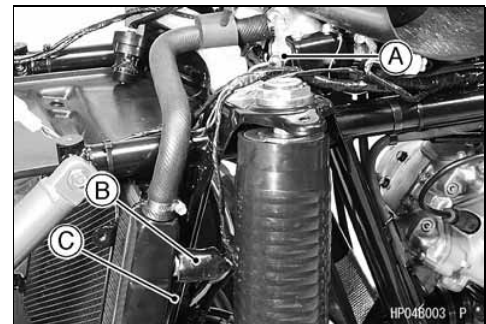
2WD/4WD Shift Switch [A]
 Front Brake Light Switch [B]
 Ignition Switch [C]



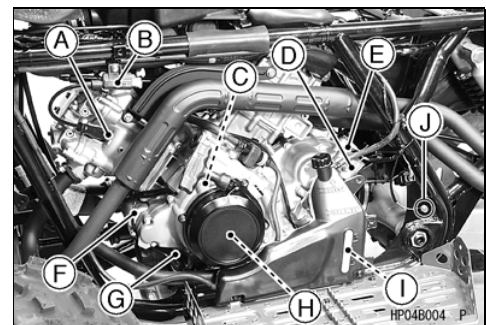
Battery [A]
 Fuel Pump, Fuel Level Sensor [B] (in fuel tank)
 Main Fuse 30 A [C]
 Starter Relay [D]
 Fuse Assembly [E]
 Igniter [F]
 Starter Circuit Relay (Brake) [G]
 Actuator Controller [H]
 Starter Circuit Relay (Neutral) [I]



Water Temperature Switch [A]
 Radiator Fan Switch [B]
 Radiator Fan [C]



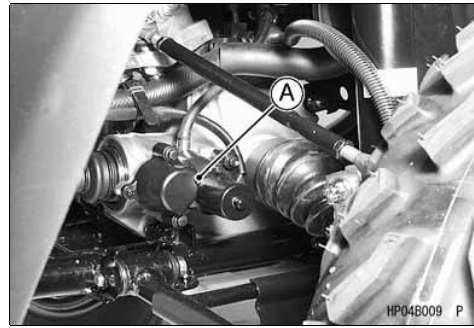
Spark Plug [A]
 Ignition Coil [B]
 Pickup Coil [C]
 Reverse Position Switch [D]
 Neutral Position Switch [E]
 Starter Motor [F]
 Oil Pressure Warning Light Switch [G]
 Alternator [H]
 Forward/Reverse Detecting Sensor [I]
 Ground Wire (Frame) [J]



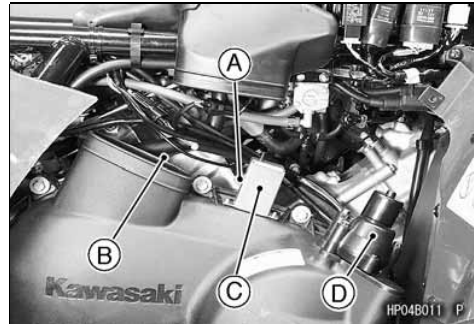
16-4 ELECTRICAL SYSTEM

Parts Location

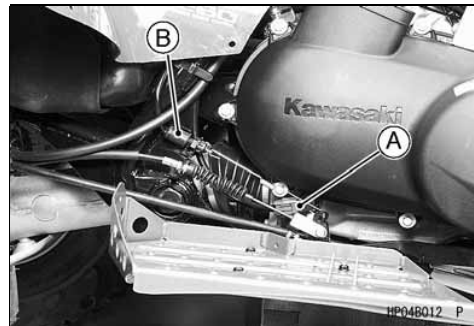
2WD/4WD Actuator [A]



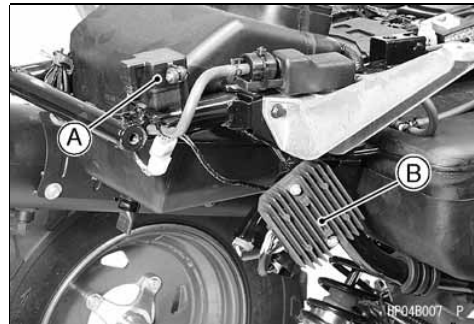
Ground Wire (Engine) [A]
Spark Plug [B]
Drive Belt Failure Detection Switch [C]
Engine Brake Actuator [D]



Speed Sensor [A]
Rear Brake Light Switch [B]

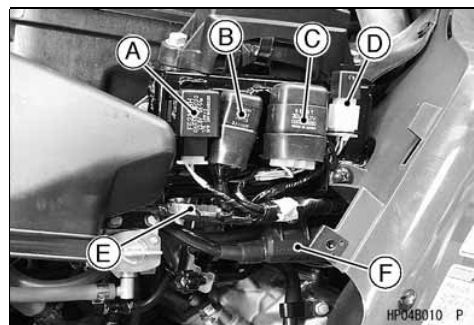


Vehicle Down Sensor [A]
Regulator/Rectifier [B]



(KVF650-A1/B1 models)

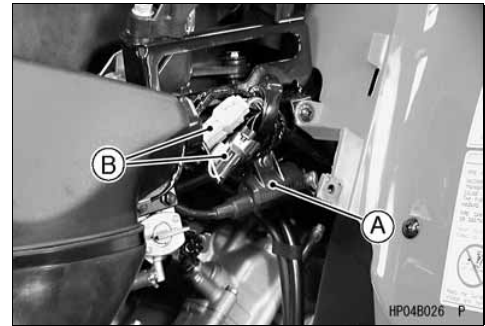
Flashing Relay [A]
System Circuit Relay [B]
Switch Circuit Relay [C]
Diode Assembly [D]
Diode (in harness) [E]
Ignition Coil [F]



Parts Location

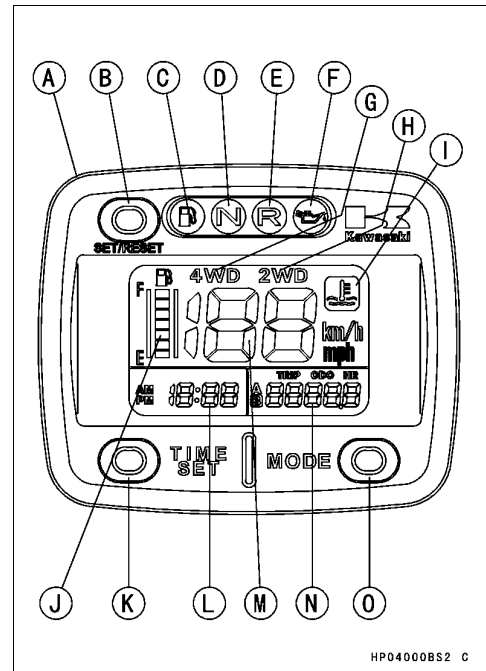
(KVF650–A2/B2 models)

- Ignition Coil [A]
- Reset Connectors [B]



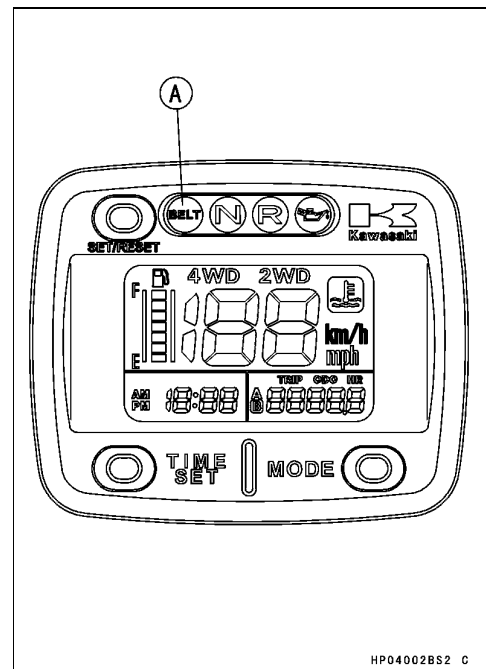
(KVF650–A1/B1 models)

- Multifunction Meter [A]
- “SET/RESET” Button [B]
- Fuel 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]
- Coolant Temperature Warning Symbol [I]
- Fuel Level Gauge [J]
- “TIME SET” Button [K]
- Clock [L]
- Speedometer [M]
- Trip Meter/Odometer/Hour Meter [N]
- “MODE” Button [O]



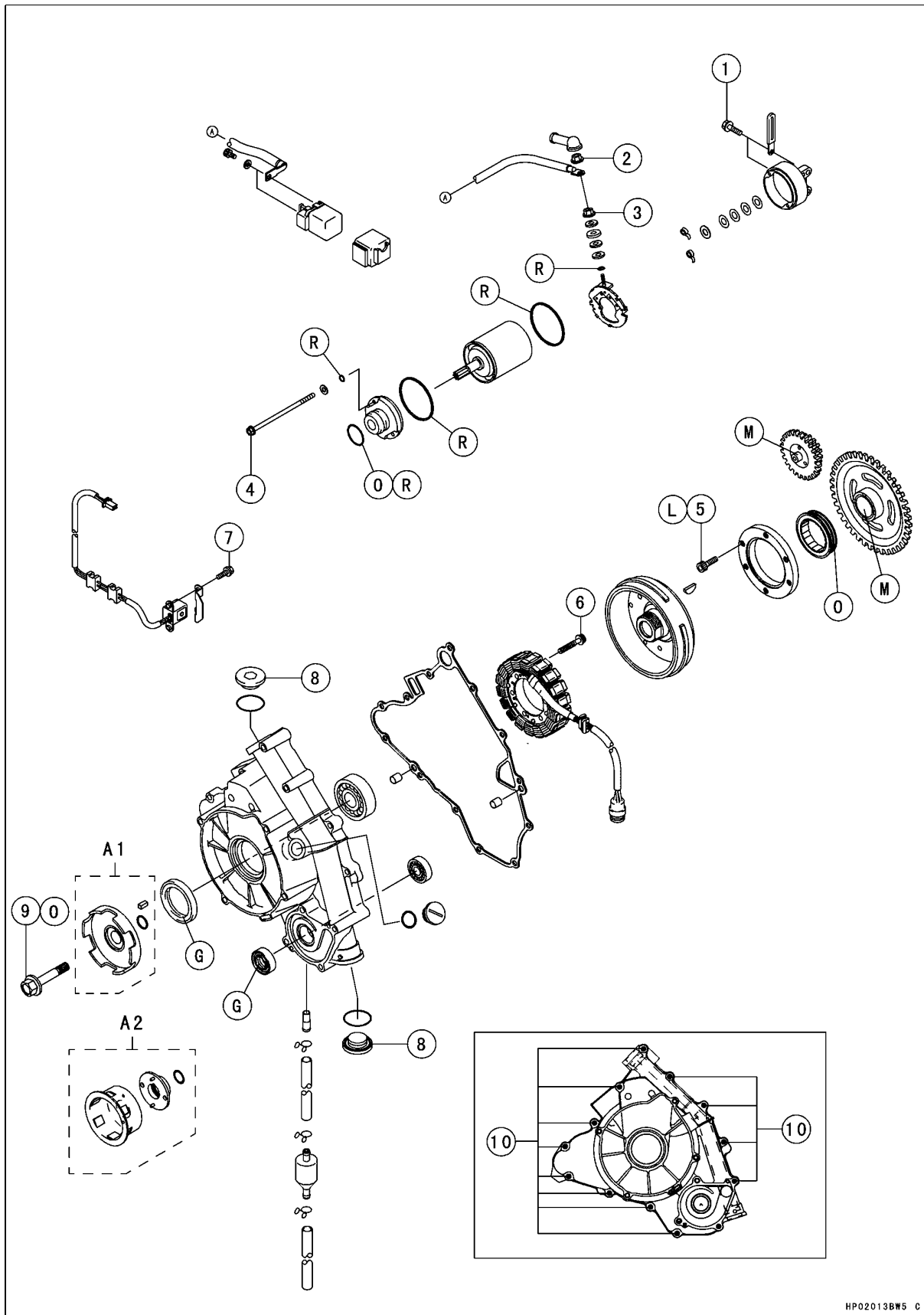
(KVF650–A2/B2 models)

- Belt Check Indicator Light [A]



16-6 ELECTRICAL SYSTEM

Exploded View



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ELECTRICAL SYSTEM 16-7

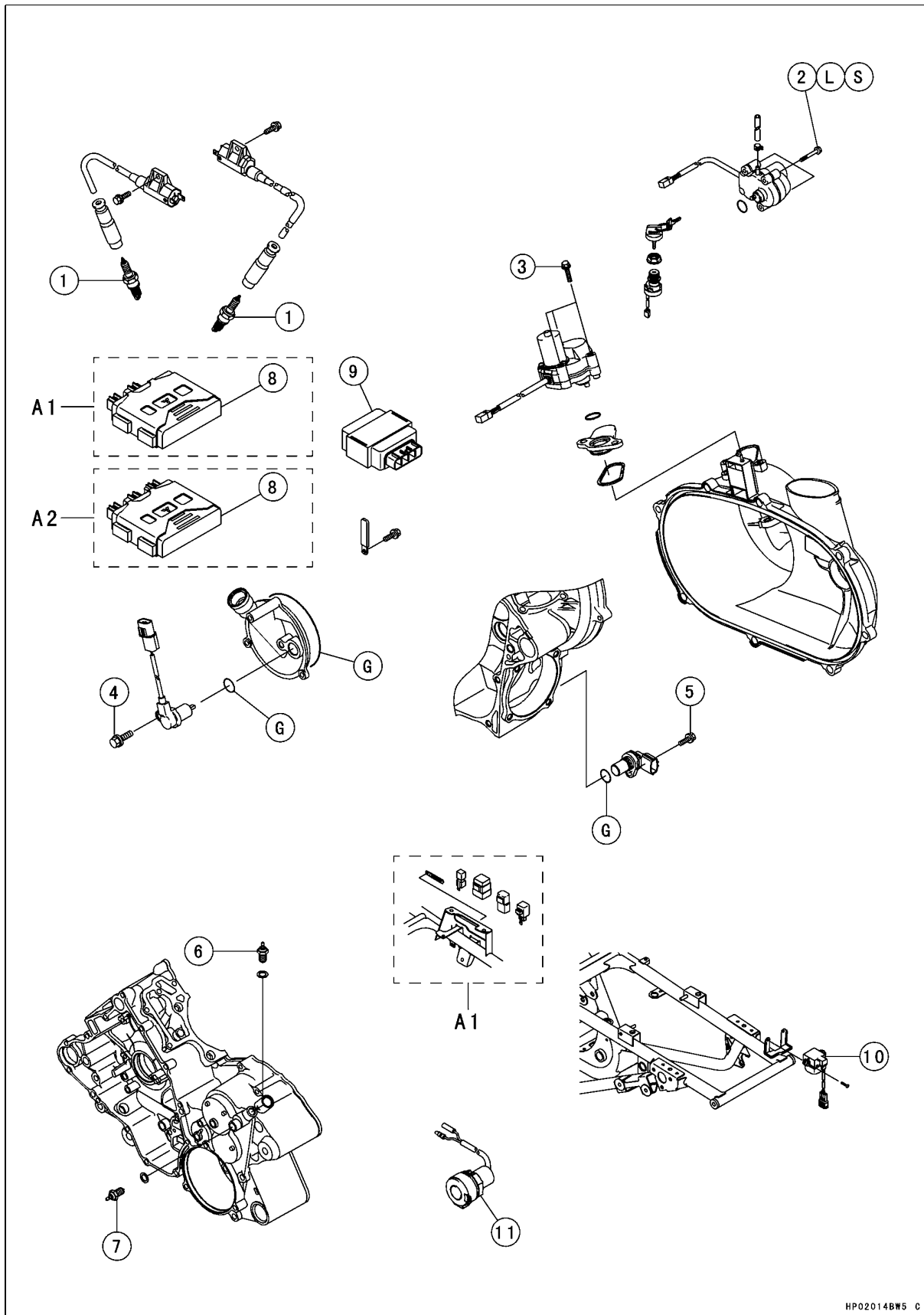
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter motor mounting bolts	8.8	0.9	78 in·lb	
2	Starter motor terminal nut	4.9	0.5	43 in·lb	
3	Starter motor terminal locknut	6.9	0.7	61 in·lb	
4	Starter motor bolts	3.9	0.4	35 in·lb	
5	Starter motor clutch bolts	34	3.5	25	L
6	Alternator stator bolts	13	1.3	113 in·lb	
7	Pickup coil mounting bolts	5.9	0.6	52 in·lb	
8	Alternator cover plugs	18	1.8	13	
9	Alternator rotor bolt	127	13	94	O
10	Alternator cover bolts	8.8	0.9	78 in·lb	

- G: Apply grease for oil seal and O-ring.
- L: Apply a non-permanent locking agent.
- M: Apply molybdenum disulfide grease.
- O: Apply engine oil.
- R: Replacement Parts
- A1: KVF650–A1/B1 models
- A2: KVF650–A2/B2 models

16-8 ELECTRICAL SYSTEM

Exploded View



ELECTRICAL SYSTEM 16-9

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Spark plugs	13	1.3	113 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	0.9	78 in·lb	
4	Forward/Reverse detecting sensor mounting bolt	15	1.5	11	
5	Speed sensor mounting bolt	8.8	0.9	78 in·lb	
6	Neutral position switch	15	1.5	11	
7	Reverse position switch	15	1.5	11	

8. Igniter

9. Actuator Controller

10. Vehicle Down Sensor

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

L: Apply a non-permanent locking agent.

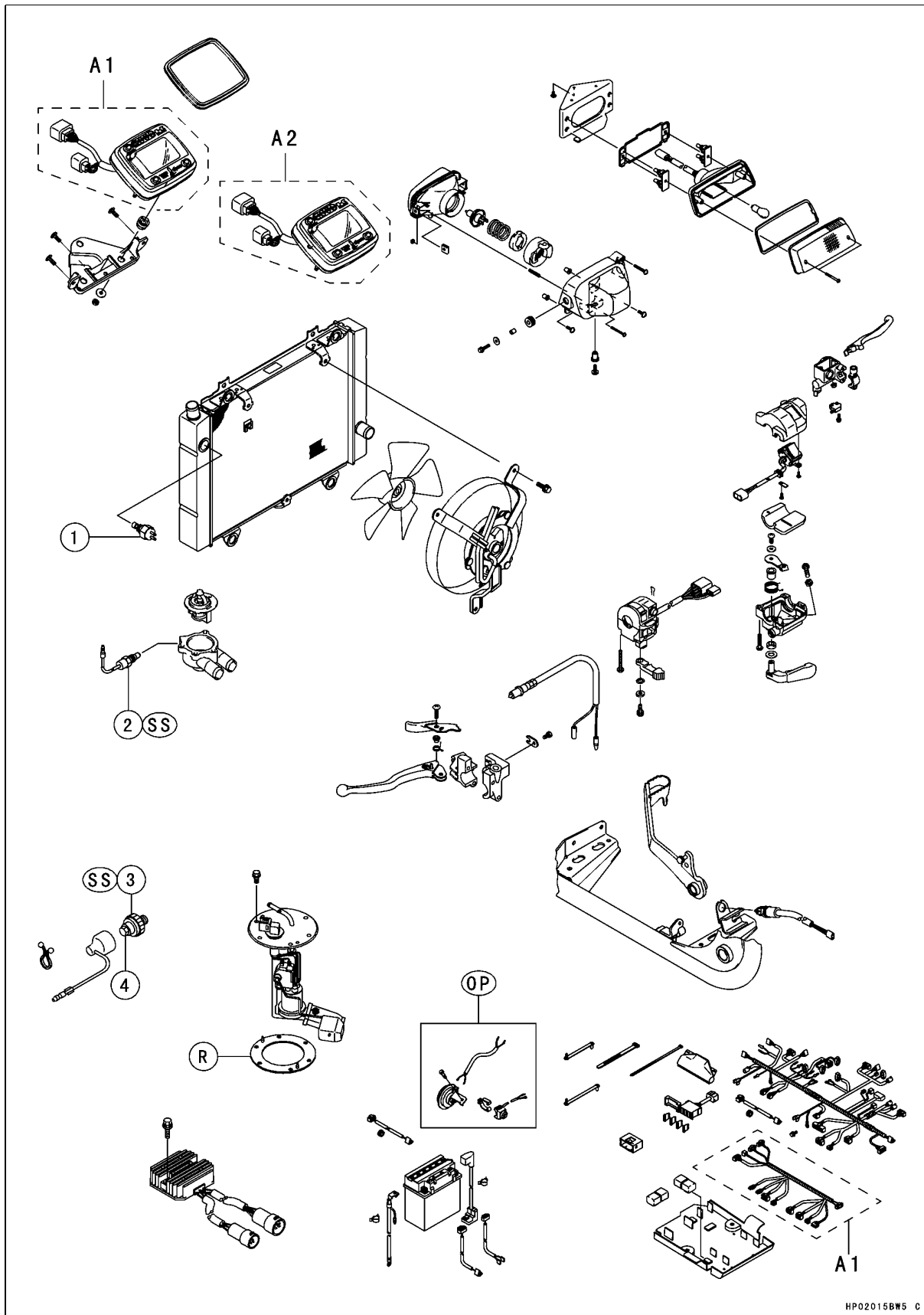
S: Follow the specific tightening sequence.

A1: KVF650-A1/B1 models

A2: KVF650-A2/B2 models

16-10 ELECTRICAL SYSTEM

Exploded View



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ELECTRICAL SYSTEM 16-11

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Radiator fan switch	18	1.8	13	
2	Coolant temperature warning light switch	7.9	0.8	69 in·lb	SS
3	Oil pressure switch	15	1.5	11	SS
4	Oil pressure switch terminal bolt	1.5	0.15	13 in·lb	

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

R: Replacement Part (Fuel Pump Gasket)

OP: Optional Parts for U.S.A. and Canada models

A1: KVF650-A1/B1 models

A2: KVF650-A2/B2 models

16-12 ELECTRICAL SYSTEM

Specifications

Item	Standard	Service Limit
Battery: Type Capacity	MF (Maintenance Free) Battery 12 V 12 Ah	--- ---
Charging System: Alternator type Charging voltage (Regulator/rectifier output voltage) Alternator output voltage Stator coil resistance	Three-phase AC 14 ~ 15 V 39 ~ 59 V 3 000 r/min (rpm) 0.33 ~ 0.49 Ω	--- --- --- ---
Ignition System: Spark plug: Spark plug gap Spark plug cap resistance Ignition coil: 3 needle arcing distance Primary winding resistance Secondary winding resistance Primary peak voltage Pickup coil resistance Pickup coil peak voltage Vehicle-down Sensor Detection method Detection angle Detection time Output voltage	0.7 ~ 0.8 mm (0.028 ~ 0.031 in.) 4.75 ~ 6.25 k Ω 7 mm or more 0.09 ~ 0.13 Ω 3.8 ~ 5.8 k Ω 100 V or more 110 ~ 140 Ω 3.6 V or more Magnetic flux detection method More than 65° ± 5° for each bank Within 0.5 ~ 1.0 sec. in the text	--- --- --- --- --- --- --- --- ---
Electric Starter System: Starter motor: Commutator diameter Brush length	28 mm (1.10 in.) 12 mm (0.47 in.)	27 mm (1.06 in.) 4 mm (0.16 in.)
Fuel Pump/Fuel Level Sensor: Fuel pump pressure Fuel level sensor resistance: Full level position Empty level position	17.7 ~ 22.6 kPa (0.18 ~ 0.23 kgf/cm ² , 2.6 ~ 3.3 psi) 120 Ω 3 Ω	--- --- ---
Switches: Brake light switch timing Radiator fan switch resistance: Rising temperature Falling temperature Coolant temperature warning light switch resistance: Rising temperature Falling temperature	ON after 10 mm (0.4 in.) of pedal travel From OFF to ON at 96 ~ 100°C (205 ~ 212°F) From ON to OFF at 91 ~ 95°C (196 ~ 203°F) ON: Less than 0.5 Ω OFF: More than 1 M Ω From OFF to ON at 112 ~ 118°C (234 ~ 244°F) From ON to OFF at 108 ~ 111°C (226 ~ 232°F) ON: less than 0.5 Ω OFF: More than 1 M Ω	--- --- --- --- ---

Special Tools - Hook Wrench : 57001-1101
Timing Light : 57001-1241
Flywheel Holder: 57001-1313
Hand Tester: 57001-1394
Flywheel Puller : 57001-1405
Needle Adapter Set: 57001-1457

Precautions

There are a number of important precautions that should be taken when servicing electrical systems. Learn and observe all the rules below.

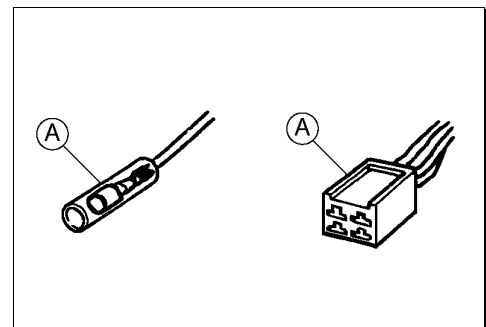
- Do not reverse the battery lead connections. This will burn out the diodes in the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is required for conducting accurate electrical system tests.
- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- To prevent damaging electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the high current, never keep the starter button depressed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Only use an illumination bulb rated for the voltage or wattage specified in the wiring diagram, or the handle cover could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to chassis ground.
- Troubles may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they too must be repaired or replaced, or the new replacement will soon fail again.
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, etc. Defective wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).

○ Color Codes:

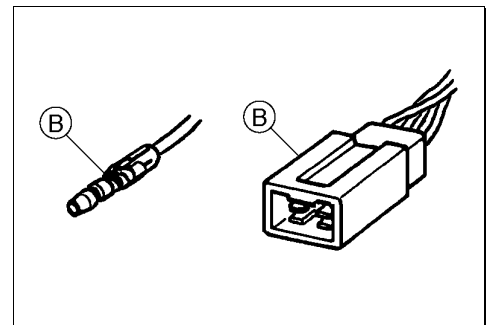
BK	Black	G	Green	P	Pink
BL	Blue	GY	Gray	PU	Purple
BR	Brown	LB	Light blue	R	Red
CH	Chocolate	LG	Light green	W	White
DG	Dark green	O	Orange	Y	Yellow

○ Electrical Connectors:

Female Connectors [A]



Male Connectors [B]



16-14 ELECTRICAL SYSTEM

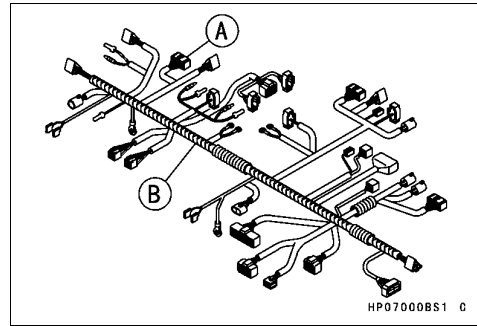
Electrical Wiring

Wiring Inspection

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

Special Tool - Hand Tester: 57001-1394

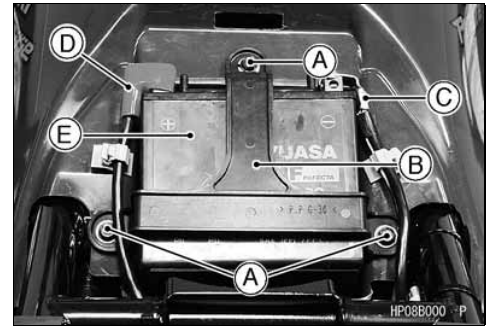
- Set the tester to the x 1 Ω range.
- ★ If the tester does not read 0 Ω , the lead is defective. Replace the lead or the wiring harness [B] if necessary.



Battery

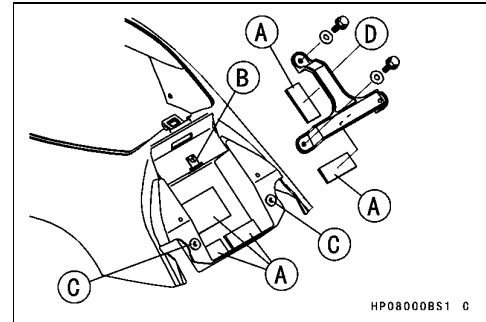
Battery Removal

- Turn off the ignition switch.
- Remove:
 - Seat (see Frame chapter)
 - Battery Holder Bolts [A] and Washer
 - 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]
 - Collars [C]
 - Battery Holder [D]
- Connect the positive cable first and then the negative.
- Put a light coat of grease on the terminals to prevent corrosion.

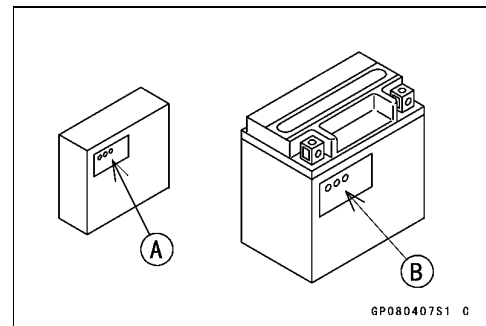


Electrolyte Filling

- 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 KVF650: KMX 14-BS

CAUTION
<p>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.</p>

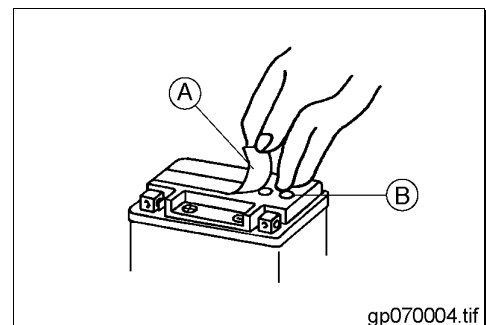


- Check to see that there is no peeling, tears or holes in the seal sheet on the top of the battery.
- Place the battery on a level surface.
- Remove the seal sheet.

CAUTION
<p>Do not remove the aluminum seal sheet [A] sealing the filler ports [B] until just before use.</p>

NOTE

- A battery whose seal sheet has any peeling, tears, holes, or from which the air-sucking sound was not heard requires a refreshing charge (initial charge).



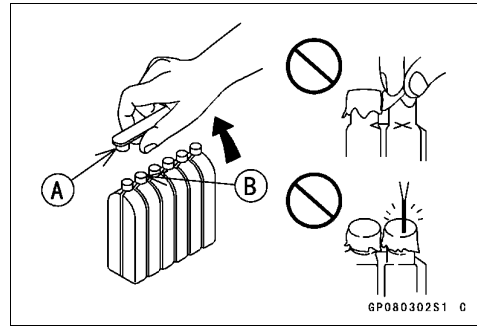
16-16 ELECTRICAL SYSTEM

Battery

- Take the electrolyte container out of the vinyl bag.
- Detach the seal caps [A] from the container.

NOTE

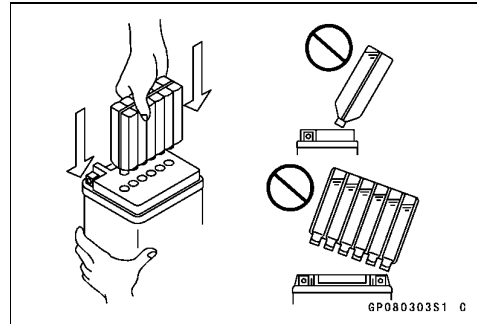
- Do not discard the seal caps because it is used as the battery plugs later.
- Do not peel back or pierce the seals [B] on the container.



- Place the electrolyte container upside down aligning the six seals with the six battery filler ports.
- Push the container down strongly enough to break the seals. Now the electrolyte should start to flow into the battery.

NOTE

- Do not tilt the container as the electrolyte flow may be interrupted.



- Make sure air bubbles [A] are coming up from all six filler ports.
- Leave the container this way for 5 minutes or longer.

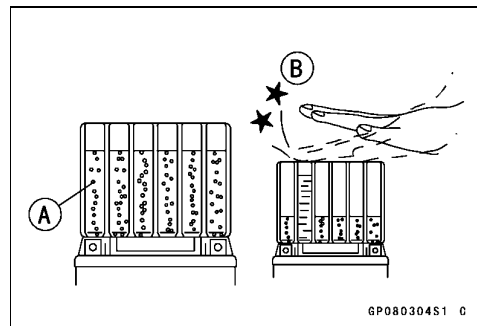
NOTE

- If no air bubbles are coming up from a filler port, tap [B] the bottom of the bottle two or three times. Never remove the container from the battery.

CAUTION

Fill the electrolyte into the battery until the container is completely emptied.

- Be certain that all the electrolyte has flowed out.
- Tap the bottom the same way as above if there is any electrolyte left in the container.
- Now pull the container gently out of the battery.
- Let the battery sit for **20** minutes. During this time, the electrolyte permeates the special separators and the gas generated by chemical reaction is released.



Battery

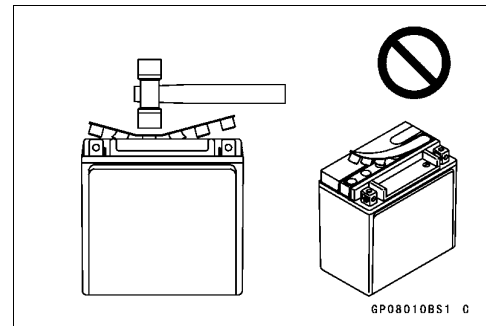
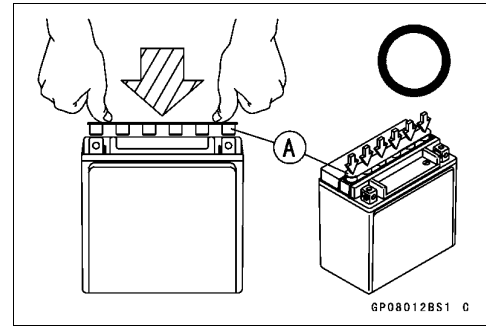
- Fit the seal caps [A] tightly into the filler ports until the seal caps are at the same level as the top of the battery.

NOTE

- Do not hammer. Press down evenly with both hands.

CAUTION

Once you installed the seal caps after filling the battery, never remove it, nor add any water or electrolyte.



Initial Charge

While an sealed battery can be used after only filling with electrolyte, a battery may not be able to sufficiently move a starter motor to start an engine in the cases shown in the table below, where an initial charge is required before use. However, if a battery shows a terminal voltage of higher than 12.6 V after 10 minutes of filling (Note 1), no initial charge is necessary.

Condition requiring initial charge	Charging method
At low temperatures (lower than 0°C)	1.4 A x 2 ~ 3 hours
Battery has been stored in high temperature and humidity.	1.4 A x 15 ~ 20 hours
Seal has been removed, or broken - peeling, tear or hole. (If you did not hear the air-sucking sound "Shoosh" as you removed the seal.)	
Battery as old as 2 years or more after manufacture. Battery manufacturing date is printed on battery top. Example) <u>12</u> <u>10</u> <u>99</u> <u>T1</u> Day Month Year Mfg. location	

Note 1 : Terminal voltage — To measure battery terminal voltage, use a digital voltmeter.

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
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.

CAUTION

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above.

Never remove the seal 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.

16-18 ELECTRICAL SYSTEM

Battery

- 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.)

⚠WARNING

Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases.

No fire should be drawn near the battery, or no terminals should have the tightening loosened.

The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water. Get medical attention if severe.

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).

CAUTION

Be sure to disconnect the negative (-) lead first.

- Measure the battery terminal voltage.

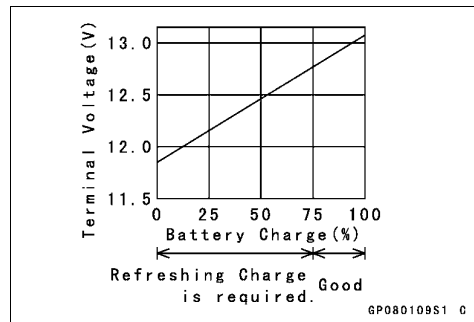
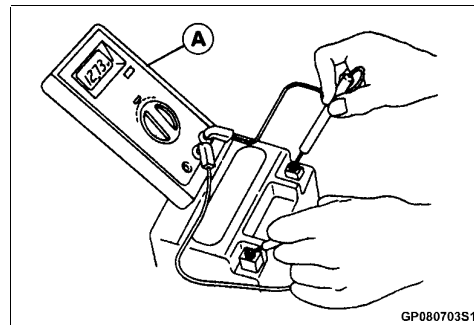
NOTE

- Measure with a digital voltmeter [A] which can be read to one decimal place voltage.

★ If the reading is below the specified, refreshing charge is required.

Battery Terminal Voltage

Standard: 12.8 V or more

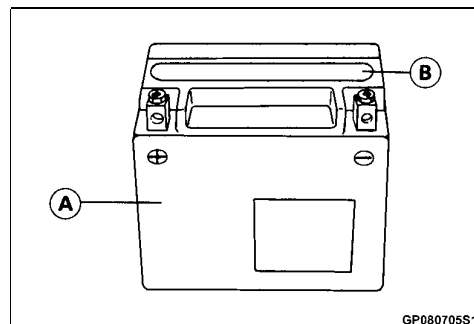


Refreshing Charge

- 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.



Battery

Terminal Voltage: 11.5 ~ less than 12.5 V
 Standard Charge
 1.4 A x 5 ~ 10 h (see following chart)
 Quick Charge
 6.0 A x 1.0 h

CAUTION

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: 1.4 A x 20 h

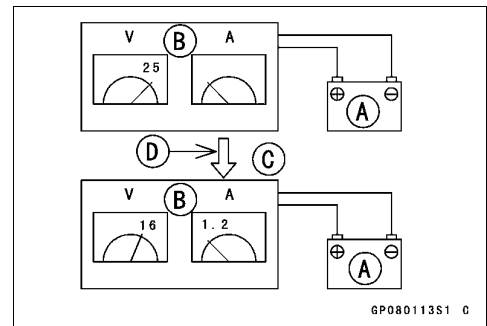
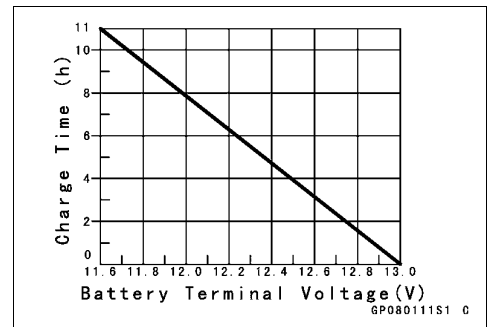
NOTE

- 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]

- 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 ~ 12.5 V or lower	Charge insufficient → Recharge
12.0 V or lower	Unserviceable → Replace

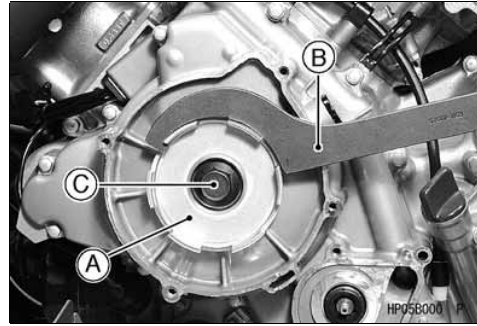


16-20 ELECTRICAL SYSTEM

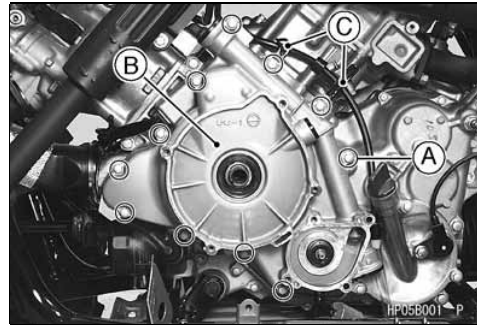
Charging System

Alternator Cover Removal (KVF650-A1/B1 models)

- Drain the coolant (see Cooling System chapter).
 - Remove:
 - Recoil Starter (see Recoil Starter chapter)
 - Water Pump Impeller (see Cooling System chapter)
 - Holding the recoil starter pulley [A] with a hook wrench [B], loosen the alternator rotor bolt [C].
- Special Tool - Hook Wrench: 57001-1101**
- Remove the alternator rotor bolt, pulley, and key.

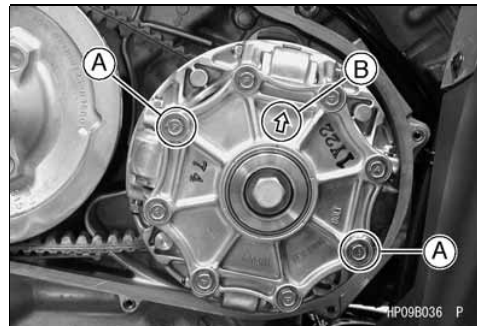


- Place an oil pan under the engine left side.
- Remove:
 - Alternator and Pickup Coil Connectors (disconnect)
 - Alternator Cover Bolts [A]
 - Alternator Cover [B]
 - Clamps [C]

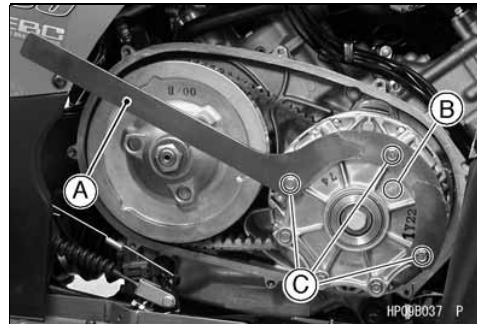


Alternator Cover Removal (KVF650-A2/B2 models)

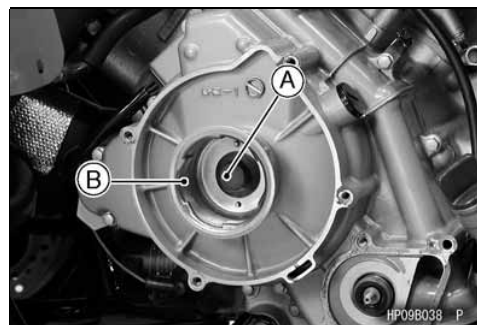
- Drain the coolant (see Cooling System chapter).
 - Remove:
 - Recoil Starter (see Recoil Starter chapter)
 - Water Pump Impeller (see Cooling System chapter)
 - Torque Converter Cover (see Converter System chapter)
 - Remove the three bolts of the drive pulley cover, except for at the dowel pin parts [A] as shown.
- [B] Arrow



- Install and tighten the drive pulley holder [A] and the three bolts [C].
- Special Tool - Drive Pulley Holder: 57001-1520**
- [B] Arrow

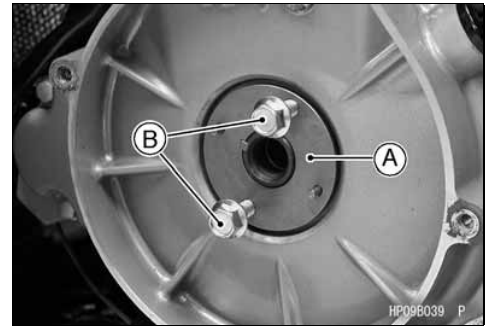


- Holding the drive pulley with the drive pulley holder, loosen the alternator rotor bolt [A].
- Remove:
 - Alternator Rotor Bolt
 - Pulley [B]

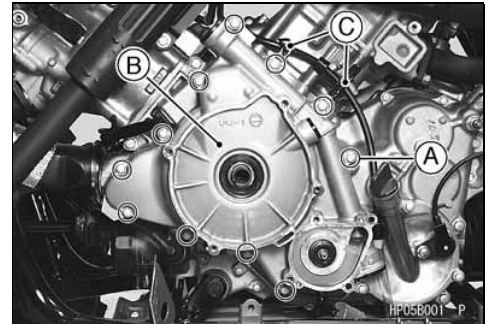


Charging System

- Remove:
 - Collar [A]
- Install the M6 bolts [B] to the collar, and remove it.

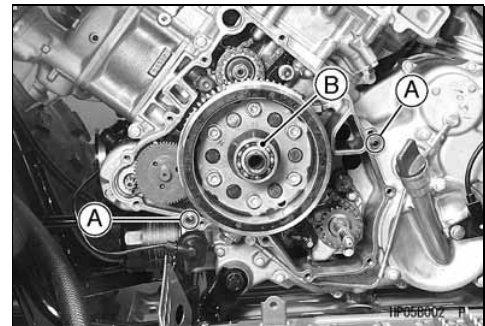


- Place an oil pan under the engine left side.
- Remove:
 - Alternator and Pickup Coil Lead Connectors (disconnect)
 - Alternator Cover Bolts [A]
 - Alternator Cover [B]
 - Clamp [C]



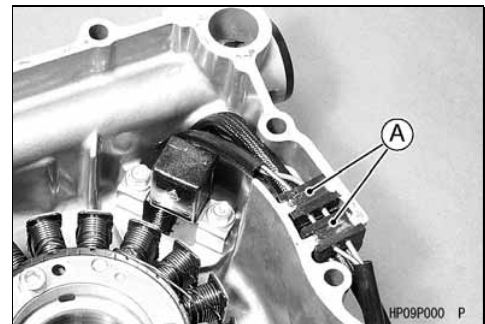
Alternator Cover Installation

- 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.
- Check that the bearing [B] is in place.



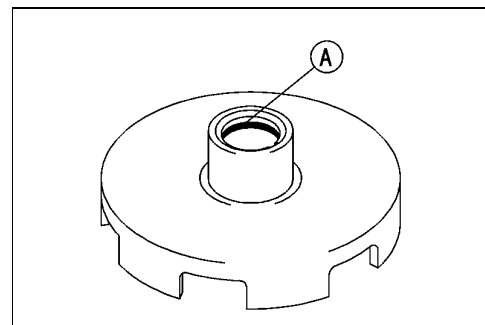
- Fit the grommets [A] into the notch in the cover.
- Grease the alternator cover oil seal.
- Tighten

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



(KVF650-A1/B1 models)

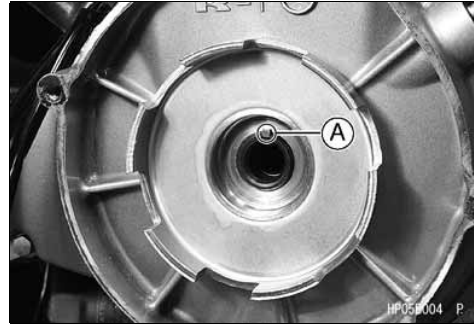
- Check that the pulley O-ring [A] is in good condition.
- Clean the pulley boss and apply oil to the O-ring and boss.



16-22 ELECTRICAL SYSTEM

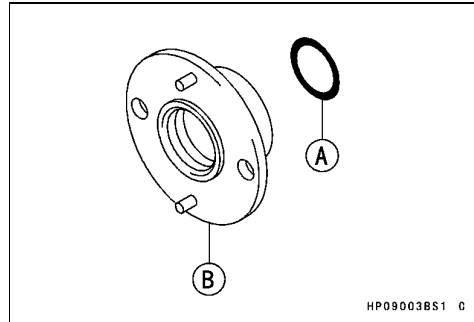
Charging System

- Install the pulley.
- Fit the key [A] in the groove between the pulley and the crankshaft.
- Tighten:
 - Torque - Alternator Rotor Bolt: 127 N·m (13 kgf·m, 94 ft·lb)**
- Add engine oil.



(KVF650-A2/B2 models)

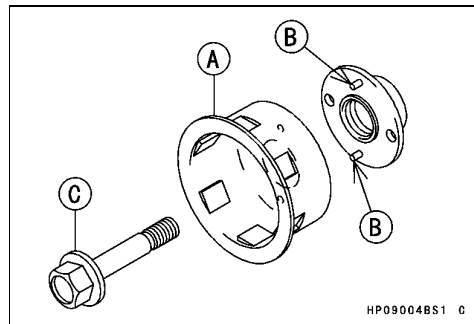
- Check that the O-ring [A] in the collar [B] is in good condition.
- Apply grease to the O-ring.
- Install the collar on the alternator cover.



- Hold the drive pulley with the drive pulley holder [A].
 - Special Tool - Drive Pulley Holder: 57001-1520**



- Install the pulley [A] so that the holes of the pulley fit on the pins [B] of the collar.
- Tighten:
 - Torque - Alternator Rotor Bolt [C]: 127 N·m (13 kgf·m, 94 ft·lb)**
- Add engine oil.



Alternator Rotor Removal

- Remove:
 - Alternator Cover (see Alternator Cover Removal)
 - Ball Bearing [A]

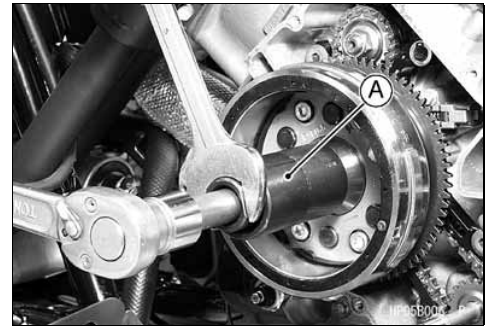


Charging System

- Thread the flywheel puller [A] onto the alternator rotor.
- **Special Tool - Flywheel Puller: 57001-1405**
- Holding the flywheel puller, turn the rotor puller until the alternator rotor is forced off the end of the crankshaft.

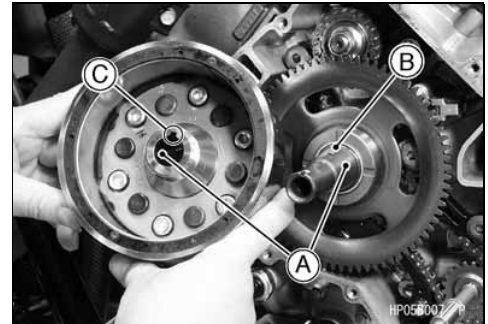
CAUTION

If the rotor is difficult to remove, turn the puller while tapping the end of the puller. Do not strike the alternator rotor. Striking the rotor can cause the magnets to lose magnetism.

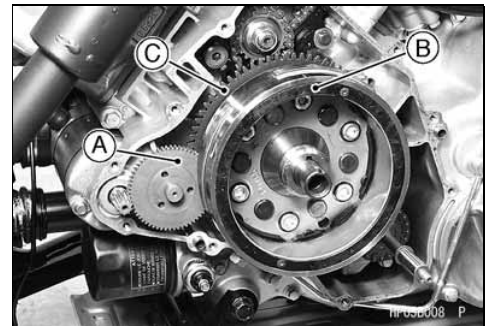


Alternator Rotor Installation

- Clean [A] the inside of the rotor and the end of the crankshaft.
- Fit the rotor onto the crankshaft so that woodruff key [B] fits in the groove [C] in the hub of the rotor.

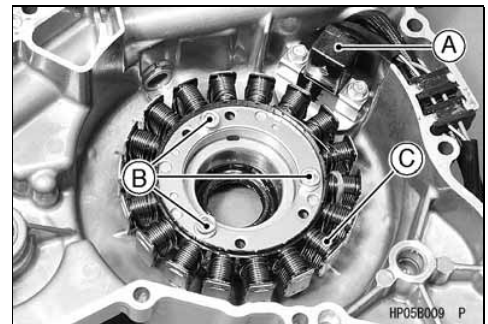


- Install the torque limiter [A].
- Install the alternator rotor [B] while turning the starter clutch gear [C].



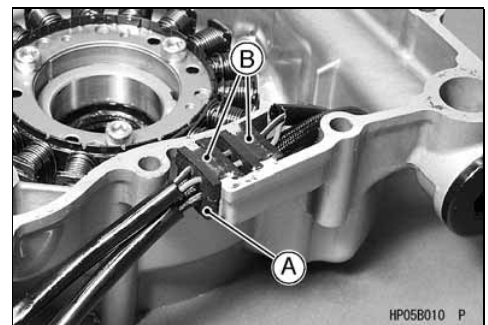
Alternator Stator Removal

- Remove:
 - Alternator Cover (see Alternator Cover Removal)
 - Pickup Coil [A] (see Pickup Coil Removal)
 - Bolts [B] and Alternator Stator [C]



Alternator Stator Installation

- Tighten:
 - Torque - Alternator Stator Bolts: 13 N·m (1.3 kgf·m, 113 in·lb)**
- Install:
 - Pickup Coil (see Pickup Coil Installation)
- Fit the lead grommets into the notch on the alternator cover.
 - Grommets [A] for Alternator Leads
 - Grommets [B] for Pickup Coil Leads



16-24 ELECTRICAL SYSTEM

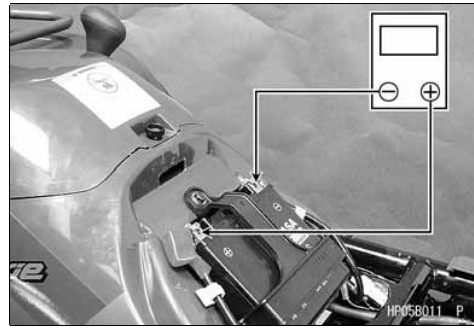
Charging System

Regulator/Rectifier Output Voltage Inspection

- Remove the seat (see Frame chapter).
- Check the battery condition (see Battery section).
- Warm up the engine to obtain actual alternator operating conditions.
- Check that the ignition switch is turned off, and connect a hand tester to the battery terminals.

Special Tool - Hand Tester : 57001-1394

- 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

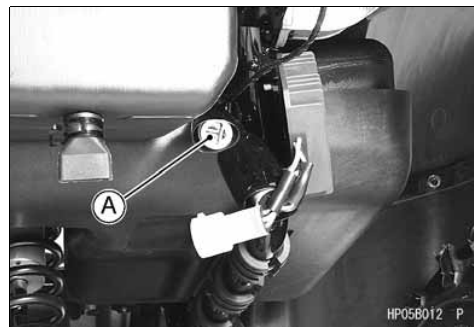
Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
25 V DC	Battery (+)	Battery (-)	14 ~ 15 V

- 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.
- ★ 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.
 - Disconnect the alternator connector [A].
 - Connect a hand tester as shown in the table.
 - Start the engine.
 - Run it at the rpm given in the table.
 - Note the voltage readings (total 3 measurements).



Alternator Output Voltage

Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
250 V AC	One black lead	Another black lead	@3 000rpm 39 ~ 59 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

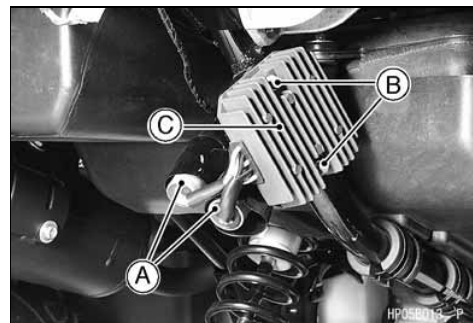
Tester Range	Connections		Reading
	Tester (+) to	Tester (-) to	
x 1 Ω	One black lead	Another black lead	0.33 ~ 0.49 Ω

- ★ If there is more resistance than shown in the table, or no 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 Tool - Hand Tester : 57001-1394

Regulator/Rectifier Inspection

- Remove:
 - Connectors [A] (disconnect)
 - Bolts [B] and Regulator/Rectifier [C]



Rectifier Circuit Check:

- Check conductivity of the following pair of terminals.

Rectifier Circuit Inspection

Tester connection	W/R-Y1,	W/R-Y2,	W/R-Y3
		BK-Y1,	BK-Y2,

- ★ The resistance should be low in one direction and more than ten times as much in the other direction. If any two leads are low or high in both directions, the rectifier is defective and must be replaced.

NOTE

- The actual meter reading varies with the meter and the individual rectifier. Generally speaking the lower reading should be from zero to one half of the scale.

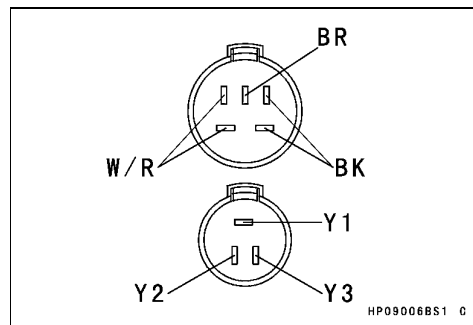
Regulator Circuit Check:

To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~ 6 W bulb in a socket with leads).

CAUTION

The test light works as an indicator and also a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.

- Check to be sure the rectifier circuit is correct before continuing.



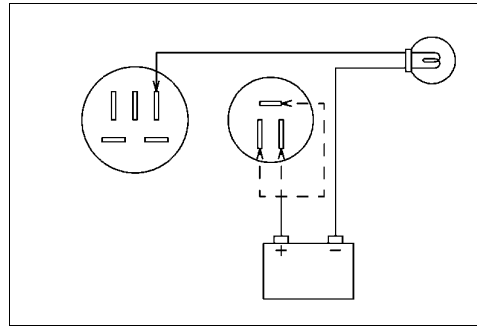
HP09006BS1 C

16-26 ELECTRICAL SYSTEM

Charging System

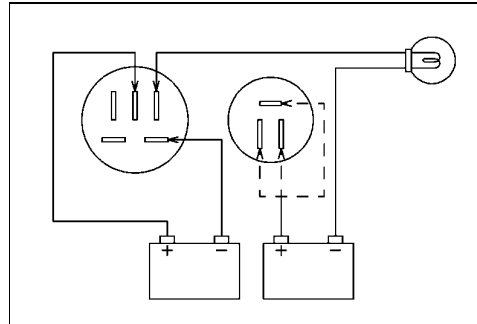
Regulator Circuit Test-1st Step:

- Connect the test light and the 12 V battery to the regulator/rectifier as shown.
- Check Y1, Y2, and Y3 terminal respectively.
- ★ If the test light turns on, the regulator/rectifier is defective.
- ★ If the test light does not turn on, continue the test.



Regulator Circuit Test-2nd Step:

- Connect the test light and a 12 V battery in the same manner as specified in the "Regulator Circuit Test-1st Step".
- Apply 12 V to the BR terminal.
- Check Y1, Y2, and Y3 terminals.
- ★ If the test light turns on, the regulator/rectifier is defective.
- ★ If the test light does not turn on, continue the test.



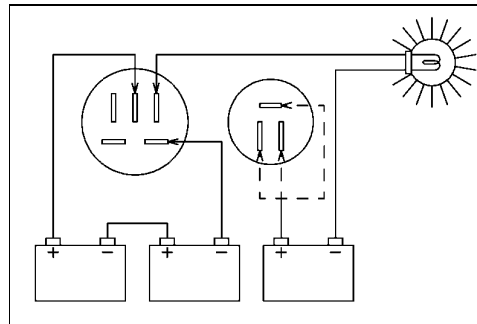
Regulator Circuit Test-3rd Step:

- Connect the test light and a 12 V battery in the same manner as specified in the "Regulator Circuit Test-1st Step".
- Momentarily apply 24 V to the BR terminal by adding a 12 V battery.
- Check Y1, Y2, and Y3 terminals.

CAUTION

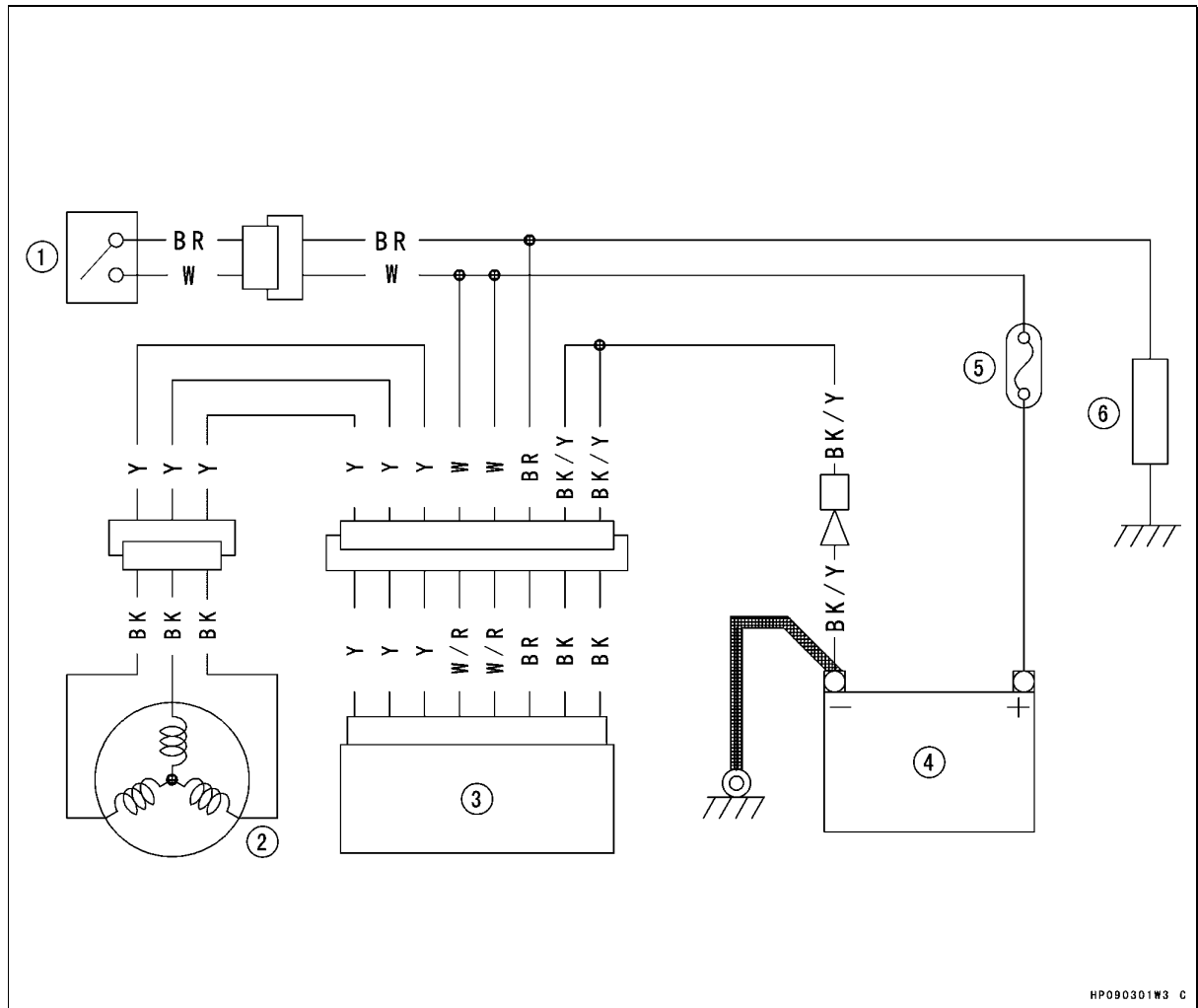
Do not apply more than 24 V to the regulator/rectifier. Do not leave the 24 V applied for more than a few seconds, or the unit will be damaged.

- ★ If the test light did not light when the 24 V was applied momentarily to the BR terminal, the regulator/rectifier is defective.
- ★ If the regulator/rectifier passes all of the tests described, it may still be defective. If the charging system still does not work properly after checking all of the components and the battery, test the regulator/rectifier by replacing it with a known good unit.



Charging System

Charging System Circuit



1. Ignition Switch
2. Alternator

3. Regulator/Rectifier
4. Battery

5. Main Fuse 30 A
6. Load

16-28 ELECTRICAL SYSTEM

Ignition System

⚠ WARNING

The ignition system produces extremely high voltage. Do not touch the spark plug, ignition coil, or spark plug lead while the engine is running, or you could receive a severe electrical shock.

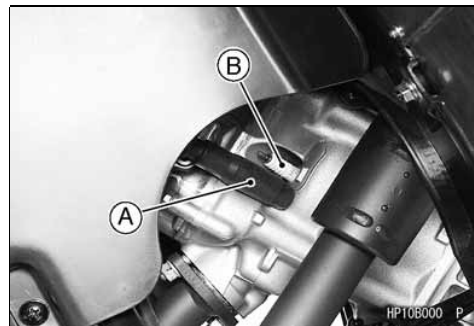
CAUTION

Do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter damage. Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and igniter. Use the standard regulator/rectifier, or the igniter will be damaged.

Spark Plug Removal

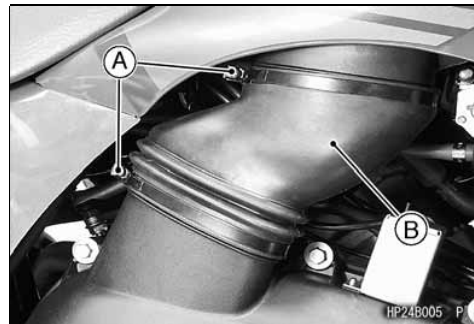
Front Side:

- Remove:
 - Spark Plug Cap [A]
 - Spark Plug [B]

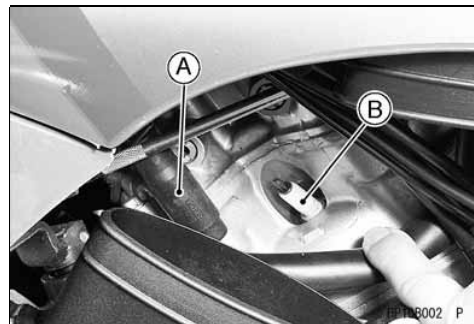


Rear Side:

- Remove:
 - Clamp Screws [A] and Clamps
 - Rubber Air Duct [B]



- Remove:
 - Spark Plug Cap [A]
 - Spark Plug [B]



Spark Plug Installation

- Tighten:
 - Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)**
- Fit the spark plug caps securely.
- Pull up the spark plug caps lightly to make sure of the installation of the spark plug caps.

Ignition System

Spark Plug Cleaning/Inspection

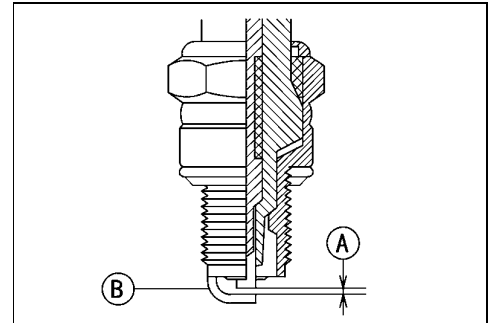
- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a wire brush or other suitable tool.
- ★ If the spark plug electrodes are corroded or damaged, or if the insulator is cracked, replace the plug. Use the standard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

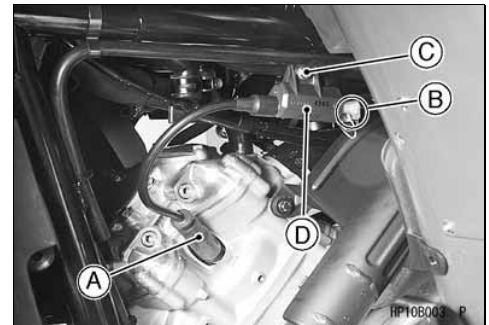
0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)



Ignition Coil Removal

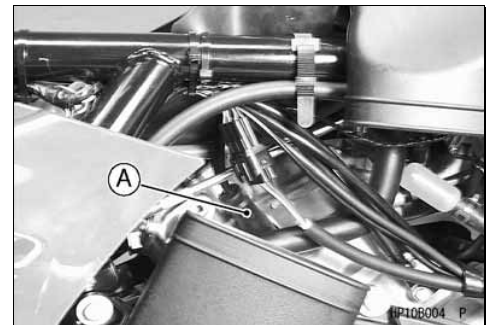
Front Side:

- Remove:
 - Front Left Inner Cover (see Frame chapter)
 - Spark Plug Cap [A]
 - Primary Lead Connectors [B]
 - Bolt [C]
 - Ignition Coil [D]

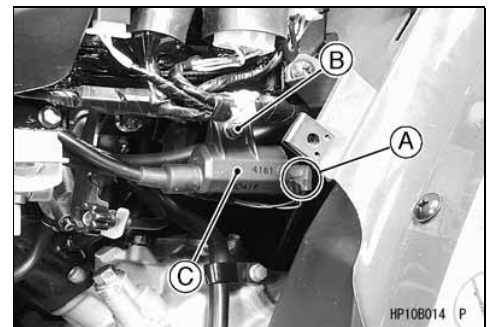


Rear Side:

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Rubber Air Duct (see Frame chapter)
 - Spark Plug Cap [A]



- Remove:
 - Primary Lead Connectors [A]
 - Bolt [B]
 - Ignition Coil [C]



16-30 ELECTRICAL SYSTEM

Ignition System

Ignition Coil Installation

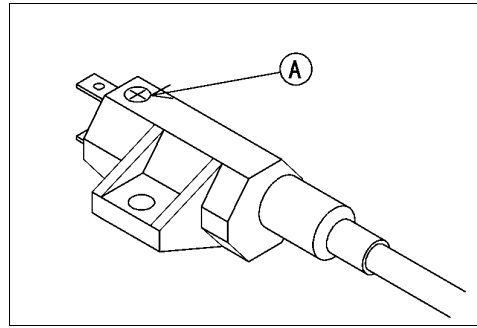
- Connect the primary leads to the ignition coil terminals as shown.

Front Side:

- G/W Lead → (+) Mark [A]
- BK/Y Lead → (-) Mark

Rear Side:

- BL/W Lead → (+) Mark [A]
- BK/Y Lead → (-) Mark



Ignition Coil Inspection

- Remove the ignition coil.
- Measure the arcing distance with a coil tester [A] to check the condition of the ignition coil [B].
- Connect the ignition coil (with the spark plug cap left attached at the end of the spark plug lead) to the tester in the manner prescribed by the manufacturer and measure the arcing distance.

Ignition Coil Arcing Distance

7 mm or more

⚠ WARNING

To avoid extremely high voltage shocks, do not touch the ignition coil body or leads.

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.
- To determine which part is defective, measure the arcing distance again with the spark plug cap removed from the ignition coil. 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.

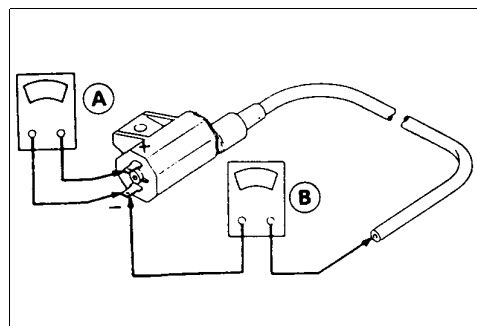
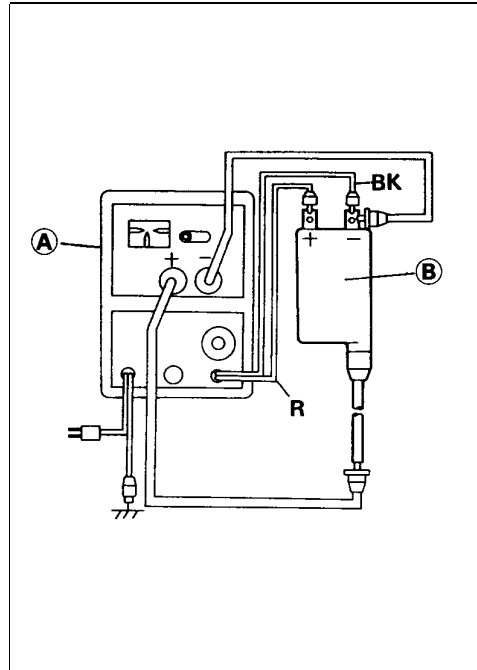
- Measure the primary winding resistance [A] as follows:
 - Connect the tester between the coil terminals.
 - Set the tester to the x 1 Ω range.
- Measure the secondary winding resistance [B] as follows:
 - Remove the plug cap by turning it counterclockwise.
 - Connect the tester between the spark plug lead and terminal.
 - Set the tester to the x 1 kΩ range.

Ignition Coil Winding Resistance

Primary windings : 0.09 ~ 0.13 Ω

Secondary windings : 3.8 ~ 5.8 kΩ

- ★ If the hand tester does not read as specified, replace the coil.
- To install the plug cap, turn it clockwise.



Ignition 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). Install the needle adapters [C] on the peak voltage adapter leads.

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

Recommended Tool - Peak Voltage Adapter
Type: KEK-54-9-B
Brand: KOWA SEIKI

- Insert the needle adapter inside the seal of the G/W (front) or BL/W (rear) lead in the igniter connector [D] until the needle reaches the terminal in the connector.
- Install a new spark plug [E] into the spark plug cap, and ground it to the engine.
 [F] 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: 100 V or more

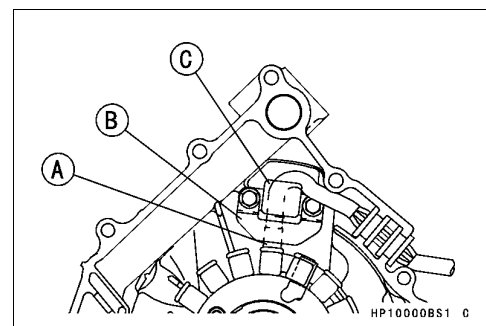
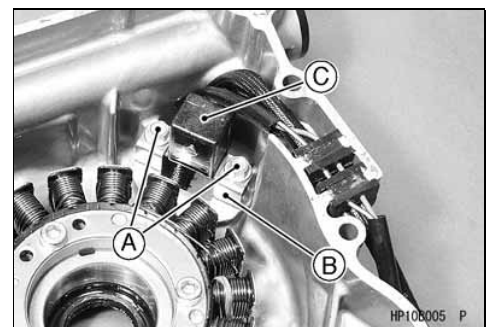
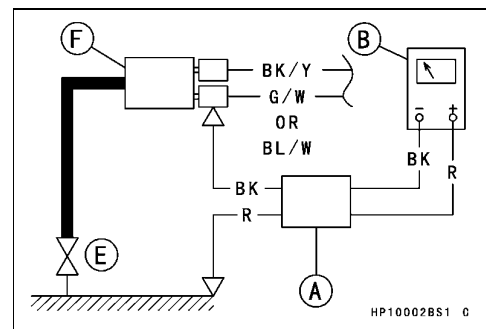
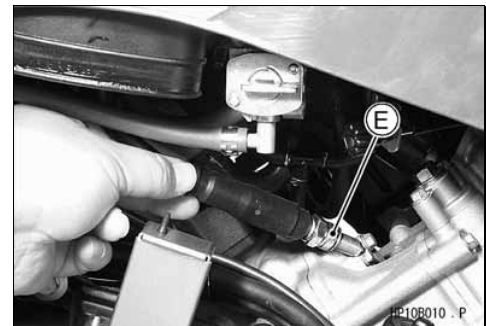
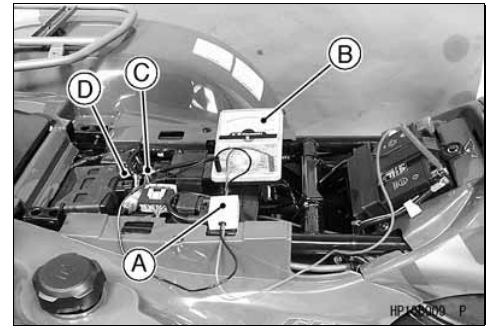
- Repeat the test for the other ignition coil.
- ★ If the reading is less than the specified value, check the following.
 Ignition Coils (see Ignition Coil Inspection)
 Pickup Coil (see Pickup Coil Inspection)
- ★ If the ignition coils and pickup coil are normal, see the Ignition System Troubleshooting chart on page 16-31.

Pickup Coil Removal

- Remove:
 Alternator Cover (see Alternator Cover Removal)
 Pickup Coil Mounting Bolts [A]
 Plate [B]
 Pickup Coil [C]

Pickup Coil Installation

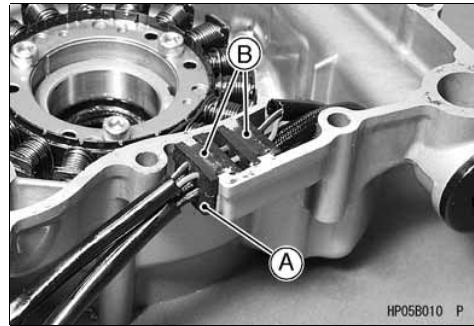
- Install:
 Stator Coil Leads [A]
 Plate [B]
 Pickup Coil [C]
- Tighten:
Torque - Pickup Coil Mounting Bolts: 5.9 N·m (0.6 kgf·m, 52 in·lb)



16-32 ELECTRICAL SYSTEM

Ignition System

- Fit the lead grommets into the notch on the alternator cover.
 - Grommets [A] for Alternator Leads
 - Grommets [B] for Pickup Coil Leads

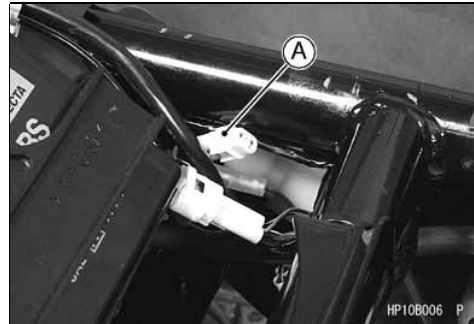


Pickup Coil Inspection

- Remove the seat (see Frame chapter).
- Disconnect the pickup coil lead connector [A].
- Measure the pickup coil resistance.
 - Connect a hand tester between the BK/W lead and the BL lead.
 - Set the tester to the x 10 Ω range.

Pickup Coil Resistance
110 ~ 140 Ω

★ If the tester does not read as specified, replace the pickup coil.



Pickup Coil Peak Voltage Inspection

NOTE

- Be sure the battery is fully charged.
- Remove the spark plug caps, but do not remove the spark plugs.
- Disconnect:
 - Pickup Coil Wire Connector [A]
- Set the hand tester [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the hand tester and pickup coil leads in the connector.

Special Tool - Hand Tester: 57001-1394

Recommended Tool - Peak Voltage Adapter
Type: KEK-54-9-B
Brand: KOWA SEIKI

Connections:

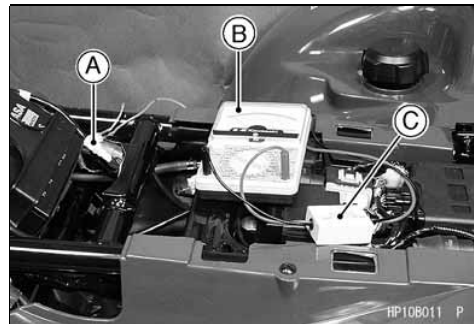
Crankshaft Sensor Wire		Adapter		Hand Tester
Yellow	←	Red	→	(+)
Green/White	←	Black	→	(-)

- Turn the ignition switch on, and rotate the engine for 4 ~ 5 seconds with the transmission gear in neutral to measure the pickup coil peak voltage.
- Repeat the measurement 5 or more times.

Pickup Coil Peak Voltage

Standard: 3.6 V or more

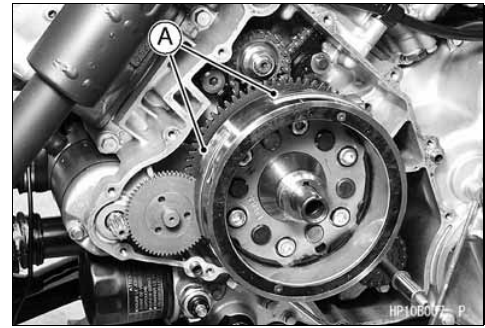
★ If the peak voltage is lower than the standard, inspect the pickup coil.



Ignition System

Alternator Rotor Inspection

- Check the timing projection [A] for damage such as chipping or grooving.
- ★ If the timing projection on the rotor is visibly damaged, replace the alternator rotor.



Ignition Timing Test

- Remove the ignition timing inspection plug.
- 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.



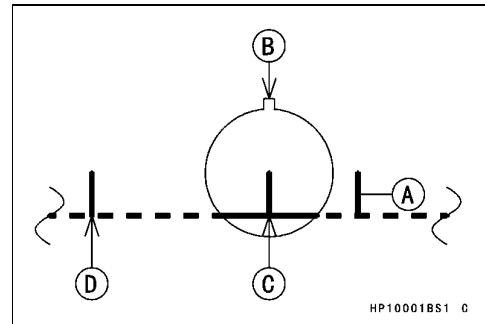
[A] F or R mark

Ignition Timing

Engine speed r/min (rpm)	Slot [B] aligned with:
1 100 and below	Advanced mark [C] on alternator rotor
5 000 and above	Advanced mark [D] on alternator rotor

NOTE

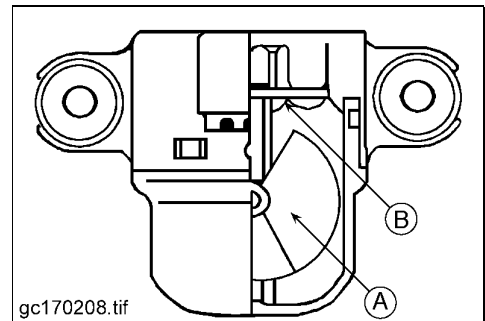
- Do not mix up the timing marks with mark [A].
- ★ If the ignition timing is incorrect, replace the igniter and the pickup coil.



Vehicle-down Sensor Outline

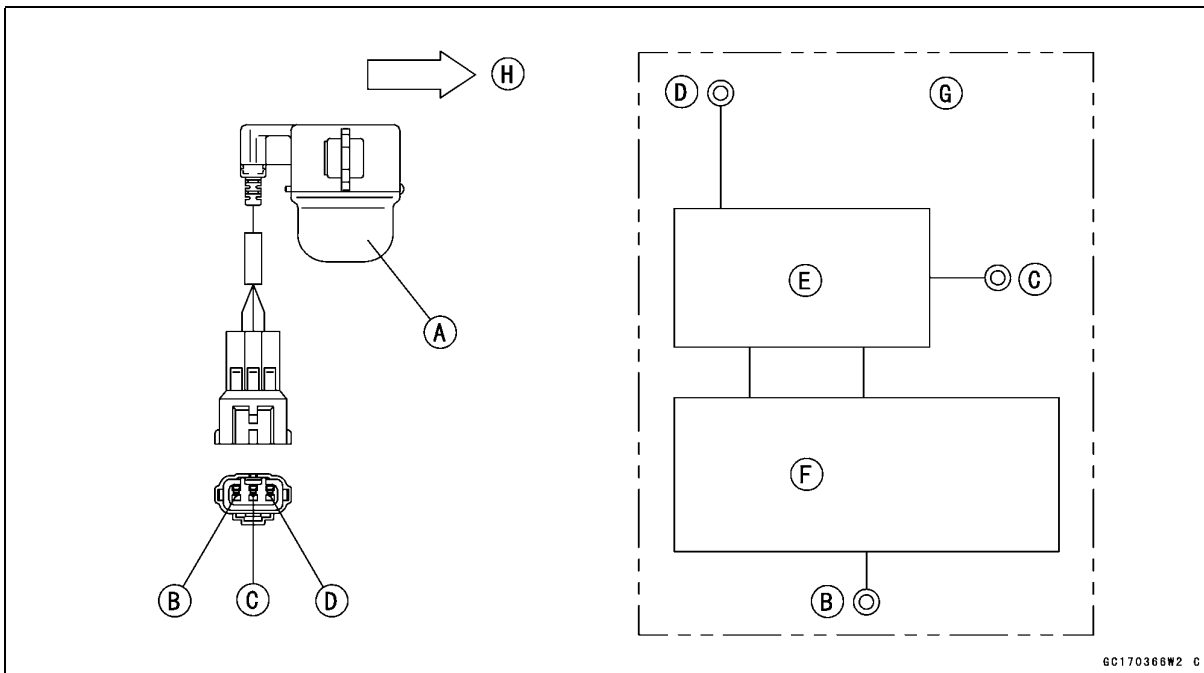
This sensor has a weight [A] with two magnets inside, and sends a signal to the igniter. But when the vehicle banks 60 ~ 70° or more to either side (in fact falls down), the weight turns and shuts off the signal in the vehicle-down sensor circuit. The igniter senses this change, and stops the fuel pump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

Hall IC [B]



16-34 ELECTRICAL SYSTEM

Ignition System



GC170366W2 C

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

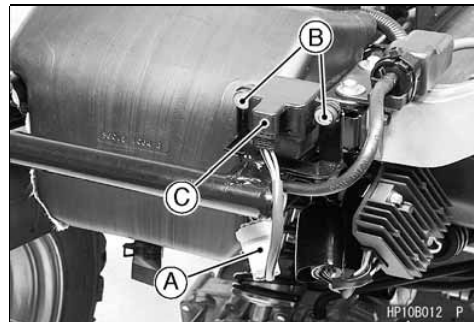
Constant Voltage Circuit [E]
 Hall IC (Integrated Circuit) [F]
 Vehicle-down Sensor Circuit [G]
 Front [H]

Vehicle-down Sensor Removal

CAUTION

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

- Remove:
 - Rear Fender (see Frame chapter)
 - Vehicle-down Sensor Lead Connector [A]
 - Screws [B]
 - Vehicle-down Sensor [C]

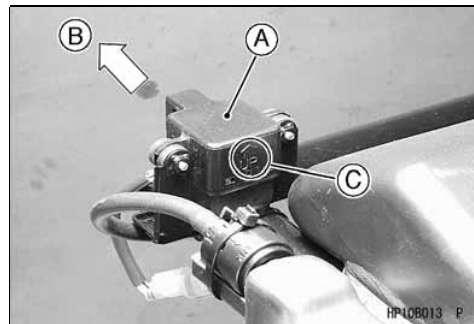


Vehicle-down Sensor Installation

- Install the vehicle-down sensor [A] so that the sensor lead faces backwards [B], and the arrow mark [C] on the sensor points upward.
- Tighten the screws securely.

WARNING

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



Vehicle-down Sensor Inspection

NOTE

- Be sure the battery is fully charged.

Vehicle-down Sensor Power Source Voltage:

- Remove:
 - Rear Fender (see Frame chapter)
 - Vehicle-down Sensor Lead Connector

Ignition System

- Connect:
 - Vehicle-down Sensor Lead Connector [A] (harness side)
 - Digital Volt Meter [B]
- I. **Connections to Connector (12 V circuit)**
 - Meter (+) → Connector BR Lead [C]
 - Meter (-) → Connector BK/Y Lead [D]
- Turn the ignition switch ON, and measure the power source voltage.

Vehicle-down Sensor Power Source Voltage
Standard: Battery Voltage (12.5 V or more)

- Turn the ignition switch OFF.
- ★ If there is no battery voltage, check the following:
 - Main Fuse 30A
 - Ignition Switch
 - Wiring for Vehicle-down Sensor Power Source

II. Connections to Connector (5 V circuit)

- Meter (+) → Connector Y/G Lead [E]
- Meter (-) → Connector BK/Y Lead [D]
- Turn the ignition switch ON, and measure the power source voltage.

Vehicle-down Sensor Power Source Voltage
Standard: about 5 V

- Turn the ignition switch OFF.
- ★ If there is no standard voltage, check the following:
 - Igniter
 - Wiring for Vehicle-down Sensor Power Source

Vehicle-down Sensor Output Voltage:

- Remove the vehicle-down sensor (see Vehicle-down Sensor Removal).
- Connect the vehicle-down sensor [A] to the connector of the harness.
- Hold the sensor almost vertical [B] with the arrow mark pointed up.
- Connect:
 - Vehicle-down Sensor Lead Connector [C]
 - Digital Volt Meter [D]
 - Needle Adapters [E]

Special Tool - Needle Adapter Set: 57001-1457

Connection to Connector (5 V circuit)

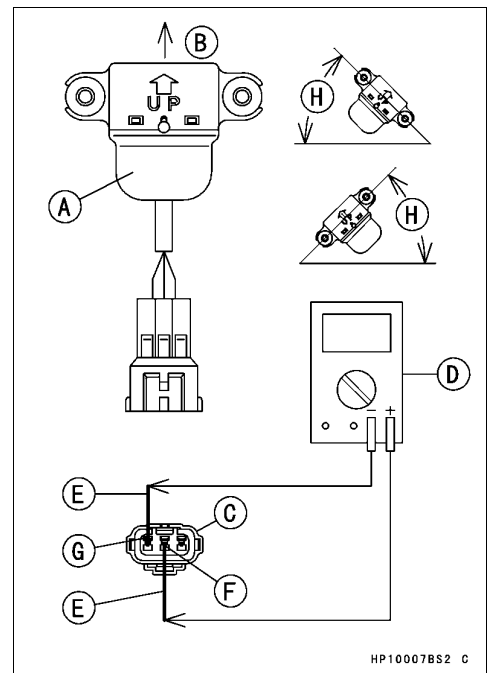
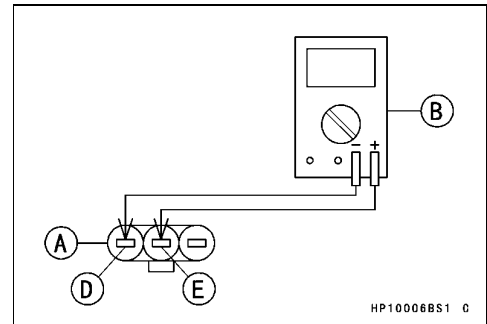
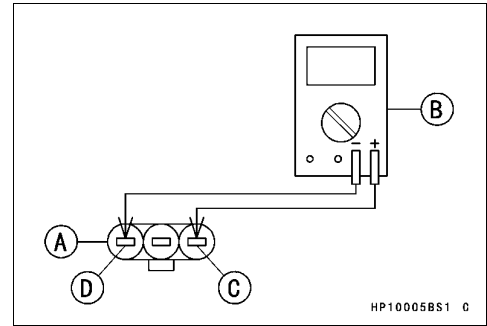
- Meter (+) → Connector Y/G Lead [F]
- Meter (-) → Connector BK/Y Lead [G]
- Turn the ignition switch ON, and measure the output voltage with the connector joined.

Vehicle-down Sensor Power Output Voltage
Standard: 0.4 ~ 1.4 V
 (with sensor arrow mark pointed up)

- Tilt the sensor 60 ~ 70° or more [H] right or left, and measure the output voltage.
- The time lag is from 0.5 to 1 second.

Vehicle-down Sensor Power Output Voltage
Standard: 3.7 ~ 4.4 V
 (with sensor tilted 60 ~ 70° or more, right or left)

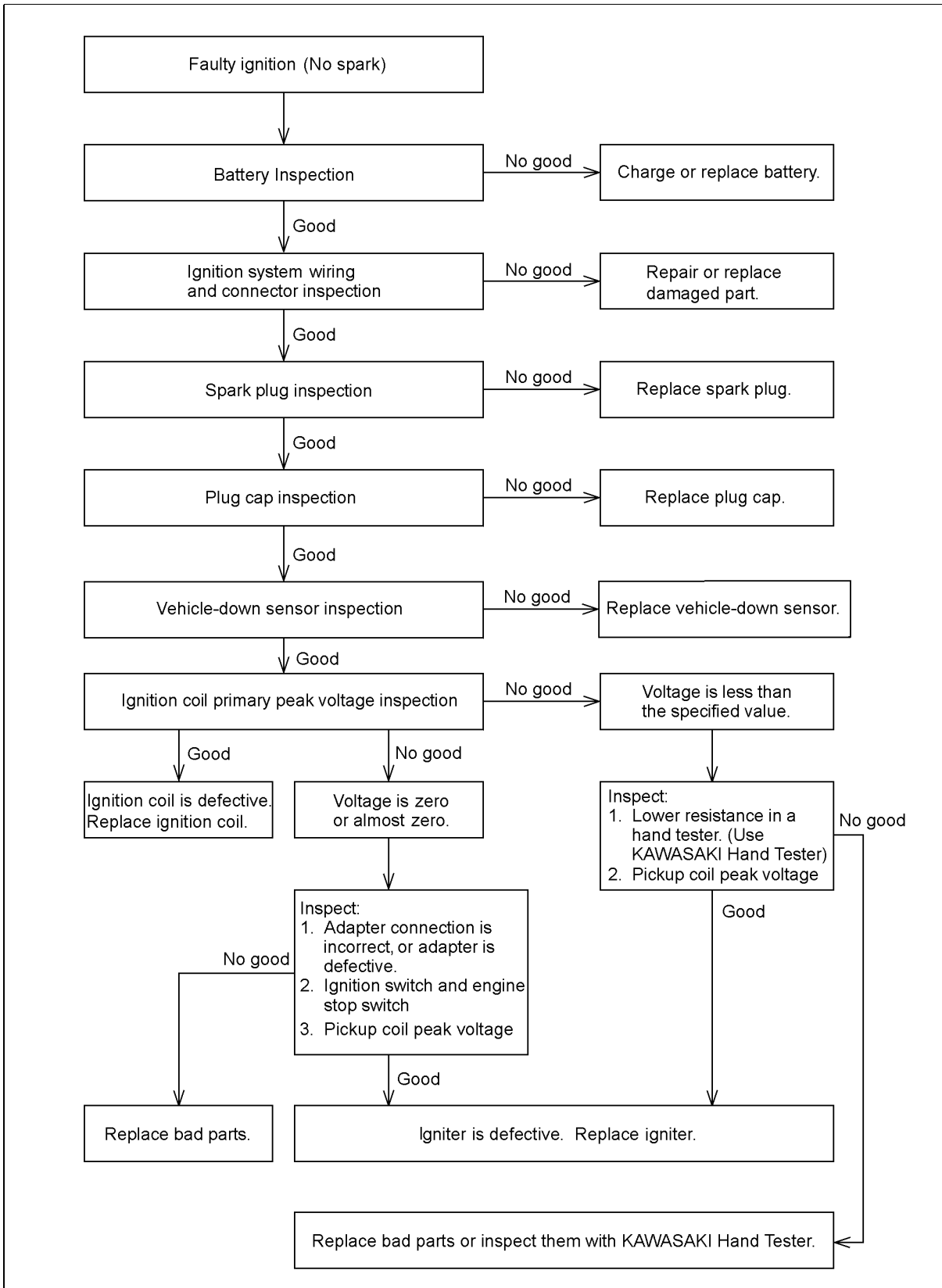
- ★ If the output voltage is out of the specified, replace the vehicle-down sensor.



16-36 ELECTRICAL SYSTEM

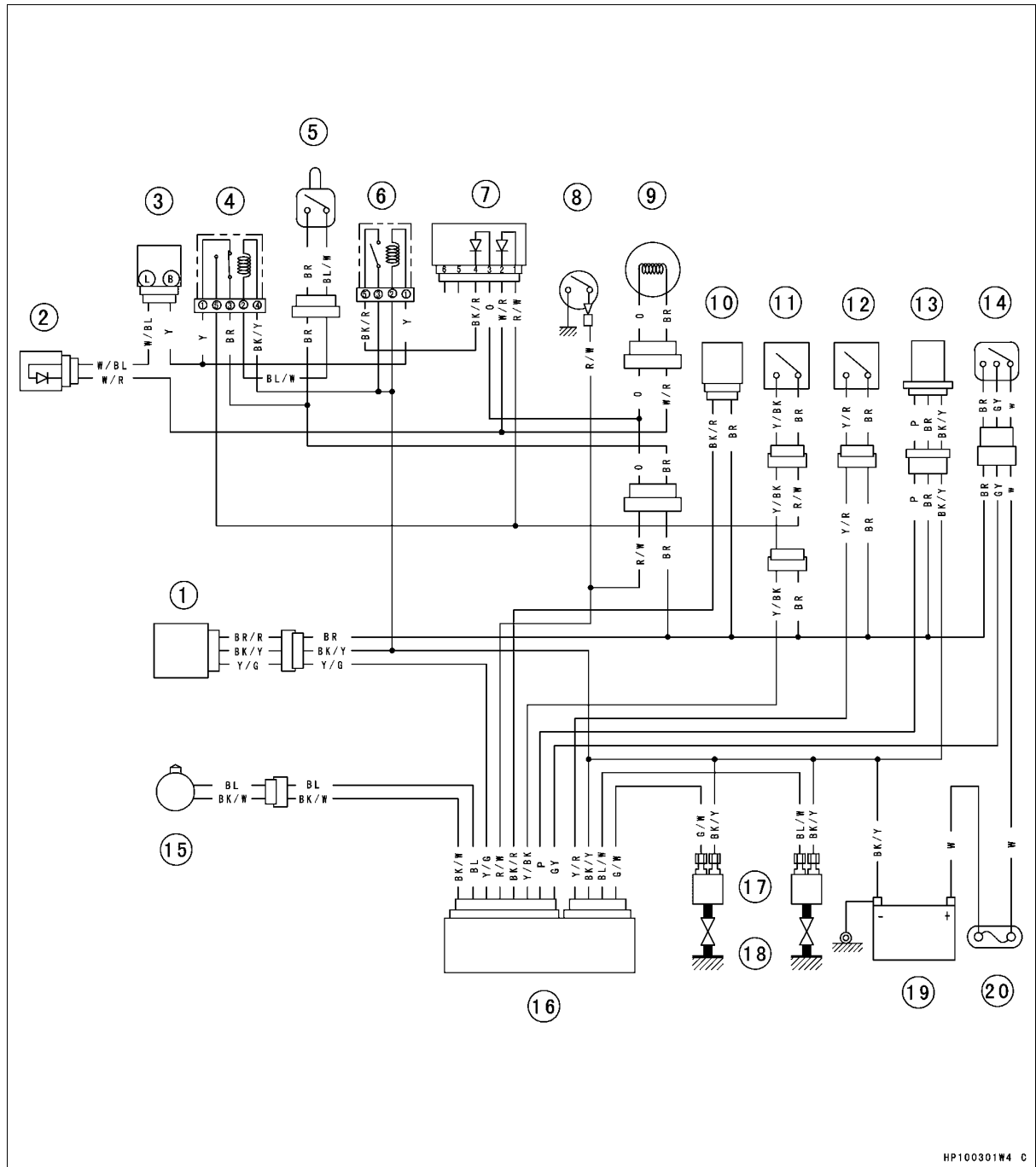
Ignition System

Ignition System Troubleshooting



Ignition System

Ignition System Circuit (KVF650-A1/B1 models)



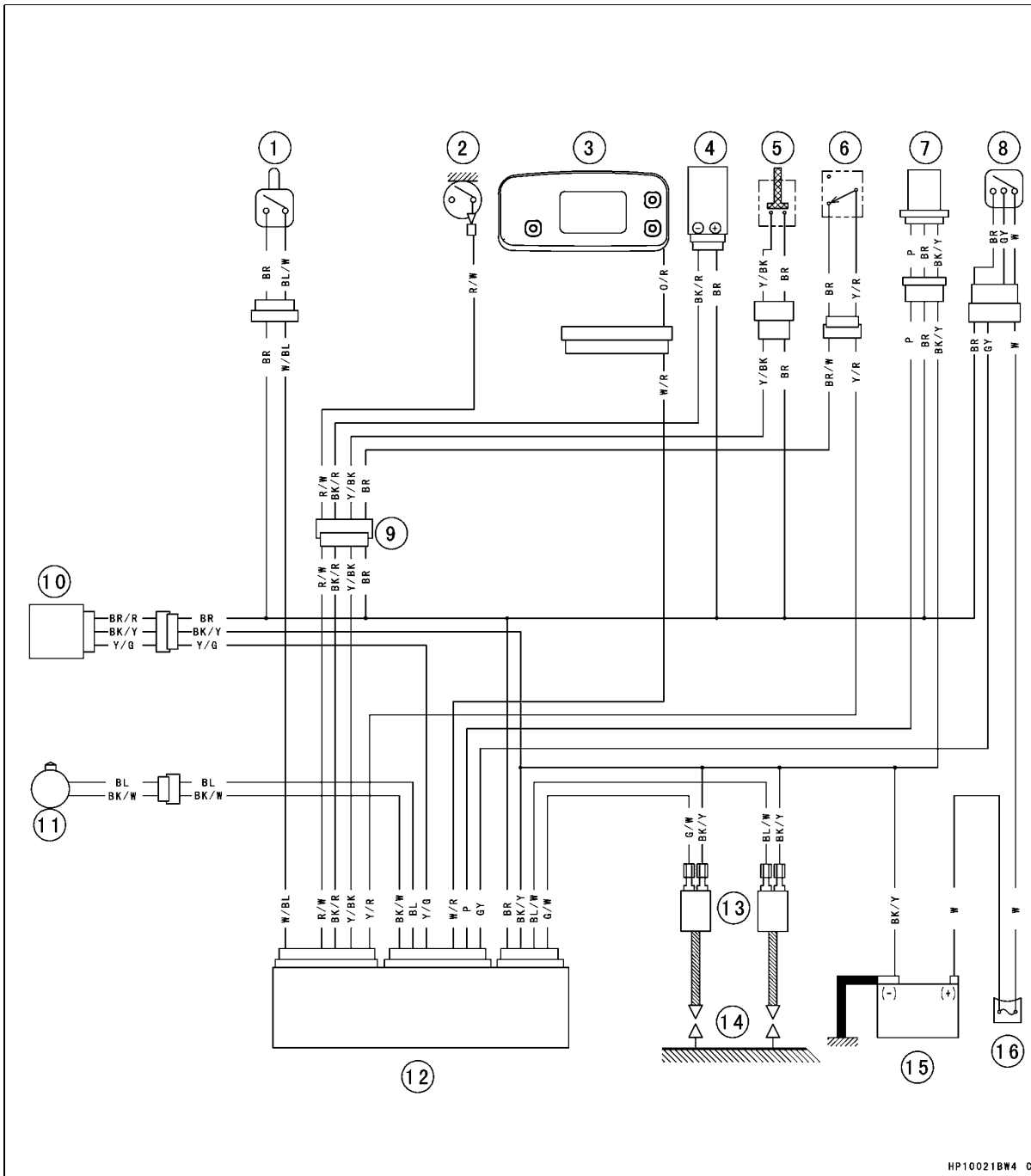
HP100301W4 C

- | | | |
|----------------------------------|--|---------------------|
| 1. Vehicle-down Sensor | 8. Reverse Switch | 14. Ignition Switch |
| 2. Diode | 9. Multifunction Meter | 15. Pickup Coil |
| 3. Flashing Relay | 10. Fuel Pump | 16. Igniter |
| 4. Switch Circuit Relay | 11. Reverse Power Assist Switch (Override) | 17. Ignition Coils |
| 5. Belt Failure Detection Switch | 12. Engine Stop Switch | 18. Spark Plugs |
| 6. System Circuit Relay | 13. Speed Sensor | 19. Battery |
| 7. Diode Assembly | | 20. Main Fuse 30A |

16-38 ELECTRICAL SYSTEM

Ignition System

Ignition System Circuit (KVF650-A2/B2 models)



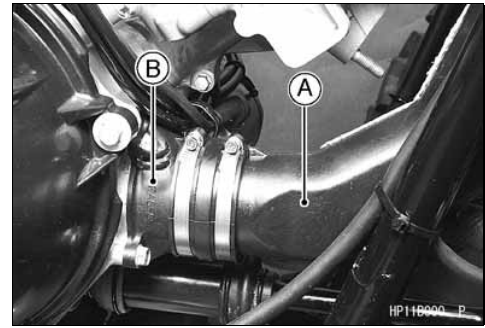
- | | | |
|---|-------------------------|--------------------|
| 1. Belt Failure Detection Switch | 6. Engine Stop Switch | 11. Pickup Coil |
| 2. Reverse Switch | 7. Speed Sensor | 12. Igniter |
| 3. Multifunction Meter | 8. Ignition Switch | 13. Ignition Coils |
| 4. Fuel Pump | 9. Reset Connector | 14. Spark Plugs |
| 5. Reverse Power Assist Switch (Override) | 10. Vehicle-down Sensor | 15. Battery |
| | | 16. Main Fuse 30A |

HP10021BW4 C

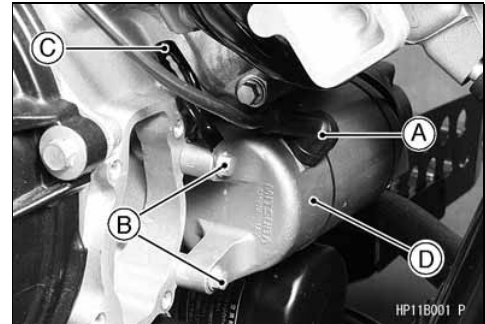
Electric Starter System

Starter Motor Removal

- Remove:
 - Air Intake Snorkel Duct [A]
 - Joint Duct [B] and Collars



- Remove:
 - Starter Motor Cable [A]
 - Starter Motor Mounting Bolts [B]
 - Clamp [C]
 - Starter Motor [D]

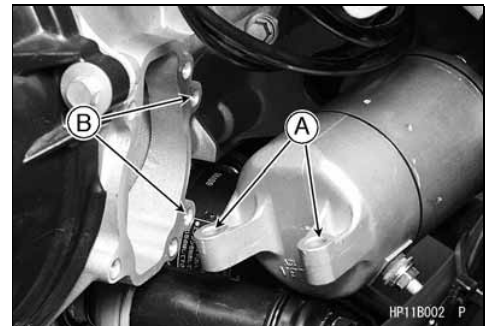


CAUTION

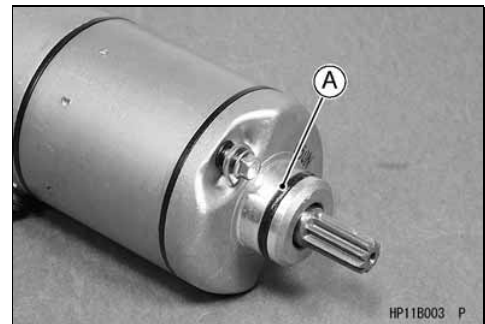
Do not tap the end of the starter motor shaft or the motor may be damaged.

Starter Motor Installation

- When installing the starter motor, clean the starter motor lugs [A] and crankcase [B] where the starter motor is grounded.



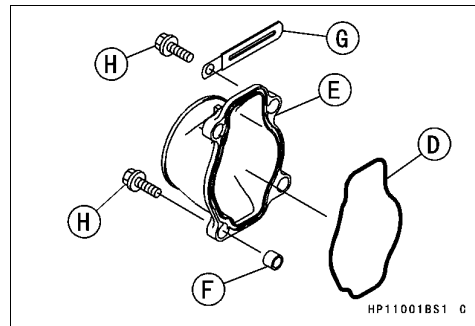
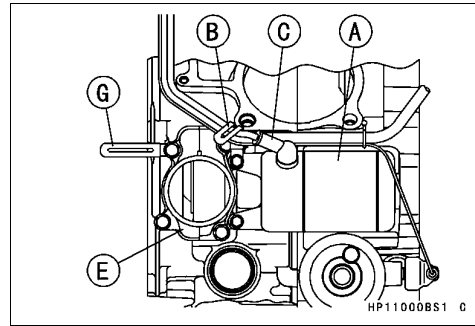
- ★ If the O-ring [A] shows wear or damage, or if it is hardened, replace it with a new one.
- Apply a small amount of engine oil to the O-ring.



16-40 ELECTRICAL SYSTEM

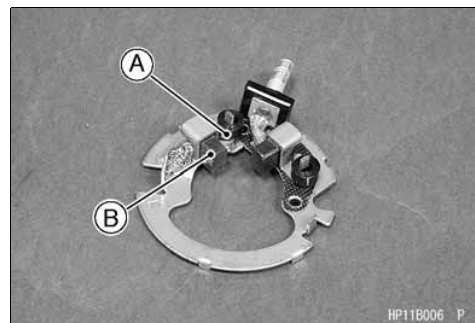
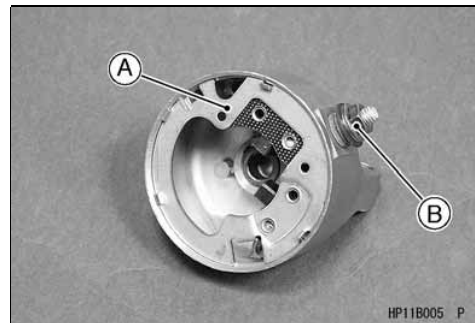
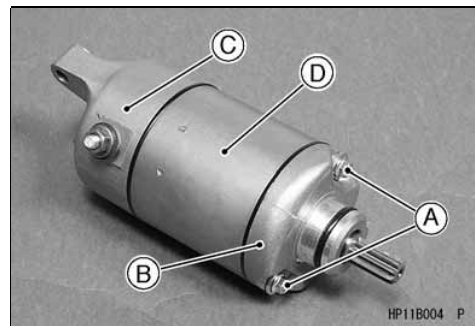
Electric Starter System

- Install:
 - Starter Motor [A]
 - Clamp [B] (as shown)
 - Starter Motor Cable [C]
- Tighten:
 - Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**
 - Torque - Starter Motor Terminal Nut: 4.9 N·m (0.5 kgf·m, 43 in·lb)**
- Apply grease to the O-ring [D] in the joint duct [E].
- Install:
 - Joint Duct and Collars [F]
 - Clamp [G] (as shown)
- Tighten:
 - Torque - Joint Duct Bolts [H]: 8.8 N·m (0.9 kgf·m, 78 in·lb)**



Starter Motor Disassembly

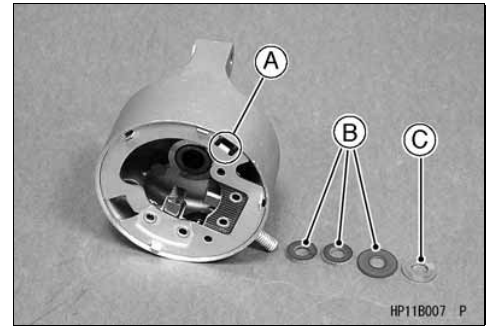
- Remove:
 - Starter Motor Bolts [A]
 - Left End Cover [B]
 - Right End Cover [C]
 - Yoke [D]
- To remove the brush plate assembly [A], remove the terminal nut [B].
- Hold the brush spring [A] with needle nose pliers, and pull the brush [B] off the holder.



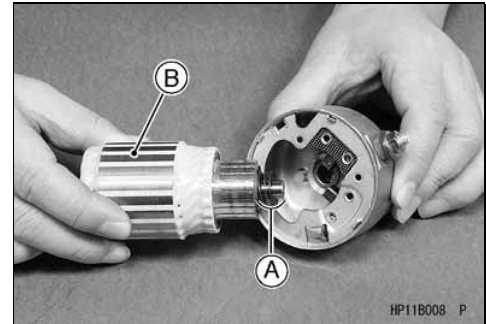
Electric Starter System

Starter Motor Assembly

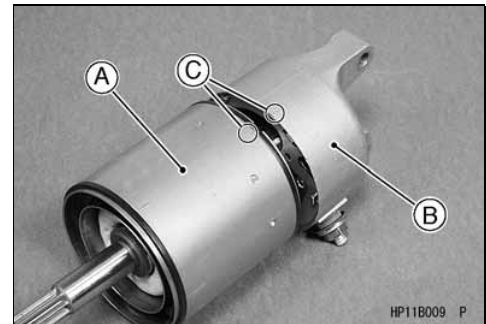
- Replace the O-rings.
- Install the brush plate assembly to the right end cover so that the projection [A] on the brush plate fits into the groove on the right end cover.
- Install the O-ring, insulators [B], and washer [C] in that order on the terminal bolt.
- Tighten:
Torque - Starter Motor Terminal Locknut: 6.9 N·m (0.7 kgf·m, 61 in·lb)



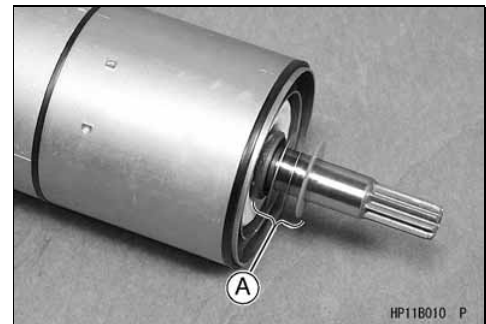
- Install the washers [A].
- Install the armature [B] between the brushes.



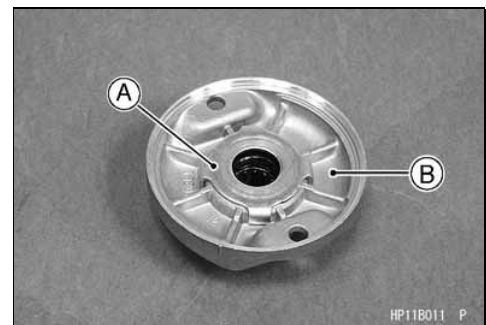
- Install the yoke [A] onto the right end cover [B] aligning the marks [C] on the yoke and right end cover.



- Install the washers [A].



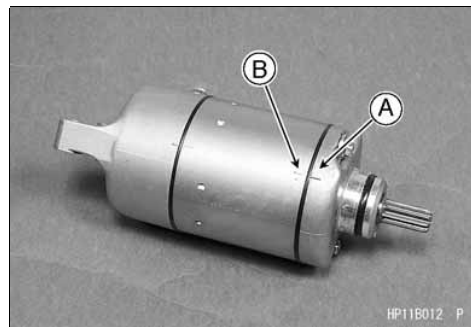
- Install the plate [A] on the left end cover [B].



16-42 ELECTRICAL SYSTEM

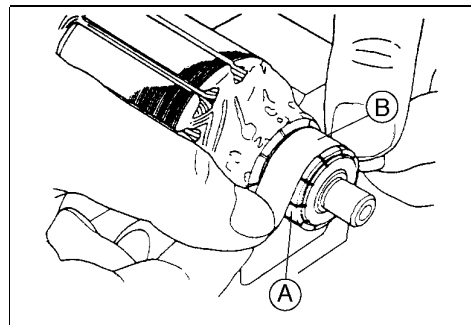
Electric Starter System

- Align the mark [A] on the left end cover with the mark [B] on the yoke.
- Tighten:
Torque - Starter Motor Bolts: 4.9 N·m (0.5 kgf·m, 43 in·lb)



Commutator Cleaning/Inspection

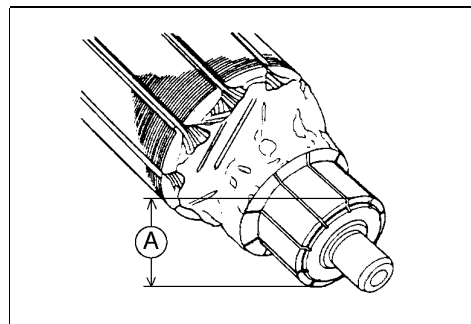
- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.



- Measure the diameter [A] of the commutator.
- ★ Replace the starter motor with a new one if the commutator diameter is less than the service limit.

Commutator Diameter

Standard:	28 mm (1.10 in.)
Service Limit:	27 mm (1.06 in.)

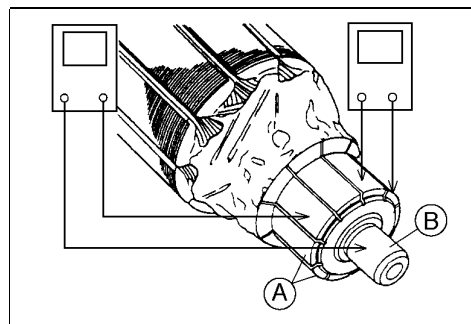


Armature Inspection

- Using the $\times 1 \Omega$ range, measure the resistance between any two commutator segments [A].
- ★ If there is a high resistance or no reading (∞) between any two segments, a winding is open. Replace the starter motor.
- Using the highest range, measure the resistance between the segments and the shaft [B].
- If there is any reading at all, the armature has a short. Replace the starter motor.

NOTE

- Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.



Electric Starter System

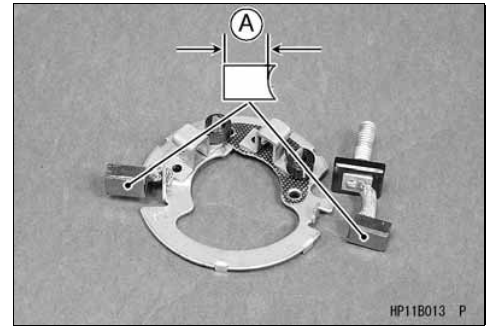
Starter Motor Brush Length

- Measure the overall length [A] of each brush.

Starter Motor Brush Length

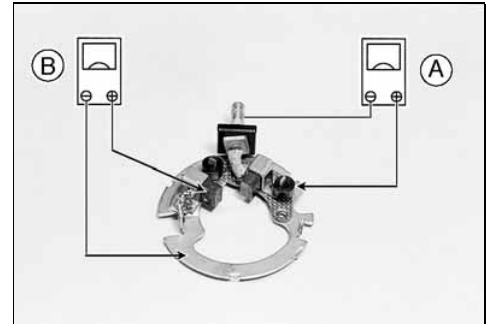
Standard: 12 mm (0.47 in.)
Service Limit: 4 mm (0.16 in.)

- ★ If any is worn down to the service limit, replace the brush plate assembly.



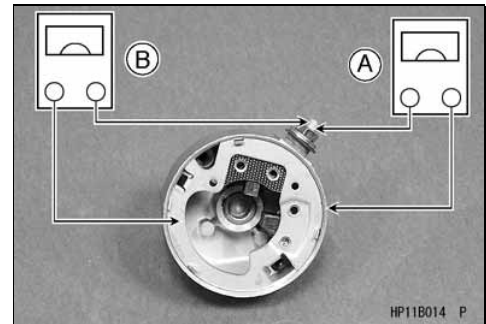
Brush Assembly Inspection

- Using the x 1 Ω range, measure the resistance as shown.
 - [A] Terminal Bolt and Positive Brush
 - [B] Brush Plate and Negative Brush
- ★ If there is not close to zero ohms, the brush lead has an open. Replace the brush plate assembly.



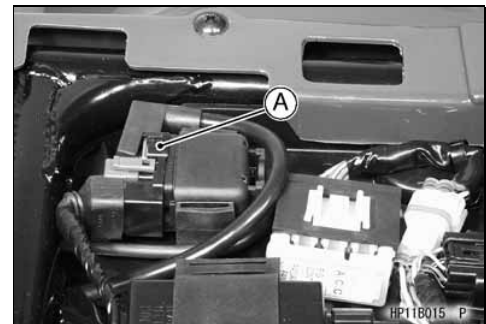
Brush Plate and Terminal Bolt Inspection

- Using the highest range, measure the resistance as follows:
 - [A] Terminal Bolt and Right – Hand End Cover
 - [B] Terminal Bolt and Brush Plate
- ★ If there is any reading, the brush holder assembly has a short. Replace the brush plate assembly.



Starter Relay Inspection

- Remove:
 - Seat (see Frame chapter)
 - Starter Relay [A]

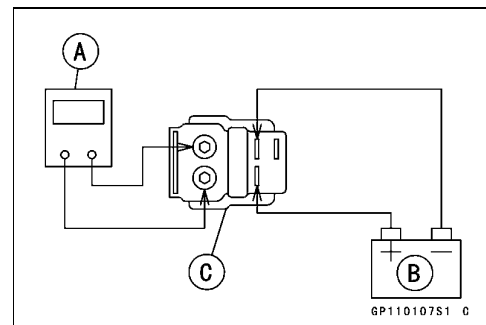


- Connect the hand tester [A] and a 12 V battery [B] to the starter relay [C] as shown.
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

Testing Relay

Hand Tester Range: x 1 Ω range

Criteria : When battery is connected \Rightarrow 0 Ω
 When battery is disconnected \Rightarrow ∞ Ω

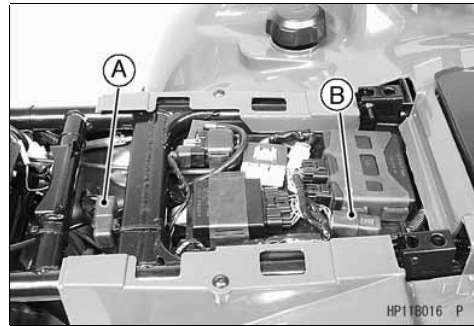


16-44 ELECTRICAL SYSTEM

Electric Starter System

Starter Circuit Relay Inspection

- Remove:
 - Seat (see Frame chapter).
 - Starter Circuit Relay [A] (Brake Switch Circuit)
 - Starter Circuit Relay [B] (Neutral Switch Circuit)
- The starter circuit relays for the brake and neutral switch circuits 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

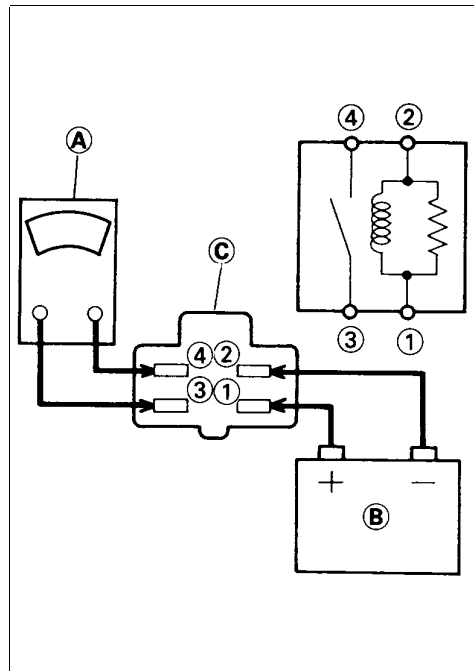
Hand Tester Range: $\times 1 \Omega$

Criteria: When battery is connected $\Rightarrow 0 \Omega$

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

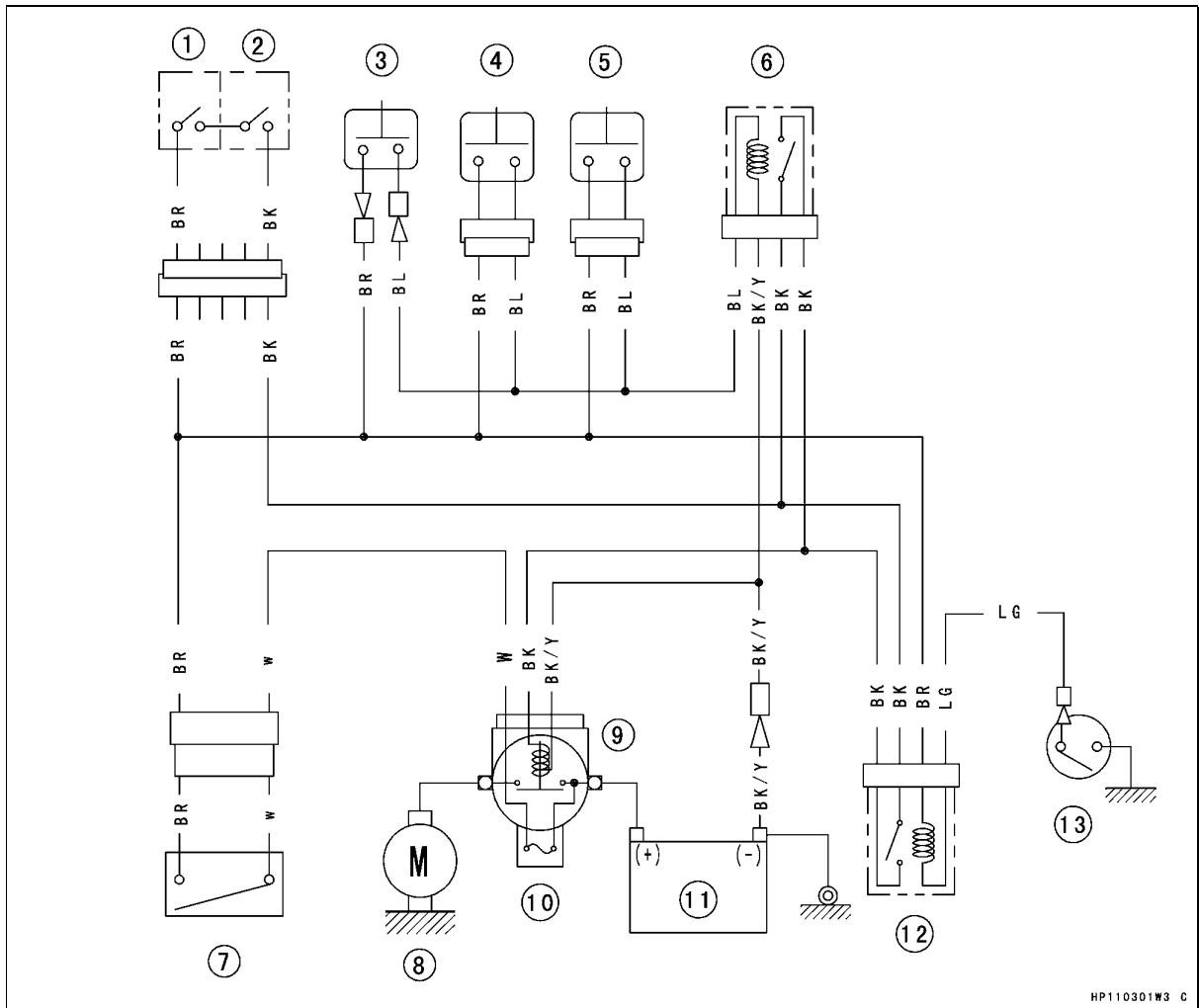
Relay Coil Terminals [1] and [2]

Relay Switch Terminals [3] and [4]



Electric Starter System

Electric Starter Circuit (KVF650-A1/B1 models)



1. Engine Stop Switch

2. Starter Button

3. Front Brake Light Switch

4. Parking Brake Light Switch

5. Rear Brake Light Switch

6. Starter Circuit Relay (Brake)

7. Ignition Switch

8. Starter Motor

9. Starter Relay

10. Main Fuse 30A

11. Battery

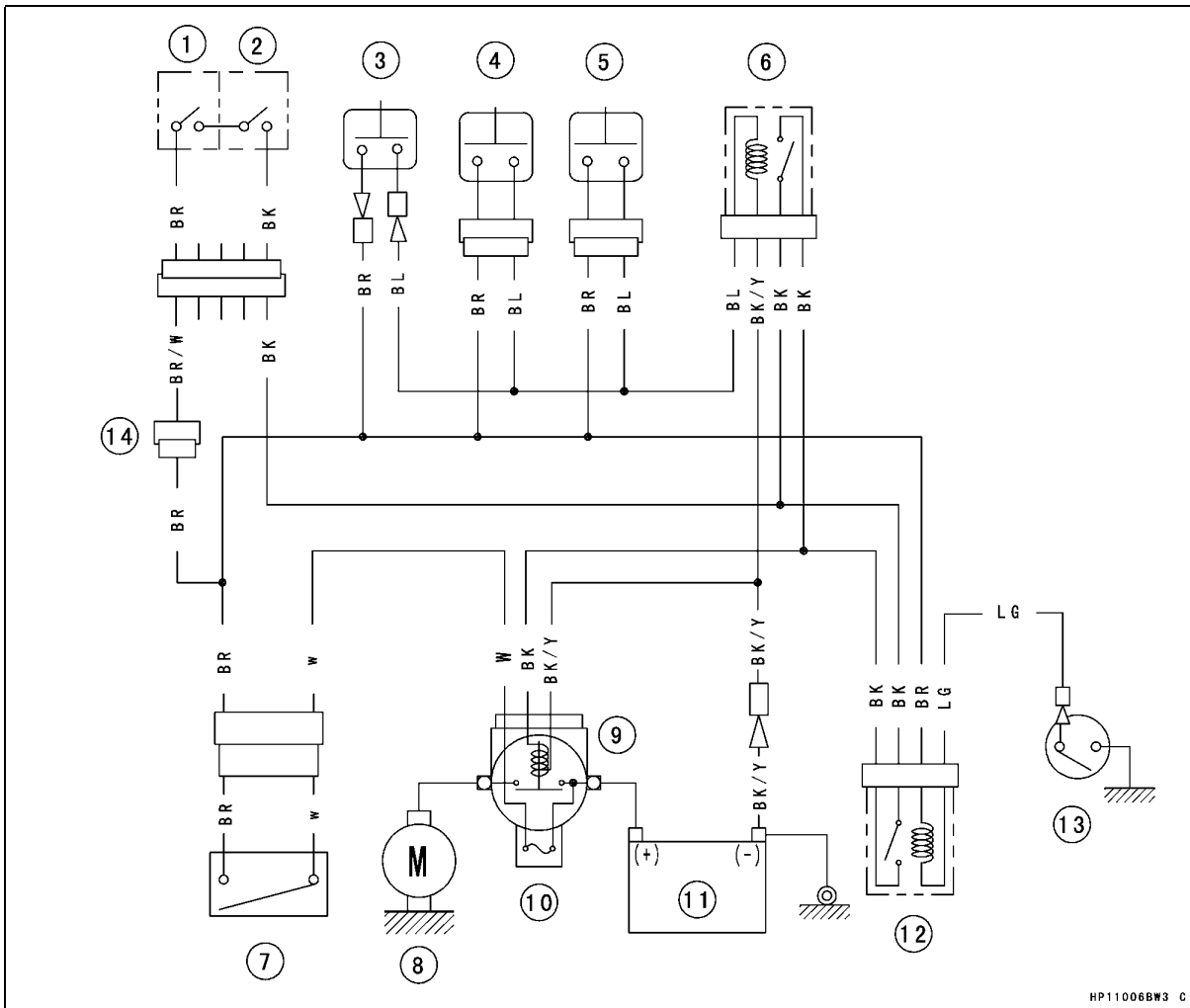
12. Starter Circuit Relay (Neutral)

13. Neutral Switch

16-46 ELECTRICAL SYSTEM

Electric Starter System

Electric Starter Circuit (KVF650-A2/B2 models)



- | | | |
|-------------------------------|----------------------------------|-------------------------------------|
| 1. Engine Stop Switch | 6. Starter Circuit Relay (Brake) | 11. Battery |
| 2. Starter Button | 7. Ignition Switch | 12. Starter Circuit Relay (Neutral) |
| 3. Front Brake Light Switch | 8. Starter Motor | 13. Neutral Switch |
| 4. Parking Brake Light Switch | 9. Starter Relay | 14. Reset Connector |
| 5. Rear Brake Light Switch | 10. Main Fuse 30A | |

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].

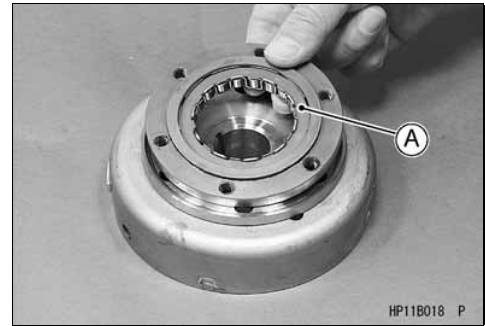
Special Tool - Flywheel Holder: 57001-1313



HP11B017 P

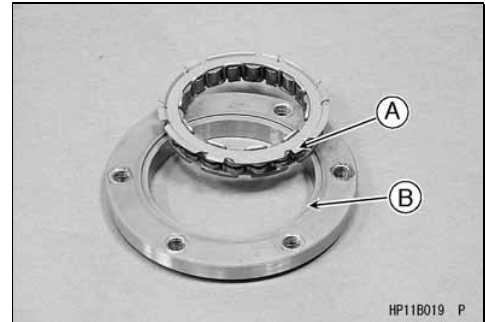
Electric Starter System

- Take out the one-way clutch [A].



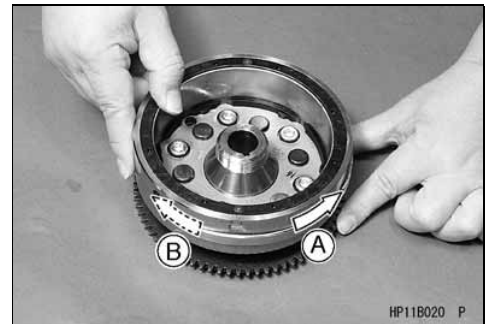
Starter Motor Clutch Installation

- Install the one-way clutch so that the flange [A] fits on the recess [B] of the race.
- Apply a non-permanent locking agent:
Starter Motor Clutch Bolts
- Tighten:
Torque - Starter Motor Clutch Bolts : 34 N·m (3.5 kgf·m, 25 ft·lb)



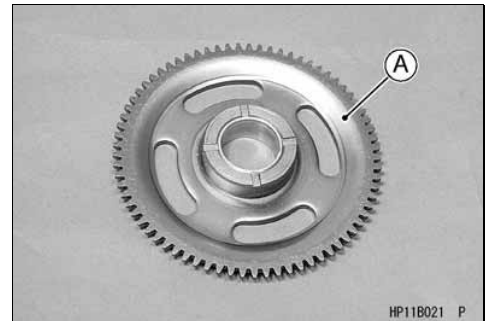
Starter Motor Clutch Inspection

- 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.



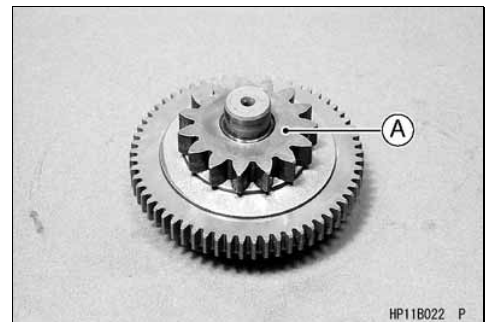
NOTE

- Examine the starter clutch gear [A]. Replace it if it is worn or damaged.



Torque Limiter Inspection

- Remove:
Alternator Rotor (see Electrical System chapter)
- Remove the torque limiter [A] and visually inspect it.
- ★ If the limiter has wear, discoloration, or other damage, replace it as a unit.



16-48 ELECTRICAL SYSTEM

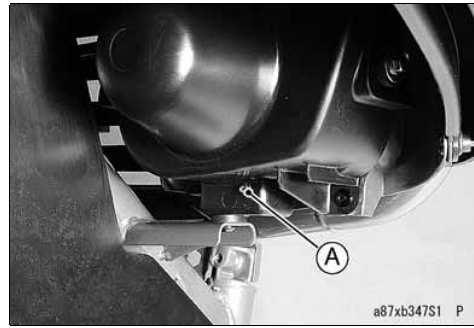
Lighting System

Headlight Beam Vertical Adjustment

- Turn the adjusting screw [A] on each headlight rim in or out to adjust the headlight vertically.

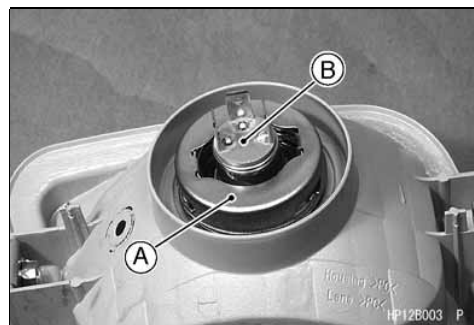
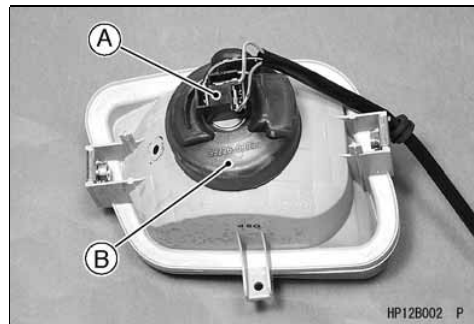
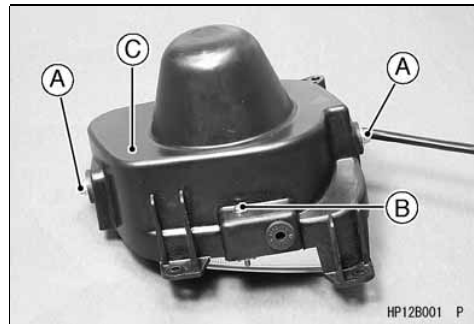
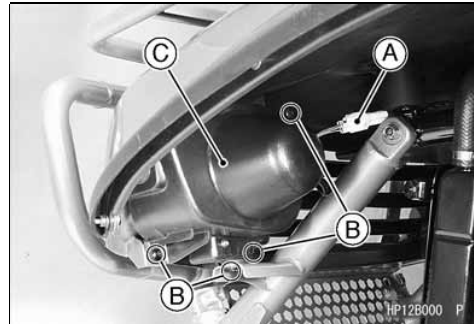
NOTE

- 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.



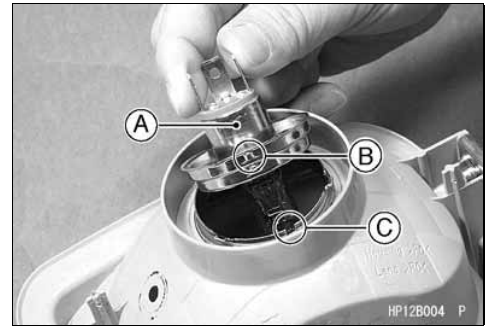
Headlight Bulb Replacement

- Remove:
 - Front Inside Cover
 - Connector [A]
 - Mounting Screws [B]
 - Headlight Unit [C]
- Remove:
 - Headlight Bolts [A], Washer, and Collar
 - Vertical Adjustment Screw [B], Spring, and Nut
 - Headlight Body [C]
- Remove:
 - Headlight Connector [A]
 - Dust Cover [B]
- Push the holder [A] and turn it counterclockwise.
- Remove:
 - Holder
 - Headlight Bulb [B]

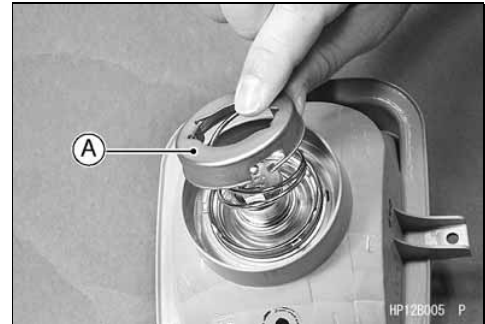


Lighting System

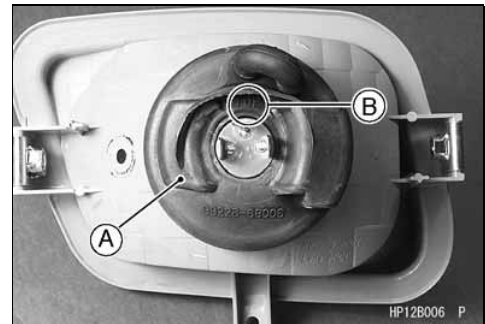
- Insert the new bulb [A] by aligning the tang [B] with the notch [C] in the headlight unit.



- Push the bulb holder [A] in, turn it clockwise, and release it. It should lock in position.



- Fit the dust cover [A].
- Face the TOP mark [B] upward.

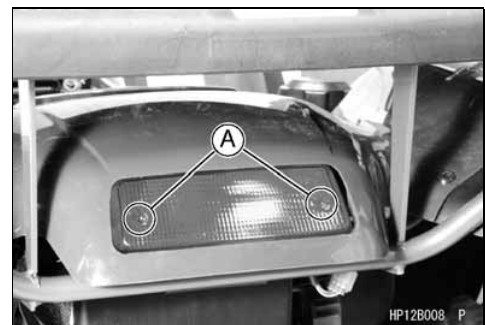


- Install:
Grommet [A]
Vertical Adjustment Screw, Spring [B], and Nut [C]
Damper and Collar [D]



Taillight Bulb Replacement

- Remove:
Taillight Lens Mounting Screws [A]



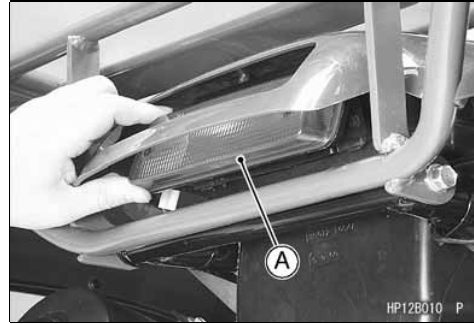
16-50 ELECTRICAL SYSTEM

Lighting System

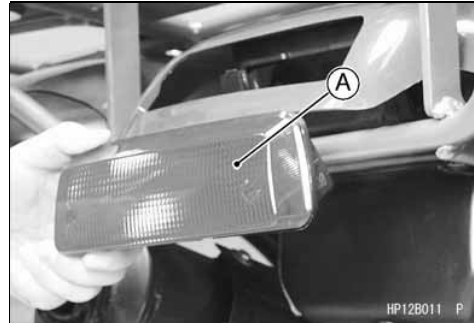
- Remove the taillight holder [A] assembly from the frame.



- Remove the taillight assembly [A] from the vehicle.



- Remove the taillight lens [A] from the taillight assembly.



- Push the bulb [A] in, turn it counterclockwise, and pull it out.
- Be sure the socket is clean.

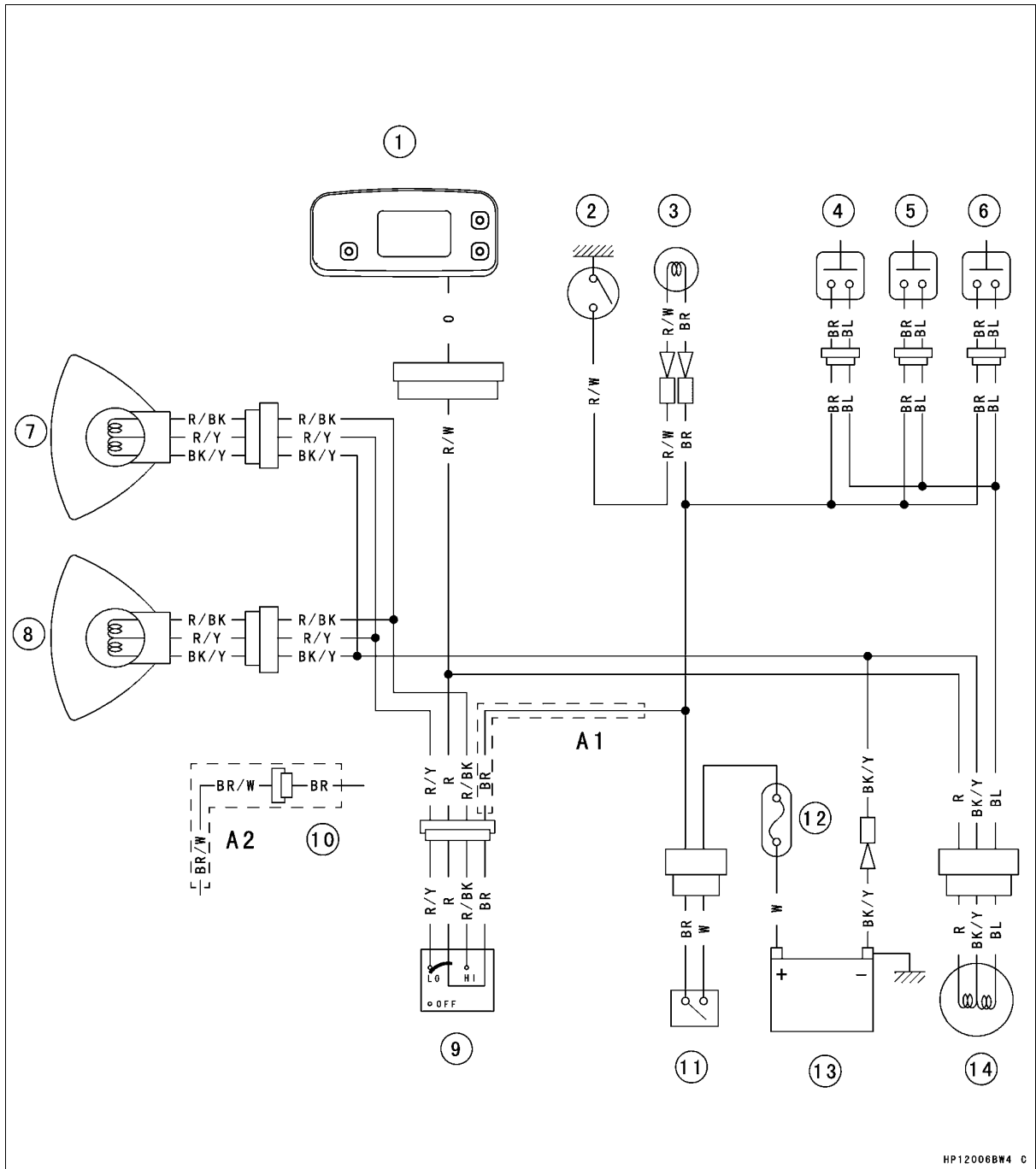


- Insert the new bulb by aligning the pins [A] with the grooves in the walls of the socket.
- Push the bulb in, turn it clockwise, and release it. It should lock in position.



Lighting System

Lighting System Circuit



- 1. Multifunction Meter
- 2. Reverse Switch
- 3. Reverse Light (EUR and GB models)
- 4. Front Brake Light Switch
- 5. Parking Brake Light Switch

- 6. Rear Brake Light Switch
- 7. Headlight (Right)
- 8. Headlight (Left)
- 9. Light/Dimmer Switch
- 10. Reset Connector

- 11. Ignition Switch
- 12. Main Fuse 30A
- 13. Battery
- 14. Tail/Brake Light
- A1: KVF650-A1/B1 Models
- A2: KVF650-A2/B2 Models

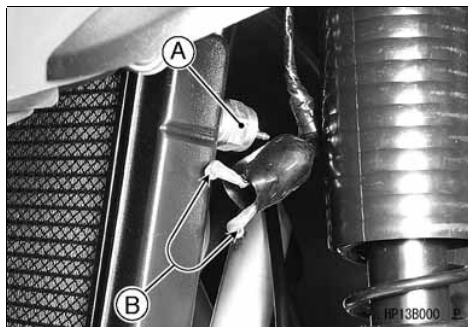
HP12008W4 C

16-52 ELECTRICAL SYSTEM

Radiator Fan System

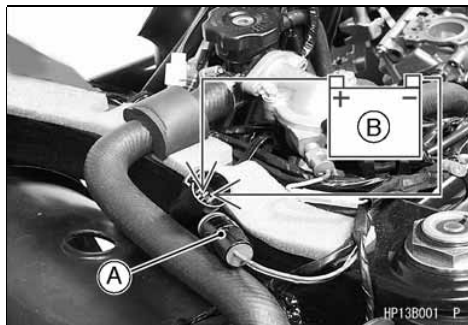
Radiator Fan Circuit Inspection

- Remove the left front side cover (see Frame chapter).
- Disconnect the leads from the radiator fan switch [A].
- Using an auxiliary wire [B], connect the radiator fan switch leads.
- ★ If the fan rotates, inspect the fan switch.
- ★ If the fan does not rotate, inspect the following.
 - Leads and Connectors
 - Main Fuse and Fan Fuse
 - Fan Motor



Radiator Fan Motor Inspection

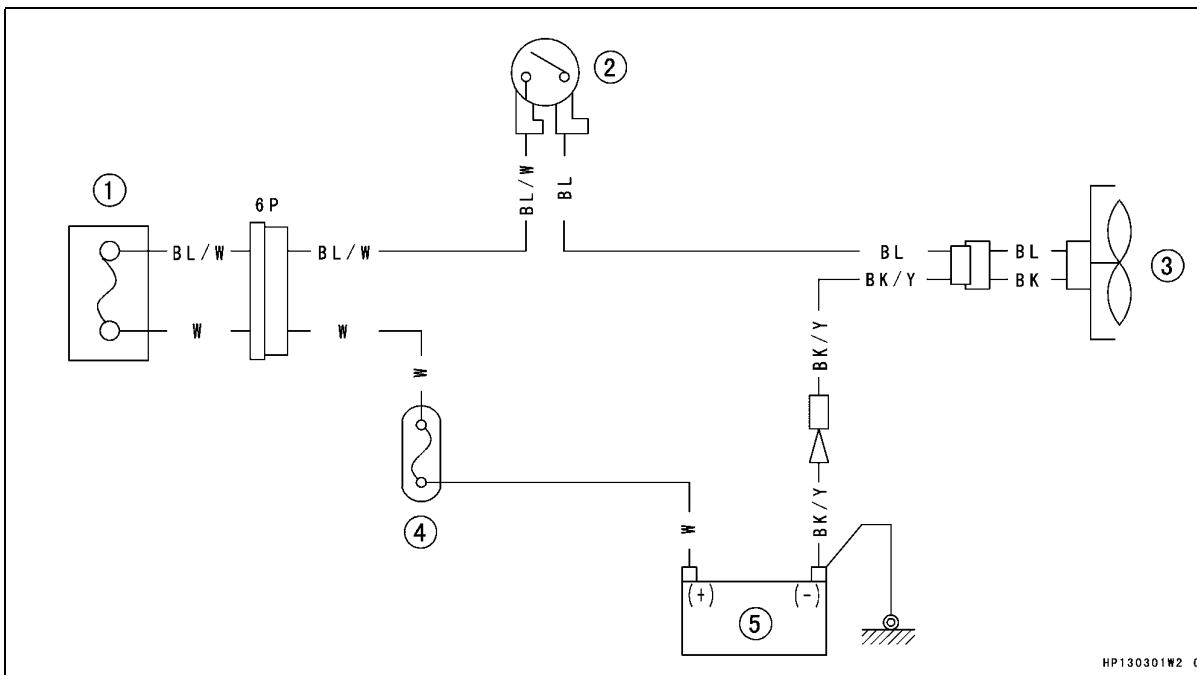
- Remove the Front Fender (see Frame chapter).
- Disconnect the connector [A] in the fan lead.
- Using two auxiliary wires, supply battery [B] voltage to the fan motor.
- ★ If the fan does not rotate, the fan motor is defective and must be replaced.



Radiator Fan Motor Leads

- BL: Battery (+)
- BK: Battery (-)

Radiator Fan Circuit



1. Radiator Fan Fuse 15A
2. Radiator Fan Switch
3. Radiator Fan

4. Main Fuse 30A
5. Battery

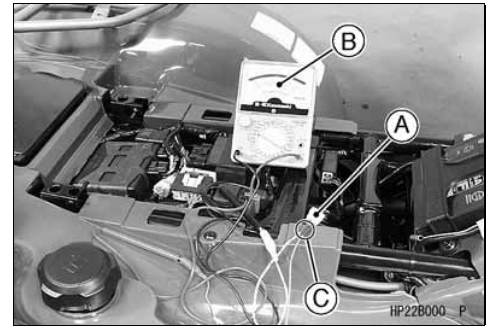
HP130301W2 C

Fuel Pump/Fuel Level Sensor

Fuel Pump Inspection

Fuel Pump Supply Voltage Inspection:

- Turn the ignition switch OFF.
- Remove:
 - Seat
 - Fuel Pump Lead Connector [A]
- Connect a hand tester [B] with suitable leads [C] as shown.
 - Hand Tester (+) → Fuel Pump Connector (BR) Terminal
 - Hand Tester (-) → Fuel Pump Connector (BK/R) Terminal
- Turn the ignition switch ON, and run the engine with the transmission in neutral.
- Measure the fuel pump supply voltage.



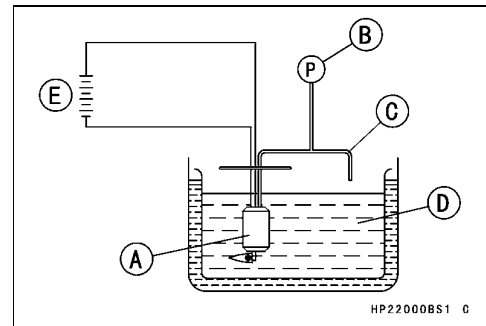
Fuel Pump Supply Voltage

Standard: near the Battery Voltage

- ★ If the reading is not as specified, replace the igniter.
- ★ If the reading is as specified, check the fuel pump.

Fuel Pump Operational Inspection:

- Remove:
 - Fuel Pump (see Fuel System chapter)
- Prepare a container filled with kerosene.
- Prepare the rubber hoses, and connect them to the pump fitting.
- Connect a suitable pressure gauge to the outlet hose as shown.
 - Fuel Pump [A]
 - Pressure Gauge [B]
 - Outlet Hose [C]
 - Kerosene [D]
 - Battery [E] (12V)
- Connect the pump leads to the battery using auxiliary wires as shown.
 - Battery (+) → Fuel Pump Connector (BR) Terminal
 - Battery (-) → Fuel Pump Connector (BK/R) Terminal
- ★ If the pump does not operate, the pump is defective. Replace the fuel pump.
- ★ If the pump operates is normal, close the outlet hose while operating the fuel pump.
- When the pump stops, read the pressure gauge.
- ★ If the pressure gauge reading is out of the specified pressure, the pump is defective. Replace the fuel pump.



Fuel Pump Pressure

Standard: 17.7 ~ 22.6 kPa (0.18 ~ 0.23 kgf/cm², 2.6 ~ 3.3 psi)

Fuel Level Sensor Inspection

- Remove:
 - Fuel Pump (see Fuel System 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.

16-54 ELECTRICAL SYSTEM

Fuel Pump/Fuel Level Sensor

- Using a hand tester [A], measure the resistance across the terminals in the fuel pump lead connector [B].

Special Tool - Hand Tester: 57001-1394

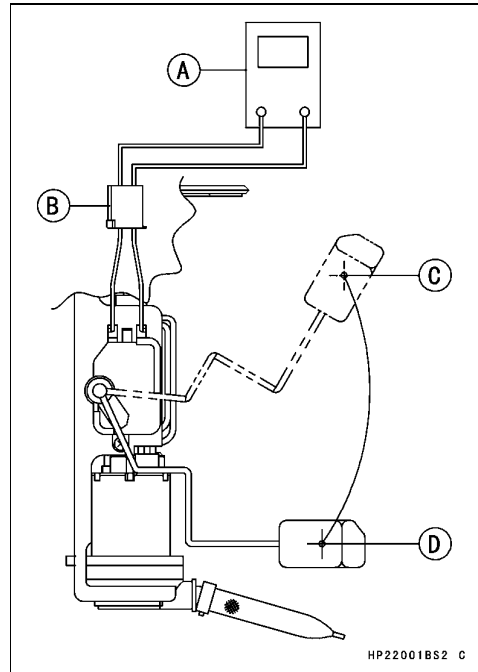
NOTE

- 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.

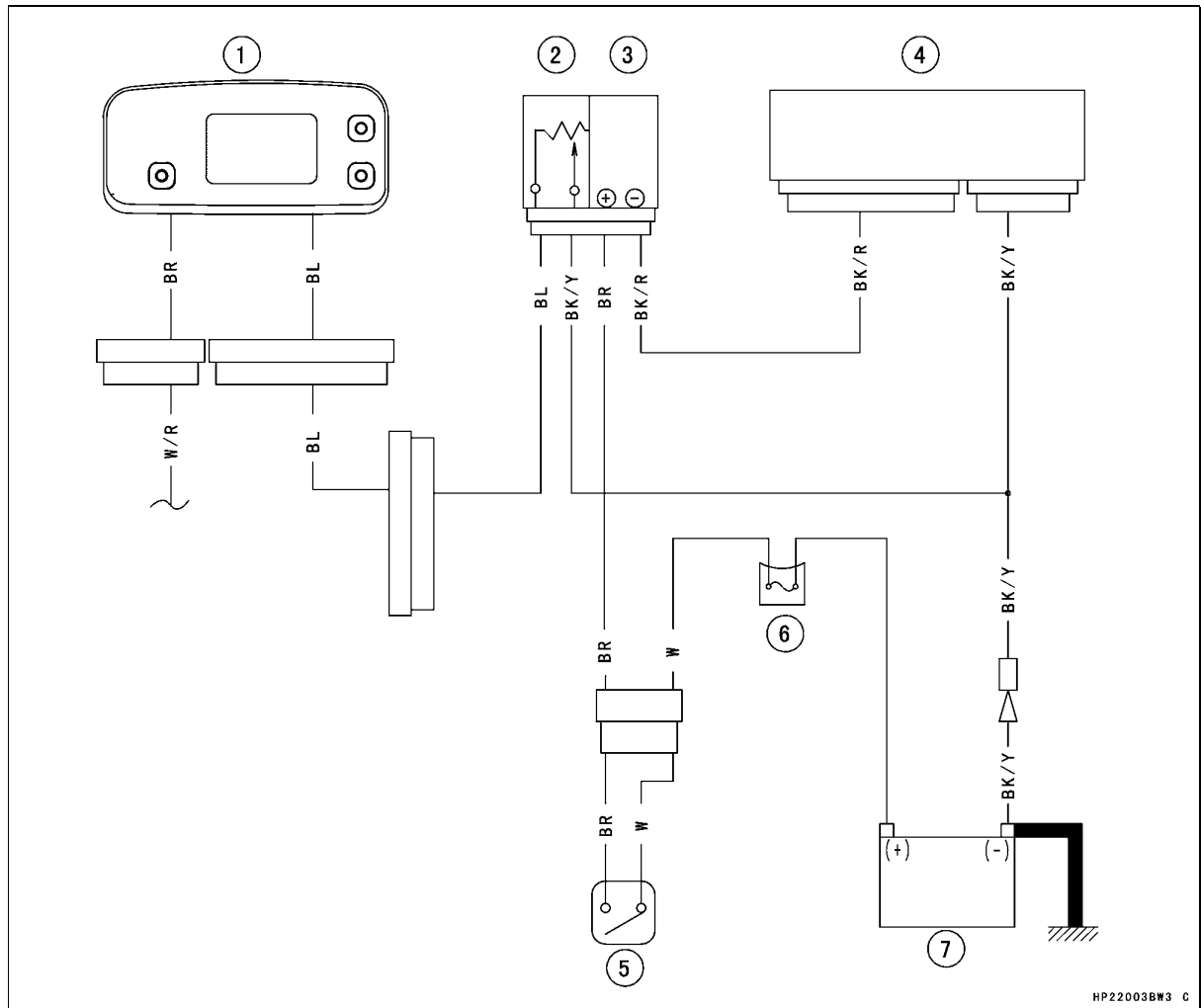
Fuel Level Sensor Resistance

Standard: Full Level Position [C]: 120 Ω
Empty Level Position [D]: 3 Ω



Fuel Pump/Fuel Level Sensor

Fuel Pump/Fuel Level Sensor Circuit (KVF650-A1/B1)



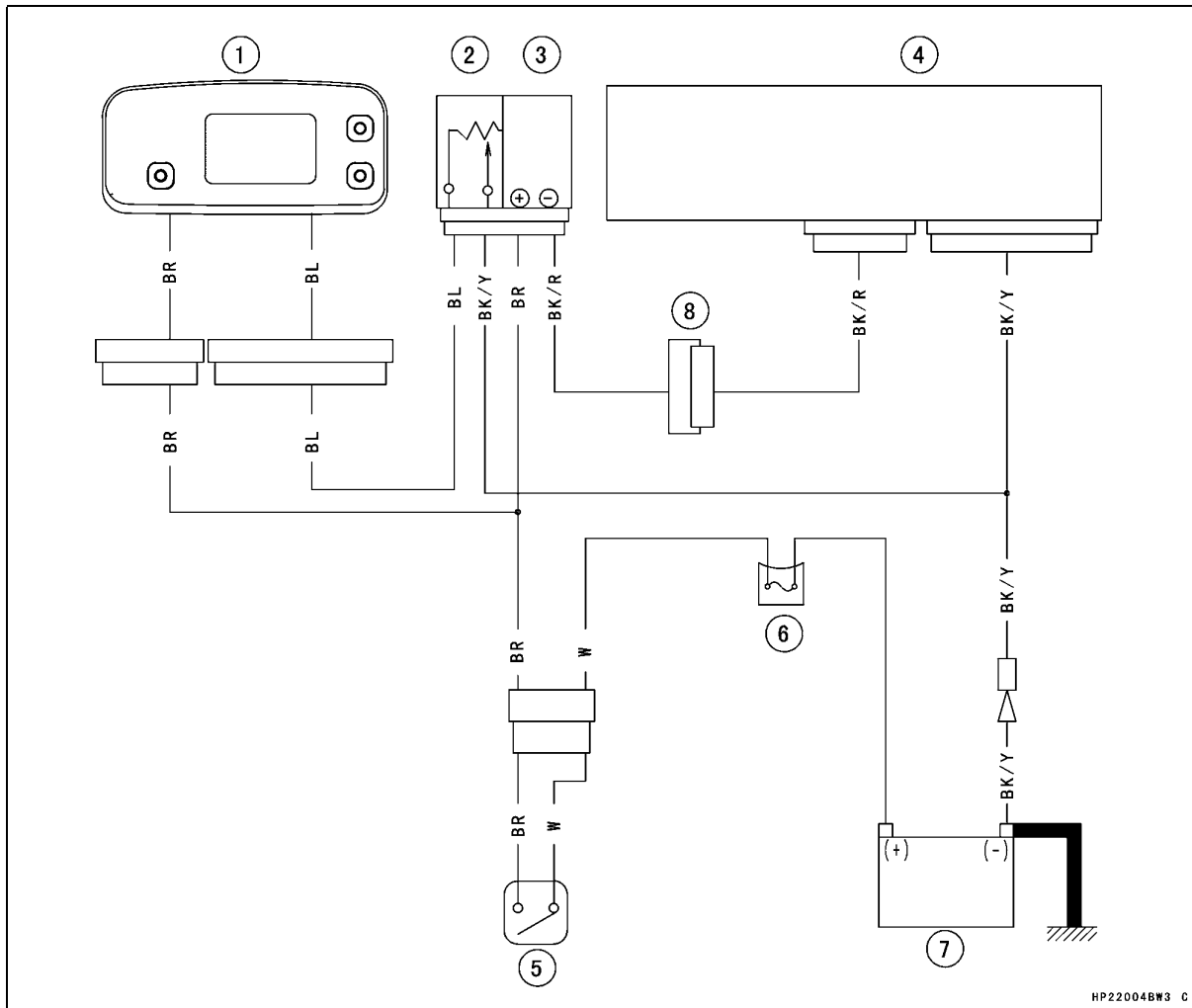
HP22003BW3 C

1. Multifunction Meter
2. Fuel Level Sensor
3. Fuel Pump
4. Igniter
5. Ignition Switch
6. Main Fuse 30 A
7. Battery

16-56 ELECTRICAL SYSTEM

Fuel Pump/Fuel Level Sensor

Fuel Pump/Fuel/Level Sensor Circuit (KVF650-A2/B2)



1. Multifunction Meter
2. Fuel Level Sensor
3. Fuel Pump
4. Igniter
5. Ignition Switch
6. Main Fuse 30 A
7. Battery
8. Reset Connector

Meter

Multifunction Meter Unit Removal

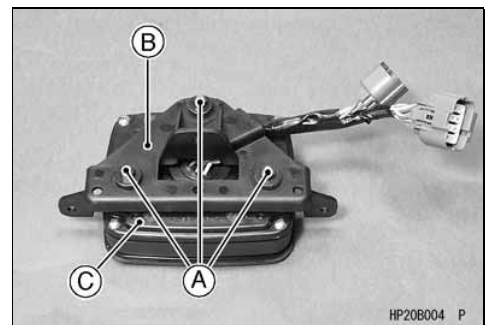
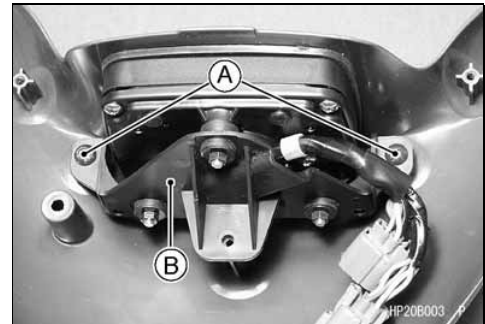
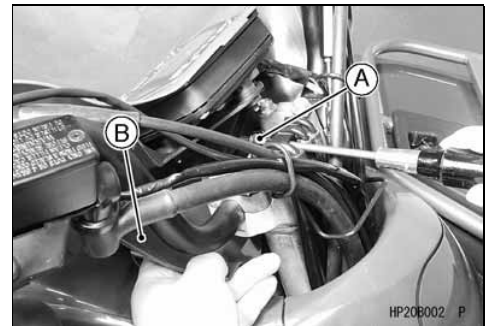
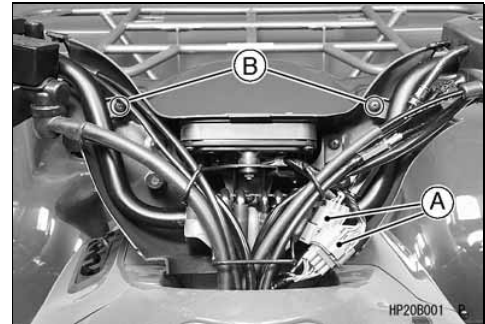
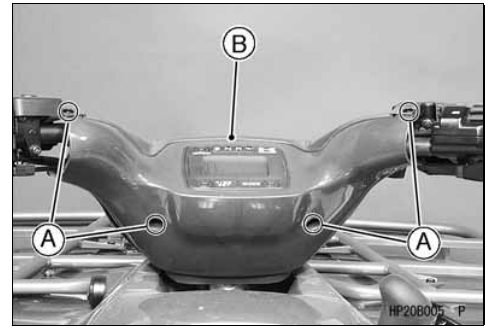
- Remove:
 - Handle Cover Screws [A]
 - Handle Cover Front [B]

- Remove:
 - Meter Lead Connectors [A]
 - Handle Cover Screws [B]

- Remove:
 - Handle Cover Screw [A]
 - Handle Cover Rear [B]

- 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]



CAUTION

Do not drop the meter unit.

16-58 ELECTRICAL SYSTEM

Meter

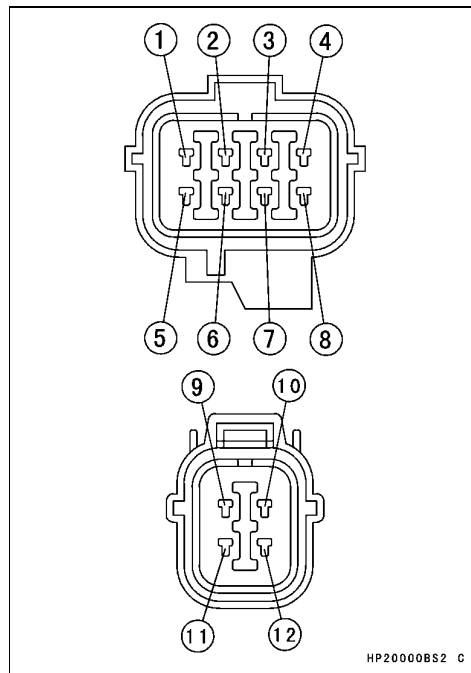
Multifunction Meter Unit Inspection

- Remove:
Multifunction Meter Unit (see Digital Meter Unit Removal)

CAUTION

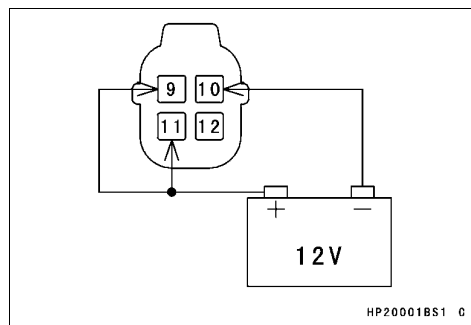
Do not drop the meter unit.

- [1] Speed Sensor Pulse
 - [2] (KVF650–A1/B1 models) Supply Voltage (unused terminal)
 - [2] (KVF650–A2/B2 models) Belt Indicator Light (LED) (–)
 - [3] Water Temperature Sensor (–)
 - [4] 2WD/4WD LCD Indicator (–)
 - [5] (KVF650–A1/B1 models) Fuel Gauge (Fuel Indicator Light LED and LCD Segments)
 - [5] (KVF650–A2/B2 models) Fuel Gauge (Fuel Indicator LCD Segments)
 - [6] Meter Illumination (+)
 - [7] Reverse Indicator Light (LED) (–)
 - [8] Neutral Indicator Light (LED) (–)
 - [9] Battery (+)
 - [10] Battery (–)
 - [11] Ignition (+)
 - [12] Oil Pressure Warning Indicator Light (LED) (–)
- LED: Light Emitting Diode
LCD: Liquid Crystal Display



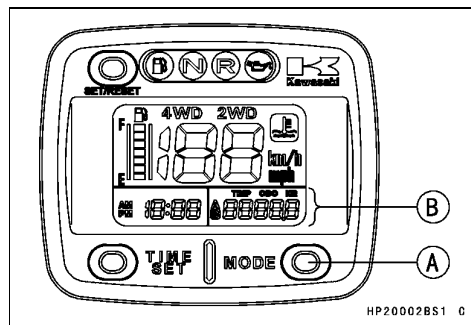
Check 1: LCD Segments Check

- Using auxiliary wires, connect a 12 V battery to the meter unit connector as follows.
 - Connect the battery positive (+) terminal to terminal [9].
 - Connect the battery negative (–) terminal to terminal [10].
 - Connect terminal [11] to the battery (+) terminal.
 - When the terminal [11] is connected, all the LCD segments appear for one second.
 - When the terminal [11] is disconnected, all the LCD segments disappear.
- ★ If this display function does not work, replace the meter unit.

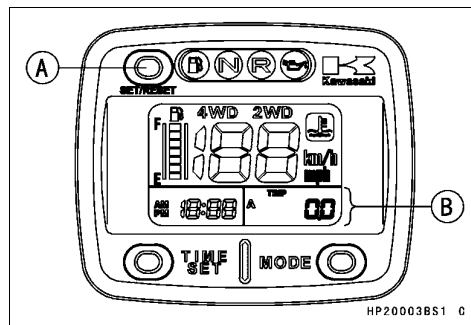


Check 2: MODE and TIME SET Buttons Operation Check

- 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.

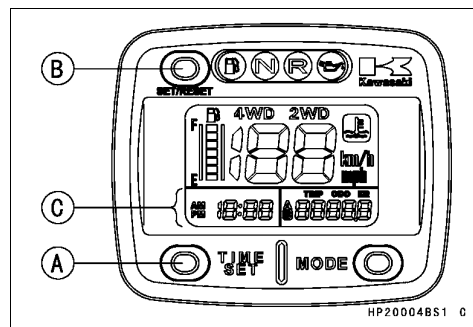


- Cycle the meter to TRIP A or TRIP B mode.
 - Check that when the SET/RESET button [A] is pushed, the display turns to 0.0.
- ★ If this display function does not indicate 0.0 [B], replace the meter unit.



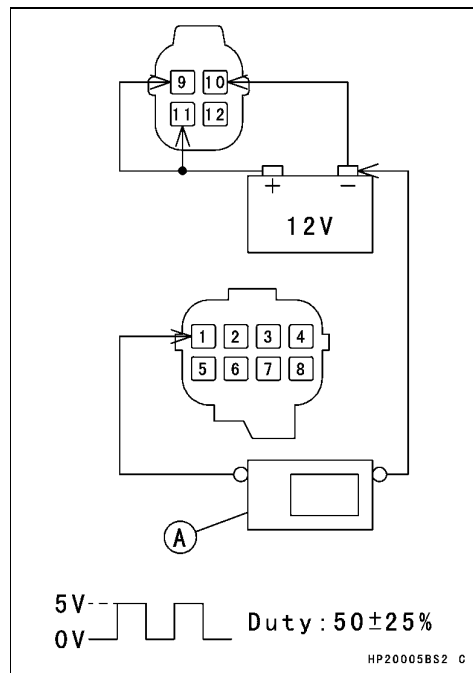
Meter

- 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.



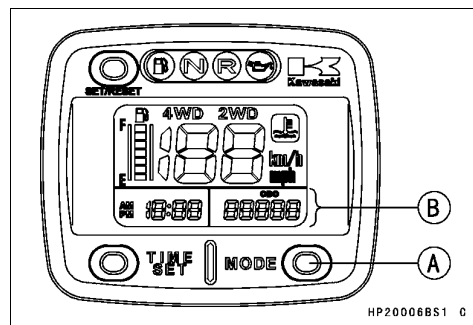
Check 3: Speedometer Check

- 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.



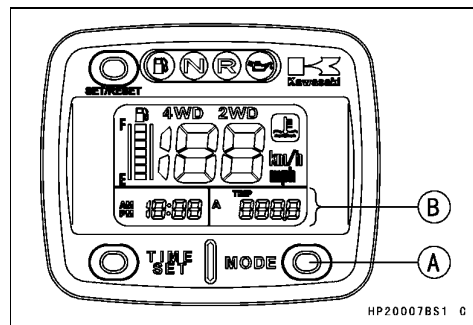
Check 4: Odometer Check

- 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.



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.



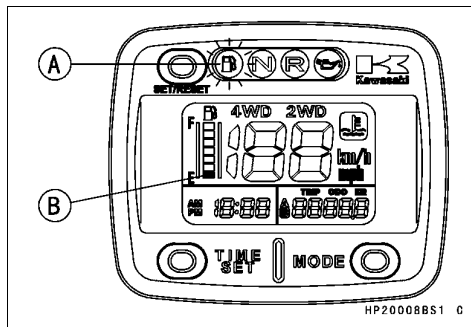
16-60 ELECTRICAL SYSTEM

Meter

Check 6: Fuel Meter Check

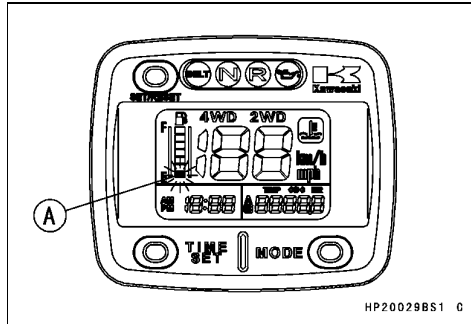
(KVF650–A1/B1 models)

- Connect the wires in the same manner as Check 1.
- The fuel indicator light (LED) [A] should flash and the first segment [B] in the fuel level gauge should appear.
- ★ If the LED light does not go on, or this display function does not work, replace the meter unit.



(KVF650–A2/B2 models)

- Connect the wires in the same manner as Check 1.
- The first segment (LCD) [A] should flash.
- ★ If the segment (LCD) does not flash, replace the meter unit.



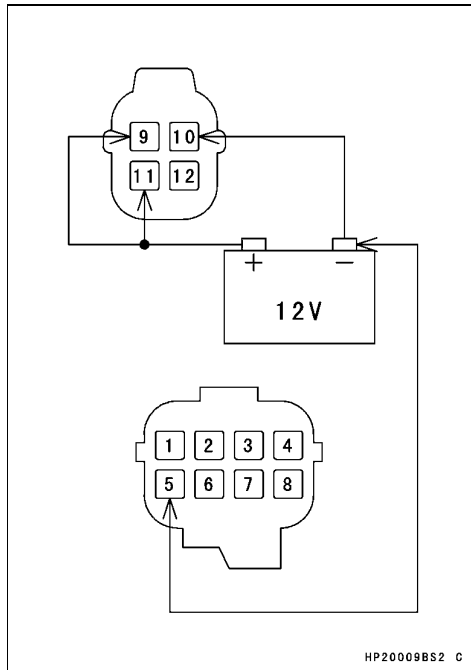
(KVF650–A1/B1, A2/B2 models)

- Connect terminal [5] to the battery (–) terminal.
- When terminal [5] is connected, one segment in the fuel gauge should appear every 15 seconds.

CAUTION

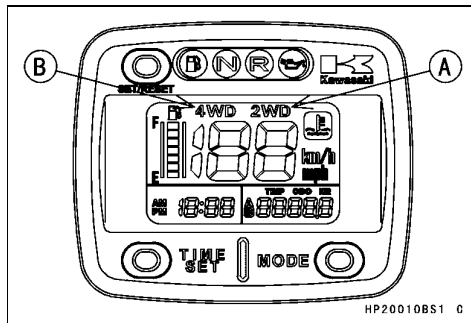
When all segments appeared, disconnect the terminal [5].

- ★ If this display function does not work, replace the meter unit.



Check 7: 2WD/4WD Indicator Lights Check

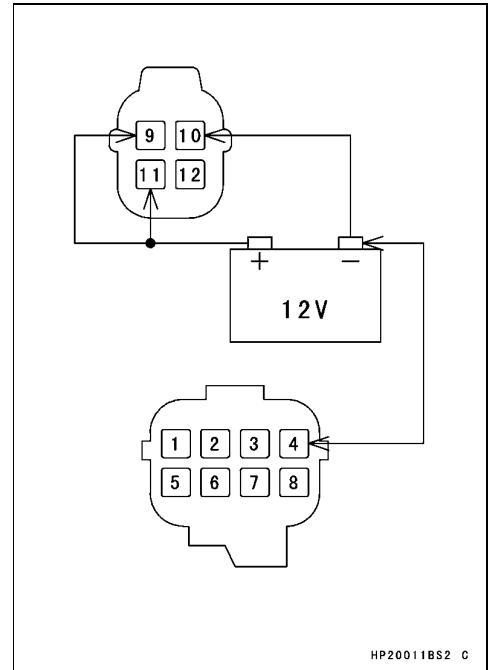
- Connect the wires in the same manner as Check 1.
- The 2WD indicator light (LCD) [A] should appear.



ELECTRICAL SYSTEM 16-61

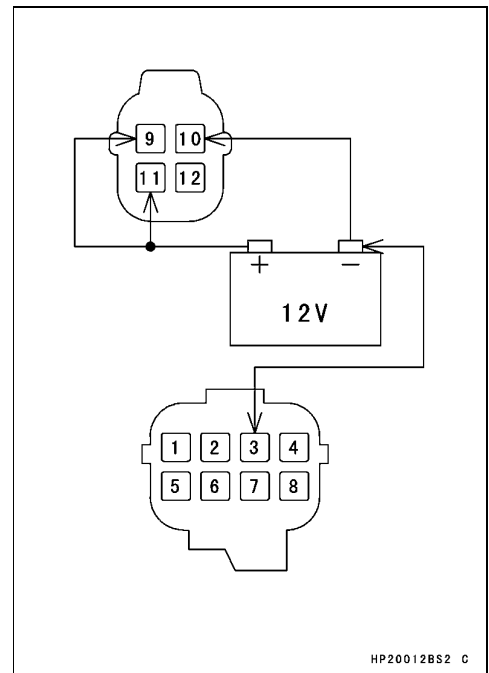
Meter

- Connect terminal [4] to the battery (-) terminal.
- The 4WD indicator light (LCD) [B] should appear.
- ★ If this display function does not work, replace the meter unit.

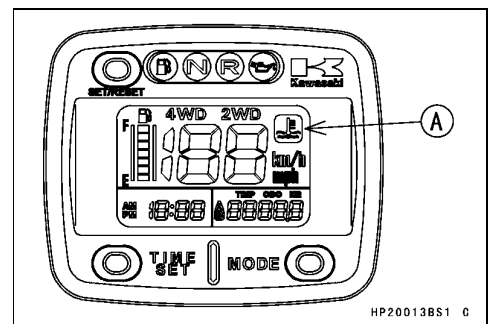


Check 8: Coolant Temperature Warning Symbol Check

- Connect the wires in the same manner as Check 1.
- Connect terminal [3] to the battery (-) terminal.



- The coolant temperature warning symbol (LCD) [A] should appear.
- ★ If this display function does not work, replace the meter unit.

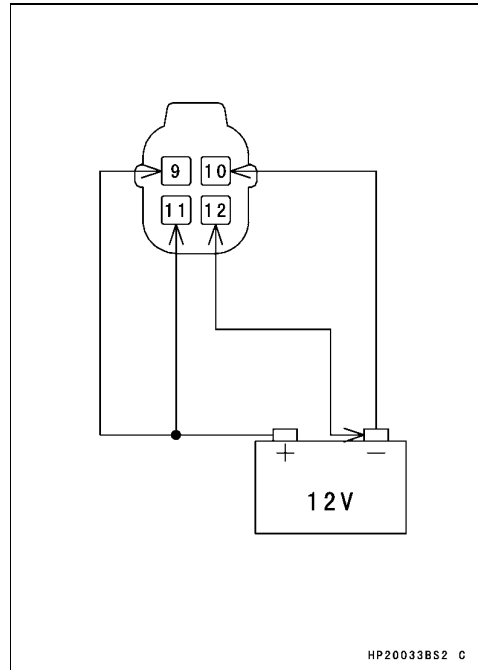


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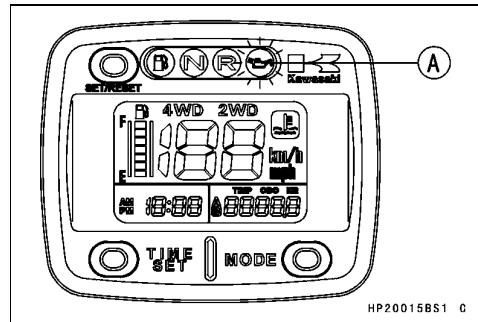
Meter

Check 9: Oil Pressure Warning Light Check

- Connect the wires in the same manner as Check 1.
- Connect terminal [12] to the battery (-) terminal.

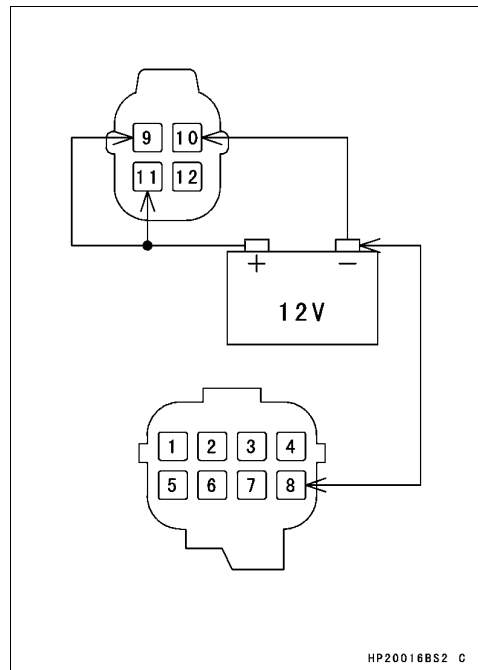


- The oil pressure warning light (LED) [A] should flash.
- ★ If the LED light does not flash, replace the meter unit.



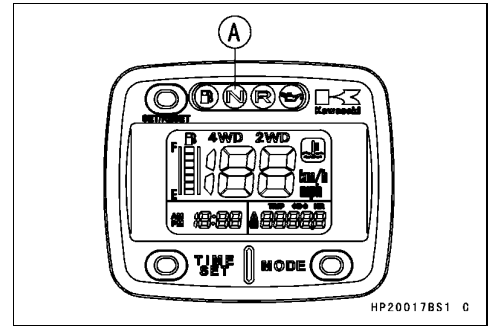
Check 10: Neutral Indicator Light Check

- Connect the wires in the same manner as Check 1.
- Connect terminal [8] to the battery (-) terminal.



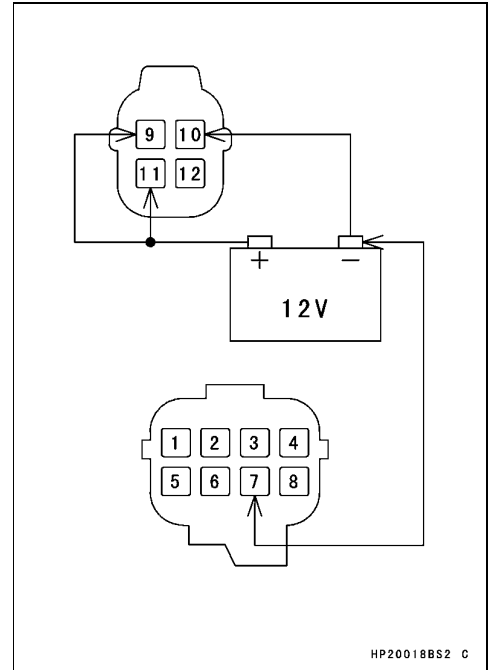
Meter

- The neutral indicator light (LED) [A] should go on.
- ★ If the LED light does not go on, replace the meter unit.

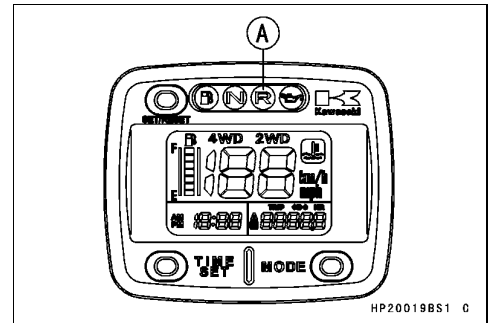


Check 11: Reverse Indicator Light Check

- 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.

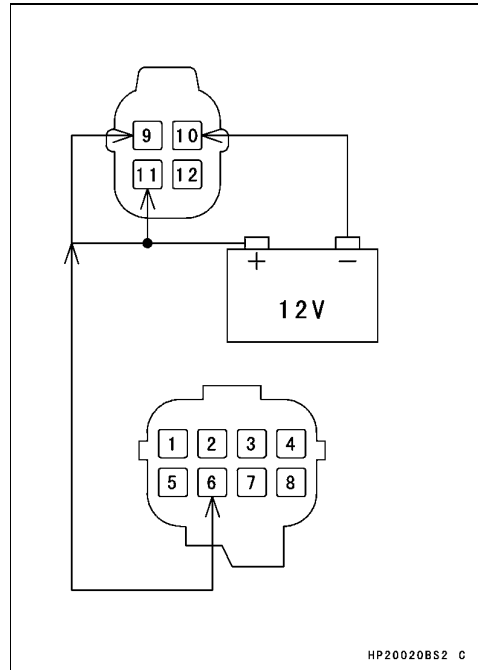


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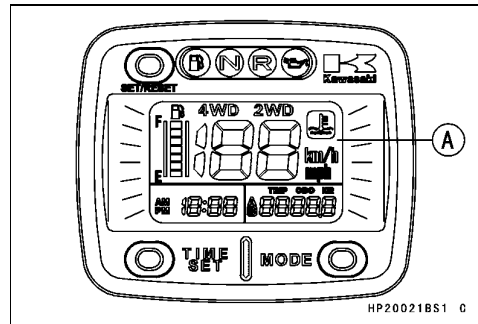
Meter

Check 12: Meter Illumination Check

- Connect the wires in the same manner as Check 1.
- Connect terminal [6] to battery (+) terminal.

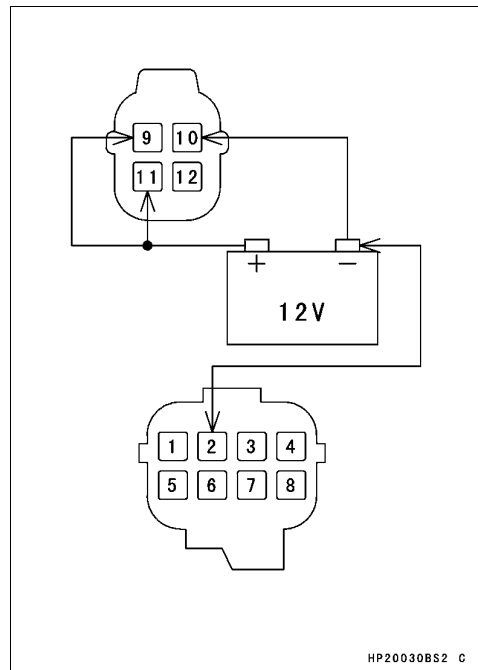


- The meter illumination [A] should go on.
- ★ If the illumination does not go on, replace the meter unit.



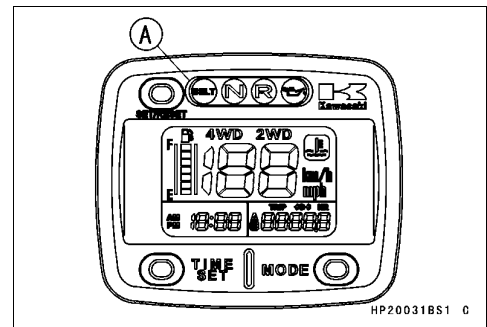
Check 13: Belt Check Indicator Light check (KVF650-A2/B2 models)

- Connect the wires in the same manner as Check 1.
- Connect terminal [2] to the battery (-) terminal.



Meter

- The belt check indicator light (LED) [A] should go on.
- ★ If the LED does not go on, replace the meter unit.

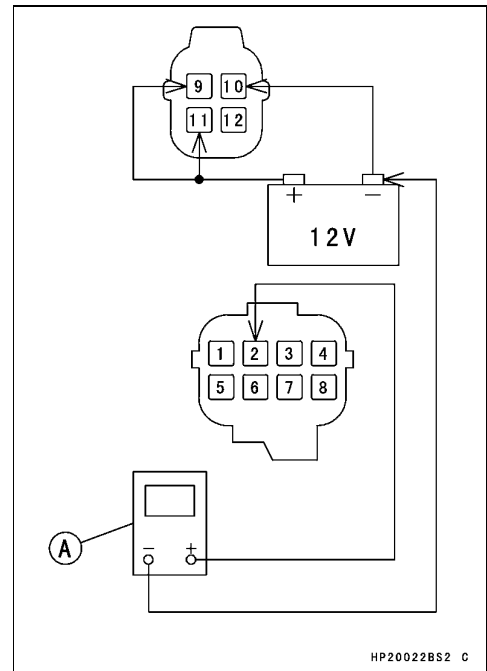


Reference Information (KVF650–A1/B1 models): Supply Voltage (unused terminal)

- Connect the wires in the same manner as Check 1.
- Set the hand tester [A] to the DC 25 V range and connect it to terminals [2] and battery (-) terminal.
 - Hand Tester (+) to Terminal [2]
 - Hand Tester (-) to Battery (-) Terminal

Supply Voltage (unused terminal)

Standard: 7 V or more

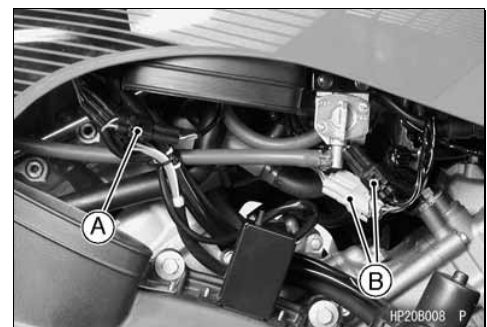


Drive Belt Failure Mode Memory Clearing Procedure (KVF650–A2/B2 models)

A flashing BELT warning LED (Light Emitting Diode) light means that the drive belt needs inspection. The belt warning light will activate every 100 key-on hours, or sooner if the belt becomes damaged or fails.

NOTE

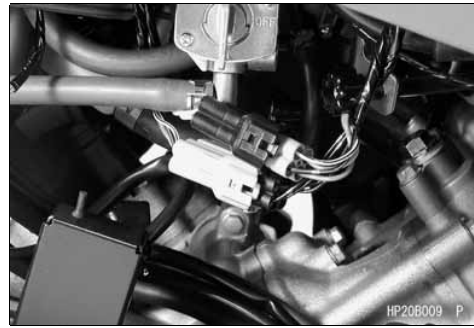
- Follow the instruction on pages 5–10 to 5–12 of this Service Manual to complete the necessary inspections.
- After completing the inspections, follow these instructions to clear the system memory and stop the flashing light.
 - Turn off the ignition switch.
 - Remove the air duct on the torque converter cover.
 - Disconnect the belt switch at the 2 pin connector [A] above the torque converter cover.
 - Disconnect both sets of 4 pin connectors [B] which are located above the torque converter cover.



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Meter

- Reconnect these 4 pin connectors to their opposite gray to black and black to gray.



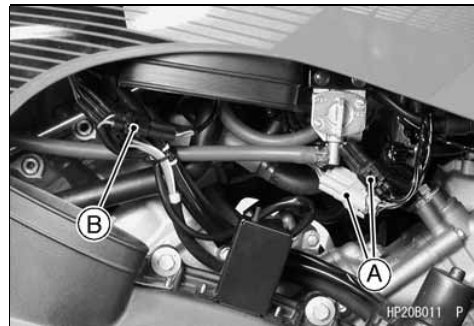
- Turn on the ignition switch.
- Observe the belt warning light [A].
- It should be flashing.
- Let it flash for at least five seconds.

NOTE

- *More than five seconds is OK.*
- While observing the belt warning light, turn off the ignition switch.



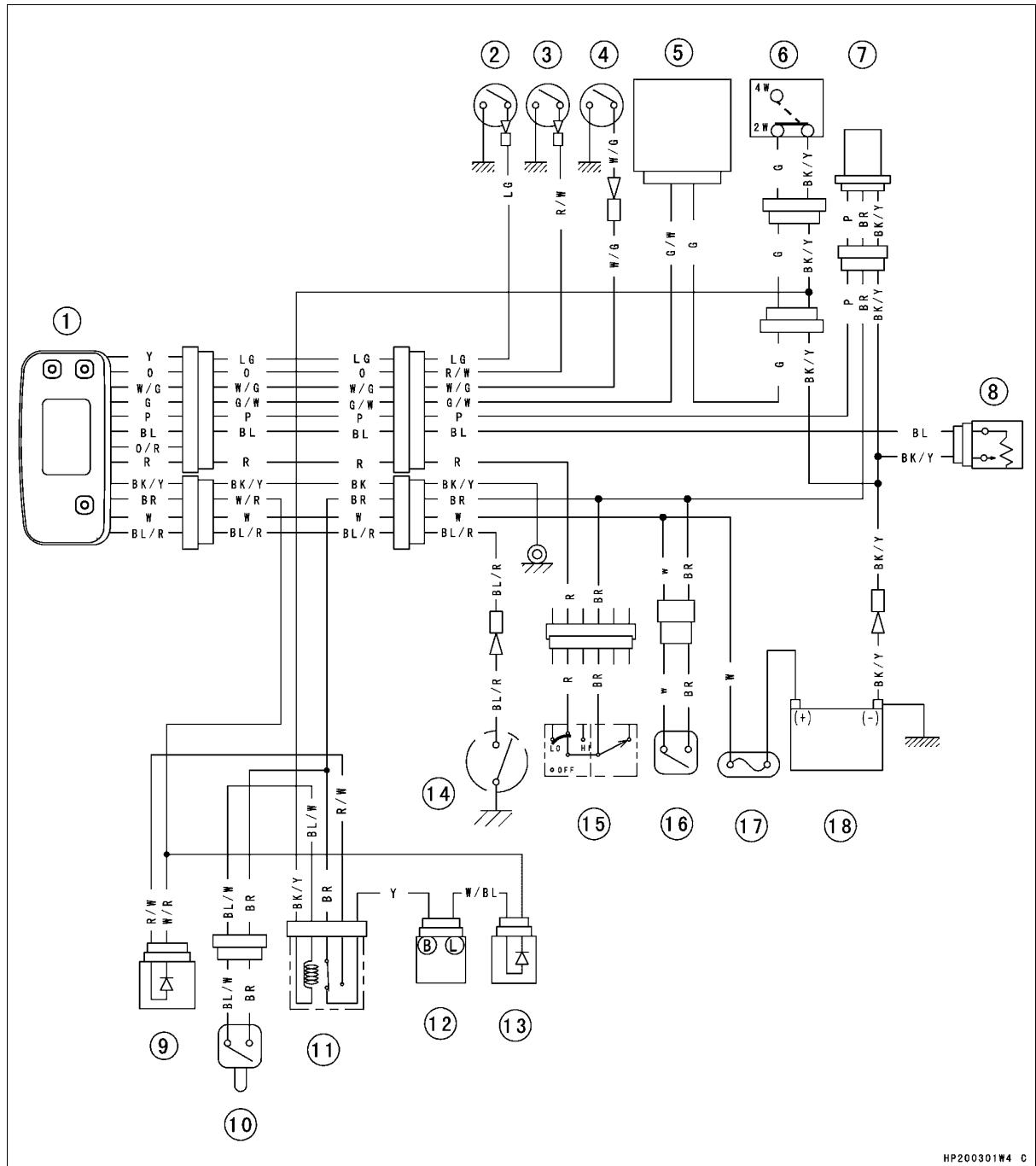
- Disconnect the mismatched 4 pin connector sets and reconnect them normally. (Black to black, gray to gray) [A].
- Connect the belt switch 2 pin connector [B].



- Turn on the ignition switch.
- Confirm that no warning light is flashing.

Meter

Meter Circuit (KVF650-A1/B1 models)



1. Multifunction Meter

2. Neutral Switch

3. Reverse Switch

4. Coolant Temperature Switch

5. Actuator Controller

6. 2WD/4WD Switch

7. Speed Sensor

8. Fuel Level Sensor

9. Diode Assembly

10. Belt Failure Detection Switch

11. Switch Circuit Relay

12. Flashing Relay

13. Diode

14. Oil Pressure Switch

15. Light/Dimmer Switch

16. Ignition Switch

17. Main Fuse 30A

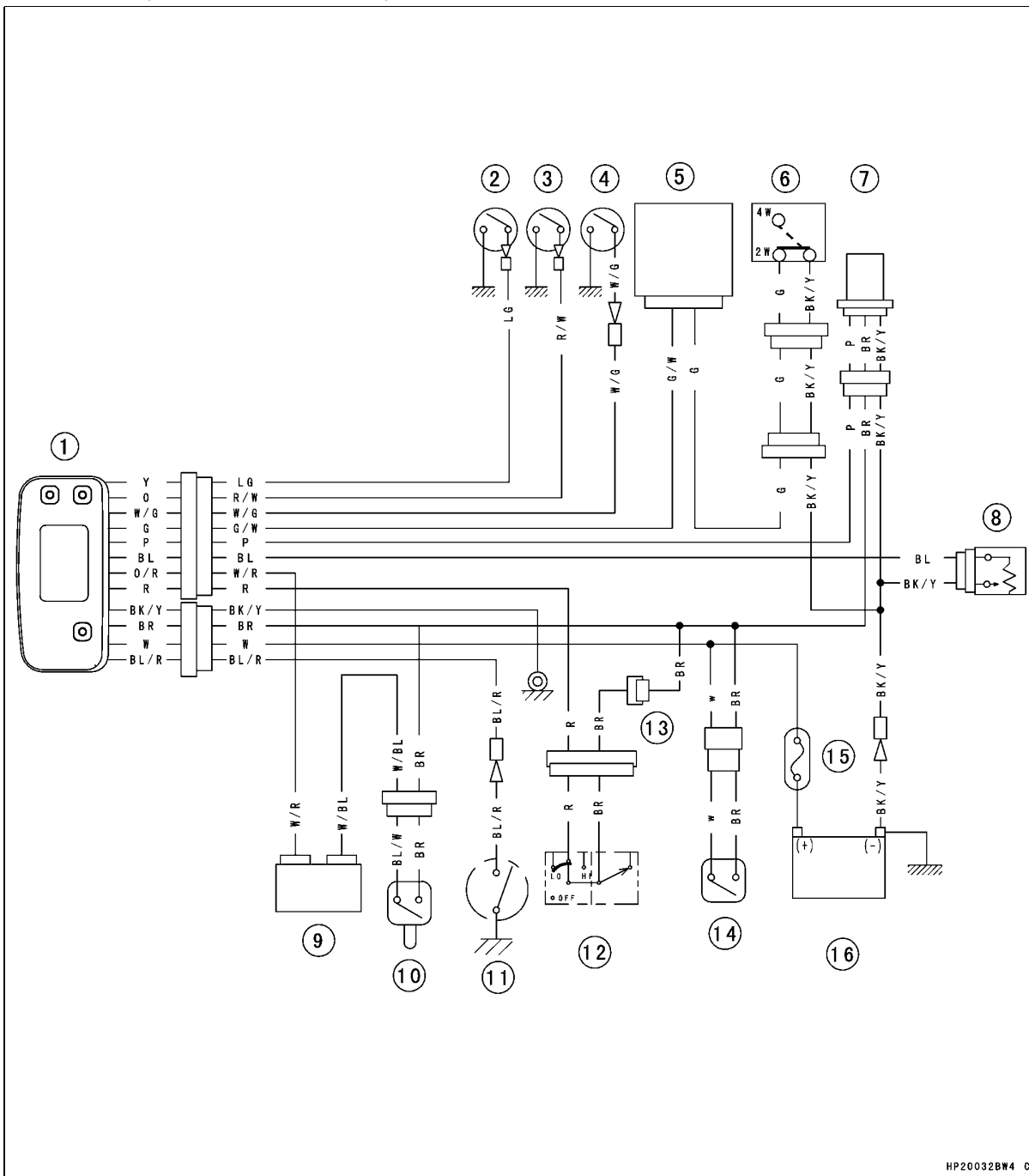
18. Battery

HP200301W4 C

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Meter

Meter Circuit (KVF650-A2/B2 models)



HP20032BW4 C

1. Multifunction Meter

2. Neutral Switch

3. Reverse Switch

4. Coolant Temperature Switch

5. Actuator Controller

6. 2WD/4WD Switch

7. Speed Sensor

8. Fuel Level Sensor

9. Igniter

10. Belt Failure Detection Switch

11. Oil Pressure Switch

12. Light/Dimmer Switch

13. Reset Connector

14. Ignition Switch

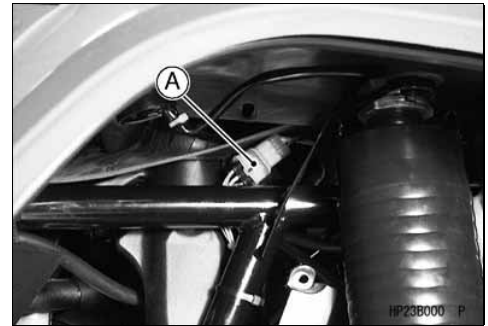
15. Main Fuse 30A

16. Battery

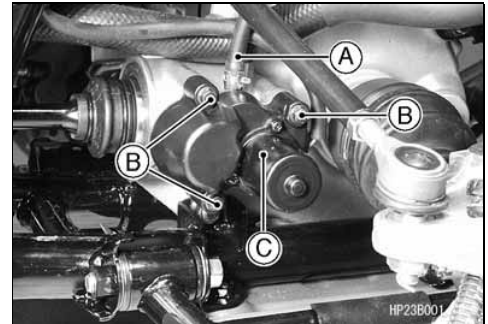
Actuator Control System

2WD/4WD Actuator Removal

- Remove:
 - Right Front Inner Cover (see Frame chapter)
 - Actuator Lead Connector [A]

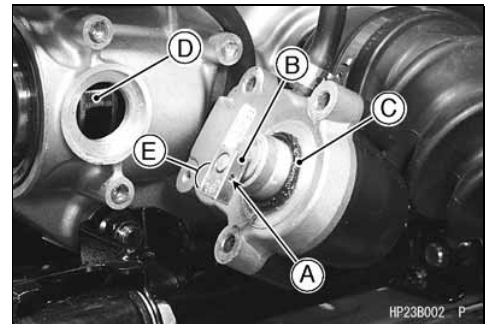


- Remove:
 - Breather Hose [A]
 - Actuator Mounting Bolts [B]
 - Actuator [C]

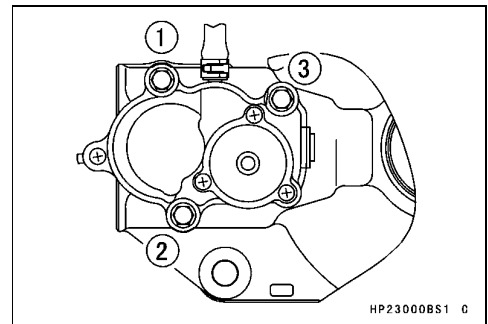


2WD/4WD Actuator Installation

- 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.

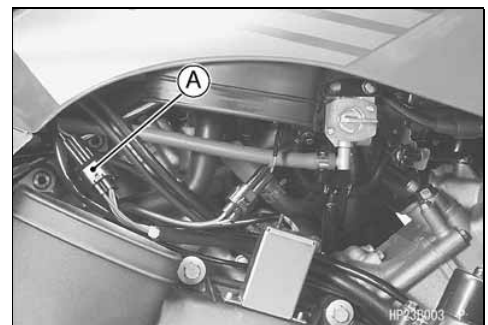


- Apply a non-permanent locking agent to the actuator mounting bolts, and tighten them following the tightening sequence [1 ~ 3].
- Torque - 2WD/4WD Actuator Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



Engine Brake Actuator Removal

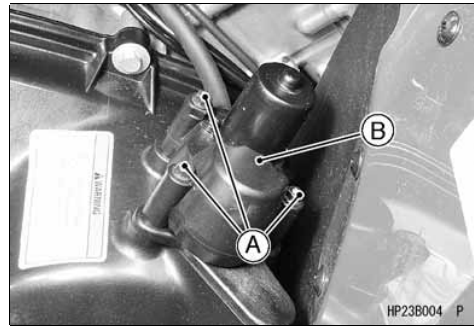
- Confirm that the ignition switch is in OFF position.
- Remove:
 - Air Duct
 - Actuator Lead Connector [A]



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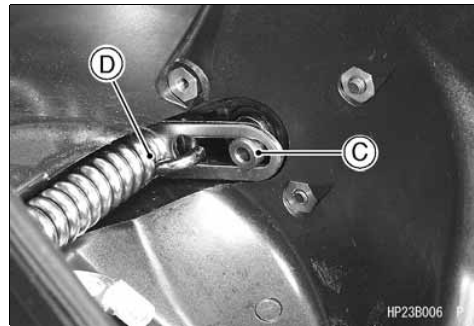
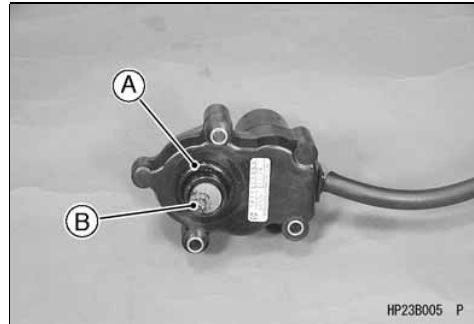
Actuator Control System

- Remove:
 - Actuator Mounting Bolts [A]
 - Actuator [B]



Engine Brake Actuator Installation

- Apply grease and Install:
 - O-ring [A]
- Apply molybdenum disulfide grease to the pin [B].
- Insert the pin into the collar [C] of the engine brake lever assembly [D].
- Tighten:
 - Torque - Engine Brake Actuator Mounting Bolts: 8.8 N·m (0.9 kgf·m, 78 in·lb)**

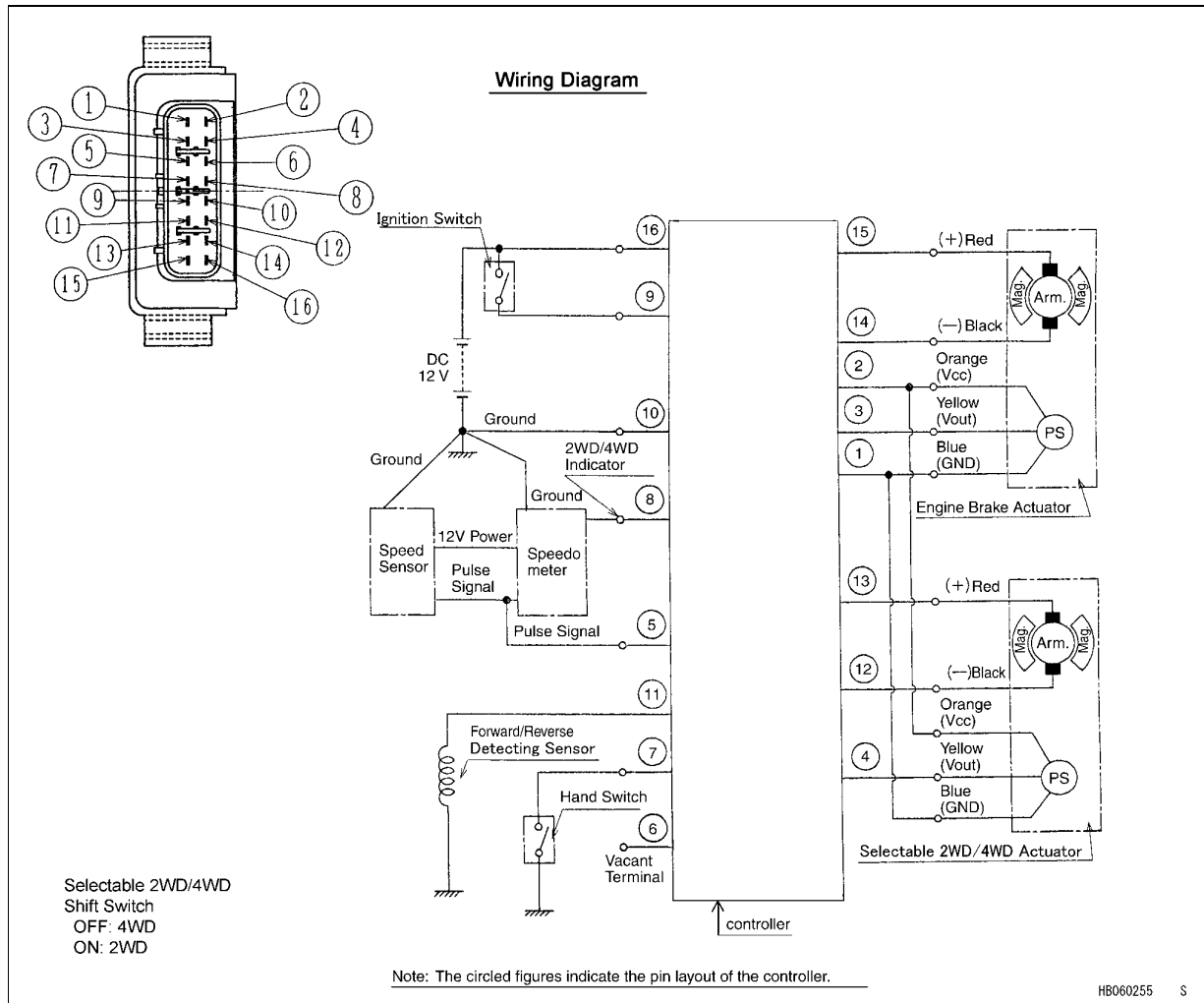


Actuator Control System Outline

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



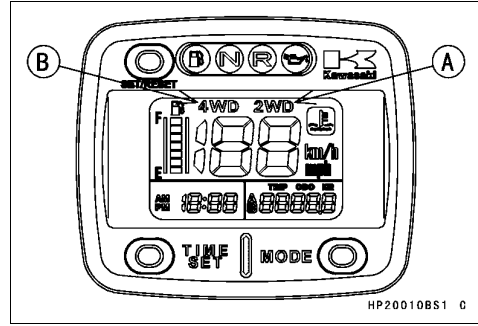
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Actuator Control System

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)



Failure Indication Pattern and Failure Part

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

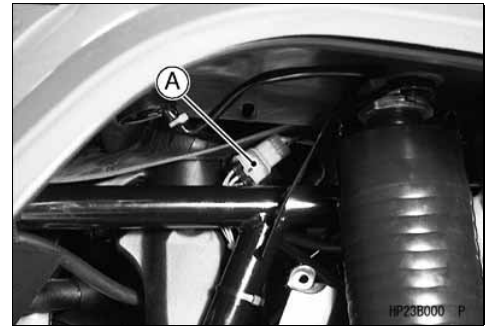
Malfunction Mode

No.	Malfunction Mode	Probable Faulty Part/Location	Check Number
1	The 2WD/4WD actuator does not operate correctly.	2WD/4WD actuator Controller power supply Speed sensor 2WD/4WD shift switch Controller	1 3 4 5 6
2	The engine brake actuator does not operate correctly.	Engine brake actuator Controller power supply Speed sensor F/R detecting sensor Controller	2 3 4 7 6
3	The 2WD/4WD indicator light does not switch.	Indicator light (LCD) Controller	8 6

Actuator Control System

Check 1. 2WD/4WD Actuator Inspection

- Remove:
 - Right Front Inner Cover (see Frame chapter)
 - Actuator Lead Connector [A]



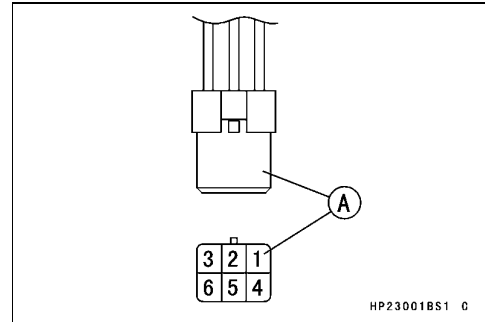
- Measure the resistance between the following terminals in the actuator lead connector [A].

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

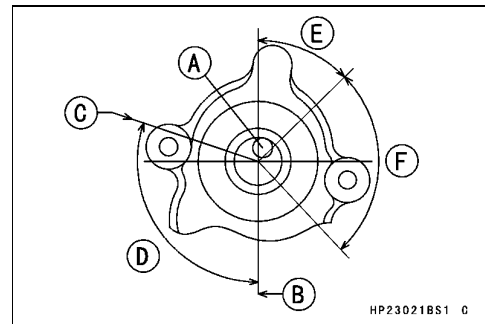
- ★ If any reading is not within the specified range, replace the 2WD/4WD actuator.



(KVF650-A1/B1 models only)

- ★ If the reading is within the specified range, inspect the position of the actuator output shaft as following procedure.

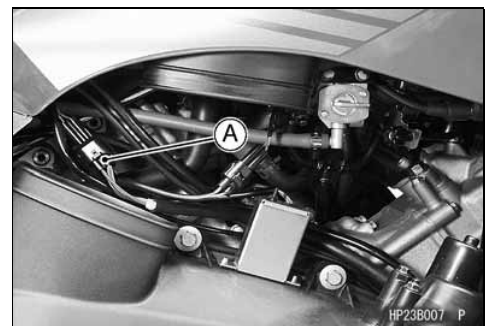
- Remove:
 - 2WD/4WD Actuator (see 2WD/4WD Actuator Removal)
- Check if the output shaft [A] position is within the inoperative angle range [F] as shown in the figure.
 - [A] Actuator Output Shaft
 - [B] 2WD Point
 - [C] 4WD Point
 - [D] Operative Range Angle = 109.5 deg.
 - [E] Angle = 45.6 deg.
 - [F] Inoperative Range Angle = 91.2 deg.
 - [G] Actuator Lead Connector



- ★ If the output shaft is in the inoperative range angle, move the shaft in the operative range angle.
- Apply the 12 V battery voltage to the actuator.
 - Battery (+) → Connector 4 terminal (Red)
 - Battery (-) → Connector 6 terminal (Black)
- Stop applying the power when the output shaft comes near the 2WD point [B].
- Install the actuator (see 2WD/4WD Actuator Installation).
- ★ If the output shaft is in the operative range angle, the malfunction of the 2WD/4WD actuator could be caused by other parts.

Check 2. Engine Brake Actuator Inspection

- Remove:
 - Air Duct
 - Actuator Lead Connector [A]



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Actuator Control System

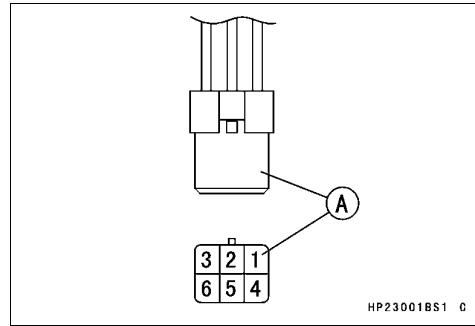
- Measure the resistance between the following terminals in the actuator lead connector [A].

Special Tool - Hand Tester: 57001-1394

Actuator Internal Resistance

4 (Red) – 6 (Black):	3 ~ 15 Ω
1 (Orange) – 3 (Blue):	3.5 ~ 6.5 k Ω
2 (Yellow) – 3 (Blue):	630 ~ 5,330 Ω

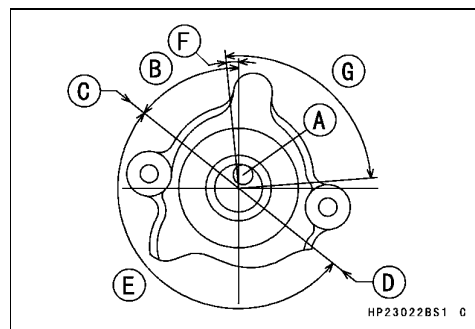
- ★ If any reading is not within the specified range, replace the engine brake actuator.



(KVF650-A1/B1 models only)

- ★ If the reading is within the specified range, inspect the position of the actuator output shaft as following procedure.

- Remove:
 - Engine Brake Actuator (see Engine Brake Actuator Removal)
- Check if the output shaft [A] position is within the inoperative angle range [G] as shown in the figure.
 - [A] Actuator Output Shaft
 - [B] Angle = 51.4 deg.
 - [C] Starting Point
 - [D] Ending Point
 - [E] Operative Range Angle = 180 deg.
 - [F] Angle = 7 deg.
 - [G] Inoperative Range Angle = 91.2 deg.
 - [H] Actuator Lead Connector



- ★ If the output shaft is in the inoperative angle range, move the shaft in the operative angle range.
- Apply the 12 V battery voltage to the actuator.
 - Battery (+) → Connector 4 terminal (Red)
 - Battery (-) → Connector 6 terminal (Black)
- Stop applying the power when the output shaft comes near the starting point [C].
- Install the actuator (see Engine Brake Actuator Installation).
- ★ If the output shaft is in the operative angle range, the engine brake malfunction could be caused by other parts.

Check 3. Controller Power Supply Inspection

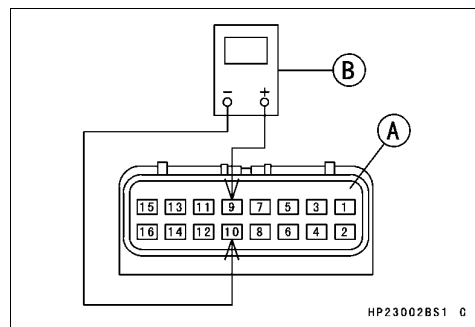
NOTE

- Be sure the battery is fully charged.
 - Remove:
 - Seat (see 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.



Actuator Control System

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 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.

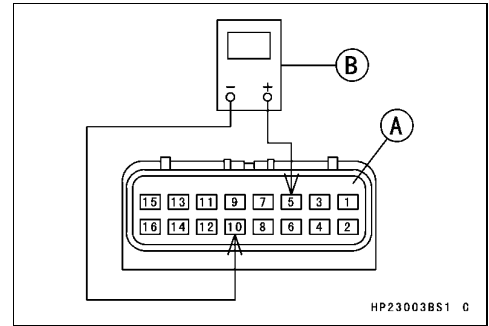
Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457

- 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.



Check 5. 2WD/4WD Shift Switch Inspection

NOTE

- *Be sure the battery is fully charged.*
- Remove:
 - Seat (see Frame chapter)
- Connect:
 - Controller Connector [A]
 - Hand Tester [B] (range: DC 25 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.
- Push the switch to the 2WD position.

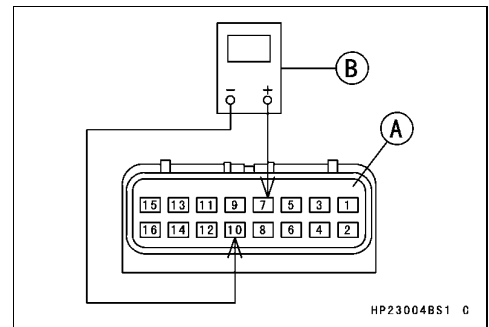
Controller Output Voltage (at 2WD/4WD Shift Switch ON, 2WD)

Standard: 0 V

- ★ If the reading is not standard, check the 2WD/4WD shift switch or actuator controller unit.
- ★ 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.*



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Actuator Control System

Check 6. Controller Unit Inspection

NOTE

- Be sure the battery is fully charged.

- Remove:
 - Seat (see 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.

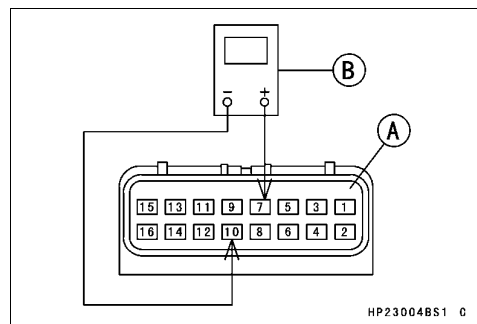
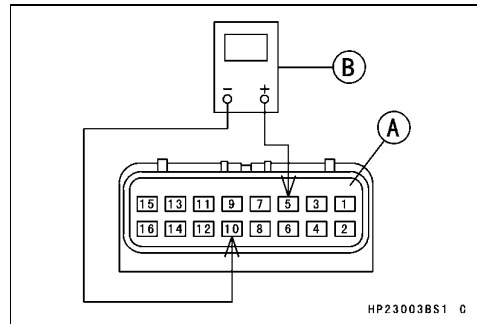
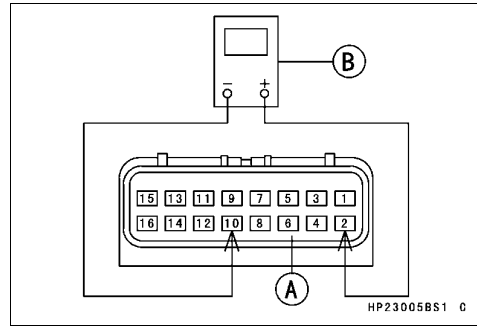
- Disconnect the 2WD/4WD shift switch lead connector.
- Connect:
 - Controller Connector [A]
 - Hand Tester [B] (range: DC 10 V)
 - Tester (+) → Connector (G) Terminal [7]
 - Tester (-) → Connector (BK/Y) Terminal [10]
- Install the needle adapters on the tester leads.

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.



Actuator Control System

- 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 [12]
 - Tester (-) → Connector (BK/Y) Terminal [10]
- Install the needle adapters on the tester leads.

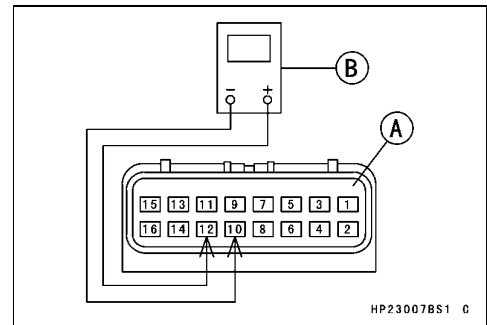
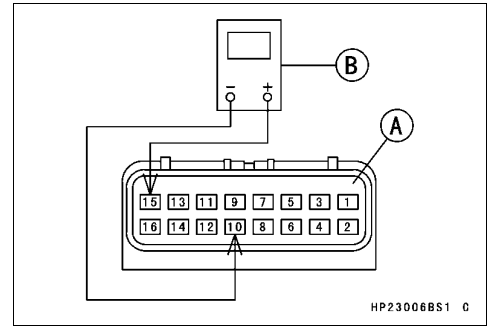
Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457

- Turn ON the ignition switch.
- 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.



16-78 ELECTRICAL SYSTEM

Actuator Control System

Check 7. Forward/Reverse Detecting Sensor Inspection

- Remove:
 - Rear Left Flap (see Frame chapter)
- Disconnect forward/reverse detecting sensor lead wire 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 $\times k\Omega$ range.

Special Tool - Hand Tester: 57001-1394

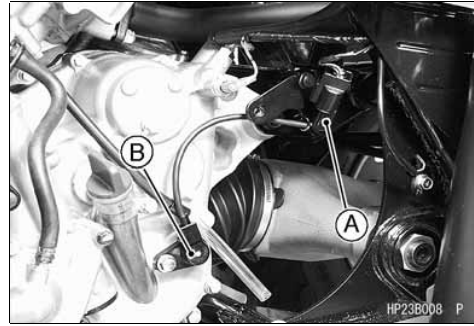
Forward/Reverse Detecting Sensor Resistance

Standard: 1.2 ~ 1.6 k Ω

- ★ If the reading is not within the specified range, replace the forward/reverse detecting sensor [B].
- 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.

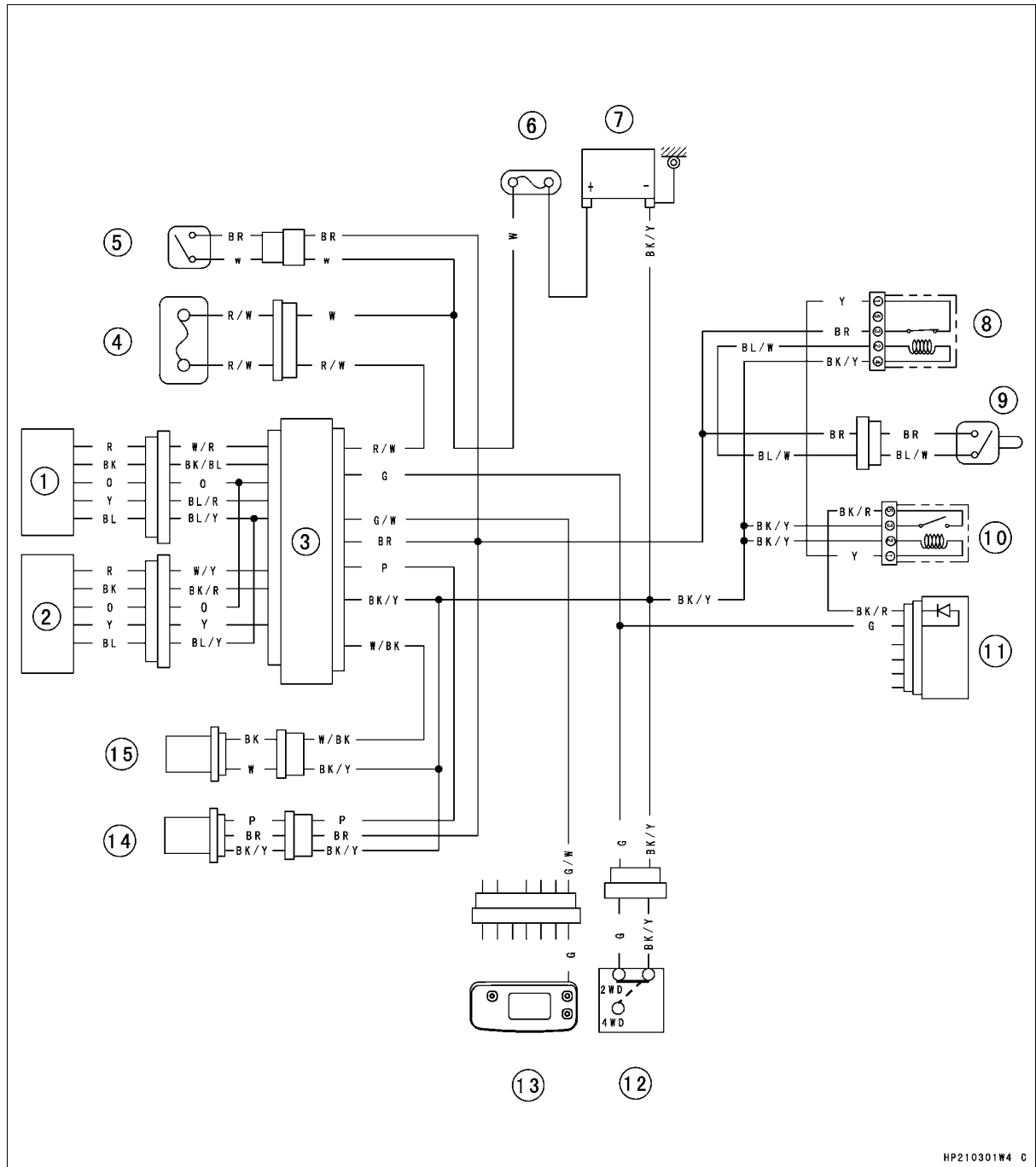
Check 8. Indicator Light (LCD) Inspection

- Refer to Check 7: 2WD/4WD Indicator Lights Check in Multifunction Meter Unit Inspection.



Actuator Control System

Actuator Control System Circuit (KVF650-A1/B1 models)



1. Engine Brake Actuator
2. 2WD/4WD Actuator
3. Actuator Controller
4. Controller Fuse 10A
5. Ignition Switch
6. Main Fuse 30A

7. Battery
8. Switch Circuit Relay
9. Belt Failure Detection Switch
10. System Circuit Relay
11. Diode Assembly

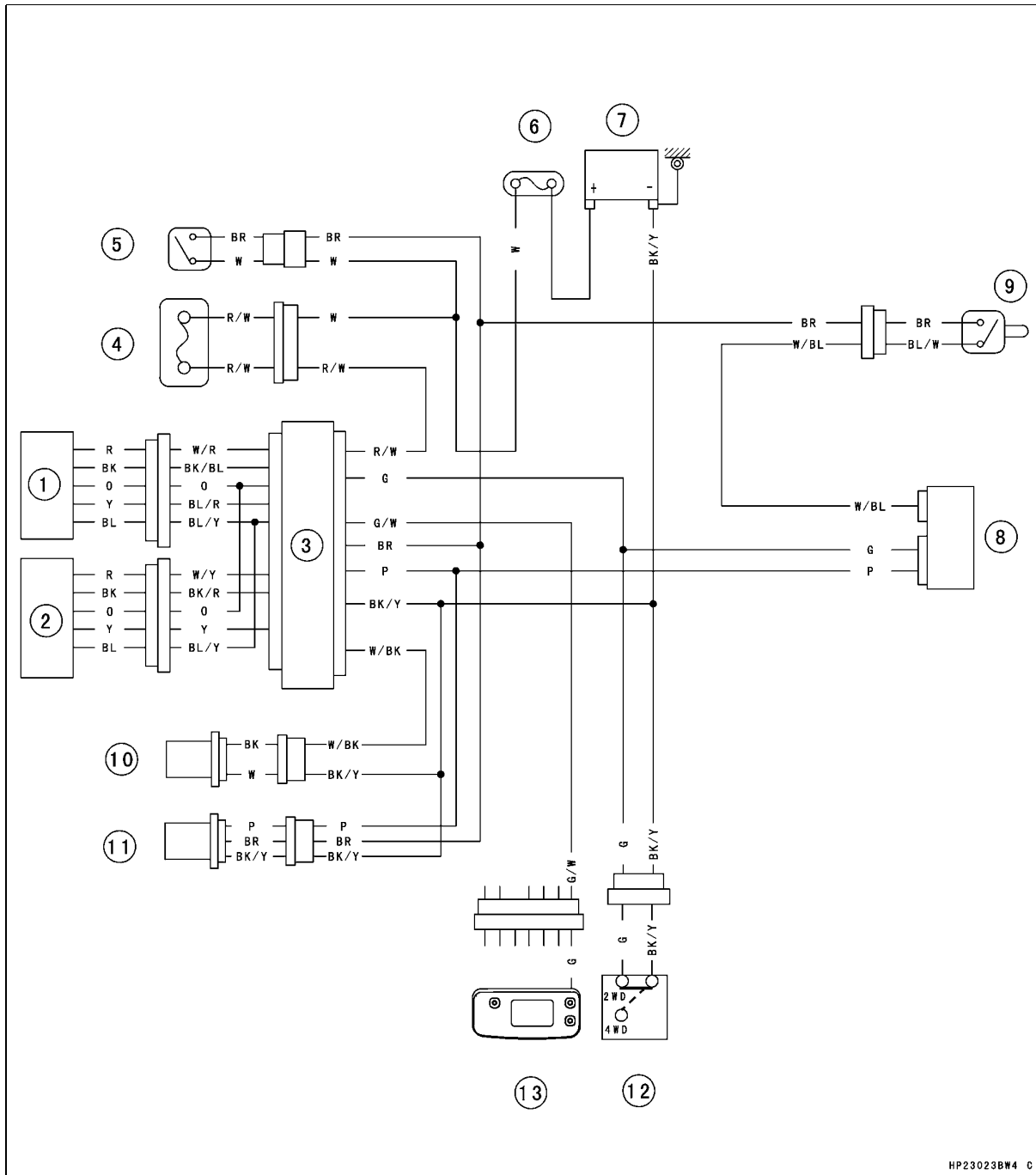
12. 2WD/4WD Shift Switch
13. Multifunction Meter
14. Speed Sensor
15. Forward/Reverse Detecting Sensor

HP210301W4 C

16-80 ELECTRICAL SYSTEM

Actuator Control System

Actuator Control System Circuit (KVF650-A2/B2 models)



HP23023BW4 C

- 1. Engine Brake Actuator
- 2. 2WD/4WD Actuator
- 3. Actuator Controller
- 4. Controller Fuse 10A
- 5. Ignition Switch

- 6. Main Fuse 30A
- 7. Battery
- 8. Igniter
- 9. Belt Failure Detection Switch

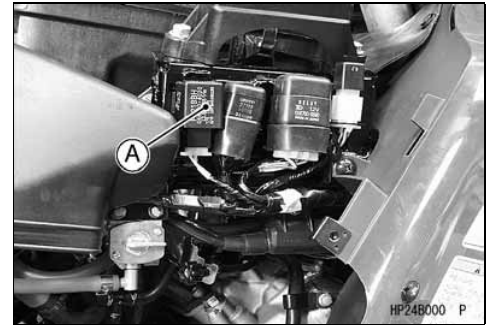
- 10. Forward/Reverse Detecting Sensor
- 11. Speed Sensor
- 12. 2WD/4WD Shift Switch
- 13. Multifunction Meter

Drive Belt Failure Detection System (KVF650-A1/B1 Models)

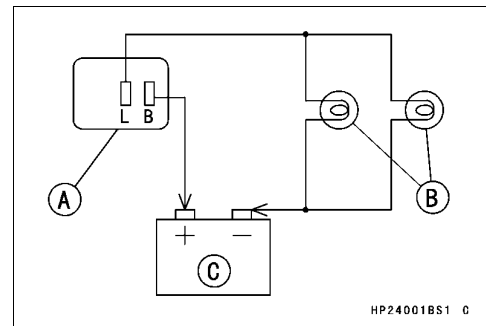
If the drive belt failure detection system is activated by abnormal belt, the drive belt failure detection switch is damaged. Make sure replace the torque converter cover (see Converter System chapter).

Flashing Relay Inspection

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Flashing Relay [A]



- Connect a 12 V battery and the following lights as indicated in the figure, and count how many times the lights flash for one minute.
 - Flashing Relay [A]
 - Lights [B]
 - 12 V Battery [C]
- ★ If the lights do not flash as specified, replace the flashing relay.



Testing Flashing Relay

Load		Flashing times (c/m*)
The Number of Turn Signal Lights	Wattage (W)	
1	10	140 - 250
2	20	75 - 95

(*): Cycle(s) per minute

System Circuit Relay Inspection

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - System Circuit Relay [A]



16-82 ELECTRICAL SYSTEM

Drive Belt Failure Detection System (KVF650-A1/B1 Models)

- Connect a hand tester [A] and a 12 V battery [B] to the system circuit relay [C] as shown.
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

Testing Relay

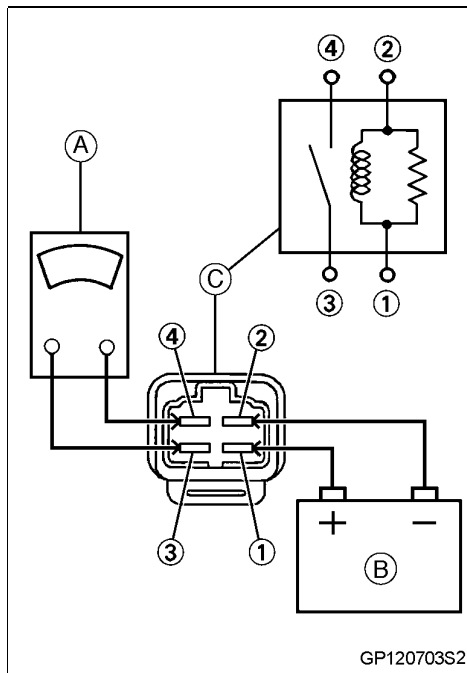
Tester Range:

x 1 Ω range

Criteria:

When battery is connected → 0 Ω

When battery is disconnected → ∞Ω

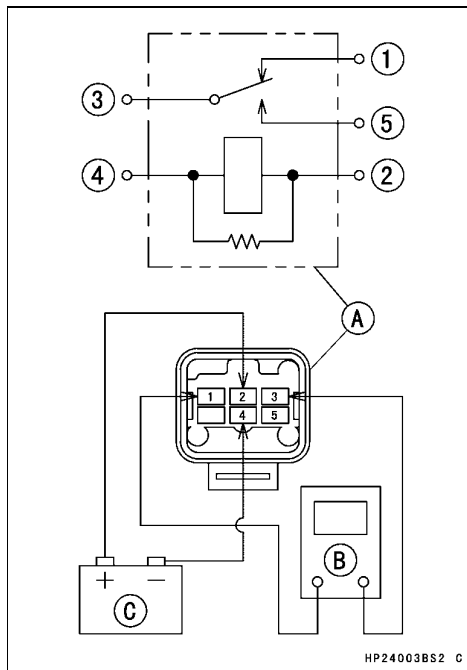
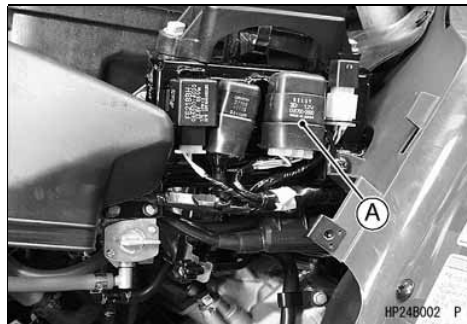


Switch Circuit Relay Inspection

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Switch Circuit Relay [A]
- Connect a hand tester [B] (x 1Ω range) and a 12 V battery [C] to the switch circuit relay as shown.
- ★ If the relay does not work as specified, the relay is defective. Replace the relay.

Testing Relay

	1	3	5
When battery is connected		○ ——— ○	
When battery is disconnected	○ ——— ○		



Drive Belt Failure Detection System (KVF650-A1/B1 Models)

Diodes Inspection

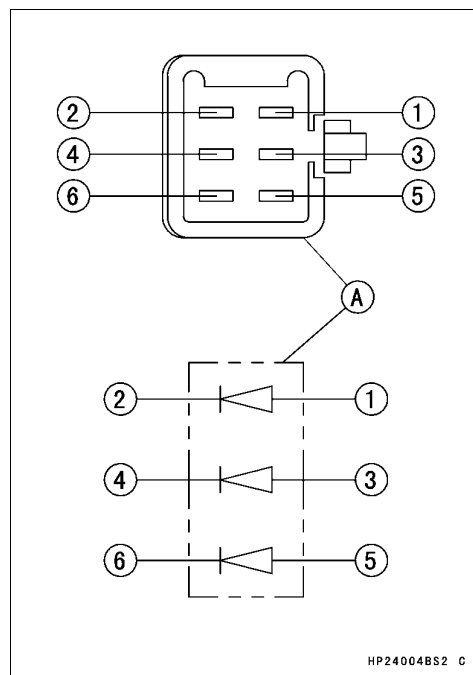
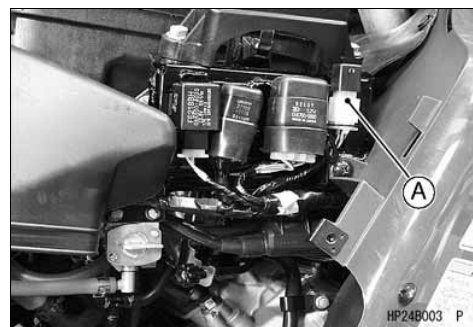
Diode Assembly:

- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Diode Assembly [A]
- Check conductivity of the following pair of terminals.

Diode Assembly Inspection

Tester connection	1-2, 3-4, 5-6
-------------------	---------------

- ★ The resistance should be low in one direction and more than ten times as much in the other direction. If any two terminals are low or high in both directions, the diode assembly is defective and must be replaced.



Diode in Harness:

- The diode [A] is located in the harness.
- Remove:
 - Air Cleaner Cover (see Frame chapter)
 - Flashing Relay Connector [B] (harness side)
 - Diode Assembly Connector [C] (harness side)
- Check conductivity of the following pair of terminals.

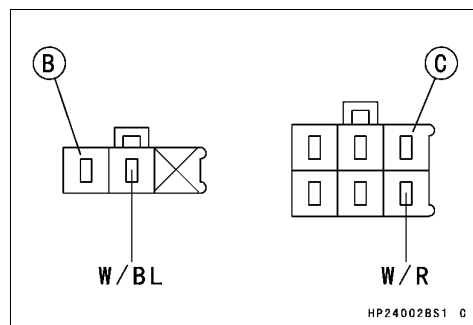
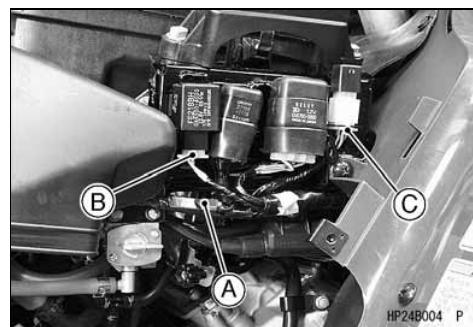
Diode in Harness Inspection

Tester connection	W/BL (Flashing Relay) - W/R (Diode Assembly)
-------------------	--

- ★ The resistance should be low in one direction and more than ten times as much in the other direction. If two terminals are low or high in both directions, the diode is defective and must be replaced.

NOTE

- The actual meter reading varies with the meter used and the individual diodes, but generally speaking the lower reading should be from zero to one half the scale.

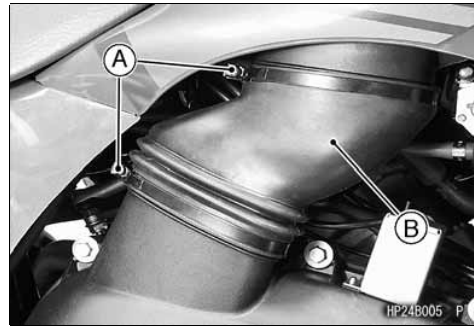


16-84 ELECTRICAL SYSTEM

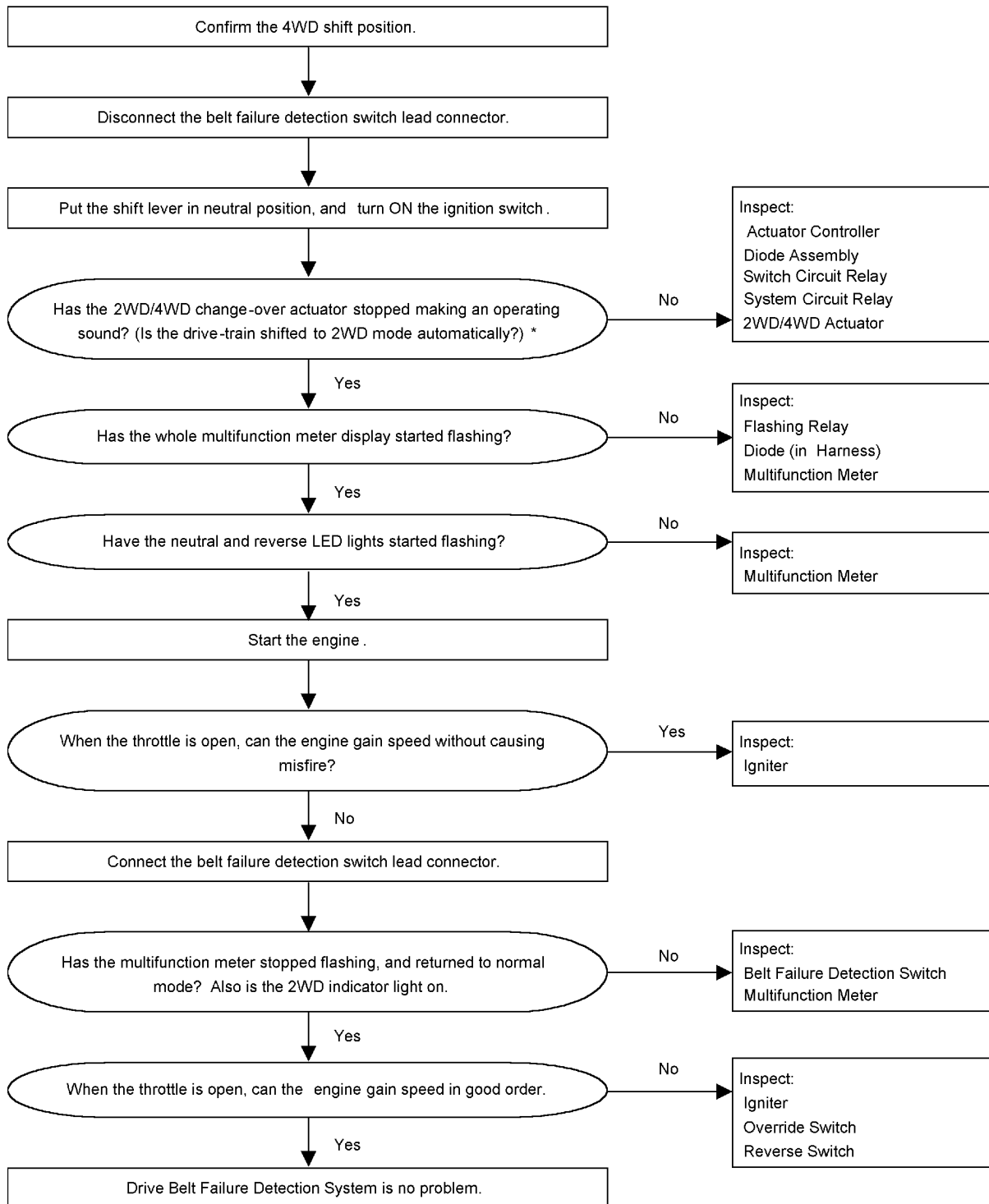
Drive Belt Failure Detection System (KVF650-A1/B1 Models)

Drive Belt Failure Detection System Inspection

- Remove:
 - Clamp Screws [A] and Clamps
 - Rubber Air Duct [B]



Drive Belt Failure Detection System (KVF650-A1/B1 Models)

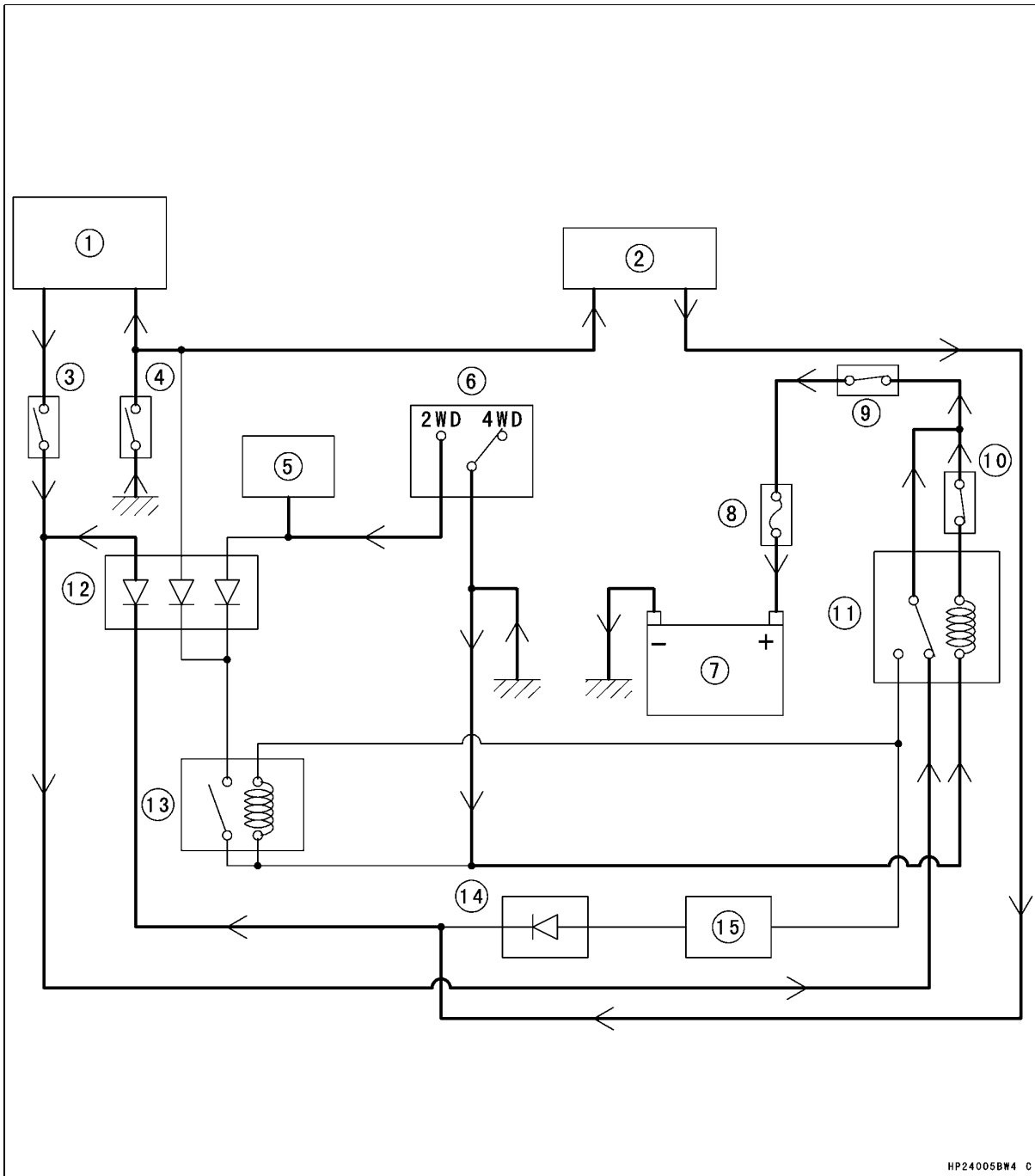


*: If (2WD/4WD change-over) the actuator keeps making a sound, try move the vehicle back and forth a little. This will help the actuator disconnect the drive train.

16-86 ELECTRICAL SYSTEM

Drive Belt Failure Detection System (KVF650-A1/B1 Models)

Drive Belt Normal Mode Circuit (Drive Belt Failure Detection Switch Closed)



HP24005BW4 C

- 1. Igniter
- 2. Multifunction Meter
- 3. Reverse Power Assist Switch (override)
- 4. Reverse Switch
- 5. Actuator Controller

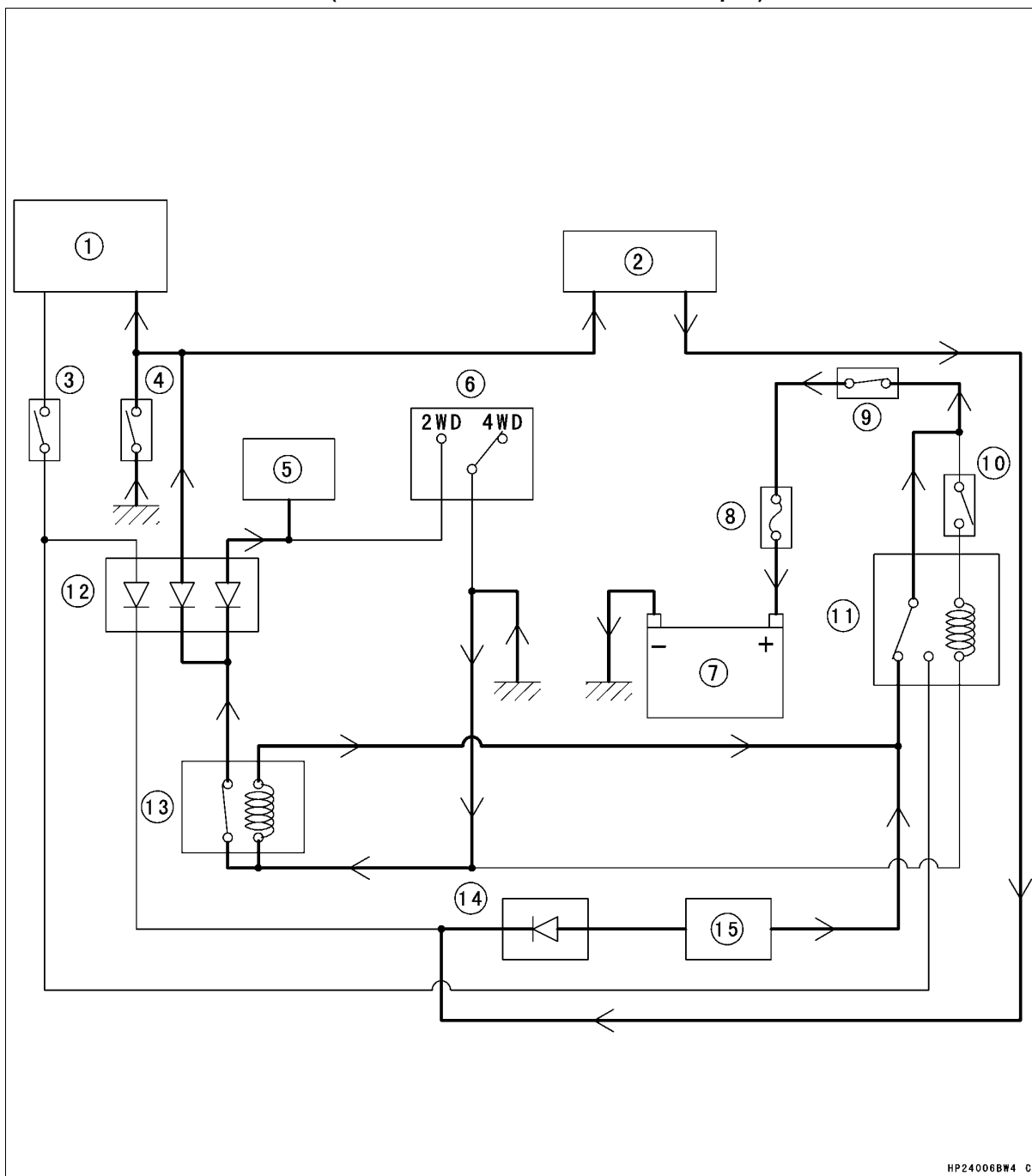
- 6. 2WD/4WD Shift Switch
- 7. Battery
- 8. Main Fuse 30A
- 9. Ignition Switch
- 10. Belt Failure Detection Switch (ON)

- 11. Switch Circuit Relay
- 12. Diode Assembly
- 13. System Circuit Relay
- 14. Diode (in harness)
- 15. Flashing Relay
- ↔: Current (Electrons) Flow

ELECTRICAL SYSTEM 16-87

Drive Belt Failure Detection System (KVF650-A1/B1 Models)

Drive Belt Failure Mode Circuit (Drive Belt Failure Detection Switch Open)



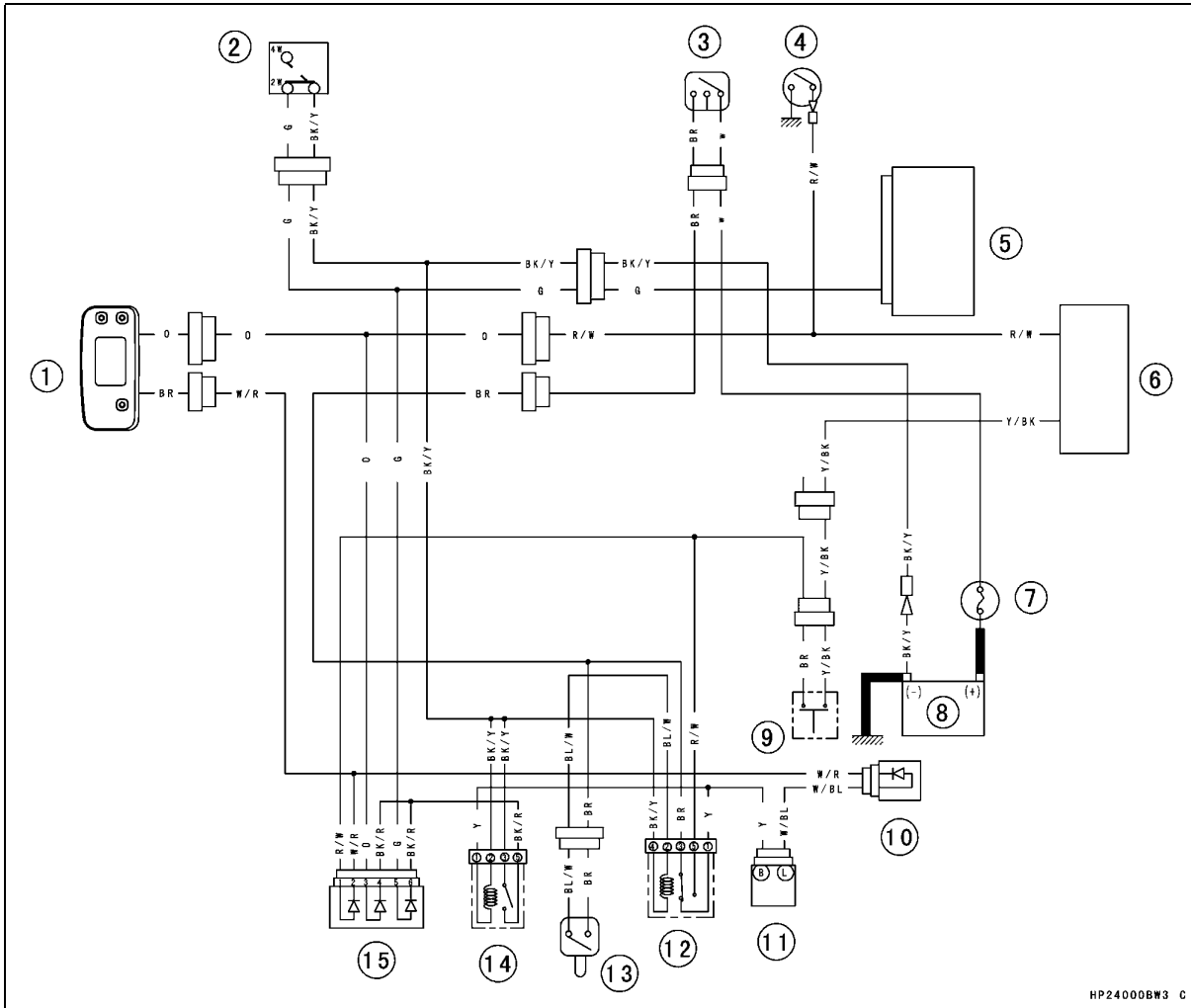
HP24006BW4 C

- | | | |
|--|--|--------------------------|
| 1. Igniter | 6. 2WD/4WD Shift Switch | 11. Switch Circuit Relay |
| 2. Multifunction Meter | 7. Battery | 12. Diode Assembly |
| 3. Reverse Power Assist Switch
(override) | 8. Main Fuse 30A | 13. System Circuit Relay |
| 4. Reverse Switch | 9. Ignition Switch | 14. Diode (in harness) |
| 5. Actuator Controller | 10. Belt Failure Detection Switch
(OFF) | 15. Flashing Relay |
- ←: Current (Electrons) Flow

16-88 ELECTRICAL SYSTEM

Drive Belt Failure Detection System (KVF650-A1/B1 Models)

Drive Belt Failure Detection System Circuit



HP24000BW3 C

- | | | |
|-------------------------|--------------------------------|-----------------------------------|
| 1. Multifunction Meter | 7. Main Fuse 30A | 11. Flashing Relay |
| 2. 2WD/4WD Shift Switch | 8. Battery | 12. Switch Circuit Relay |
| 3. Ignition Switch | 9. Reverse Power Assist Switch | 13. Belt Failure Detection Switch |
| 4. Reverse Switch | (override) | 14. System Circuit Relay |
| 5. Actuator Controller | 10. Diode (in harness) | 15. Diode Assembly |
| 6. Igniter | | |

Drive Belt Failure Detection System (KVF650–A2/B2 Models)

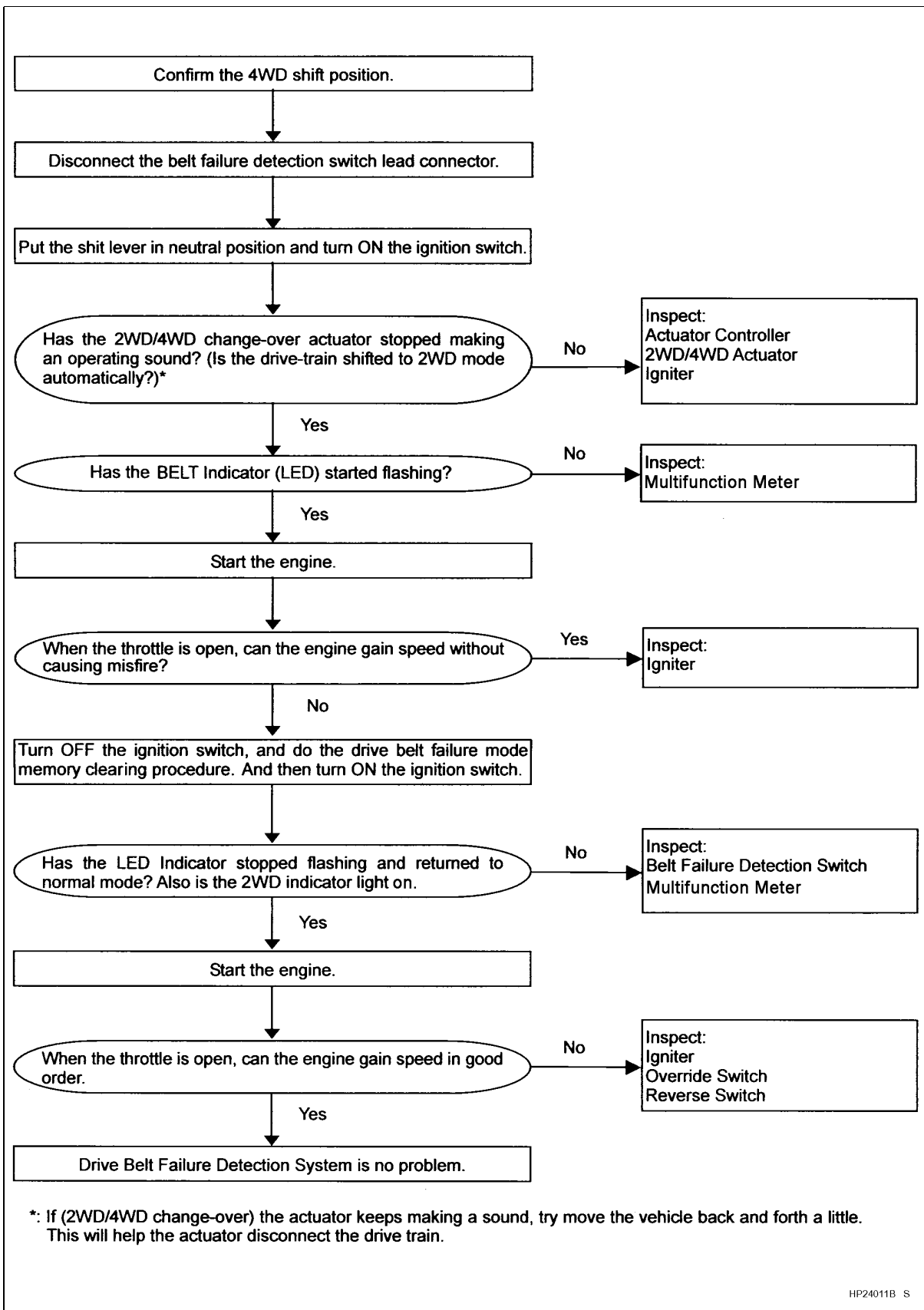
If the drive belt failure detection system activated by abnormal belt, the drive belt failure detection switch is damaged. Make sure replace the torque converter cover (see Converter System chapter).

Drive Belt Failure Detection System Inspection

- Remove:
 - Fuel Tank Cover (see Frame chapter)
- Check the drive belt failure detection system according to following chart.

16-90 ELECTRICAL SYSTEM

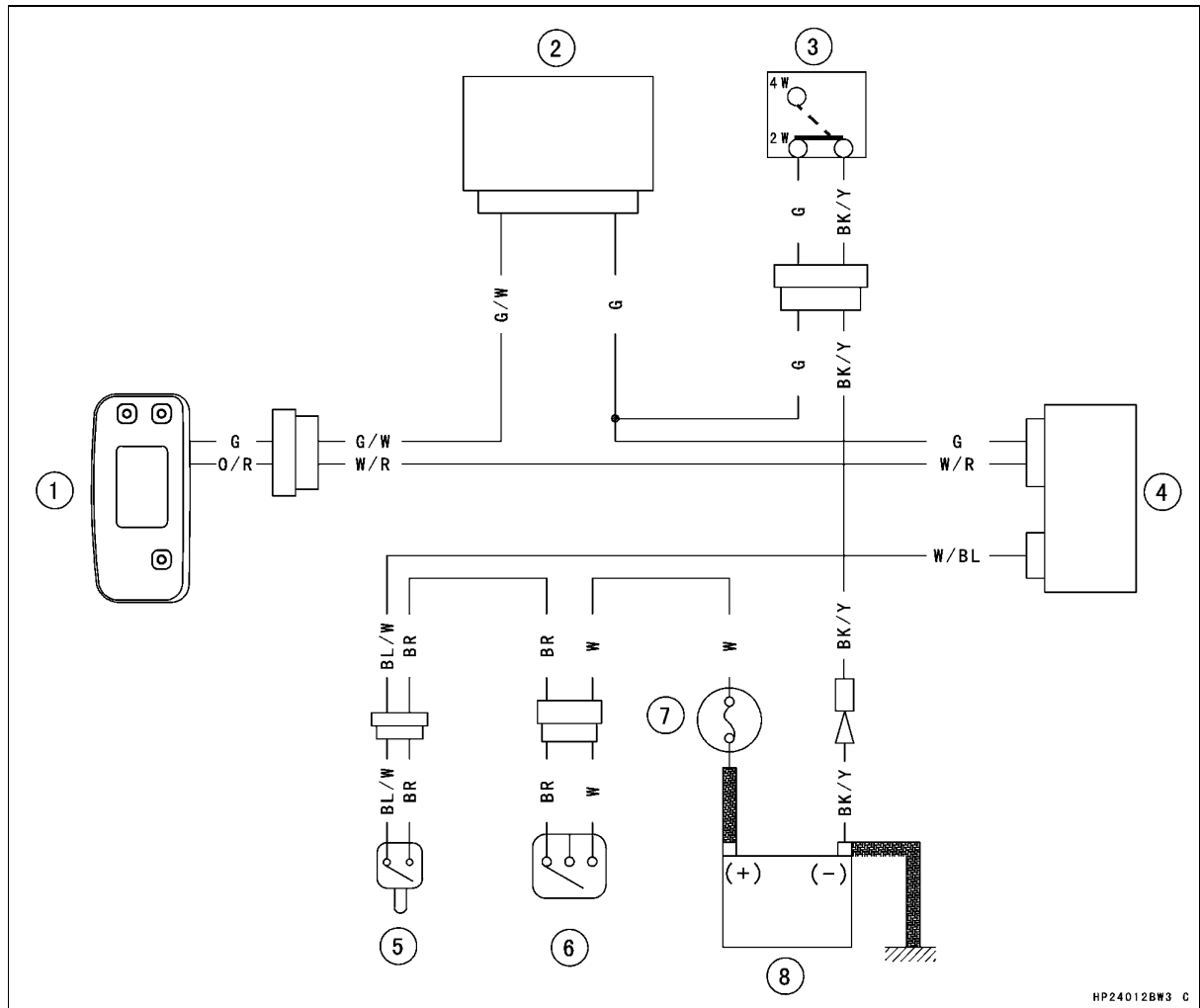
Drive Belt Failure Detection System (KVF650-A2/B2 Models)



ELECTRICAL SYSTEM 16-91

Drive Belt Failure Detection System (KVF650-A2/B2 Models)

Drive Belt Failure Detection System Circuit



HP24012BW3 C

1. Multifunction Meter
2. Actuator Controller
3. 2WD/4WD Shift Switch
4. Igniter
5. Drive Belt Failure Detecting Switch
6. Ignition Switch
7. Main Fuse 30 A
8. Battery

16-92 ELECTRICAL SYSTEM

Switches

Brake Light Switch Adjustment

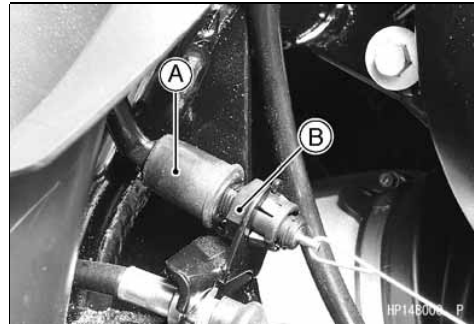
- Check the operation of the brake light switch by depressing the brake pedal [A]. The brake light should go on after about 10 mm (0.4 in.) of pedal travel [B].



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

Brake Light Switch Adjustment

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



CAUTION

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

Radiator Fan Switch Inspection

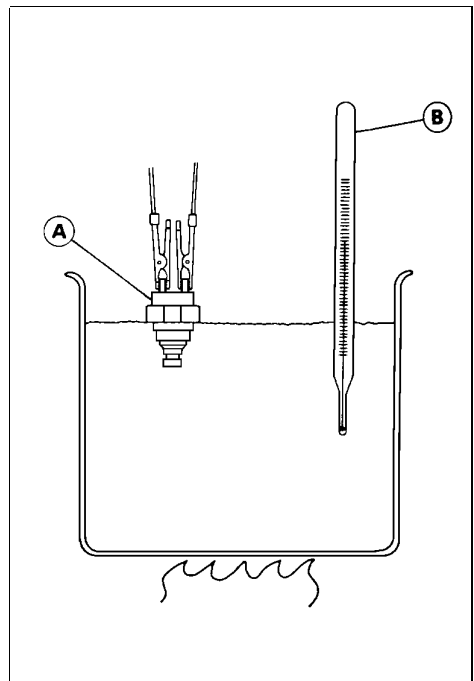
- Remove:
 - Radiator Fan Switch (see Cooling System chapter)
- Suspend the fan switch [A] in a container of coolant so that the temperature sensing projection and threaded portion are submerged.
- Suspend an accurate thermometer [B] in the coolant.

NOTE

- The switch and thermometer must not touch the container sides or bottom.
- Place the container over a source of heat and gradually raise the temperature of the coolant while stirring the coolant gently.
- Using the hand tester, measure the internal resistance of the switch across the terminals at the temperatures shown in the table.
- ★ If the hand tester does not show the specified values, replace the switch.

Radiator Fan Switch Resistance

- Rising temperature:
 - From OFF to ON at 96 ~ 100°C (205 ~ 212°F)
- Falling temperature:
 - From ON to OFF at 91 ~ 95°C (196 ~ 203°F)
 - ON: Less than 0.5 Ω
 - OFF: More than 1 MΩ



Switches

Coolant Temperature Warning Light Switch Inspection

- Remove:
 - Coolant Temperature Warning Light Switch (see Cooling System chapter)
- Suspend the switch [A] in a container of coolant so that the temperature sensing projection and threaded portion are submerged.
- Suspend an accurate thermometer [B] in the coolant.

NOTE

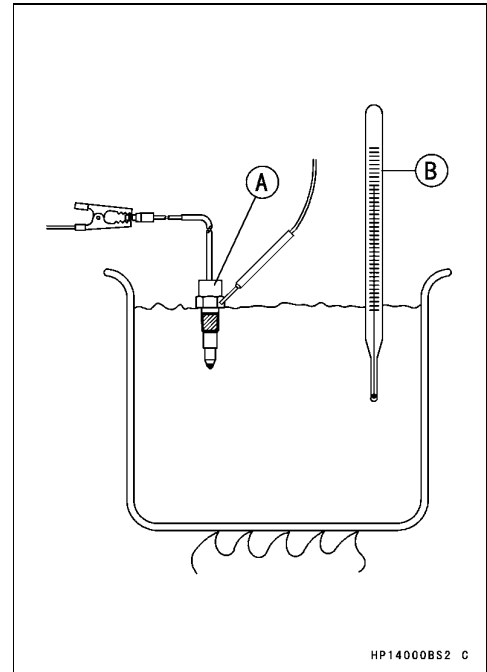
- *The switch and thermometer must not touch the container sides or bottom.*
- Place the container over a source of heat and gradually raise the temperature of the coolant while stirring the coolant gently.
- Using the hand tester, measure the internal resistance of the switch across the connector and the body at the temperatures shown in the table.
- ★ If the hand tester does not show the specified values, replace the switch.

Coolant Temperature Warning Light Switch Resistance

- **Rising temperature:**
 - From OFF to ON at 112 ~ 118°C (234 ~ 244°F)
- **Falling temperature:**
 - From ON to OFF at 108 ~ 111°C (226 ~ 232°F)
 - ON: Less than 0.5 Ω
 - OFF: More than 1 MΩ

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.



16-94 ELECTRICAL SYSTEM


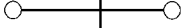
Switches

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

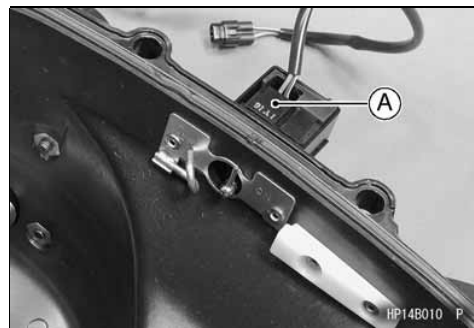
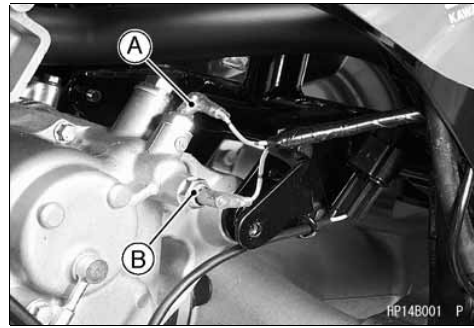
Drive Belt Failure Detection Switch

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 Converter System chapter).

- Remove:
Torque Converter Cover (see Torque Converter Removal section in Converter System)

	BR	BL/W
When drive belt failure detection switch is in ON position		
When drive belt failure detection switch is in OFF position		

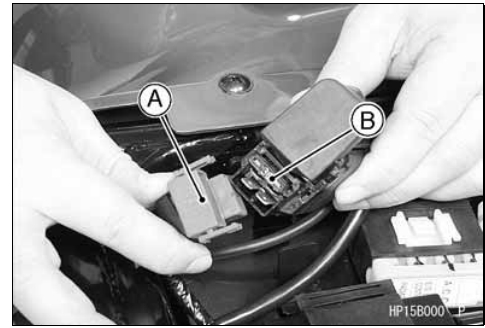
[A] Drive Belt Failure Detection Switch



Fuses

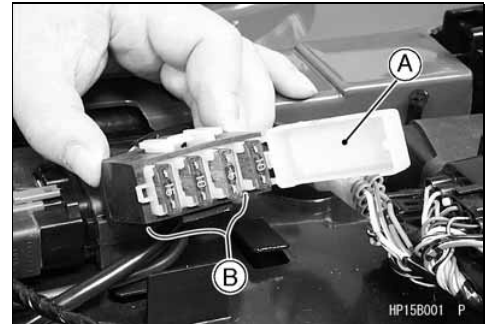
30 A Main Fuse Removal

- Remove:
 - Seat (see Frame chapter)
 - Starter Relay and 30A Main Fuse Connector [A]
- Pull out the main fuse [B] from the starter relay with a needle nose pliers.



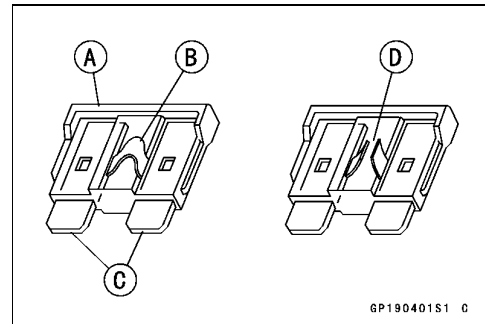
Fuse Removal

- Remove:
 - Seat (see Frame chapter)
 - Fuse Case Cover [A]
- Pull out the fuse [B] from the fuse case with a needle nose pliers.



Fuse Inspection

- Inspect the fuse element.
- ★ If it is blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
 - Housing [A]
 - Fuse Element [B]
 - Terminals [C]
 - Blown Element [D]

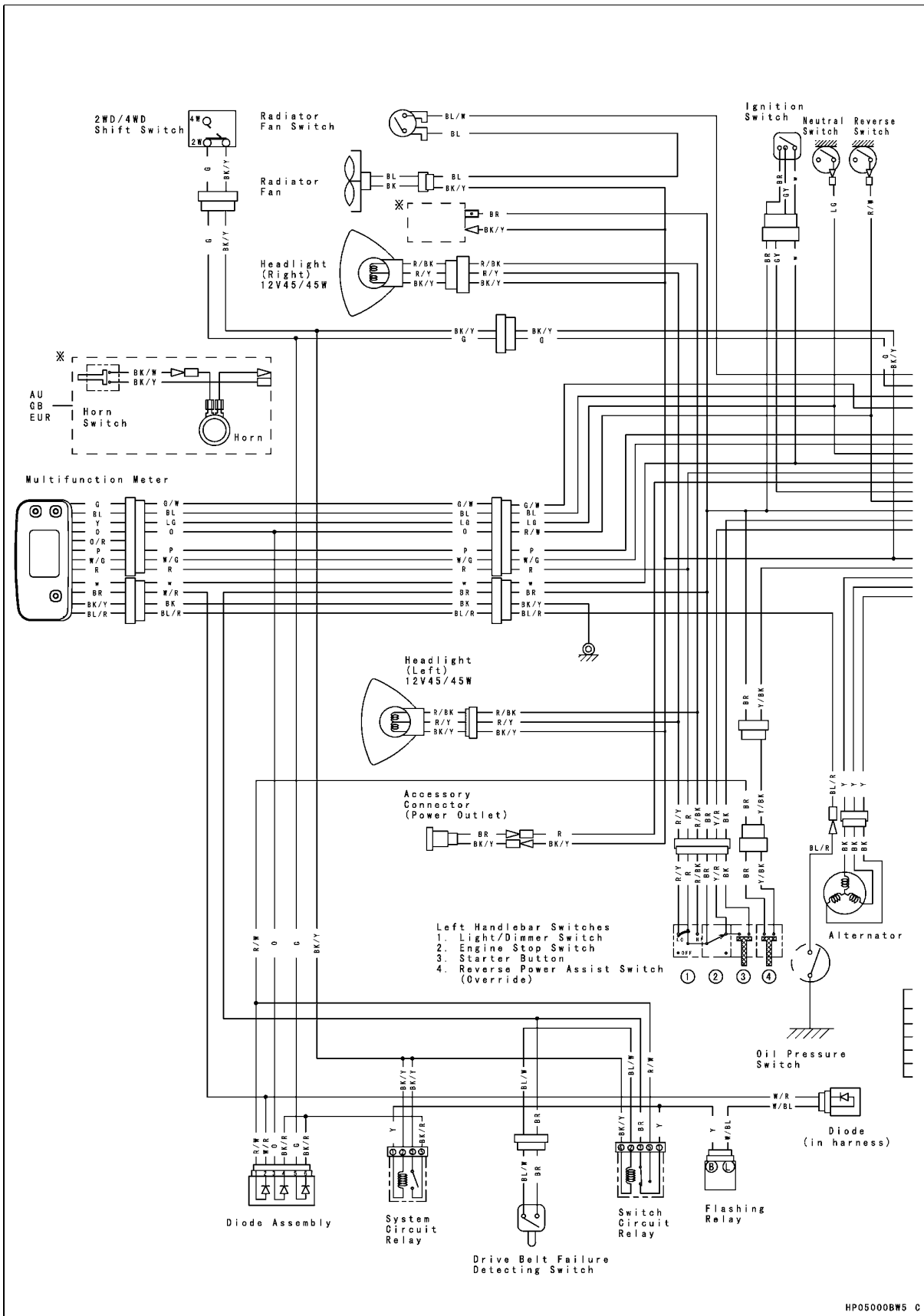


CAUTION

When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.

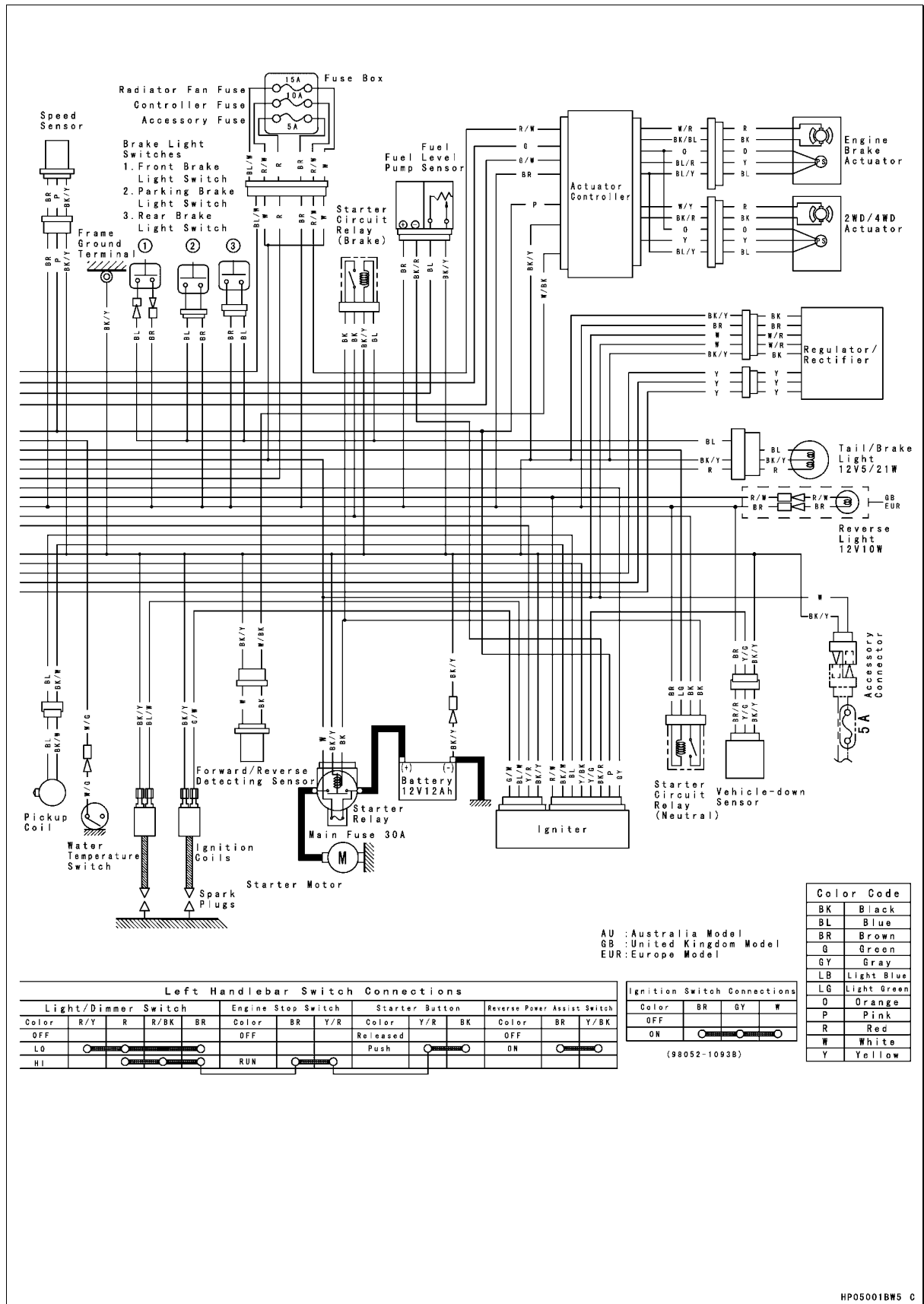
16-96 ELECTRICAL SYSTEM

Wiring Diagram (KVF650-A1/B1 Models)



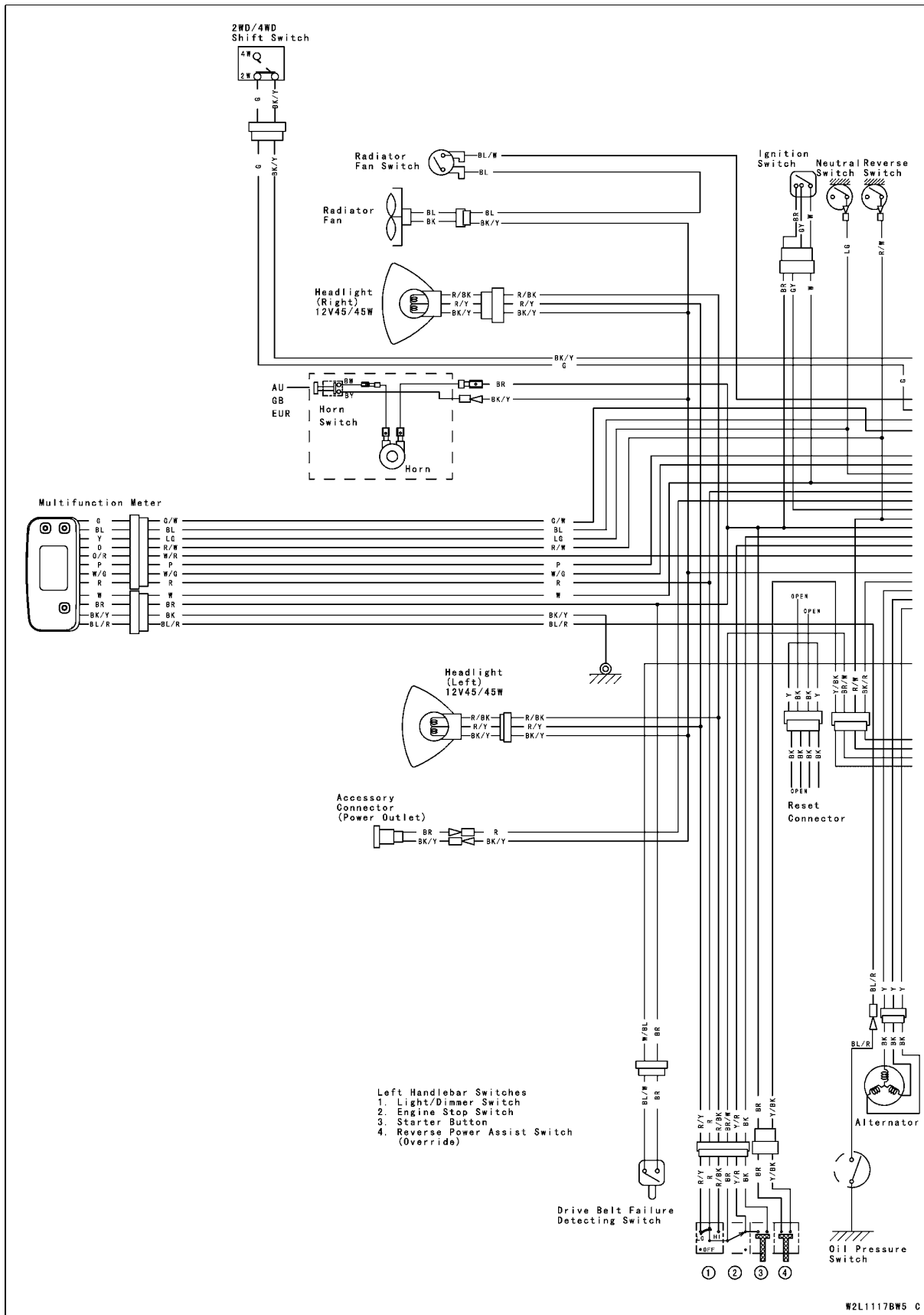
ELECTRICAL SYSTEM 16-97

Wiring Diagram (KVF650-A1/B1 Models)



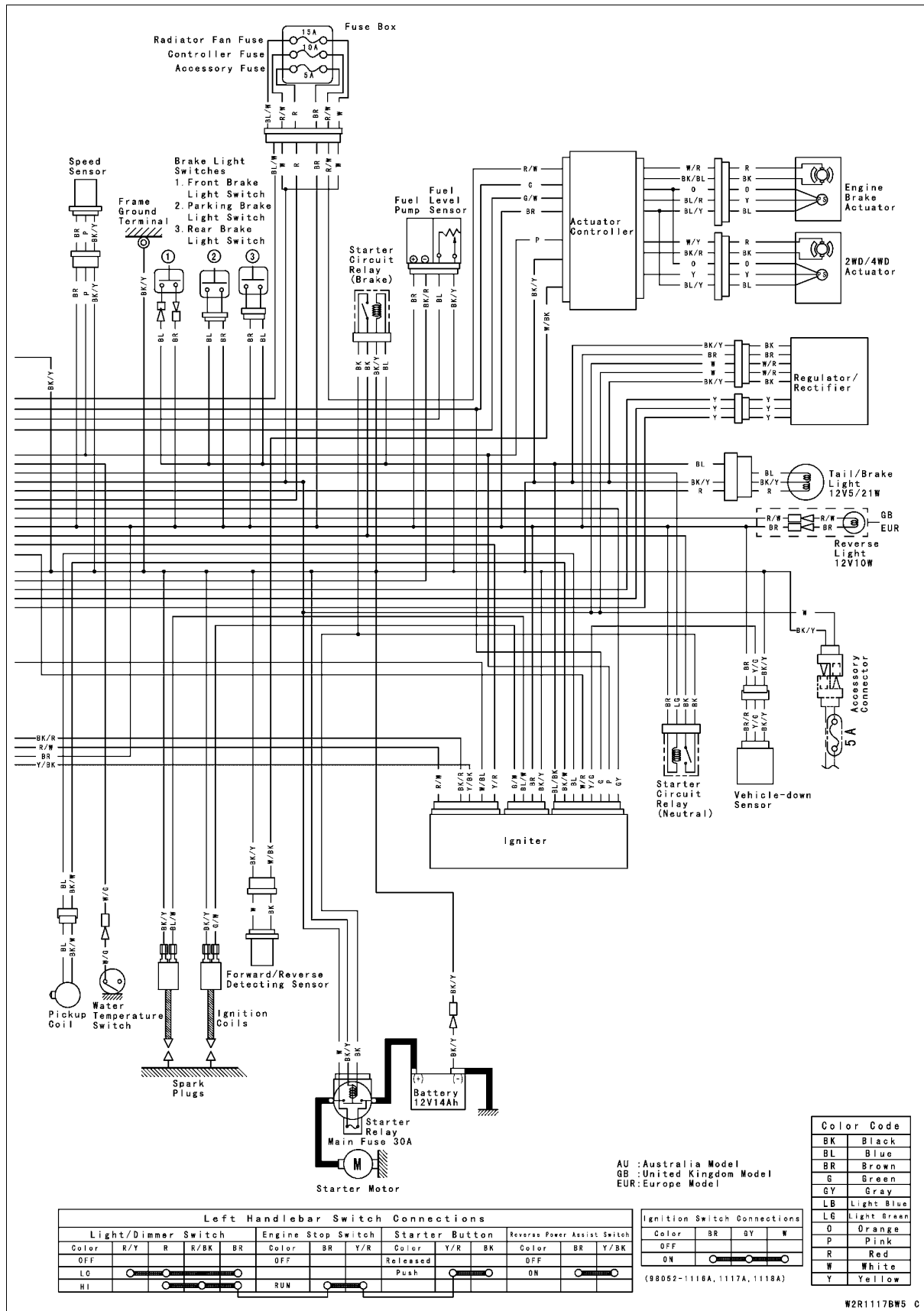
16-98 ELECTRICAL SYSTEM

Wiring Diagram (KVF650-A2/B2 Models)



ELECTRICAL SYSTEM 16-99

Wiring Diagram (KVF650-A2/B2 Models)



Appendix

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Tightness Inspection	17-9
Unit Conversion Table	17-10

17-2 APPENDIX

Considerations for Various Riding Conditions

This vehicle has been designed and manufactured to operate under a wide range of riding conditions. However, it is not feasible to anticipate all of the conditions under which this vehicle might be used. Extremes of temperature, altitude, and riding usage may make changing some carburetor parts or the spark plug desirable to maintain the vehicle in peak operating condition.

Carburetor:

Sometimes an alteration may be desirable for good performance under different riding conditions when proper mixture is not obtained after the carburetor has been properly adjusted, and all parts cleaned and found to be functioning properly.

If the engine still exhibits symptoms of overly rich or lean carburetion after all maintenance and adjustments are correctly performed, the main jet can be replaced with a smaller or larger one. A smaller numbered jet gives a leaner mixture and a larger numbered jet a richer mixture.

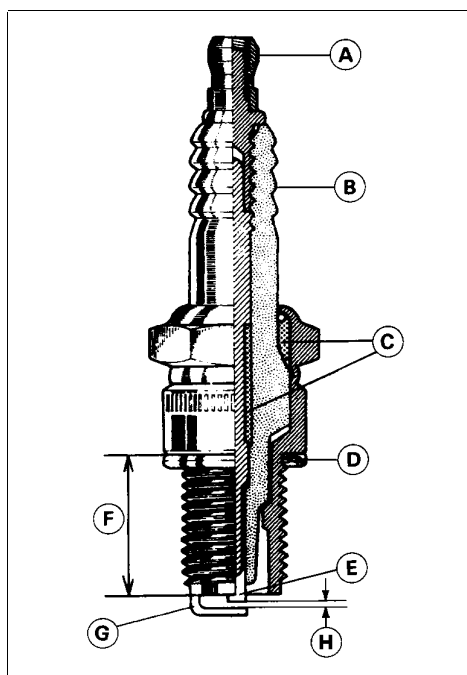
Spark Plug:

The spark plug ignites the fuel and air mixture in the combustion chamber. To do this effectively and at the proper time, the correct spark plug must be used, and the spark plug must be kept clean and the gap adjusted.

Tests have shown the plug listed in the General Information chapter to be the best plug for general use.

Since spark plug requirements change with the ignition and carburetion adjustments and with riding conditions, whether or not a spark plug of the correct heat range is used should be determined by removing and inspecting the plug.

- Terminal [A]
- Insulator [B]
- Cement [C]
- Gasket [D]
- Center Electrode [E]
- Reach [F]
- Side Electrode [G]
- Gap [H] 0.7 ~ 0.8 mm (0.028 ~ 0.0031 in.)



When a plug of the correct heat range is being used, the electrodes will stay hot enough to keep all the carbon burned off, but cool enough to keep from damaging the engine and the plug itself. This temperature is about 400 ~ 800°C (750 ~ 1,450°F) and can be judged by noting the condition and color of the ceramic insulator around the center electrode. If the ceramic is clean and of a light brown color, the plug is operating at the right temperature.

A spark plug for higher operating temperatures sometimes may be needed for severe conditions, such as continuous high-speed riding, or towing heavy loads. Such a plug is designed for better cooling efficiency so that it will not overheat and thus is often called a "colder" plug. If a spark plug with too high a heat range is used – that is, a "cold" plug that cools itself too well, – the plug will stay too cool to burn off the carbon, and the carbon will collect on the electrodes and the ceramic insulator.

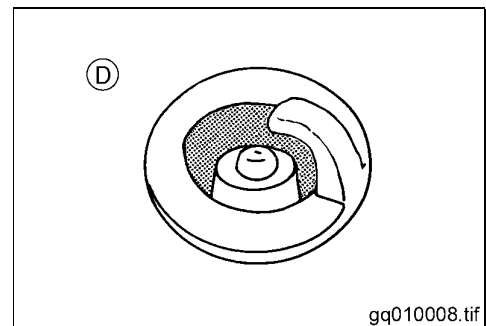
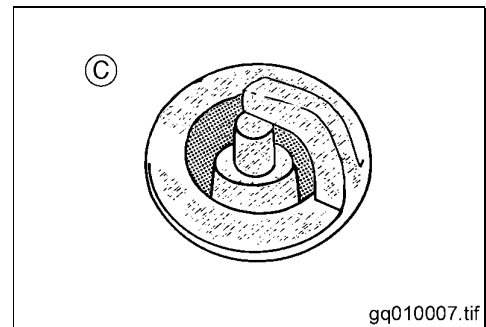
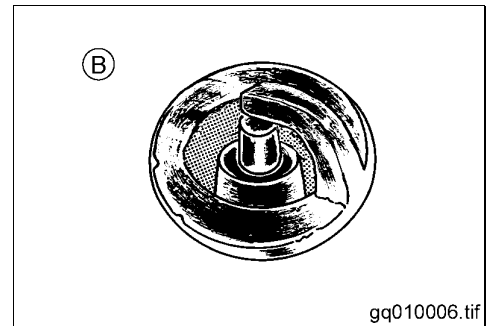
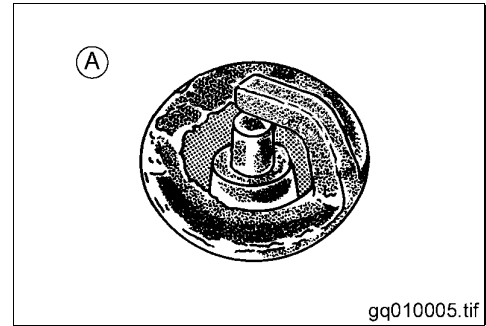
The carbon on the electrodes conducts electricity, and can short the center electrode to ground by either coating the ceramic insulator or bridging across the gap. Such a short will prevent an effective spark. Carbon build-up on the plug can also cause other troubles. It can heat up red-hot and cause preignition and knocking, which may eventually burn a hole in the top of the piston.

Considerations for Various Riding Conditions

Spark Plug Inspection

- Remove the spark plug and inspect the ceramic insulator.
- ★ Whether or not the right temperature plug is being used can be ascertained by noting the condition of the ceramic insulator around the electrode. A light brown color indicates the correct plug is being used. If the ceramic is black, it indicates that the plug is firing at too low a temperature, so the next hotter type should be used instead. If the ceramic is white, the plug is operating at too high a temperature and it should be replaced with the next colder type.

- Carbon Fouling [A]
- Oil Fouling [B]
- Normal Operation [C]
- Overheating [D]



CAUTION

If the spark plug is replaced with a type other than the standard plug, make certain the replacement plug has the same thread pitch and reach (length of threaded portion) and the same insulator type (regular type or projected type) as the standard plug.

If the plug reach is too short, carbon will build up on the plug hole threads in the cylinder head, causing overheating and making it very difficult to insert the correct spark plug later.

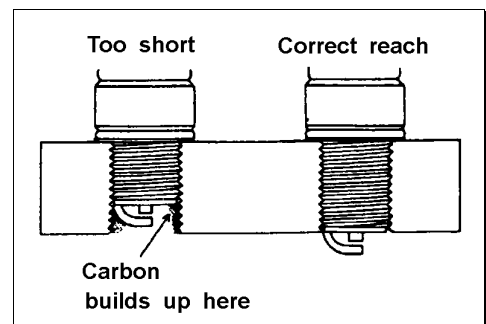
If the reach is too long, carbon will build up on the exposed spark plug threads causing overheating, preignition, and possibly burning a hole in the piston top. In addition, it may be impossible to remove the plug without damaging the cylinder head.

Standard Spark Plug Threads

- Diameter: 10 mm (0.39 in.)
- Pitch: 1 mm (0.04 in.)
- Reach: 19 mm (0.75 in.)

CAUTION

The heat range of the spark plug functions like a thermostat for the engine. Using the wrong type of spark plug can make the engine run too hot (resulting in engine damage) or too cold (with poor performance, misfiring, and stalling).



17-4 APPENDIX

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.*

Engine Doesn't Start, Starting Difficulty:

Starter motor not rotating:

- Neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Relays not contacting or operating
- Starter button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

Starter motor rotating but engine doesn't turn over:

- Starter motor clutch trouble

Recoil starter not operating

- Recoil starter spring broken
- Recoil starter pawl not engaging

Engine won't turn over:

- Valve seizure
- Rocker arm seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure

No fuel flow:

- Fuel tank air vent obstructed
- Fuel tap clogged
- Fuel line clogged
- Float valve 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
- Pilot jet or air passage clogged
- Air cleaner clogged, poorly sealed, or missing
- Starter jet clogged

No spark; spark weak:

- Spark plug dirty, broken, or maladjusted
- Spark plug cap or spark plug lead trouble
- Spark plug cap not in good contact
- Spark plug incorrect
- Pickup coil trouble
- Igniter trouble
- Ignition coil trouble
- Battery voltage low
- Ignition or engine stop switch shorted
- Wiring shorted or open
- Fuse blown

Compression Low:

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance

Cylinder, piston worn

Piston ring bad (worn, weak, broken, or sticking)

Piston ring/groove clearance excessive

Cylinder head gasket damaged

Cylinder head warped

Valve spring broken or weak

Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Compression release cam (K.A.C.R.) 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
- Igniter trouble
- Pickup coil trouble
- Ignition coil trouble
- Battery voltage low

Fuel/air mixture incorrect:

- Pilot screw and/or idle adjusting screw maladjusted
- Pilot jet or air passage clogged
- Starter plunger stuck open
- Air cleaner clogged, poorly sealed, or missing
- Fuel level too high or too low
- Fuel tank air vent obstructed
- Carburetor holder loose
- Air cleaner duct loose

Compression low:

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)
- Compression release cam (K.A.C.R.) sticks open
(Engine stalls when moving off)

Other:

- Carburetor vacuum piston doesn't slide smoothly
- Engine oil viscosity too high
- Brake dragging
- Igniter trouble
- 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
- Pickup coil trouble
- Igniter trouble
- Ignition coil trouble
- Drive belt failure detection switch activated

Troubleshooting Guide

- Fuel/air mixture incorrect:**
 Main jet clogged or wrong size
 Jet needle or needle jet worn
 Main air jet clogged
 Bleed holes of air bleed pipe or needle jet clogged
 Fuel level too high or too low
 Air cleaner clogged, poorly sealed, or missing
 Starter plunger stuck open
 Water or foreign matter in fuel
 Carburetor holder loose
 Air cleaner duct loose
 Fuel tank air vent obstructed
 Fuel tap clogged
 Fuel line clogged
- Compression low:**
 Spark plug loose
 Cylinder head not sufficiently tightened down
 No valve clearance
 Cylinder, piston worn
 Piston rings bad (worn, weak, broken, or sticking)
 Piston ring/groove clearance excessive
 Cylinder head gasket damaged
 Cylinder head warped
 Valve spring broken or weak
 Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)
 Compression release 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
 Igniter trouble
- Miscellaneous:**
 Throttle valve won't fully open
 Carburetor vacuum piston doesn't slide smoothly
 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
 Igniter trouble
- Fuel/air mixture incorrect:**
 Main jet clogged
 Fuel level too low
 Carburetor holder loose
 Air cleaner poorly sealed, or missing
 Air cleaner duct loose
 Air cleaner clogged
- Compression high:**
 Carbon built up in combustion chamber
- Engine load faulty:**
 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
 Radiator fan switch trouble
 Fan motor broken
 Fan blade damaged
 Water pump not turning
 Water pump impeller damaged
- Over Cooling:**
- Cooling system component incorrect:**
 Radiator fan switch trouble
 Thermostat trouble
- 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
 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

17-6 APPENDIX

Troubleshooting Guide

Abnormal Engine Noise:

Knocking:

- Igniter trouble
- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Spark plug incorrect
- Overheating

Piston Slap:

- Cylinder/piston clearance excessive
- Cylinder, piston worn
- Connecting rod bent
- Piston pin, piston holes worn

Valve noise:

- Valve clearance incorrect
- Valve spring broken or weak
- Camshaft bearing worn
- Rocker arm worn

Other noise:

- Connecting rod small end clearance excessive
- Connecting rod big end clearance excessive
- Piston ring worn, broken, or stuck
- Piston seizure, damage
- Cylinder head gasket leaking
- Exhaust pipe leaking at cylinder head connection
- Crankshaft runout excessive
- Engine mounts loose
- Crankshaft bearing worn
- Camshaft chain tensioner trouble
- Camshaft chain, sprocket, guides worn
- 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
- Main jet too large or fallen off
- Starter plunger stuck open
- Fuel level too high

Brown smoke:

- Main jet too small
- Fuel level too low
- Air cleaner duct loose
- Air cleaner poorly sealed or missing

Handling and/or Stability Unsatisfactory

Handlebar hard to turn:

- Tire air pressure too low
- Steering stem bearing damaged
- Steering stem bearing lubrication inadequate
- Steering stem bent
- 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

Troubleshooting Guide

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

K-EBC 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

17-8 APPENDIX

General Lubrication

Lubrication

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

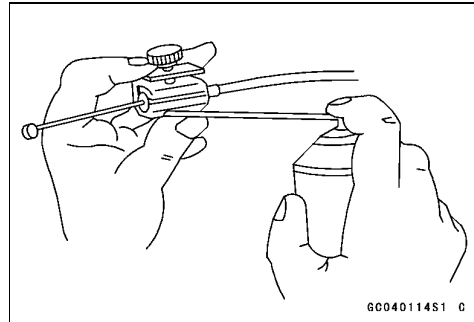
NOTE

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

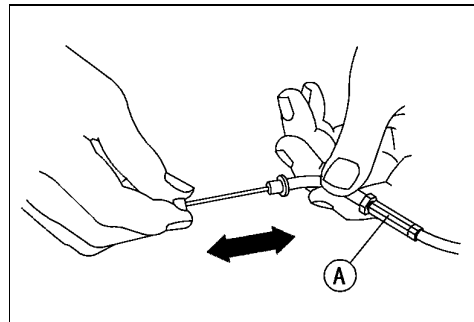
Cables: Lubricate with Cable Lubricant

Brake Cables
Throttle Cable
Choke Cable

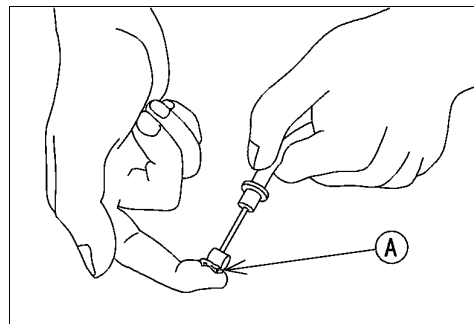
- Lubricate the cables by seeping the oil between the cable and housing.
- The cable may be lubricated by using a pressure cable luber with an aerosol cable lubricant.



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



Points: Lubricate with Grease.
Throttle Inner Cable Ends [A]
Choke Cable Lower End
Brake Cable Ends



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

Bolt and Nut 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 in the General Information chapter). 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:

- Master Cylinder Clamp Bolts
- Brake Lever Pivot Bolt
- Brake Lever Pivot Nut
- Caliper Mounting Bolts
- Brake Pedal Cotter Pin

Steering/Suspension:

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

Engine:

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

Front Final Drive:

- Gear Case Bracket Bolts

Others:

- Footrest Mounting Bolts
- Throttle Mounting Bolts
- Carrier Mounting Bolts

17-10 APPENDIX

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

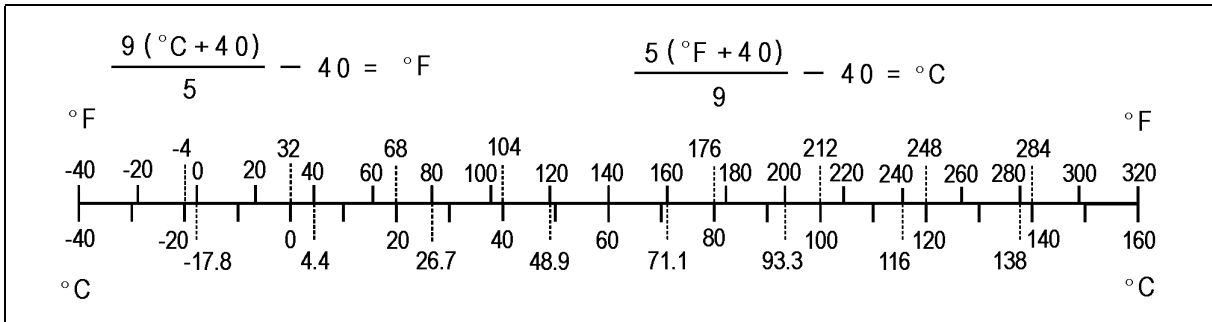
Units of Speed:

km/h	×	0.6214	=	mph
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Units of Power:

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

Units of Temperature:



MODEL APPLICATION

Year	Model	Beginning Frame No.
2002	KVF650-A1	JKAVFEA1□2B500001 or JKAVF650AAB600001
	KVF650-B1	JKAVFEB1□2B500001
2003	KVF650-A2	JKAVFEA1□3B535301 or JKAVF650AAB602501
	KVF650-B2	JKAVFEB1□3B535301

□: This digit in the frame number changes from one machine to another.



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