Quick Reference Guide

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

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

General Information

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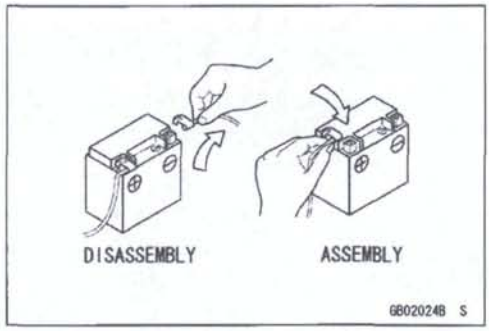
Before Servicing

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

Especially note the following:

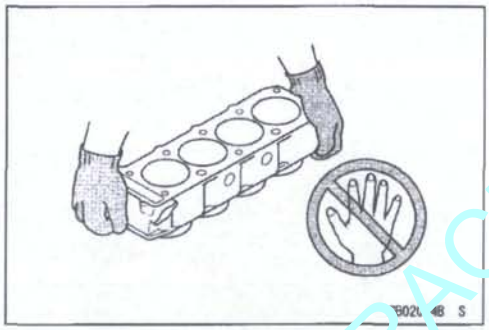
Battery Ground

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



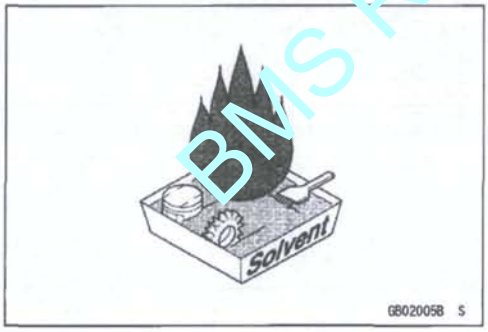
Edges of Parts

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



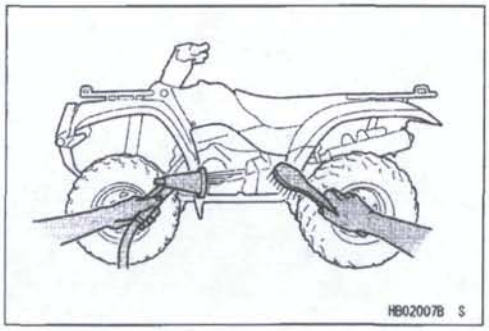
Solvent

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



Cleaning Vehicle before Disassembly

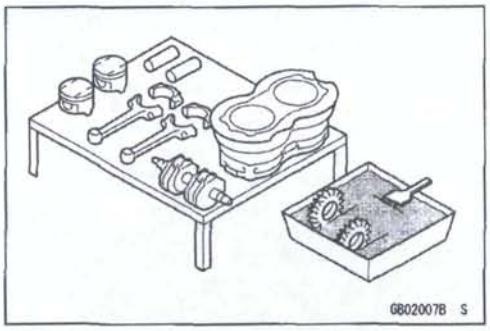
Clean the vehicle thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during vehicle disassembly can cause excessive wear and decrease performance of the vehicle.



Before Servicing

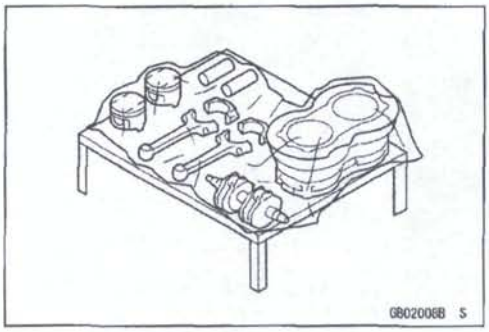
Arrangement and Cleaning of Removed Parts

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



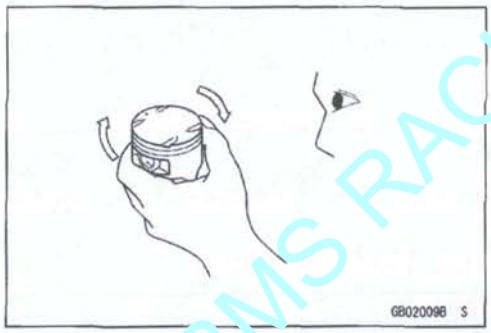
Storage of Removed Parts

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



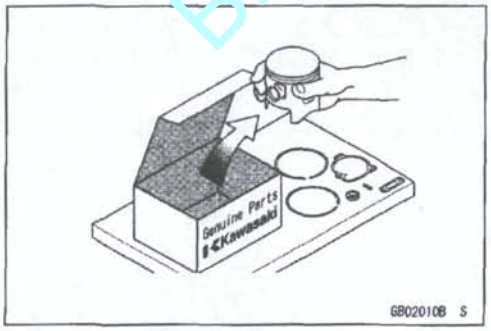
Inspection

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



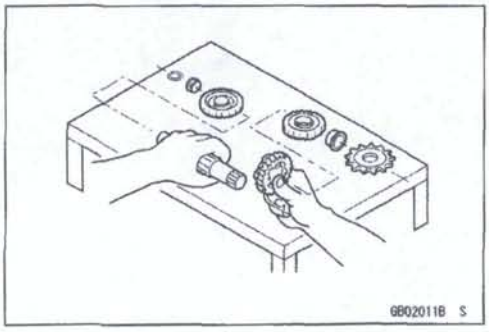
Replacement Parts

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



Assembly Order

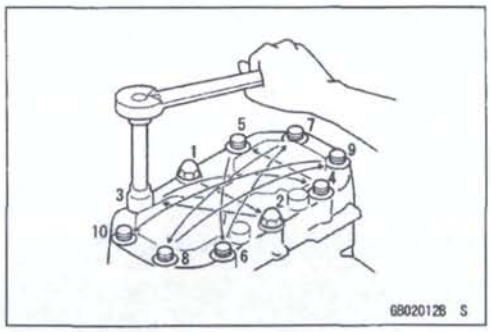
In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.



Before Servicing

Tightening Sequence

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



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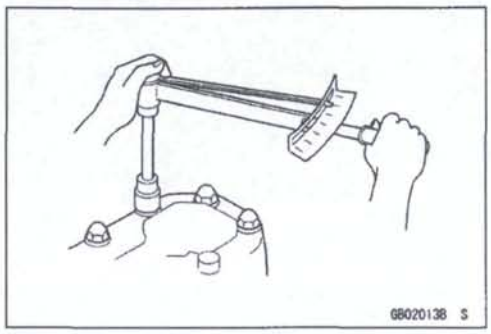
Tightening Torque

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

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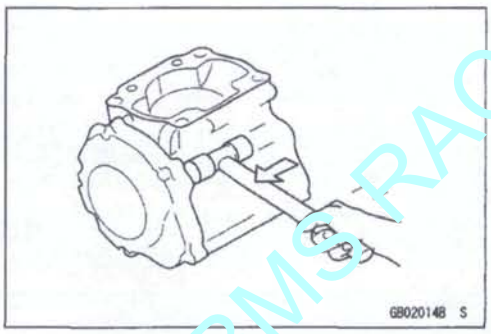
Force

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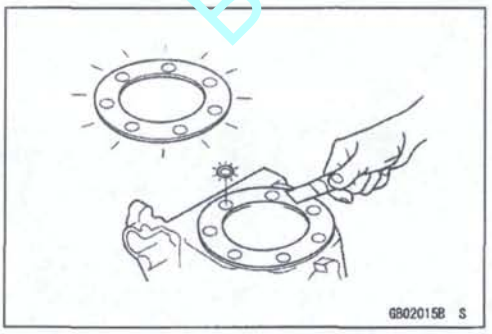
Gasket, O-ring

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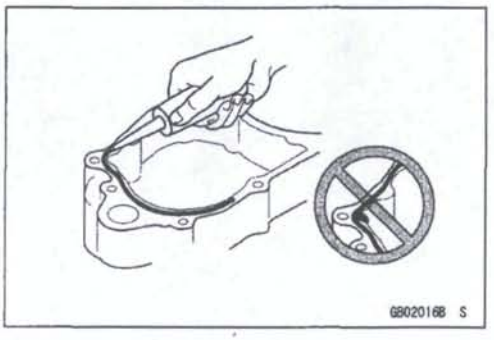
Liquid Gasket, Locking Agent

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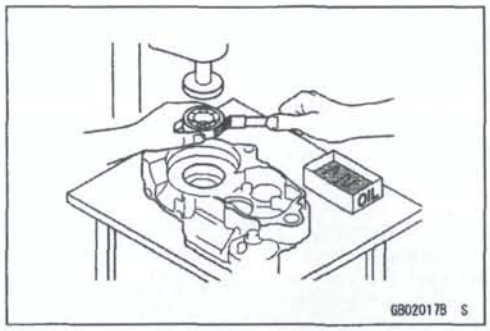
Before Servicing

Press

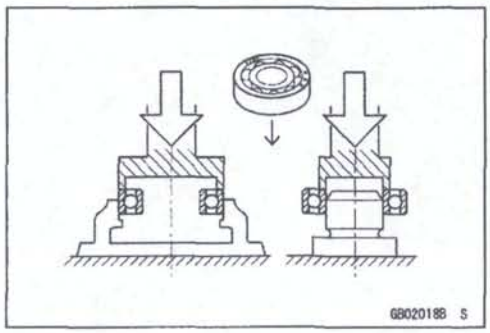
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing and Needle Bearing

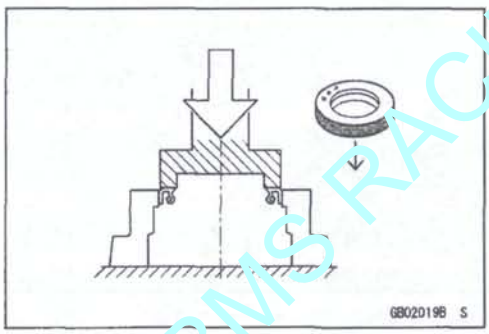
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

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

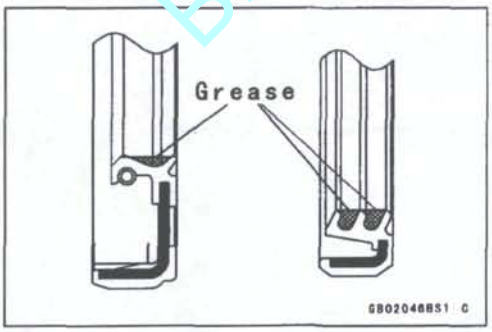


Oil Seal, Grease Seal

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

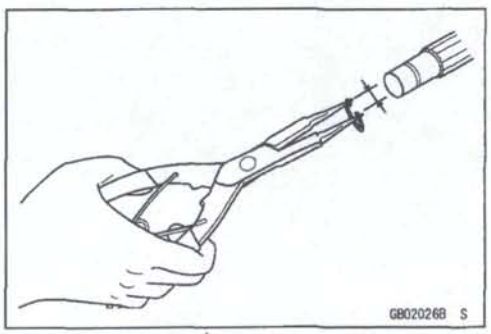


Apply specified grease to the lip of seal before installing the seal.



Circlips, Cotter Pins

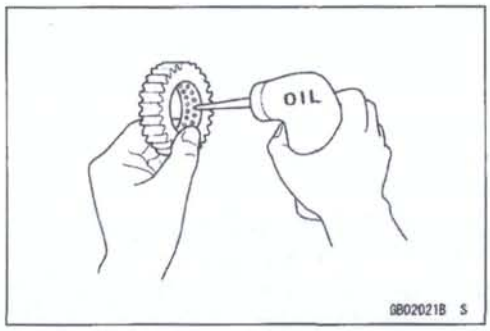
Replace circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.



Before Servicing

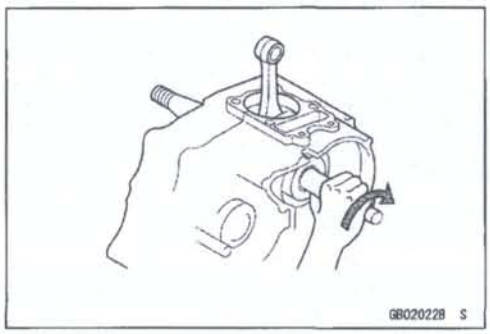
Lubrication

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



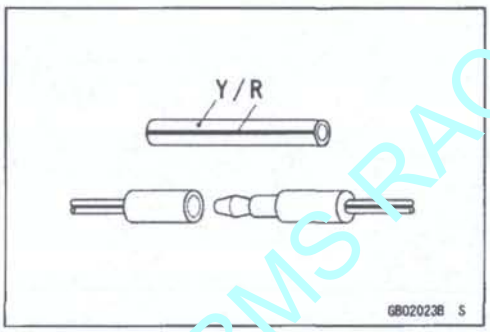
Direction of Engine Rotation

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



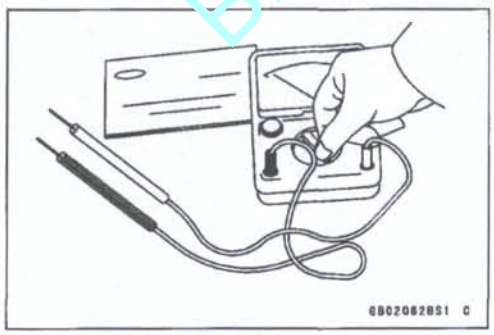
Electrical Wires

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



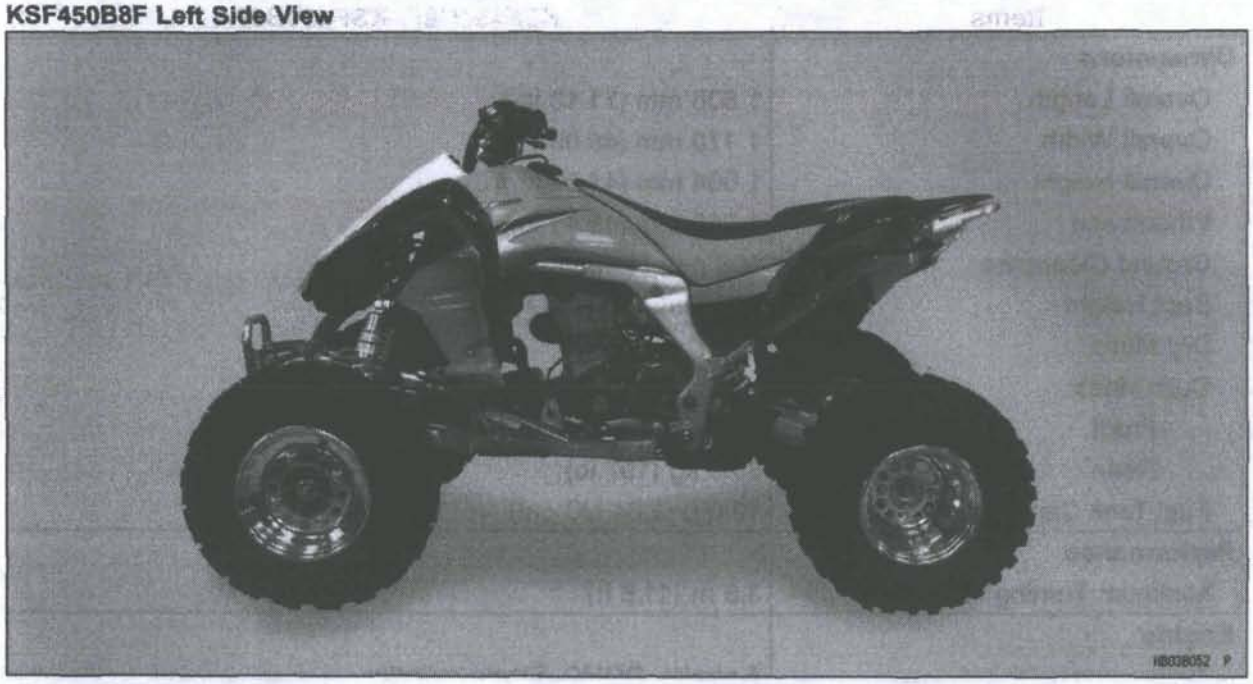
Instrument

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



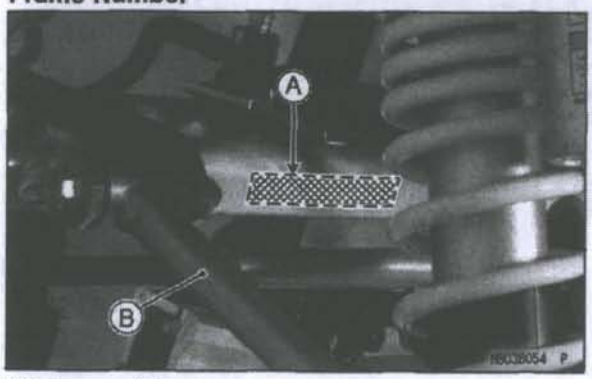
Model Identification

KSF450B8F Left Side View



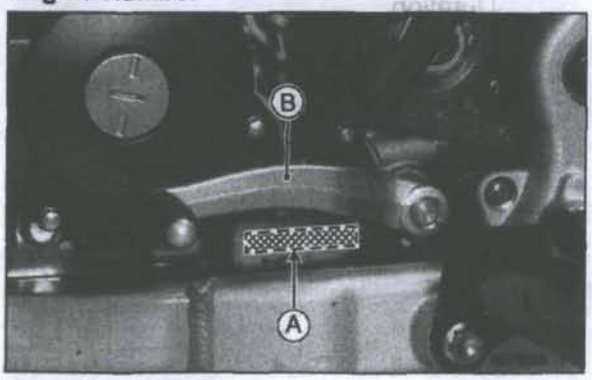
KSF450B8F Right Side View

Frame Number



[A] Frame Number
[B] Left Suspension Arm

Engine Number



[A] Engine Number
[B] Shift Pedal

General Specifications

Items	KSF450B8F, KSF450B8FA
Dimensions	
Overall Length	1 806 mm (71.10 in.)
Overall Width	1 170 mm (46.06 in.)
Overall Height	1 064 mm (41.89 in.)
Wheelbase	1 255 mm (49.41 in.)
Ground Clearance	108 mm (4.25 in.)
Seat Height	786 mm (30.94 in.)
Dry Mass	165 kg (364 lb)
Curb Mass:	
Front	88.5 kg (195 lb)
Rear	89.5 kg (197 lb)
Fuel Tank Capacity	10.0 L (2.64 US gal)
Performance	
Minimum Turning Radius	3.6 m (11.8 ft)
Engine	
Type	4-stroke, DOHC, Single-cylinder
Cooling System	Liquid-cooled
Bore and Stroke	96.0 × 62.1 mm (3.78 × 2.44 in.)
Displacement	449 cm³ (27.4 cu in.)
Compression Ratio	12.0 : 1
Maximum Horsepower	31.9 kW (43 PS) @7 500 r/min (rpm), (US) -
Maximum Torque	41.9 N·m (4.3 kgf·m, 31 ft·lb) @7 000 r/min (rpm)
Carburetion System	FI (Fuel Injection) Keihin ϕ42
Starting System	Electric Starter
Ignition System	Battery and Coil (transistorized ignition)
Timing Advance	Electronically advanced
Ignition Timing	From 10° BTDC@1 800 r/min (rpm) to 39.5° BTDC@6 000 r/min (rpm)
Spark Plug	NGK CPR8EB-9
Valve Timing:	
Inlet:	
Open	26° BTDC
Close	70° ABDC
Duration	276°
Exhaust:	
Open	82° BBDC
Close	24° ATDC
Duration	284°
Lubrication System	Forced lubrication (semi dry sump)
Engine oil:	
Type	API SF or SG API SH, SJ or SL with JASO MA
Viscosity	SAE 10W-40
Capacity	1.35 L (1.43 US qt)

General Specifications

Items	KSF450B8F, KSF450B8FA
Drive Train	
Primary Reduction System:	
Type	Gear
Reduction Ratio	2.952 (62/21)
Clutch Type	Wet, multi disc
Transmission:	
Type	5-speed and reverse, constant mesh, return shift
Gear ratios:	
1st	2.230 (29/13)
2nd	1.800 (27/15)
3rd	1.529 (26/17)
4th	1.278 (23/18)
5th	1.048 (22/21)
Reverse	2.364 (16/11 × 26/16)
Final Drive System:	
Type	Chain drive
Reduction Ratio	2.714 (38/14)
Overall Drive Ratio	8.395 @Top gear
Frame	
Type	Tubular, Double cradle
Caster (Rake Angle)	1.8°
Camber	-2°
King Pin Angle	14.7°
Trail	7.6 mm (0.30 in.)
Tread:	
Front	972 mm (38.27 in.)
Rear	899 mm (35.39 in.)
Front Tire:	
Type	Tubeless
Size	AT21 × 7-10
Rear Tire:	
Type	Tubeless
Size	AT20 × 10-9
Rim Size:	
Front	10 × 5.5
Rear	9 × 8
Suspension:	
Front:	
Type	Double Wishbone
Wheel Travel	215 mm (8.46 in.)
Rear:	
Type	Swingarm
Wheel Travel	254 mm (10.0 in.)

General Specifications

Items	KSF450B8F, KSF450B8FA
Brake:	
Front	Disc × 2
Rear	Disc
Parking Brake	Disc (Mechanical)
Electrical Equipment	
Battery	12 V 6 Ah
Headlight:	
Type	Semi-sealed beam
Bulb	12 V 30/30 W × 2
Tail/brake Light:	
Bulb	12 V 0.5/4.1 W (LED)
Alternator:	
Type	Three - phase AC
Rated Output	14 A, 14 V @5 000 r/min (rpm)

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

Unit Conversion Table

Prefixes for Units:

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

Units of Mass:

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume:

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

Units of Force:

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

Units of Length:

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

Units of Torque:

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

Units of Pressure:

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

Units of Speed:

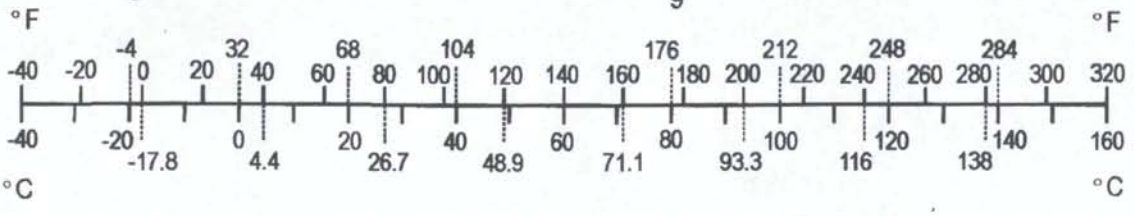
km/h	×	0.6214	=	mph

Units of Power:

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

Units of Temperature

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



Periodic Maintenance

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Periodic Maintenance Chart

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

FREQUENCY / OPERATION	First Service	Regular Service				
	After 10 hrs. or 100 km (60 mi.) of use	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days or 1 700 km (1 100 mi.) of use	Every year of use	See page
ENGINE						
Air cleaner - inspect*	•	•				2-15
Throttle lever play - inspect	•	•				2-14
Idle speed - inspect			•			2-14
Reverse lock release lever play - inspect	•	•				2-26
Valve clearance - inspect*	First 1 700 km (1 100 mi.); thereafter every 3 400 km (2 200 mi.)					2-20
Engine oil - change*	•			•		2-24
Oil filter - replace *	•			•		2-25
Spark plug - clean and gap	•			•		2-35 2-36
Spark arrester - clean						2-23
Fuel hoses and connections - inspect				•		2-16
Fuel hose - replace	4 years					2-16
Radiator - clean*	•	•				2-17
Radiator hoses and connections - check*					•	2-18
Coolant - change*	2 years					2-18
Clutch operation (play, disengagement, engagement) - inspect	•	•				2-24
CHASSIS						
Joint boots - inspect*	•	•				2-35
Bolts and nuts - tighten	•	•				2-38
Brake pad wear - inspect*	•		•			2-30
Brake light switch - inspect*	•		•			2-36
Steering - inspect	•			•		2-35
Tire wear - inspect*			•			2-27
General lubrication*			•			2-36
Brake fluid level - inspect	•		•			2-32
Brake fluid - change					•	2-33
Brake hoses and connections - inspect				•		2-30
Brake master cylinder piston assembly and dust cover - replace	2 years					2-34
Brake caliper fluid seal and dust seal - replace	2 years					2-34

Periodic Maintenance Chart

OPERATION \ FREQUENCY	First Service	Regular Service				
	After 10 hrs. or 100 km (60 mi.) of use	Every 10 days or 200 km (120 mi.) of use	Every 30 days or 600 km (360 mi.) of use	Every 90 days or 1 700 km (1 100 mi.) of use	Every year of use	See page
Brake hose - replace	4 years					2-31
Drive chain lubrication condition - inspect*				●		2-29
Drive chain slack - inspect*				●		2-27
Drive chain wear - inspect*				●		2-28
Drive chain guide wear - inspect				●		2-30

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

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

Torque and Locking Agent

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

Letters used in the "Remarks" column mean:
L: Apply a non-permanent locking agent.
Lh: Left-hand Threads
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10:1).
R: Replacement Parts
S: Follow the specified tightening sequence.
Si: Apply silicone grease.
SS: Apply silicone sealant (Kawasaki Bond: 56019-120).
St: Stake the fasteners to prevent loosening.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System (DFI)				
Fuel Tank Mounting Bolts	9.3	0.95	82 in·lb	
Air Cleaner Housing Bolts	8.8	0.90	78 in·lb	
Front Air Cleaner Duct Clamp Screws	1.4	0.14	12 in·lb	
Rear Air Cleaner Duct Clamp Screws	1.4	0.14	12 in·lb	
Fuel Pump Bolts	9.8	1.0	87 in·lb	L
ECU Mounting Bolts	8.8	0.90	78 in·lb	
Inlet Air Pressure Sensor Bracket Mounting Bolt	8.8	0.90	78 in·lb	
Inlet Air Temperarure Sensor Mounting Screw	4.9	0.50	43 in·lb	
Throttle Case Cover Screws	2.0	0.20	18 in·lb	
Throttle Lever Assy Mounting Bolts	3.8	0.39	34 in·lb	
Air Cleaner Housing Bracket Bolts	1.0	0.10	8.9 in·lb	
Cooling System				
Radiator Hose Fitting Bolts	9.8	1.0	87 in·lb	
Coolant Drain Bolt	7.0	0.71	62 in·lb	
Water Pump Impeller Bolt	9.8	1.0	87 in·lb	
Water Pump Cover Bolts	9.8	1.0	87 in·lb	
Reserve Tank Screws	3.5	0.36	31 in·lb	
Radiator Hose Clamp Screws	2.0	0.20	18 in·lb	
Radiator Mounting Bolts	8.8	0.90	78 in·lb	
Radiator Screen Screws	3.5	0.36	31 in·lb	
Radiator Fan Bolts	8.3	0.85	73 in·lb	
Engine Top End				
Throttle Body Holder Clamp Screw	2.0	0.20	18 in·lb	
Radiator Hose Fitting Bolts	9.8	1.0	87 in·lb	
Camshaft Cap Bolts	12	1.2	106 in·lb	
Decompressor Plug Plate Bolt	9.8	1.0	87 in·lb	
Plug	20	2.0	15	L
Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
Cylinder Head Bolts (M10)	59	6.0	44	S,MO
Cylinder Head Bolts (M6)	12	1.2	106 in·lb	S
Oil Passage Plug	3.0	0.30	27 in·lb	L

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Cylinder Bolts	12	1.2	106 in·lb	
Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	
Chain Tensioner Cap Bolt	5.0	0.51	44 in·lb	
Rear Camshaft Chain Guide Bolt	15	1.5	11	EO
Camshaft Sprocket Bolts	12	1.2	106 in·lb	L
Muffler Mounting Bolts	35	3.6	26	
Exhaust Pipe Cover Bolts	12	1.2	106 in·lb	
Exhaust Pipe Holder Nuts	20	2.0	15	
Muffler Joint Clamp Bolt	20	2.0	15	
Muffler Body End Cover Bolts	8.8	0.90	78 in·lb	
Oil Pump (Scavenge) Cover Bolts	9.8	1.0	87 in·lb	
Engine Right Side				
Primary Gear Nut	98	10	72	Lh
Clutch Spring Bolts	8.8	0.90	78 in·lb	
Clutch Hub Nut	98	10	72	
Clutch Cable Holder Mounting Bolts	9.8	1.0	87 in·lb	
Upper Ratchet Plate Mounting Bolt	9.8	1.0	87 in·lb	S
Lower Ratchet Plate Mounting Bolt	15	1.5	11	S, L
Clutch Cover Bolts	9.8	1.0	87 in·lb	
Right Engine Cover Bolts	9.8	1.0	87 in·lb	
Shift Pedal Bolt	9.8	1.0	87 in·lb	
Shift Drum Cam Bolt	29	3.0	21	L
Gear Positioning Lever Nut	8.8	0.90	78 in·lb	
Lubrication System				
Engine Oil Drain Bolt (M6)	7.0	0.71	62 in·lb	
Engine Oil Drain Bolt (M12)	15	1.5	11	
Oil Pump (Scavenge) Cover Bolts	9.8	1.0	87 in·lb	
Oil Pump (Feed) Cover Bolts	8.8	0.90	78 in·lb	
Oil Pressure Relief Valve	15	1.5	11	L
Oil Filter Cover Bolts	9.8	1.0	87 in·lb	
Oil Pipe Mounting Bolt	9.8	1.0	87 in·lb	
Engine Removal/Installation				
Front Engine Bracket Bolts	30	3.0	22 in·lb	
Upper Engine Mounting Bolts	46	4.7	34 in·lb	S
Lower Engine Bracket Nut	46	4.7	34 in·lb	
Front Engine Mounting Nut	46	4.7	34 in·lb	S
Lower Engine Mounting Nut	46	4.7	34 in·lb	S
Upper Engine Bracket Bolts	30	3.0	22 in·lb	
Crankshaft/Transmission				
Balancer Weight Mounting Nut	52	5.3	38	
Reverse Idle Gear Holder Bolts	12	1.2	106 in·lb	L
Neutral/Reverse Switch Screws	4.9	0.50	43 in·lb	
Reverse Cable Cap Bolt	8.8	0.90	78 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Crankcase Bolts	9.8	1.0	87 in·lb	S
Bearing Retaining Bolts	19	1.9	14	L
Piston Oil Nozzle	2.9	0.30	26 in·lb	St
Wheels/Tires				
Front Wheel Nuts	79	8.0	58	S
Rear Wheel Nuts	79	8.0	58	S
Front Hub Nuts	71.5	7.3	53	
Rear Hub Nuts	265	27	195	R
Tie-rod Locknuts	22	2.2	16	Lh (2)
Final Drive				
Rear Axle Clamp Bolts	32	3.3	24	
Rear Sprocket Bolts	36.5	3.7	27	L
Rear Sprocket Nuts	31.5	3.2	23	
Engine Sprocket Nut	127	13	94	
Engine Sprocket Cover Bolts	8.8	0.90	78 in·lb	
Chain Guide Roller Mounting Nut	31.5	3.2	23	
Rear Axle Locknut (Inner)	200	20	148	
Rear Axle Locknut (Outer)	250	25	184	
Brakes				
Brake Pedal Pivot Bolt	19.6	2.0	14	
Front Caliper Bleed Valves	7.8	0.80	69 in·lb	
Front Brake Disc Mounting Bolts	36.5	3.7	27	L
Front Brake Hose Banjo Bolts	26.5	2.7	20	
Front Brake Hose Fitting Nut	18	1.8	13	
Front Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S
Brake Lever Pivot Bolt	5.9	0.60	52 in·lb	Si
Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
Front Brake Light Swith Mounting Bolt	1.2	0.12	11 in·lb	
Front Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
Front Caliper Mounting Bolts	26.5	2.7	20	
Parking Brake Adjusting Bolt Locknut	17	1.7	12	
Parking Brake Bracket Mounting Bolts	22	2.2	16	
Parking Lever Pivot Bolt	16	1.6	12	
Rear Caliper Bleed Valve	5.4	0.55	48 in·lb	
Rear Brake Disc Mounting Bolts	36.5	3.7	27	L
Rear Brake Disc Mounting Nuts	17.5	1.8	13	
Rear Brake Hose Banjo Bolts	24.5	2.5	18	
Rear Brake Pad Bolts	17	1.7	12	
Rear Brake Reservoir Cap Bolts	1.5	0.15	13 in·lb	
Rear Caliper Mounting Bolts	26.5	2.7	20	L
Rear Master Cylinder Mounting Bolts	9.3	0.95	82 in·lb	
Rear Master Cylinder Push Rod Locknut	17	1.7	12	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Suspension				
Swingarm Pivot Shaft Nut	90.5	9.2	67	
Swingarm Adjusting Locknut	31.5	3.2	23	L
Suspension Arm Pivot Nuts	36.5	3.7	27	
Knuckle Joint Nuts	29	3.0	21	
Tie-rod Mounting Nut	71.5	7.3	53	
Rocker Arm Pivot Nut	71.5	7.3	53	
Tie-rod Adjusting Nut	61.5	6.3	45	
Tie-rod Adjusting Locknut	46.5	4.7	34	
Front Shockabsorber Mounting Nuts	36.5	3.7	27	
Rear Shockabsorber Mounting Nut (Upper)	36.5	3.7	27	
Rear Shockabsorber Mounting Nut (Lower)	36.5	3.7	27	
Swingarm Adjusting Bolt	6.0	0.61	53 in·lb	
Steering				
Steering Stem Bottom End Nut	36.5	3.7	27	
Steering Stem Bearing Joint Bolts	22	2.2	16	L
Tie-rod End Nuts	36.5	3.7	27	
Steering Stem Clamp Bolts	24.5	2.5	18	
Tie-rod Locknuts	22	2.2	16	L (2)
Handlebar Holder Mounting Nuts	36.5	3.7	27	
Handlebar Clamp Bolts	29	3.0	21	S
Left Handlebar Switch Housing Screws	3.5	0.36	31 in·lb	
Frame				
Footpeg Mounting Bolts	41.5	4.2	31	
Rear Fender Mounting Bolts	9.3	0.95	82 in·lb	
Front Guard Bolts	26.5	2.7	20	
Engine Bottom Guard Bolts	9.3	0.95	82 in·lb	
Rear Bottom Guard Bolts	24.5	2.5	18	
Rear Fender Bracket Mounting Bolts	29.5	3.0	22	
Lower Rear Frame Mounting Bolts	29.5	3.0	22	L
Upper Rear Frame Mounting Bolts	35	3.6	26	L
Lower Foot Guard Bracket Bolts	12.5	1.3	111 in·lb	L
Upper Foot Guard Bracket Bolts	27	2.8	20	L
Electrical Parts Bracket Bolts	12.5	1.3	111 in·lb	
Electrical System				
Tail/Brake Light Unit Mounting Bolts	1.2	0.12	11 in·lb	
Tolque Limiter Cover Bolt	9.8	1.0	87 in·lb	
Alternator Cover Bolts	9.8	1.0	87 in·lb	
Alternator Cover and Torque Limiter Cover Bolts	9.8	1.0	87 in·lb	
Alternator Stator Bolts	9.8	1.0	87 in·lb	L
Crankshaft Sensor Bolts	7.0	0.71	62 in·lb	
Alternator Rotor Nut	98	10	72	
Starter Motor Mounting Bolts	9.8	1.0	87 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Starter Motor Terminal Nut	9.8	1.0	87 in·lb	
Spark Plug	13	1.3	115 in·lb	
Regulator/Rectifier Bolts	8.8	0.90	78 in·lb	
Starter Relay Cable Terminal Bolts	4.0	0.41	35 in·lb	
Ignition Coil Nuts	8.8	0.90	78 in·lb	
Starter Motor Terminal Locknut	11	1.1	97 in·lb	
Starter Motor Through Bolts	5.0	0.51	44 in·lb	
Ignition Switch Mounting Nut	2.8	0.28	25 in·lb	

Torque and Locking Agent

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 ~ 0.50	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 ~ 0.50	30 ~ 43 in·lb
6 (0.24)	5.9 ~ 7.8	0.60 ~ 0.80	52 ~ 69 in·lb
8 (0.31)	14 ~ 19	1.40 ~ 1.90	10 ~ 13
10 (0.39)	25 ~ 34	2.60 ~ 3.50	19 ~ 25
12 (0.47)	44 ~ 61	4.50 ~ 6.20	33 ~ 45
14 (0.55)	73 ~ 98	7.40 ~ 10.0	54 ~ 72
16 (0.63)	115 ~ 155	11.5 ~ 16.0	83 ~ 115
18 (0.71)	165 ~ 225	17.0 ~ 23.0	125 ~ 165
20 (0.79)	225 ~ 325	23.0 ~ 33.0	165 ~ 240

Specifications

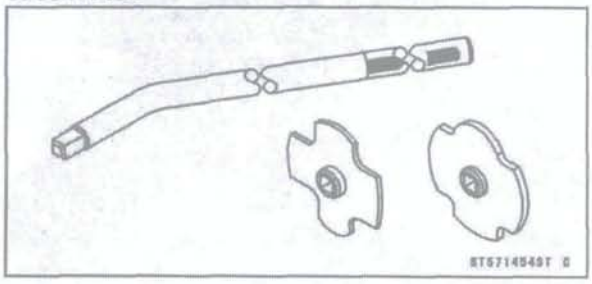
Item	Standard	Service Limit
Fuel System		
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)	– – –
Idle Speed	1 800 ±100 r/min (rpm)	– – –
Air Cleaner Element Oil	High-quality foam air filter oil	– – –
Cooling System		
Coolant:		
Type (Recommended)	Permanent type of antifreeze (soft water and ethylene 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	1.4 L (1.5 US qt.)	– – –
Engine Top End		
Valve Clearance:		
Exhaust	0.17 ~ 0.22 mm (0.0067 ~ 0.0087 in.)	– – –
Inlet	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	– – –
Engine Right Side		
Clutch Lever Free Play	5 ~ 10 mm (0.2 ~ 0.4 in.)	– – –
Engine Lubrication System		
Engine Oil:		
Type	API SF or SG API SH, SJ or SL with JASO MA	– – –
Viscosity	SAE 10 W - 40	
Capacity	1.15 L (1.22 US qt) (When filter is not removed.)	– – –
	1.20 L (1.27 US qt) (When filter is removed.)	– – –
	1.35 L (1.43 US qt) (When engine is completely dry.)	– – –
Crankshaft/Transmission		
Reverse Lock Release Lever		
Free Play	1 ~ 2 mm (0.04 ~ 0.08 in.)	– – –
Wheels/Tires		
Tire Tread Depth:		
Front	12.7 mm (0.500 in.)	3 mm (0.12 in.)
Rear	13.0 mm (0.512 in.)	3 mm (0.12 in.)
Standard tire:		
Front	AT 21 × 7 - 10 DUNLOP, KT391, Tubeless	– – – – – –
Rear	AT 20 × 10 - 9 DUNLOP, KT396, Tubless	– – – – – –

Specifications

Item	Standard	Service Limit
Final Drive		
Drive Chain Slack	40 ~ 50 mm (1.57 ~ 1.97 in.)	– – –
Drive Chain 20 Link Length	317.5 ~ 318.2 mm (12.50 ~ 12.53 in.)	323 mm (12.7 in.)
Rear Sprocket Warp	0.4 mm (0.016 in.) or less	0.5 mm (0.02 in.)
Brakes		
Brake Lever Free Play	(to suit rider)	– – –
Brake Fluid:		
Grade	DOT4	
Brake Pad Lining Thickness:		
Front	4.0 mm (0.16 in.)	1 mm (0.04 in.)
Rear	4.3 mm (0.17 in.)	1 mm (0.04 in.)
Electrical System		
Spark Plug Gap	0.8 ~ 0.9 mm (0.03 ~ 0.04 in.)	– – –
Rear Brake Light Switch Timing	ON after 10 mm (0.4 in.) of pedal travel	– – –

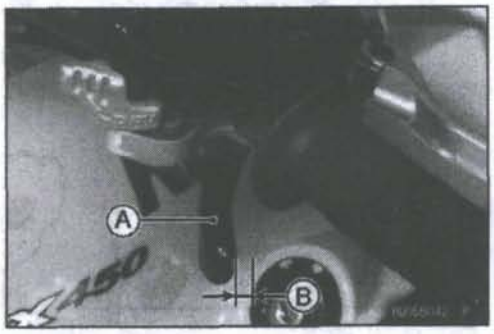
Special Tool

Filler Cap Driver:
57001-1454



Fuel System

Throttle Lever Free Play Inspection



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

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

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

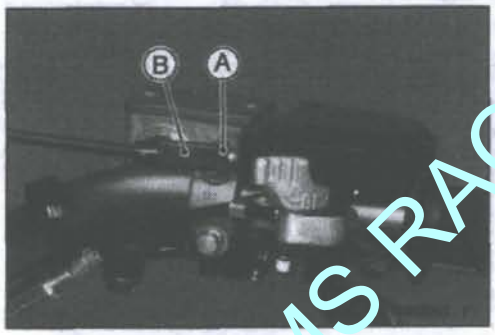
★If the idle speed increases, check the throttle lever free play and the cable routing.

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

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

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

Throttle Lever Free Play Adjustment



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

Idle Speed Inspection

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

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

⚠ WARNING

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

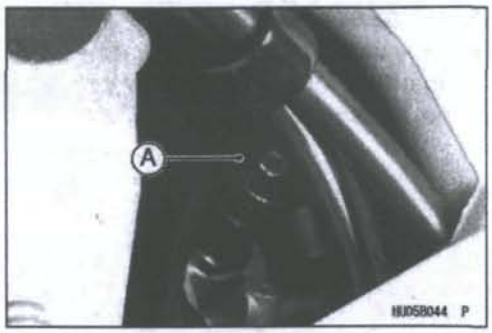
- Check idle speed with a suitable tachometer.

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

Idle Speed
Standard: 1 800 ±100 r/min (rpm)

Periodic Maintenance Procedures

Idle Speed Adjustment



- Remove:
  Left Side Cover (see Side Cover Removal in the Frame chapter)
- Start the engine and warm it up thoroughly.
- Turn the idle adjuster [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.

Air Cleaner Element Cleaning and Inspection

NOTE

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

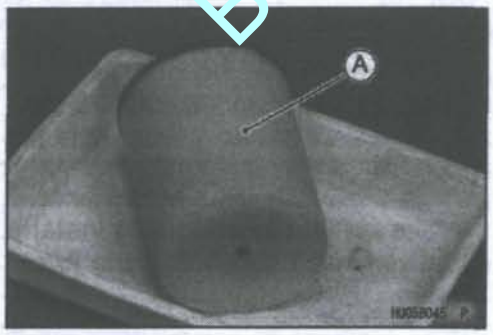
○*After riding through rain or muddy terrains, the element should be cleaned immediately.*

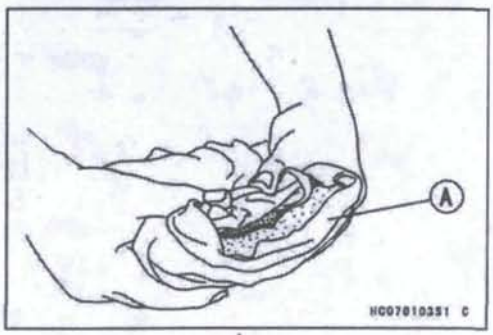
○*Also, if there is a break in the element material or any other damage to the element, replace the element with a new one.*

⚠ WARNING

Clean the element 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 a low-flash point solvent to clean the foam element.

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





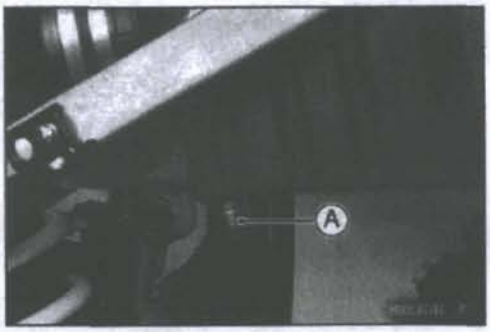
- Squeeze it dry in a clean towel [A]. Do not wring the element or blow it dry; the element can be damaged.
- Inspect the element for damage.

★If it is torn, punctured, or hardened, replace it.

- After cleaning, saturate the element with a high-quality foam-air-filter oil, squeeze out the excess oil, then wrap it in a clean rag and squeeze it as dry as possible. Be careful not to tear the element.

Air Cleaner Draining

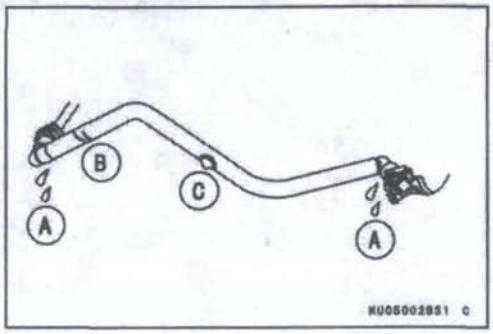
- If any water or oil accumulates in the tube, drain it by taking off the drain plug [A]. After draining, be sure to install the drain plug and clamp firmly.



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

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

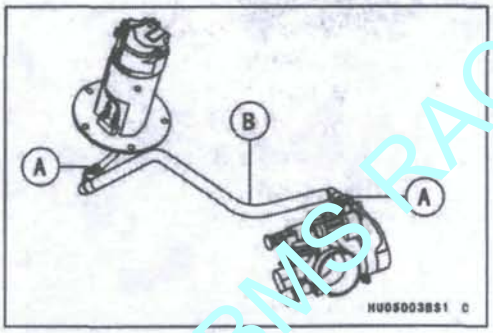
★Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.



- Check that the hoses are routed according to Cable, Wire, and Hose Routing section in the Appendix chapter.

★Replace the hose if it has been sharply bent or kinked.

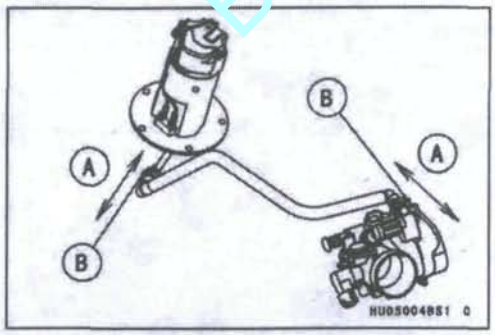
Hose Joints [A]
Fuel Hose [B]



- Check that the hose joints are securely connected.

○Push and pull [A] the hose joint [B] back and forth more than two times, and make sure it is locked.

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



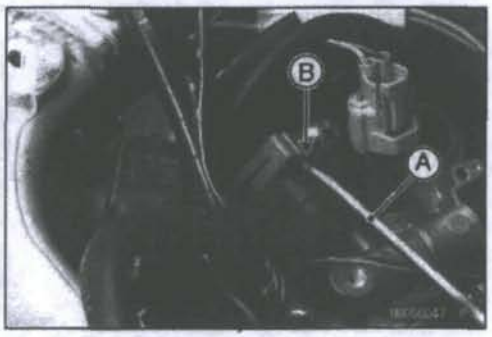
⚠ WARNING

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

Fuel Hose Replacement

CAUTION

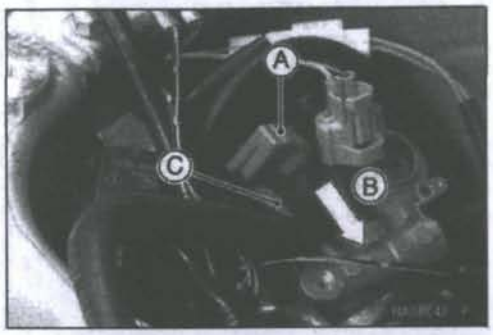
When removing and installing the fuel hose joint, do not apply strong force to the outlet pipe on the fuel pump and delivery pipe on the throttle body assy. The pipes made from resin could be damaged.



- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Be sure to place a piece of cloth around the fuel hose joint.
- Insert a minus screwdriver [A] into the slit [B] on the joint lock.

Periodic Maintenance Procedures

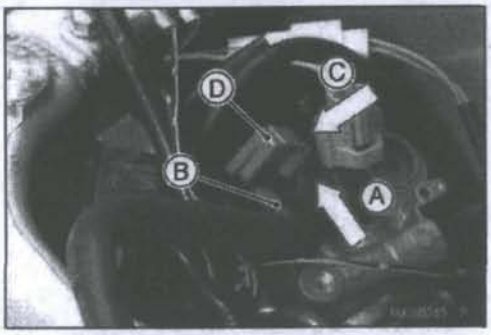
- Twist the screwdriver to disconnect the joint lock [A].
- Pull [B] the fuel hose joint [C] out of the delivery pipe.



⚠ WARNING

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

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



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

⚠ WARNING

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

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

Cooling System

Radiator Cleaning

CAUTION

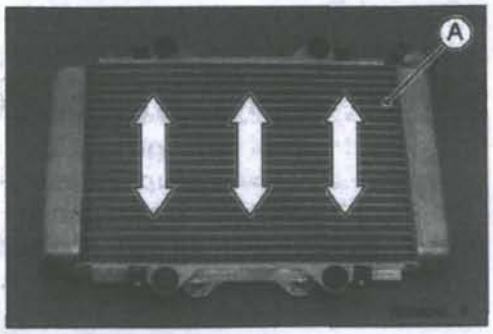
Clean the radiator screen and the radiator in accordance with the Periodic Maintenance Chart. In dusty areas, they should be cleaned more frequently than the recommended interval. After riding through muddy terrains, the radiator screen and the radiator should be cleaned immediately.

- Remove:
  Radiator (see Radiator Removal in the Cooling System chapter)
- 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.



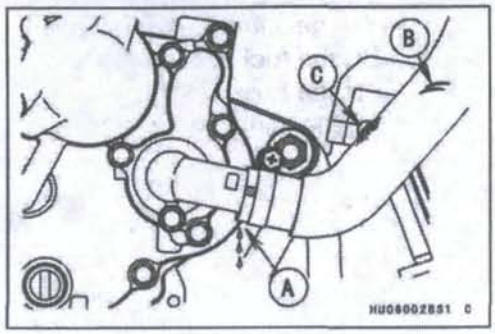
Radiator Hose and Connection Inspection

○The high pressure inside the radiator hose can cause coolant to leak [A] or the hose to burst if the line is not properly maintained. Visually inspect the hoses for signs of deterioration. Squeeze the hoses. A hose should not be hard and brittle, nor should it be soft or swollen.

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

- Check that the hoses are securely connected and tighten the radiator hose clamp screws.

Torque - Radiator Hose Clamp Screws: 2.0 N·m (0.20 kgf·m, 18 in·lb)



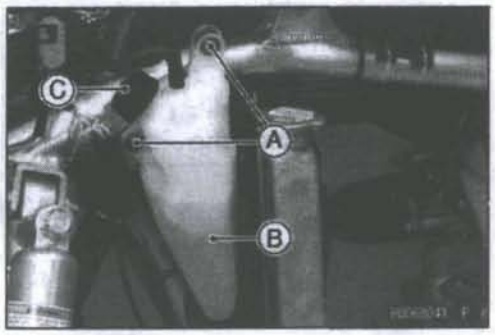
Coolant Change

⚠ WARNING

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

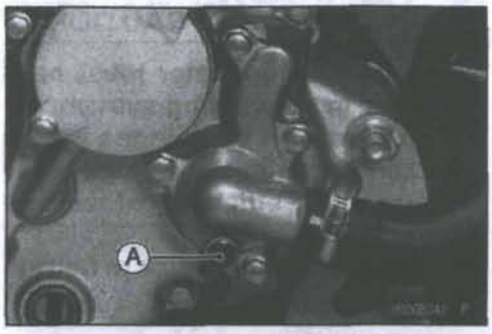
- Remove:
  Left Side Cover (see Side Cover Removal in the Frame chapter)

- Remove:
  Reserve Tank Screws [A]
  Reserve Tank [B] with Hose
- Remove the reserve tank cap [C], and pour the coolant into a container.



Periodic Maintenance Procedures

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

- Tighten:

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

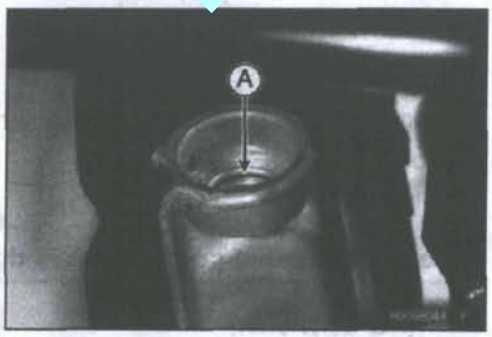
- Install the reserve tank.
- Apply a non-permanent locking agent to the reserve tank screws.
- Tighten:

Torque - Reserve Tank Screws: 3.5 N·m (0.36 kgf·m, 31 in·lb)

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

NOTE

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



Periodic Maintenance Procedures

CAUTION

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

Water and Coolant Mixture Ratio (when shipping)

Soft Water:	**50%**
Coolant:	**50%**
Freezing Point:	**−35°C (−31°F)**
Total Amount:	**1.4 L (1.5 US qt)**

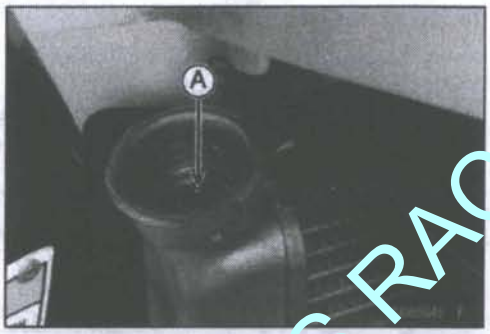
NOTE

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

- Bleed the air from the cooling system as follows.

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

- Install the radiator cap.



- Remove the reserve tank cap.
- Fill the reserve tank up to the F mark [A] with coolant and install the cap.
- Start the engine, warm it up thoroughly until the radiator fan turns on and then stop the engine.
- Check the coolant level in the reserve tank after the engine cools down.

★If the coolant level is lower than the low level line, add coolant to the full level line.

CAUTION

Do not add more coolant above the full level line.

Engine Top End

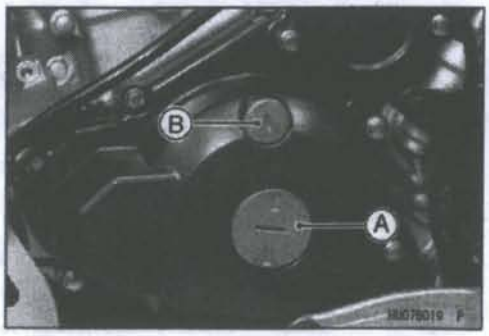
Valve Clearance Inspection

NOTE

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

- Remove:
  Cylinder Head Cover (see Cylinder Head Cover Removal in the Engine Top End chapter)
  Alternator Rotor Nut Cap [A]
  Timing Inspection Cap [B]

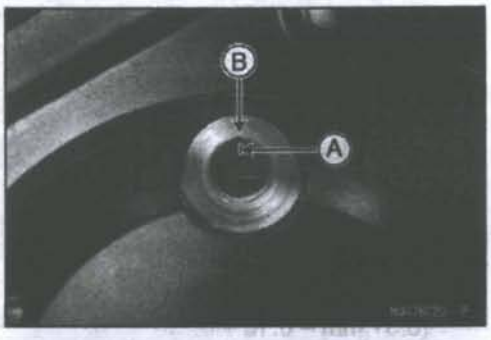
Special Tool - Filler Cap Driver: 57001-1454



Periodic Maintenance Procedures

- First, bring the piston to the top-dead-center of its compression stroke to inspect the valve clearance (the position at the end of the compression stroke), when the cam lobe faces outside of the camshaft.

○Place a wrench over the alternator rotor nut and turn it counterclockwise to align the TDC mark [A] with the center of the groove [B] of the inspection hole.



- Using a thickness gauge [A], measure the clearance between each cam lob and valve lifter for all four valves.

○For the purpose of adjusting the valve clearances, record the measured values.

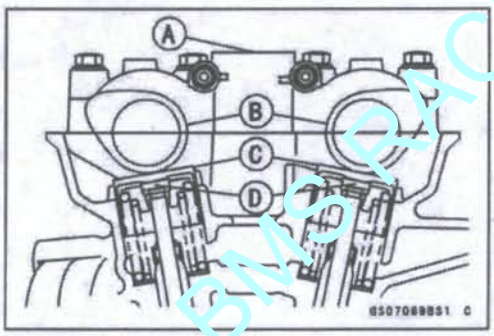
Valve Clearance: between cam and valve lifter
Standard:

Exhaust	**0.17 ~ 0.22 mm (0.0067 ~ 0.0087 in.)**
Inlet	**0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)**

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

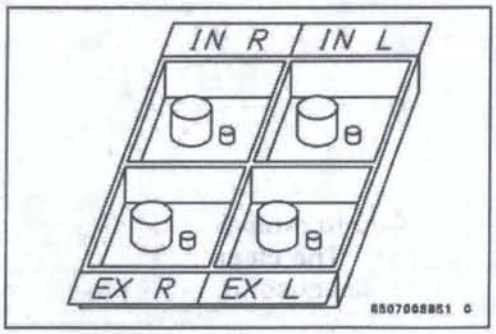
Valve Clearance Adjustment

- Remove the camshaft caps [A] (see Camshaft Removal in the Engine Top End chapter).
- Remove the camshafts [B] (see Camshaft Removal in the Engine Top End chapter).
- Remove the valve lifters [C] of the applicable valve.
- Remove the shim [D] from the top of the spring retainer.



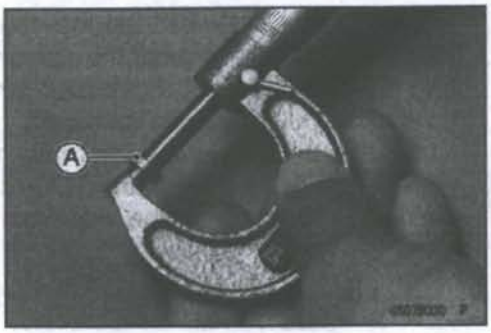
NOTE

○*Mark and record the locations of the valve lifters and shims so that they can be reinstalled in their original positions.*



- Clean the shim to remove any dust or oil.
- Measure the thickness of the removed shim [A].
- Select a new shim thickness calculation as follows.

A = (B – C) + D
[A] Replace Shim Thickness
[B] Measured Valve Clearance
[C] Specified Valve Clearance
[D] Present Shim Thickness



Example
(0.31 mm – 0.10 ~ 0.15 mm) + 2.60 mm = 2.81 ~ 2.76 mm

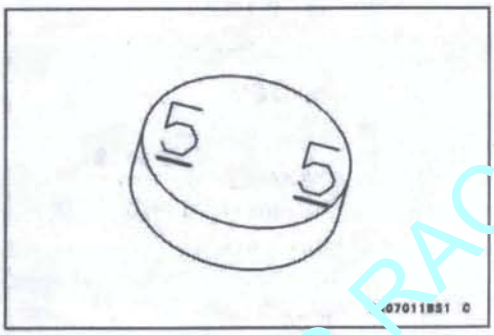
○Exchange the shims for the 2.775 or 2.800 size shim.

CAUTION

Don't use the shims for another models. This could cause wear of the valve stem end, and valve stem damage.

Adjustment shims

Thick-ness	P/No.	Mark	Thick-ness	P/No.	Mark
2.00	92025-1870	0	2.525	92025-1984	53
2.05	92025-1871	5	2.55	92025-1881	55
2.10	92025-1872	10	2.575	92025-1985	58
2.15	92025-1873	15	2.60	92025-1882	60
2.20	92025-1874	20	2.65	92025-1883	65
2.25	92025-1875	25	2.70	92025-1884	70
2.30	92025-1876	30	2.75	92025-1885	75
2.35	92025-1877	35	2.80	92025-1886	80
2.40	92025-1878	40	2.85	92025-1887	85
2.425	92025-1982	43	2.90	92025-1888	90
2.45	92025-1879	45	2.95	92025-1889	95
2.475	92025-1983	48	3.00	92025-1890	00
2.50	92025-1880	50			



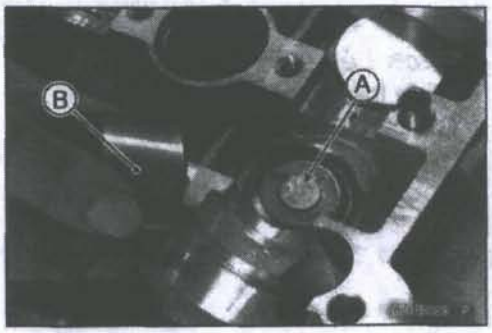
CAUTION

Be sure to remeasure the clearance after selecting a shim. The clearance can be out of the specified range because of the shim tolerance.

○If there is no valve clearance, use a shim that is a few sizes smaller, and remeasure the valve clearance.

Periodic Maintenance Procedures

- When installing the shim, face the marked side [A] toward the valve lifter [B]. At this time, apply engine oil to the shim or the valve lifter to keep the shim in place during camshaft installation.



CAUTION

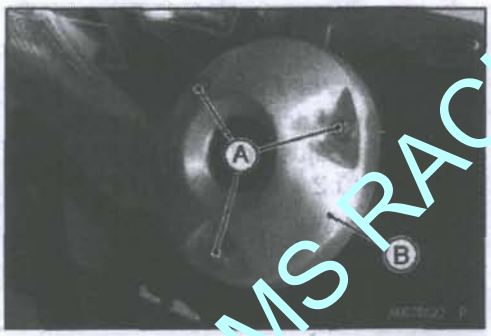
Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.
Do not grind the shim. This may cause it to fracture, causing extensive engine damage.

- Apply engine oil to the valve lifter surface and install the lifter.
- Install the camshaft (see Camshaft Installation in the Engine Top End chapter).
- Recheck the valve clearance and readjust if necessary.
- Install the cylinder head cover (see Engine Top End chapter), timing inspection cap and the alternator rotor nut cap.

Special Tool - Filler Cap Driver: 57001-1454

Spark Arrester Cleaning

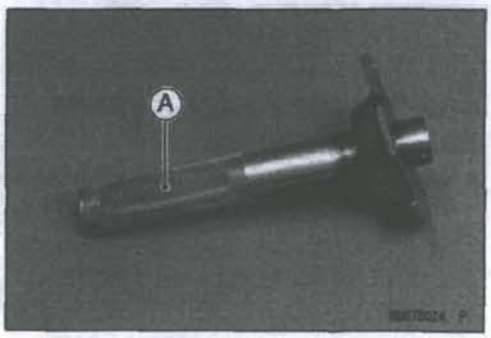
- Remove:
  Bolts [A]
  Muffler End Cover [B]



- Remove:
  Spark Arrester [A]

- Clean the spark arrester screen [A] by brushing up.
- Install:
  Spark Arrester
  Muffler Body End Cover
- Tighren:

Torque - Muffler Body End Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

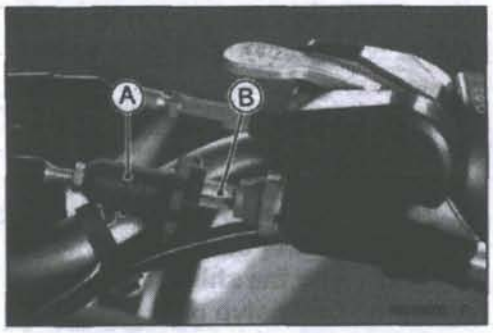


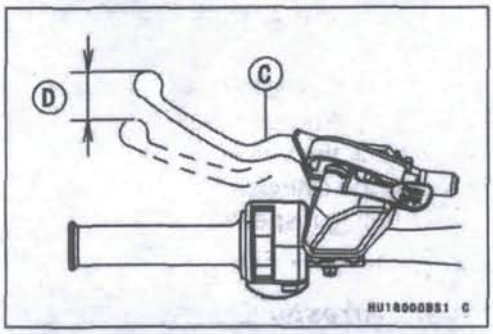
Engine Right Side

Clutch Lever Free Play Check

- Slide the clutch lever dust cover [A] out of place.
- Check that the clutch cable upper end is fully seated in the adjusting bolt [B].
- Check that the clutch lever [C] has 5 ~ 10 mm (0.2 ~ 0.4 in.) of play [D].

★If it does not, adjust the lever play.

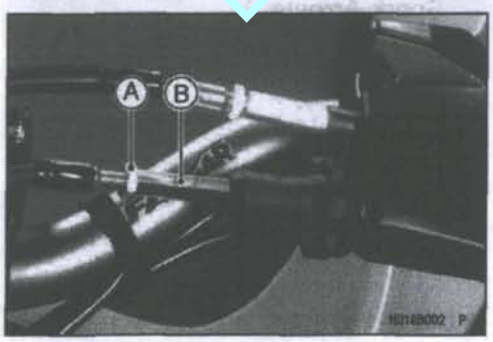




Clutch Lever Free Play Adjustment

- Slide the clutch lever dust cover out of place.
- Turn the adjuster [A] so that the clutch lever will have 5 ~ 10 mm (0.2 ~ 0.4 in.) of play.

★If it cannot be done, loosen the locknut [A] at the middle of the clutch cable, and turn the adjusting nut [B] so that clutch lever has 5 ~ 10 mm (0.2 ~ 0.4 in.) of play.



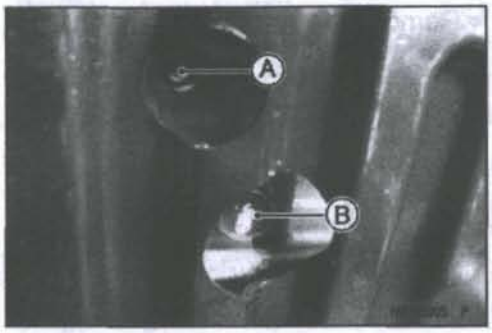
Engine Lubrication System

Engine Oil Change

- Warm up the engine thoroughly so that the oil will pick up any sediment and drain easily. Then stop the engine.

Periodic Maintenance Procedures

- Remove the engine oil drain bolts on the bottom of the engine, and let the oil drain completely.
  Drain Bolt (M6) [A]
  Drain Bolt (M12) [B]



NOTE

○Hold the vehicle upright so that the oil may drain completely.

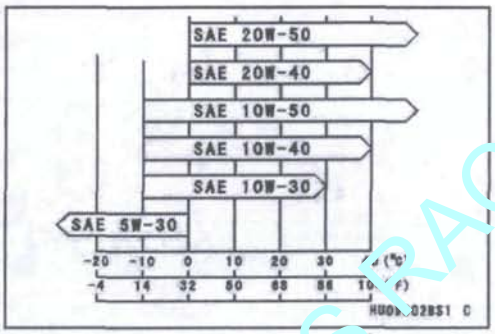
- Replace the gaskets at the drain bolts with a new one.
- After the oil has completely drained out, install the drain plugs with the gaskets, and tighten them.

Torque - Engine Oil Drain Bolt (M 6): 7.0 N·m (0.71 kgf·m, 62 in·lb)
Engine Oil Drain Bolt (M 12): 15 N·m (1.5 kgf·m, 11 ft·lb)

- Fill the engine with a good quality motor oil specified below.

Recommended Engine Oil

Type	**API SF or SG**
	API SH, SJ or SL with JASO MA
Viscosity	**SAE 10W-40**
Capacity	**1.15 L (1.22 US qt.) (when filter is not removed)**
	1.20 L (1.27 US qt.) (when filter is removed)
	1.35 L (1.43 US qt.) (when engine is completely dry)



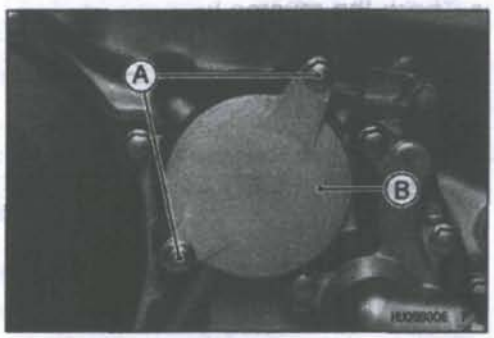
NOTE

○The oil viscosity may need to be changed to accommodate atmospheric conditions in your riding area.

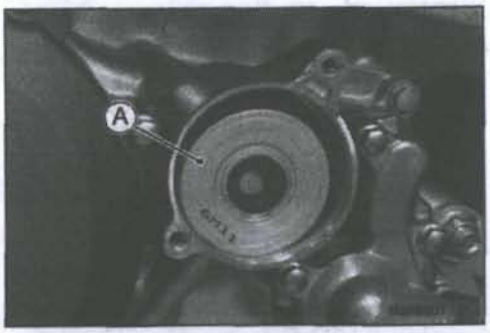
- Check the oil level (see Engine Oil Level Inspection in the Engine Lubrication System chapter).

Oil Filter Change

- Drain:
  Engine Oil (see Engine Oil Change)
- Remove:
  Oil Filter Cover Bolts [A]
  Oil Filter Cover [B]

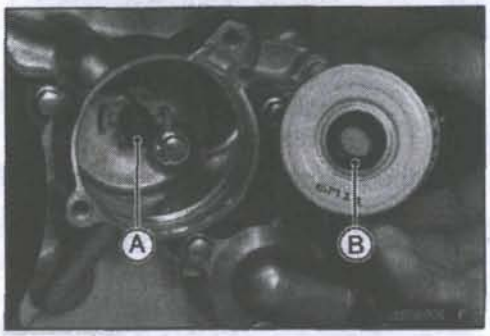


- Remove the oil filter [A].



- Install the spring [A] to the right engine cover.
- Apply grease to the grommet [B].
- Be sure to install the filter with the grommet facing outside as shown.

CAUTION
Inside out installation stop oil flow, causing engine seizure.



- Replace the oil filter cover O-rings [A] with new ones.
- Replace the oil filter with a new one.
- Apply grease to the O-rings.
- Install the oil filter cover.

Torque - Oil Filter Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Pour in the specified type and amount of oil (see Engine Oil Change).

Reverse Lock Release Cable

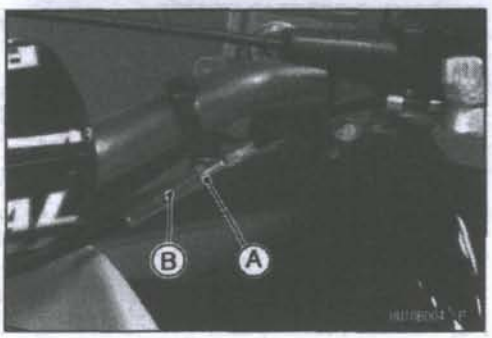
Reverse Lock Release Lever Free Play Inspection

- Check the reverse lock release lever free play [A] when the transmission is in neutral.
- If the free play is not within specifications, adjust the reverse cable.

Reverse Lock Release Lever Free Play
Standard: 1 ~ 2 mm (0.04 ~ 0.08 in.)

Reverse Lock Release Lever Free Play Adjustment

- Loosen the locknut [A] of the reverse lock release cable, and adjust the adjuster [B] until the reverse lock release lever has the proper amount of play.
- Tighten the locknut after adjustment.



Periodic Maintenance Procedures

Wheels/Tires

Tire Inspection

- Examine the tire for damage and wear.

★If the tire is cut or cracked, replace it.

○Lumps or high spots on the tread or sidewalls indicate internal damage requiring tire replacement.

○Remove any foreign objects from the tread. After removal, check for leaks with a soap and water solution.

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

★If any measurements are less than the service limit, replace the tire.

Tire Tread Depth
Service Limit:

Front:	**3 mm (0.12 in.)**
Rear:	**3 mm (0.12 in.)**

Standard Tire

Front:	**AT 21 × 7 - 10**
	DUNLOP, KT391, Tubeless
Rear:	**AT 20 × 10 - 9**
	DUNLOP, KT396, Tubeless

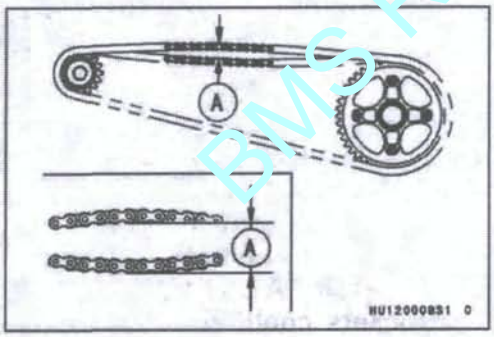
Final Drive

Drive Chain Slack Inspection

- Stop the engine.

⚠ WARNING

To prevent injury, never try to measure chain slack when the engine is running or the rear wheels are turning.



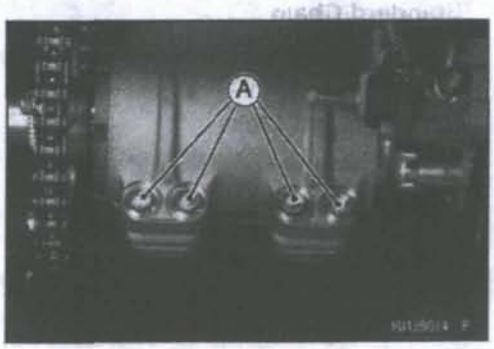
- Check the amount of chain slack [A] with your finger by firmly pulling up the chain.

★If the chain slack exceeds the standard, adjust it.

Drive Chain Slack
Standard: **40 ~ 50 mm (1.57 ~ 1.97 in.)**

Drive Chain Slack Adjustment

- Loosen the rear axle clamp bolts [A] fully on the swingarm.



- Using the hook wrench [A] in the owner's tool, hock the it to the groove of the bearing housing and turn it upward or downward until the drive chain has the correct amount of chain slack.

CAUTION

Do not overtighten the chain. Overtightening will cause accelerated wear to engine and drive line components.

- Tighten:

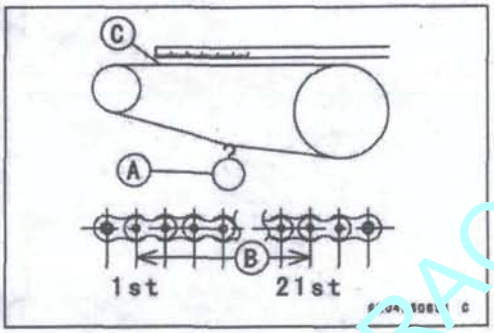
Torque - Rear Axle Clamp Bolts: 32 N·m (3.3 kgf·m, 24 ft·lb)

⚠ WARNING

If the clamp bolts are not securely tightened, an unsafe riding condition may result.

Drive Chain Wear Inspection

- Stretch the chain taut by hanging a 98 N (10 kgf, 20 lb) weight [A] on the chain.
- Measure the length of 20 links [B] on the straight part [C] of the chain from the pin center of the 1st pin to the pin center of the 21st pin. Since the chain may wear unevenly, take measurements at several places.



Chain 20-link Length

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

Service Limit: 323 mm (12.7 in.)

★If any measurements exceed the service limit, replace the chain. Also, replace the front and rear sprockets when the drive chain is replaced.

⚠ WARNING

If the drive chain wear exceeds the service limit, replace the chain or an unsafe riding condition may result. A chain that breaks or jumps off the sprockets could snag on the engine sprocket or lock the rear wheels, severely damaging the vehicle and causing it to go out of control.

Standard Chain

Make: ENUMA

Type: EK520SR-O_2

Link: 94 Links

Periodic Maintenance Procedures

Drive Chain Lubrication

○The chain should be lubricated with a lubricant which will both prevent the exterior from rusting and reduce friction in the interior of the chain.

★If the chain is especially dirty, it should be washed in diesel oil or kerosene, and afterward soaked in a heavy oil. Shake the chain while it is in the oil so that oil will penetrate to the inside of each roller.

• An effective, good quality lubricant specially formulated for chains is best for regular chain lubrication.

CAUTION

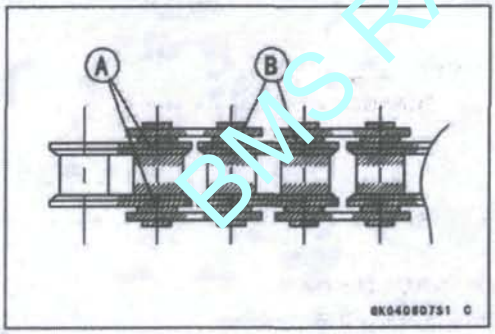
The O-rings between the side plates seal in the lubricant between the pin and the bushing. To avoid damaging the O-rings and resultant loss of lubricant, observe the following rules.
Use only kerosene or diesel oil for cleaning of the O-ring of the drive chain.
Any other cleaning solution such as gasoline or trichloroethylene will cause deterioration and swelling of the O-ring.
Immediately blow the chain dry with compressed air after cleaning.
Complete cleaning and drying the chain within 10 minutes.

• If a special lubricant is not available, a heavy oil such as SAE90 is preferred to a lighter oil because it will stay on the chain longer and provide better lubrication.

• Apply oil to the sides of the rollers so that oil will penetrate to the rollers and bushings. Apply the oil to the O-rings so that the O-rings will be coated with oil.

• Wipe off any excess oil.

Oil Applied Areas [A]
O-ring [B]



Chain Guide Inspection

- Remove:
  Swingarm (see Swingarm Removal in the Suspension chapter)
  Rear Bottom Guard (see Rear Bottom Guard Removal in the Frame chapter)
- Visually inspect the chain guides [A].

★Replace the chain guide if it shows any signs of abnormal wear or damage.

Brakes

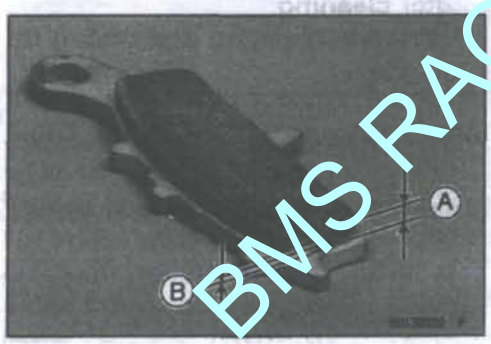
Brake Pad Wear Inspection

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

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

Pad Lining Thickness

Standard:	
Front	**4.0 mm (0.16 in.)**
Rear	**4.3 mm (0.17 in.)**
Service Limit:	**1 mm (0.04 in.)**



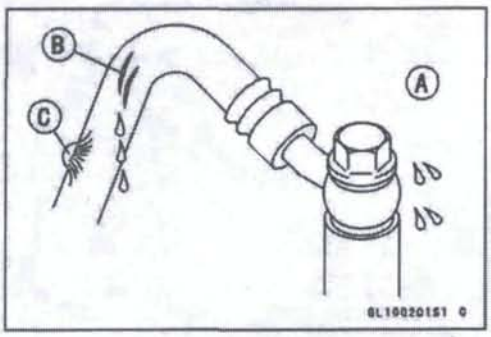
Brake Hoses and Connections Inspection

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

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

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

- Tighten any loose fittings.



Periodic Maintenance Procedures

Brake Hose Replacement

- Pump the brake fluid out of the line as explained in the Brake Fluid Change (see Brake Flude 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, and tighten the banjo bolts.

Torque - Front Brake Fitting Nut: 18 N·m (1.8 kgf·m, 13 ft·lb)
Front Brake Hose Banjo Bolts: 26.5 N·m (2.7 kgf·m, 20 ft·lb)
Rear Brake Hose Banjo Bolts: 24.5 kgf·m (2.5 kgf·m, 18 in·lb)

Brake Fluid Level Inspection

- Check the brake fluid level in the front or rear brake reservoir [A].

NOTE

Hold the reservoir horizontal when checking brake fluid level.

- The front or rear reservoir must be kept above the lower level line [B].

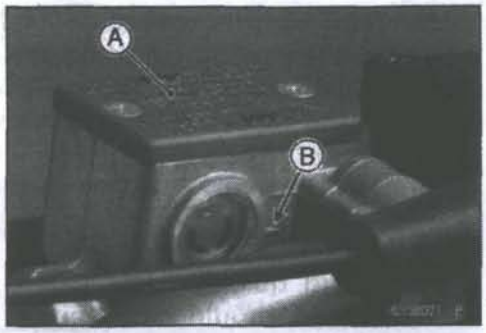
If the fluid level in front or rear reservoir is lower than the lower level line, fill the reservoir to the upper level line. Inside the reservoir is stopped end showing the upper level line [C].

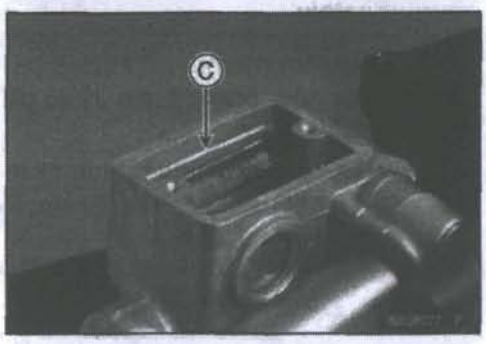
Torque - Reservoir Cap Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

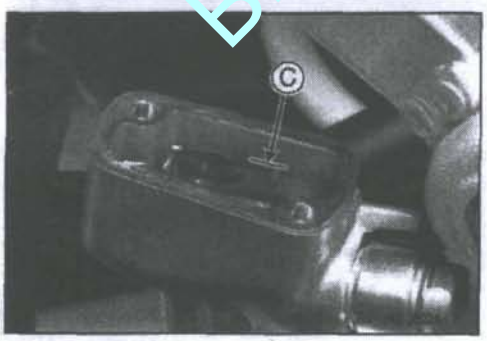
⚠ WARNING

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

Recommended Disc Brake Fluid
Grade: DOT4

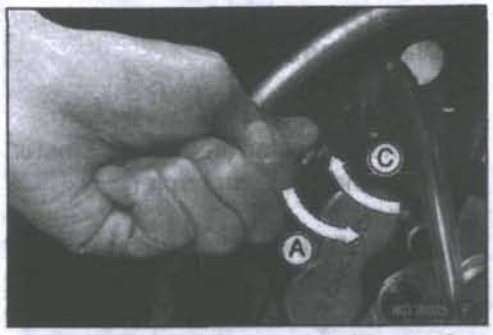


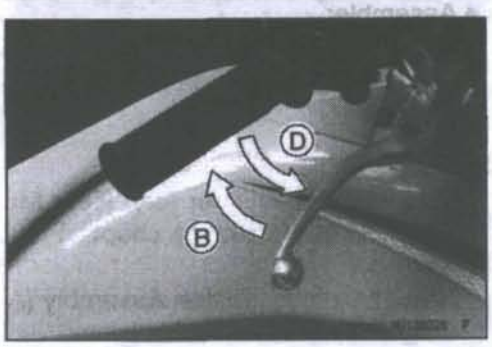




Periodic Maintenance Procedures

Brake Fluid Change





NOTE

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

- 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 - Front Caliper Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Rear Caliper Bleed Valve: 5.4 N·m (0.55 kgf·m, 48 in·lb)

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

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

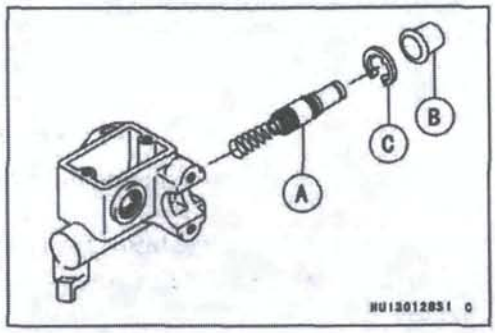
⚠ WARNING

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.

Master Cylinder Piston Assembly and Dust Cover Replacement

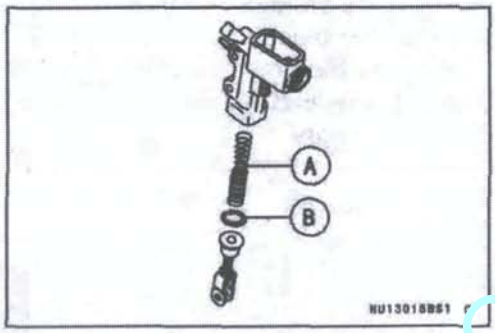
Front

- Disassemble:
  Master Cylinder (see Front Master Cylinder Disassembly in the Brakes chapter)
- Replace:
  Master Cylinder Piston Assembly [A]
  Dust Cover [B]
  Circlip [C]
- Assemble:
  Front Master Cylinder (see Front Master Cylinder Assembly in the Brakes chapter)



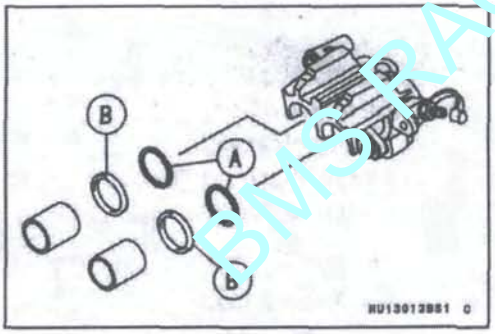
Rear:

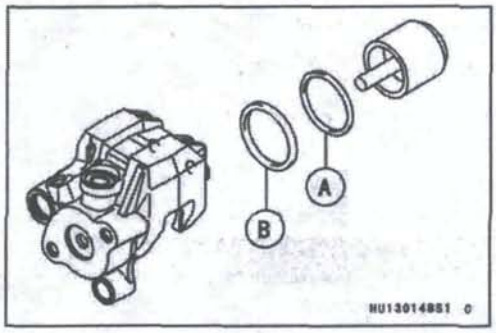
- Disassemble:
  Rear Master Cylinder (see Rear Master Cylinder Disassembly in the Brakes chapter)
- Replace:
  Master Cylinder Piston Assembly [A]
  Circlip [B]
- Assemble:
  Rear Master Cylinder (see Rear Master Cylinder Assembly in the Brakes Chapter)



Brake Caliper Fluid Seal and Dust Seal Replacement

- Disassemble:
  Front Caliper (see Front Caliper Disassembly in the Brakes chapter)
  Rear Caliper (see Rear Caliper Disassembly in the Brakes chapter)
- Replace:
  Fluid Seals [A]
  Dust Seals [B]
- Assemble:
  Front and Rear Brake Caliper (see Front Caliper Assembly/Rear caliper Assembly in the Brakes chapter)





Periodic Maintenance Procedures

Steering

Steering Inspection

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

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

NOTE

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

- Check the steering action again.

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

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

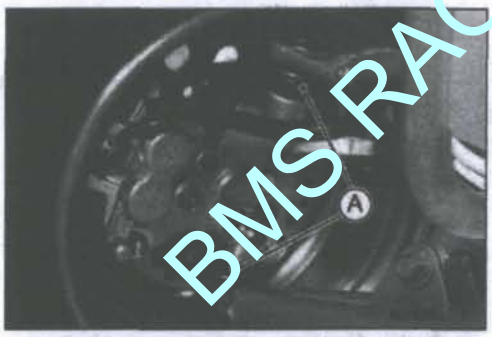
- Tighten loose bolts and nuts to the specified torque, and check the steering action again.

★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.

Knuckle Joint Boot Inspection

- Visually inspect the knuckle joint boots [A].

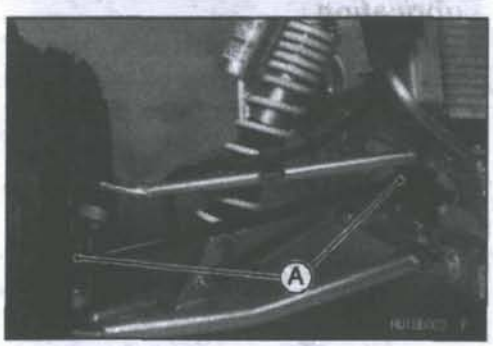
★If the joint boot is torn, worn, deteriorated, or leaks grease, replace the knuckle joint.



Tie-rod End Boot Inspection

- Visually inspect the tie-rod end boots [A] of the tie-rods.

★If the boot is torn, worn, deteriorated, or leaks grease, replace the tie-rod end.



Electrical System

Spark Plug Cleaning/Inspection

- Remove the spark plug (see Spark Plug Removal in the Electrical System chapter).
- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a wire brush or other suitable tool.

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

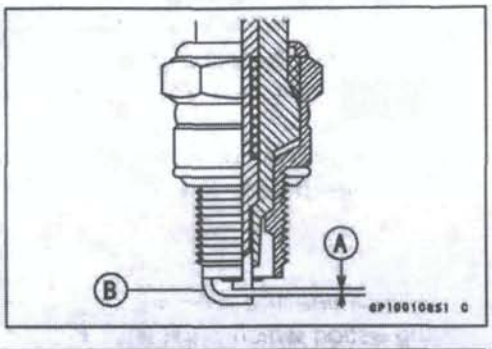
Periodic Maintenance Procedures

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
0.8 ~ 0.9 mm (0.03 ~ 0.04 in.)



Brake Light Timing Inspection

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

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

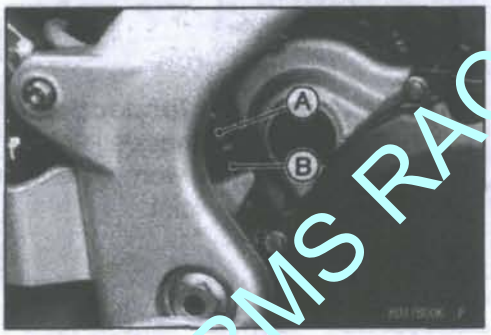
Rear Brake Light Switch Timing
Standard: On after about 10 mm (0.4 in.) of pedal travel [A]

Brake Light Timing Adjustment

- Adjust the brake light switch [A] up or down. To change the switch position, turn the adjusting nut [B].

CAUTION

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



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

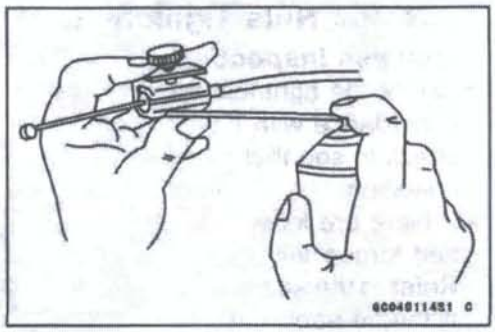
○*Whenever the vehicle has been operated under wet or rainy conditions, or especially after using a high-pressure spray water, perform the general lubrication.*

Periodic Maintenance Procedures

Cables: Lubricate with Cable Lubricant
Parking Brake Cable
Throttle Cable
Clutch Cable
Reverse Cable

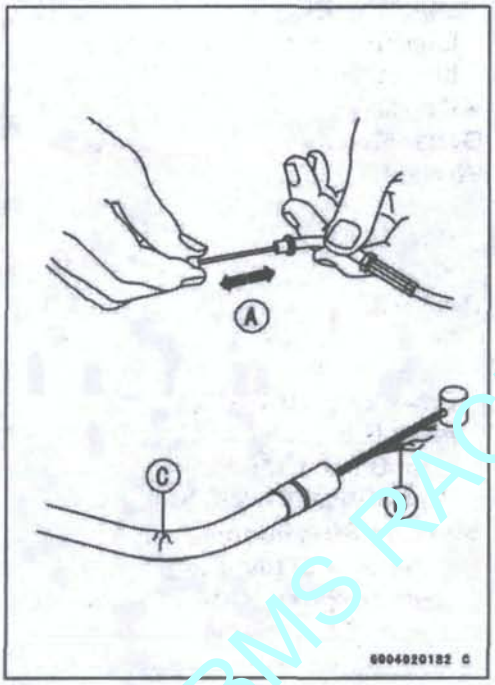
- Lubricate the cables by seeping the oil between the cable and housing.

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

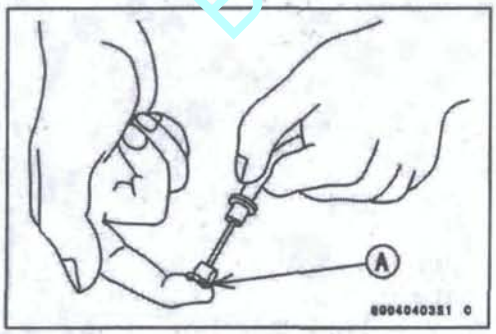


- With the cable disconnected at the both ends, the cable should move freely [A] within the cable housing.

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



Points: Lubricate with Grease.
Throttle Inner Cable Ends [A]
Clutch Cable Ends
Parking Brake Cable Ends



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

Bolts and Nuts Tightening

Tightness Inspection

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

★If there are loose fasteners, retorque them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not listed in the appropriate chapter, see the Basic Torque Table (see Torque and Locking Agent section). 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 Hub Nuts and Cotter Pins
- Rear Hub Nuts and Cotter Pins
- Wheel Nuts

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

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

Engine:
- Engine Mounting Bolts
- Engine Mounting Bracket Bolts
- Exhaust Pipe Holder Nuts
- Muffler Mounting Bolts
- Muffler Joint Clamp Bolt
- Clutch Lever Pivot Bolt and Nut

Others:
- Footpeg Mounting Bolts
- Throttle Case Mounting Bolts
- Rear Frame Mounting Bolt and Nuts

Fuel System (DFI)

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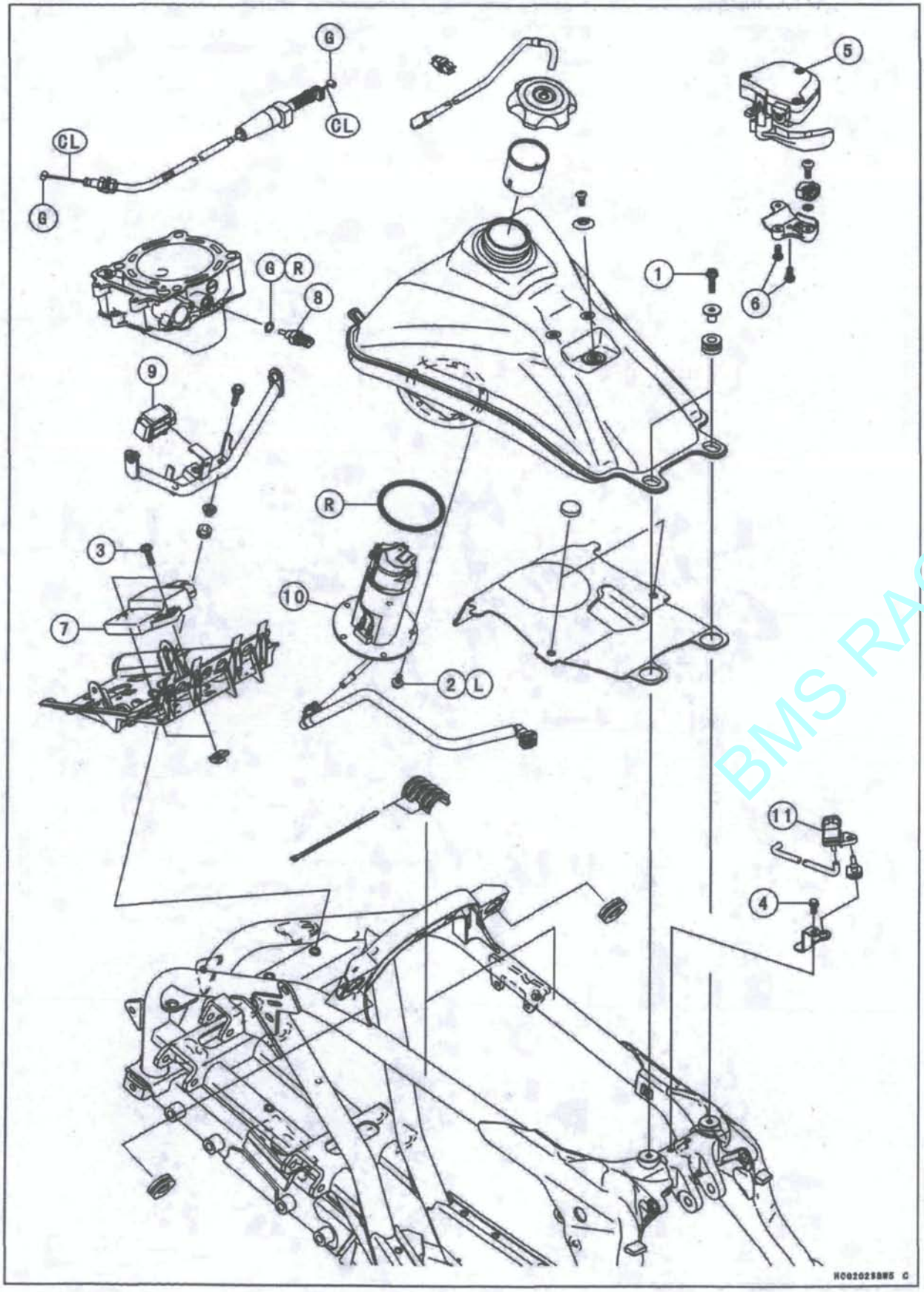
Exploded View



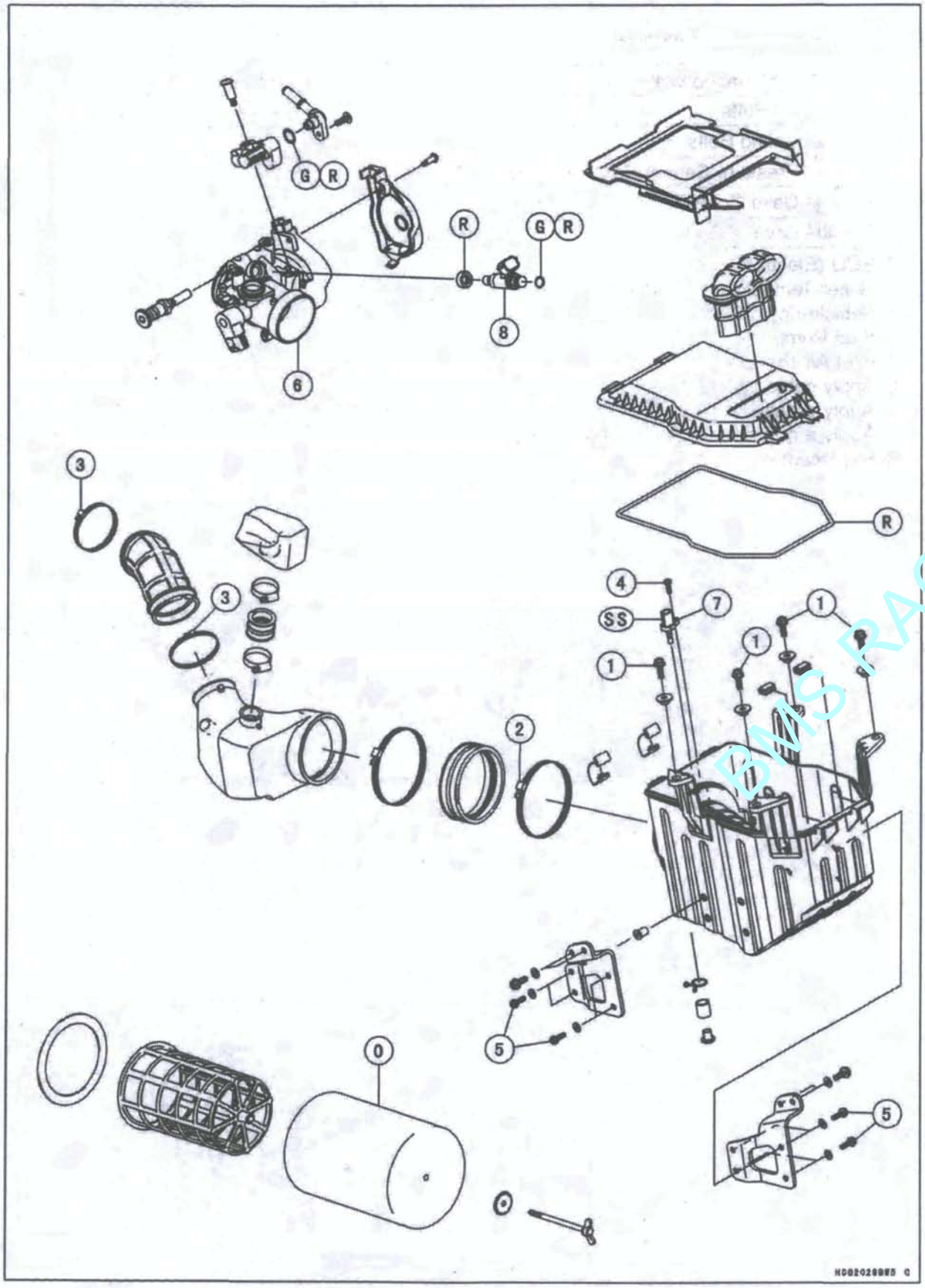
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Fuel Tank Mounting Bolts	9.3	0.95	82 in·lb	
2	Fuel Pump Bolts	9.8	1.0	87 in·lb	L
3	ECU Mounting Bolts	8.8	0.90	78 in·lb	
4	Inlet Air Pressure Sensor Bracket Mounting Bolt	8.8	0.90	78 in·lb	
5	Throttle Case Cover Screws	2.0	0.20	18 in·lb	
6	Throttle Lever Assy Mounting Bolts	3.8	0.39	34 in·lb	

7. ECU (Electronic Control Unit)
8. Water Temperature Sensor
9. Vehicle-down Sensor
10. Fuel Pump
11. Inlet Air Pressure Sensor

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

Exploded View



Exploded View

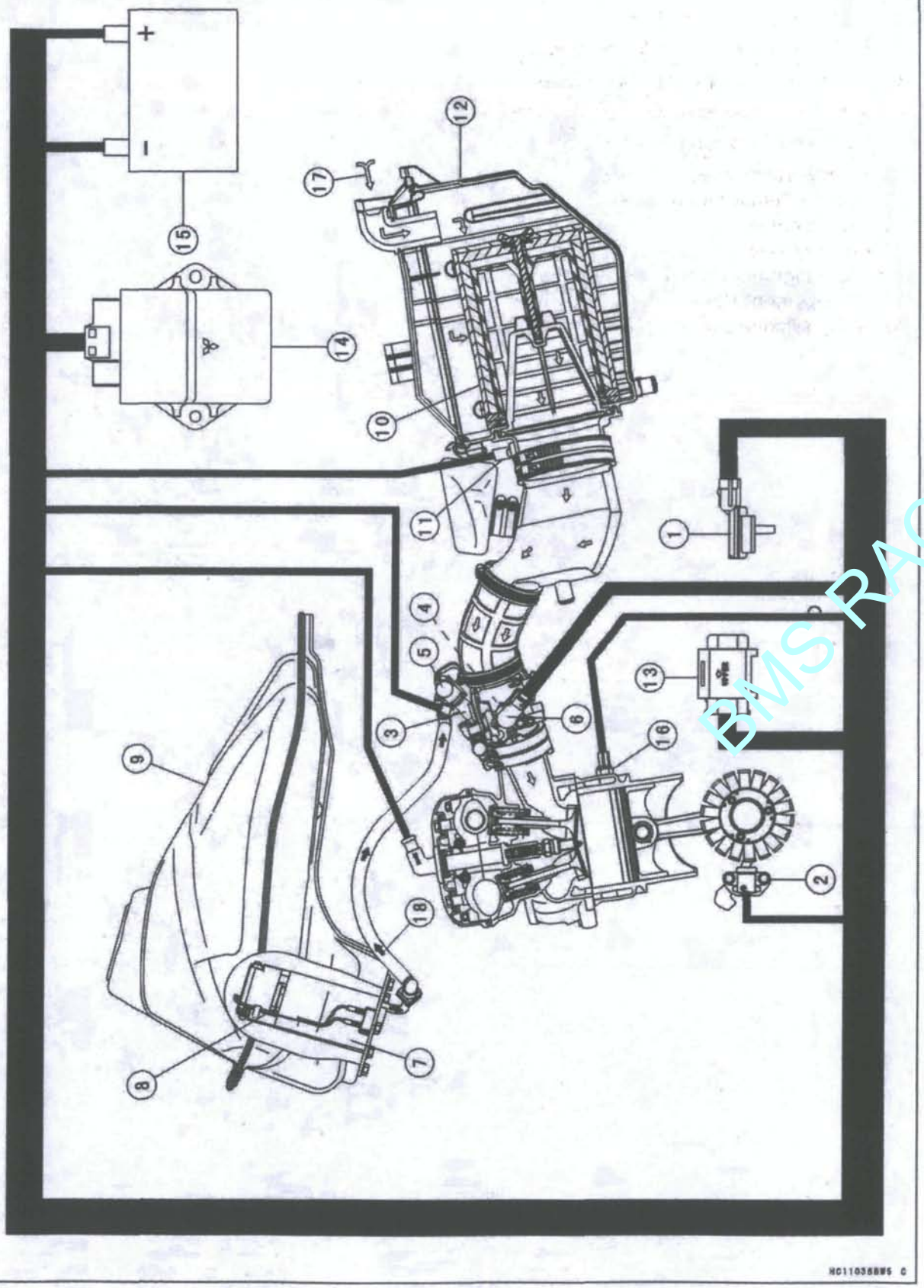
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Cleaner Housing Bolts	8.8	0.90	78 in·lb	
2	Rear Air Cleaner Duct Clamp Screw	1.4	0.14	12 in·lb	
3	Front Air Cleaner Duct Clamp Screws	1.4	0.14	12 in·lb	
4	Inlet Air Temperature Sensor Mounting Screw	4.9	0.50	43 in·lb	
5	Air Cleaner Housing Bracket Bolts	1.0	0.10	8.9 in·lb	

6. Throttle Body Assy
7. Inlet Air Temperature Sensor
8. Fuel Injector

G: Apply grease.
O: Apply high-quality foam air filter oil.
R: Replacement Parts
SS: Apply silicone sealant (Three Bond: TB1221C).

DFI System

DFI System

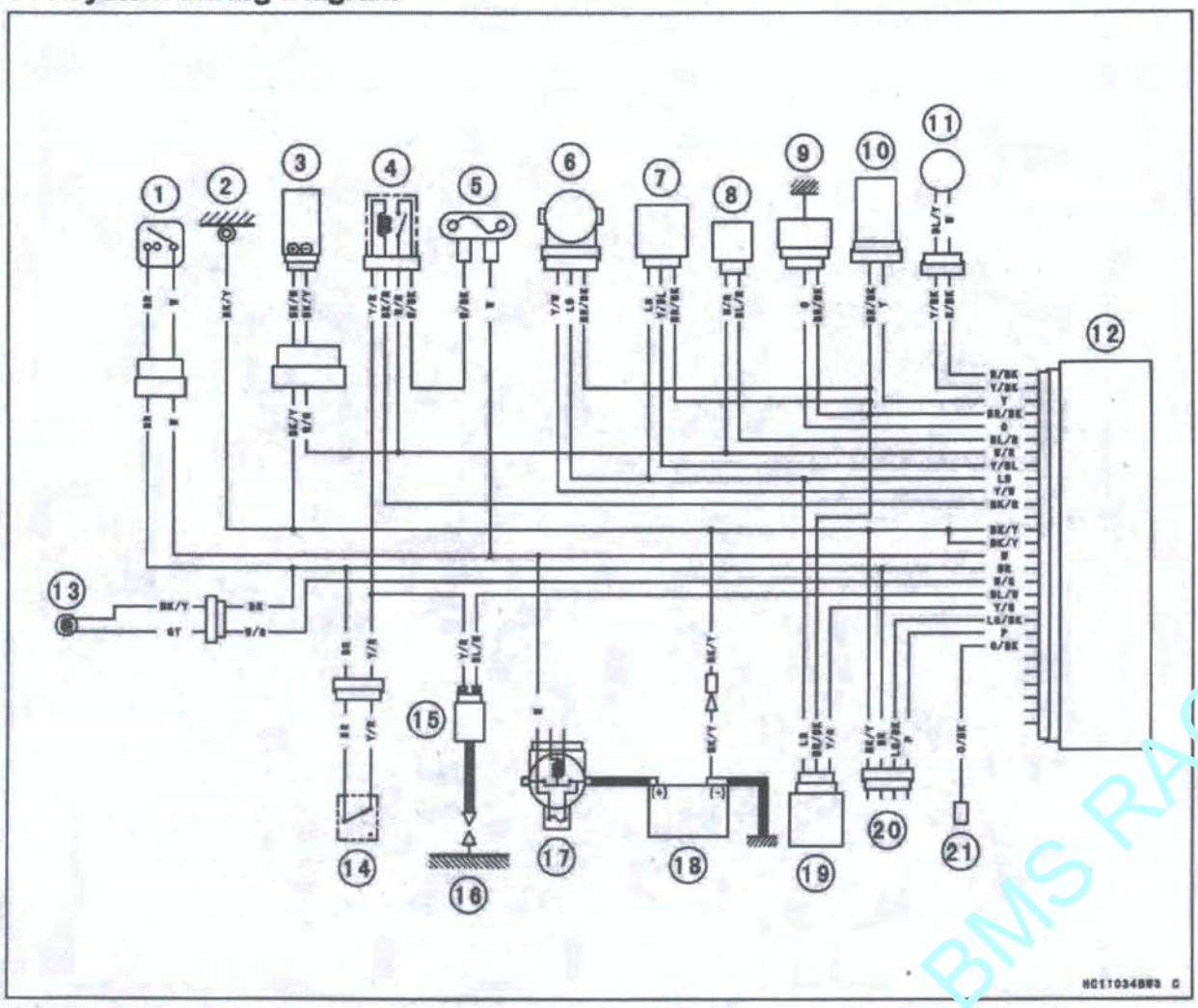


DFI System

1. Inlet Air Pressure Sensor
2. Crankshaft Sensor
3. Injector
4. Main Throttle Sensor
5. Delivery Pipe
6. Main Throttle Valve
7. Fuel Pump
8. Pressure Regulator
9. Fuel Tank
10. Air Cleaner Element
11. Inlet Air Temperature Sensor
12. Air Cleaner Housing
13. Vehicle-down Sensor
14. ECU (Electronic Control Unit)
15. Battery
16. Water Temperature Sensor
17. Air Flow
18. Fuel Flow

DFI System

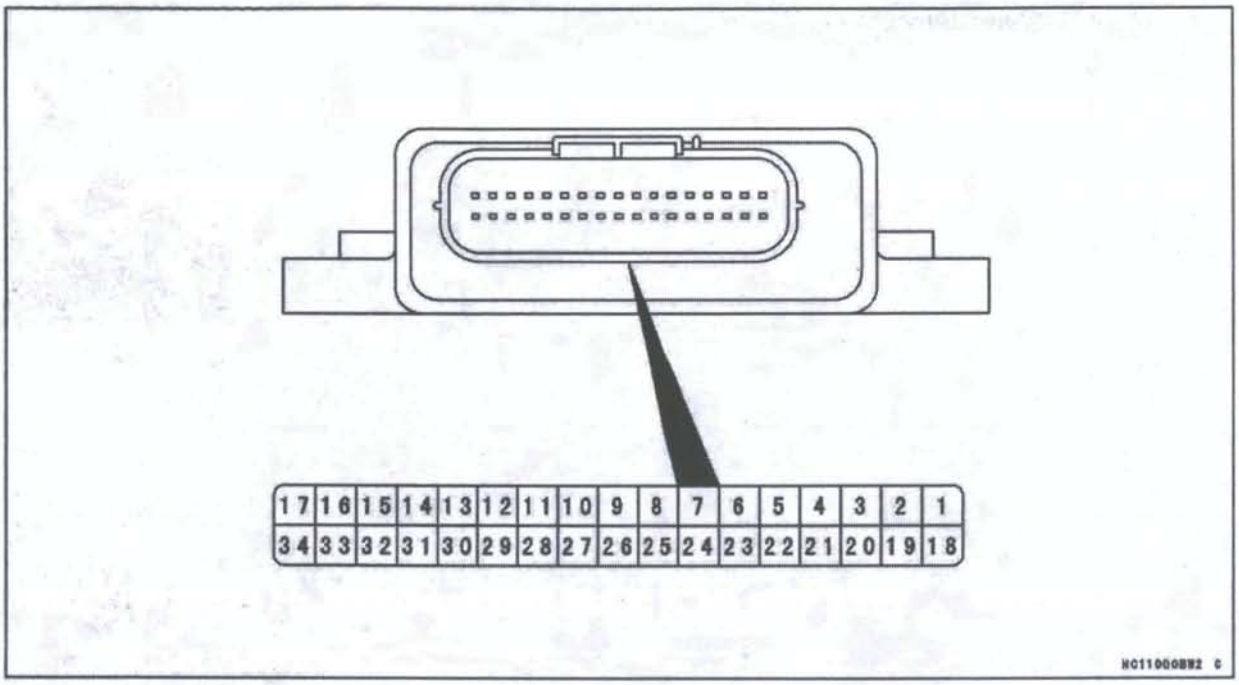
DFI System Wiring Diagram



Part Name

1. Ignition Switch
2. Frame Ground
3. Fuel Pump
4. Fuel Pump Relay
5. Fuel Pump Fuse 10 A
6. Main Throttle Sensor
7. Inlet Air Pressure Sensor
8. Fuel Injector
9. Water Temperature Sensor
10. Inlet Air Temperature Sensor
11. Crankshaft Sensor
12. ECU (Electronic Control Unit)
13. Water Temperature Warning/FI Indicator Light
14. Engine Stop Switch
15. Ignition Coil
16. Spark Plug
17. Main Fuse 30 A
18. Battery 12 V 6 Ah
19. Vehicle-down Sensor
20. Kawasaki Diagnostic System Connector
21. Self Diagnosis Terminal

DFI System

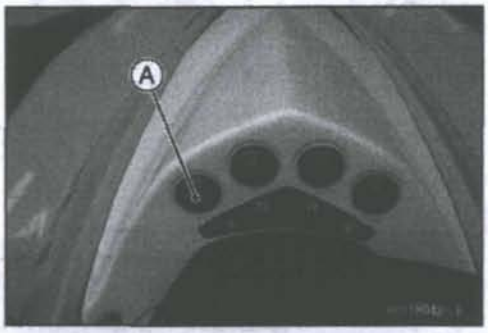


Terminal Names

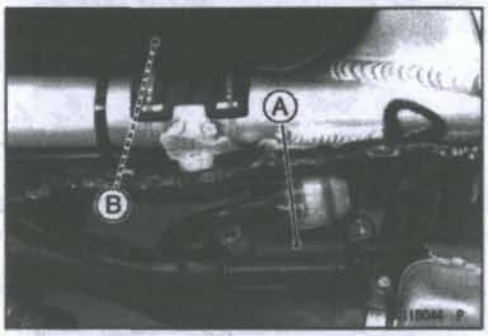
1. Ignition Coil #1 Signal
2. Radiator Fan Relay Signal
3. FI Indicator Light/Water Temperature Warning Light
4. Unused
5. Unused
6. External Communication Line (Mode Switch)
7. Communication Line B
8. Communication Line A
9. Ground for Sensors
10. Neutral Switch Signal
11. Crankshaft Sensor (+) Signal
12. Battery Monitor
13. Power Supply to ECU (from Battery)
14. Starter Lockout Switch Signal
15. Power Supply to Sensors
16. Water Temperature Sensor Signal
17. Throttle Position Sensor Signal
18. Injector Signal
19. Fuel Pump Relay Signal
20. Unused
21. ECU Ground
22. Unused
23. Self-diagnosis Terminal
24. External Communication Line (KDS)
25. Ground for Control System
26. Crankshaft Sensor (−) Signal
27. Reverse Switch Signal
28. Unused
29. Power Supply to ECU (from Battery)
30. Starter Button Signal
31. Vehicle-down Sensor Signal
32. Inlet Air Pressure Sensor Signal
33. Inlet Air Temperature Sensor
34. Unused

DFI Parts Location

FI Indicator (Water Temperature Warning) Light [A]

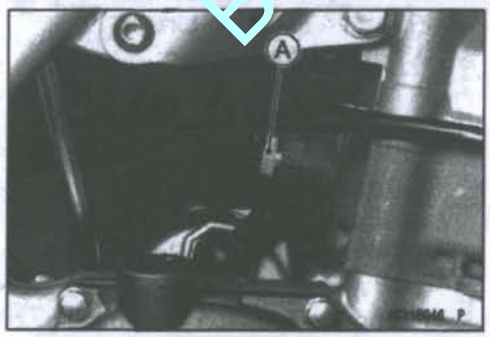


Ignition Coil [A]
Fuel Pump [B]

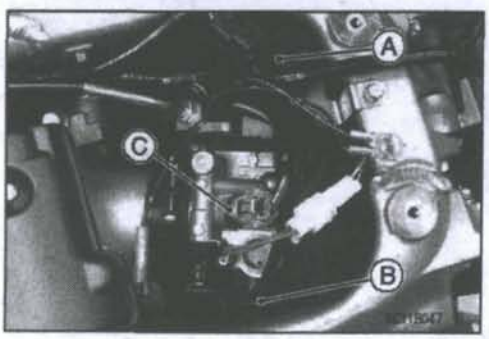


Battery 12 V 6 Ah [A]
Crankshaft Sensor [B]

Water Temperature Sensor [A]

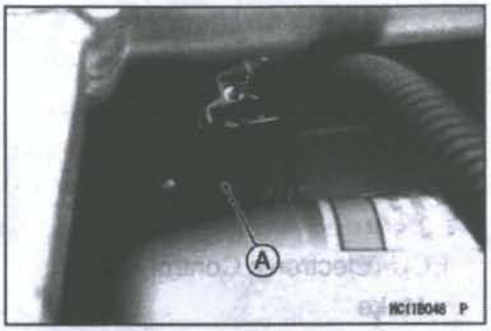


Inlet Air Pressure Sensor [A]
Main Throttle Sensor [B]
Fuel Injector [C]



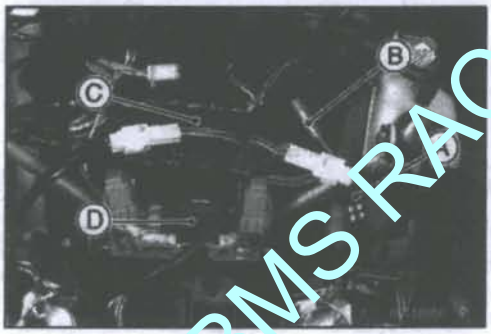
DFI Parts Location

Inlet Air Temperature Sensor [A]



Fuel Pump Relay [A]

Kawasaki Diagnostic System Connector [A]
Self Diagnosis Terminal [B]
ECU (Electronic Control Unit) [C]
Vehicle-down Sensor [D]

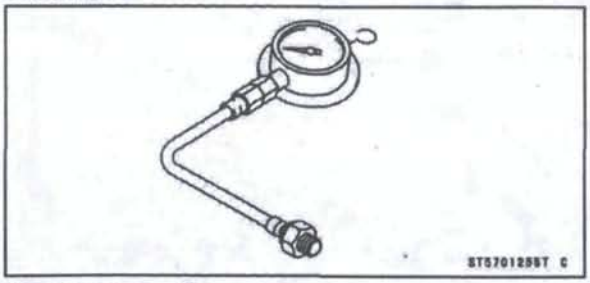


Specifications

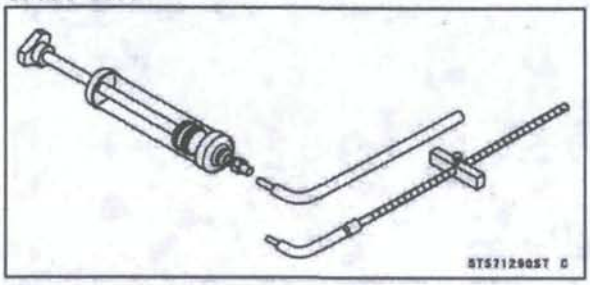
Item	Standard
Digital Fuel Injection System	
Idle Speed	1 800 ±100 r/min (rpm)
Throttle Body Assy:	
Type	Single barrel type
Bore	ϕ42 mm (1.65 in.)
ECU (Electronic Control Unit):	
Make	Mitsubishi Electric
Type	Digital memory type, with built in IC igniter, sealed with resin
Usable Engine Speed	100 ~ 10 600 r/min (rpm)
Fuel Pressure (High Pressure Line):	
With Engine Idling	294 kPa (3.0 kgf/cm², 43 psi) with fuel pump running
Fuel Pump:	
Type	In-tank friction pump
Discharge	50 mL (1.7 US oz.) or more for 3 seconds
Fuel Injectors:	
Type	INP-286
Nozzle Type	One spray type with 10 holes
Resistance	About 11.7 ~ 12.3 Ω at 20°C (68°F)
Main Throttle Sensor:	Non-adjustable and non-removable
Input Voltage	DC 4.75 ~ 5.25 V between LB and BR/BK leads
Output Voltage at Idle Throttle Opening	DC 0.58 ~ 0.62 V between Y/W and BR/BK leads
Output Voltage at Full Throttle Opening	DC 3.7 ~ 4.1 V between Y/W and BR/BK leads
Resistance	4 ~ 6 kΩ
Inlet Air Pressure Sensor:	
Input Voltage	DC 4.75 ~ 5.25 V between LB and BR/BK leads
Output Voltage	DC 3.80 ~ 4.20 V at standard atmospheric pressure (see this text for details)
Inlet Air Temperature Sensor:	
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) 0.29 ~ 0.39 kΩ at 80°C (176°F)
Output Voltage at ECU	About 2.26 ~ 2.50 V at 25°C (77°F)
Water Temperature Sensor:	
Resistance	see Electrical System chapter
Output Voltage at ECU	About 2.24 ~ 2.48 V at 25°C (77°F)
Vehicle-down Sensor:	
Detection Method	Magnetic flux detection method
Detection Angle	more than 15 ~ 35° for each bank
Output Voltage	with the sensor tilted 15 ~ 35° or more: 0.4 ~ 1.4 V with sensor arrow mark pointed up: 3.7 ~ 4.4 V
Throttle Lever and Cable	
Throttle Lever Free Play	2 ~ 3 mm (0.08 ~ 0.12 in.)
Air Cleaner	
Air Cleaner Element Oil	High quality foam air filter oil

Special Tools and Sealant

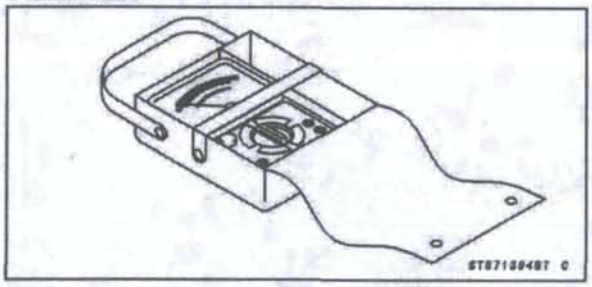
Oil Pressure Gauge, 5 kgf/cm²:
57001-125



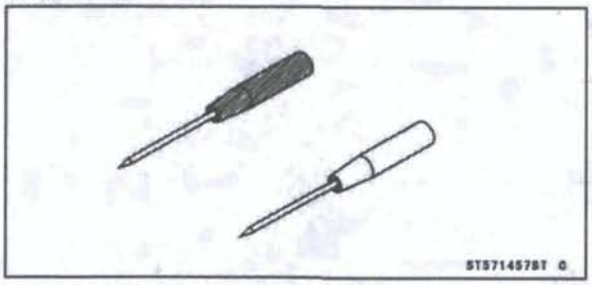
Fork Oil Level Gauge:
57001-1290



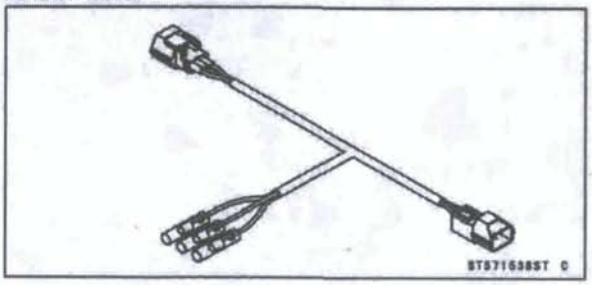
Hand Tester:
57001-1394



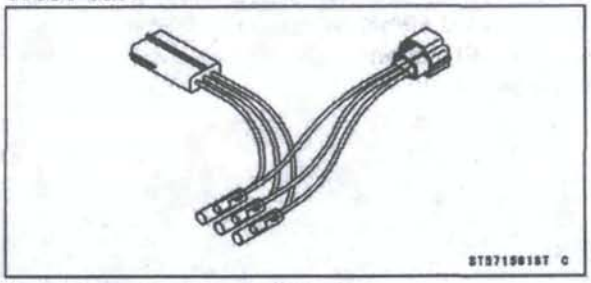
Needle Adapter Set:
57001-1457



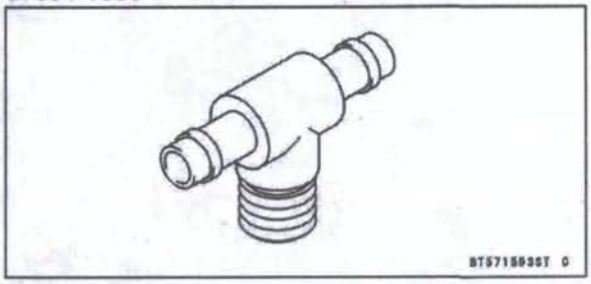
Throttle Sensor Setting Adapter:
57001-1538



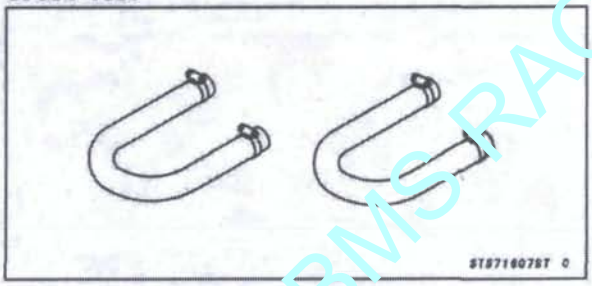
Sensor Harness Adapter:
57001-1561



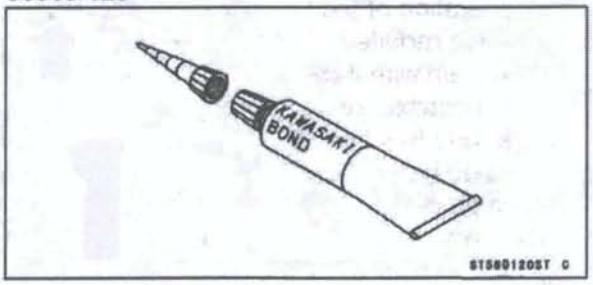
Fuel Pressure Gauge Adapter:
57001-1593



Fuel Hose:
57001-1607



Kawasaki Bond (Silicone Sealant):
56019-120

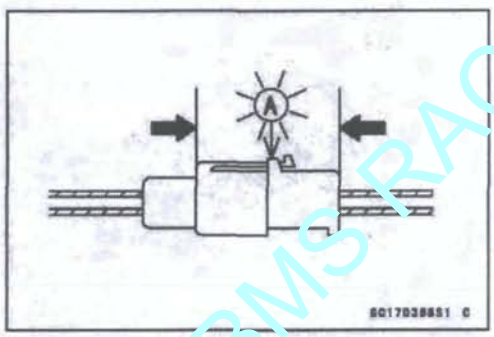


DFI Servicing Precautions

DFI Servicing Precautions

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

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on or while the engine is running.
- Take care not to short the cables that are directly connected to the battery positive (+) terminal to the chassis ground.
- When charging, remove the battery from the vehicle. This is to prevent ECU damage by excessive voltage.
- Do not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- Do not spray water on the electrical parts, DFI parts, connectors, leads, and wiring.
- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition switch, and disconnect the battery (–) terminal. Do not pull the lead, only the connector. Conversely, make sure that all the DFI electrical connections are firmly reconnected before starting the engine.
- Connect these connectors until they click [A].



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

DFI Servicing Precautions

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

Troubleshooting the DFI System

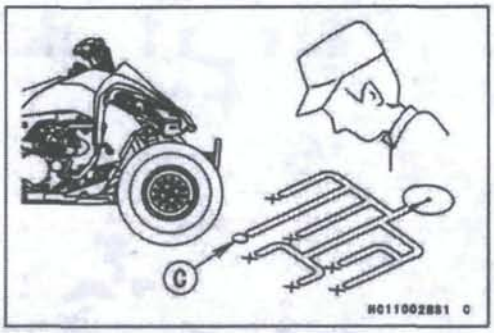
Outline

Outline

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

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

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

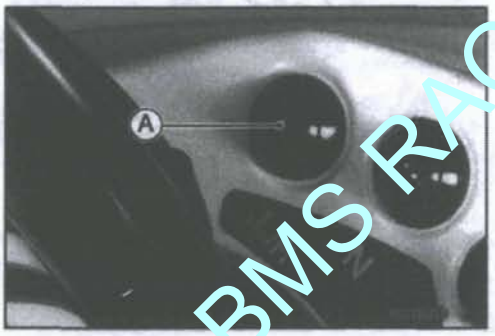


Even when the DFI system is operating normally, the FI indicator light [A] may light up under strong electrical interference. No repair needed. Turn the ignition switch OFF to stop the indicator light.

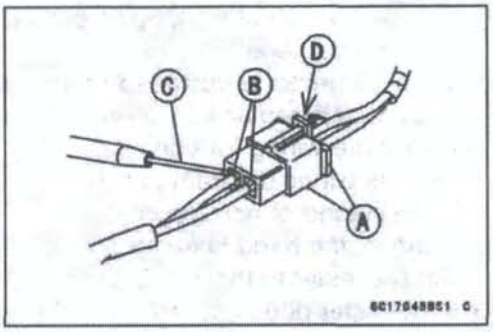
When the FI indicator light goes on and the vehicle is brought in for repair, check the service codes.

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

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



Troubleshooting the DFI System



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

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

Special Tool - Needle Adapter Set: 57001-1457

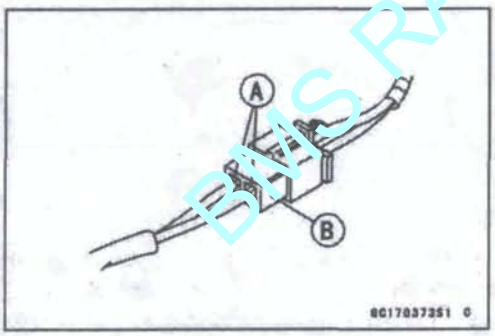
CAUTION

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

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

CAUTION

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



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

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

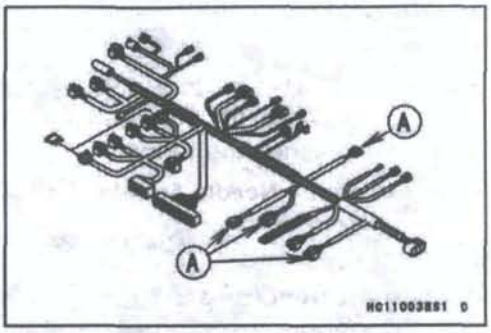
- Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.

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

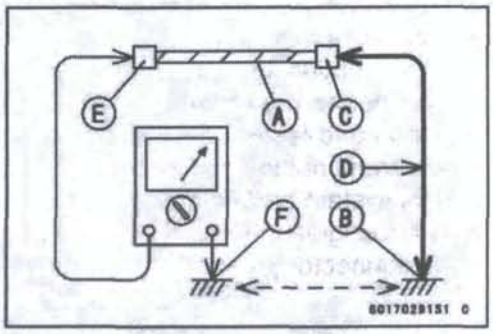
★If any wiring is deteriorated, replace the wiring.

Troubleshooting the DFI System

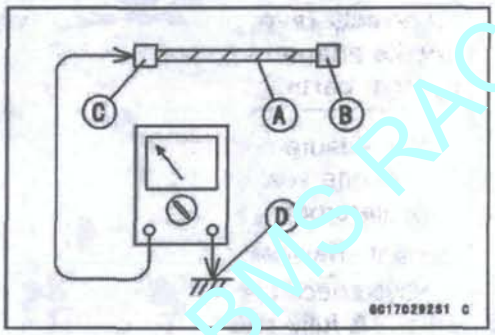
• Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it. Connect the connectors securely.
• Check the wiring for continuity.
○Use the wiring diagram to find the ends of the lead which is suspected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



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



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



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

○Lead Color Codes:

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

Troubleshooting the DFI System

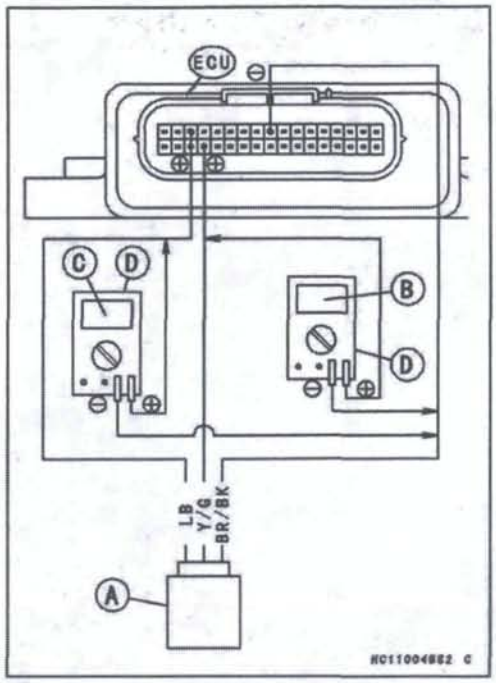
OThere are two ways to inspect the DFI system. One is voltage Check Method and the other is Resistance Check Method.

(Voltage Check Method)

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

OSometimes this method can detect a fault of the ECU.

- Refer to each sensor inspection section for detail in this chapter.
- Use a fully charged battery and a digital meter [D] which can be read two decimal places voltage or resistance.



(Resistance Check Method)

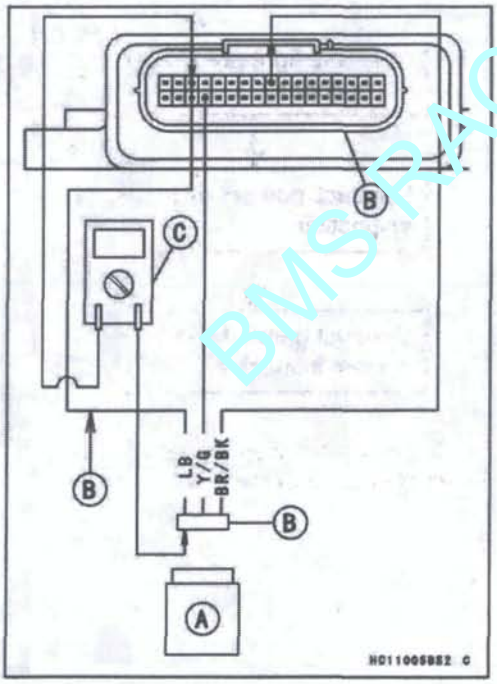
OThis method is simple. No need for a fully charged battery and the needle adapter. Just do the following especially when a sensor [A] is suspect.

- Turn the ignition switch OFF and disconnect the connectors.
- Inspect the sensor resistance, using a digital meter (see each sensor inspection).
- Inspect the wiring and connectors [B] for continuity, using the hand tester [C] (analog tester) rather than a digital meter.

Special Tool - Hand Tester: 57001-1394

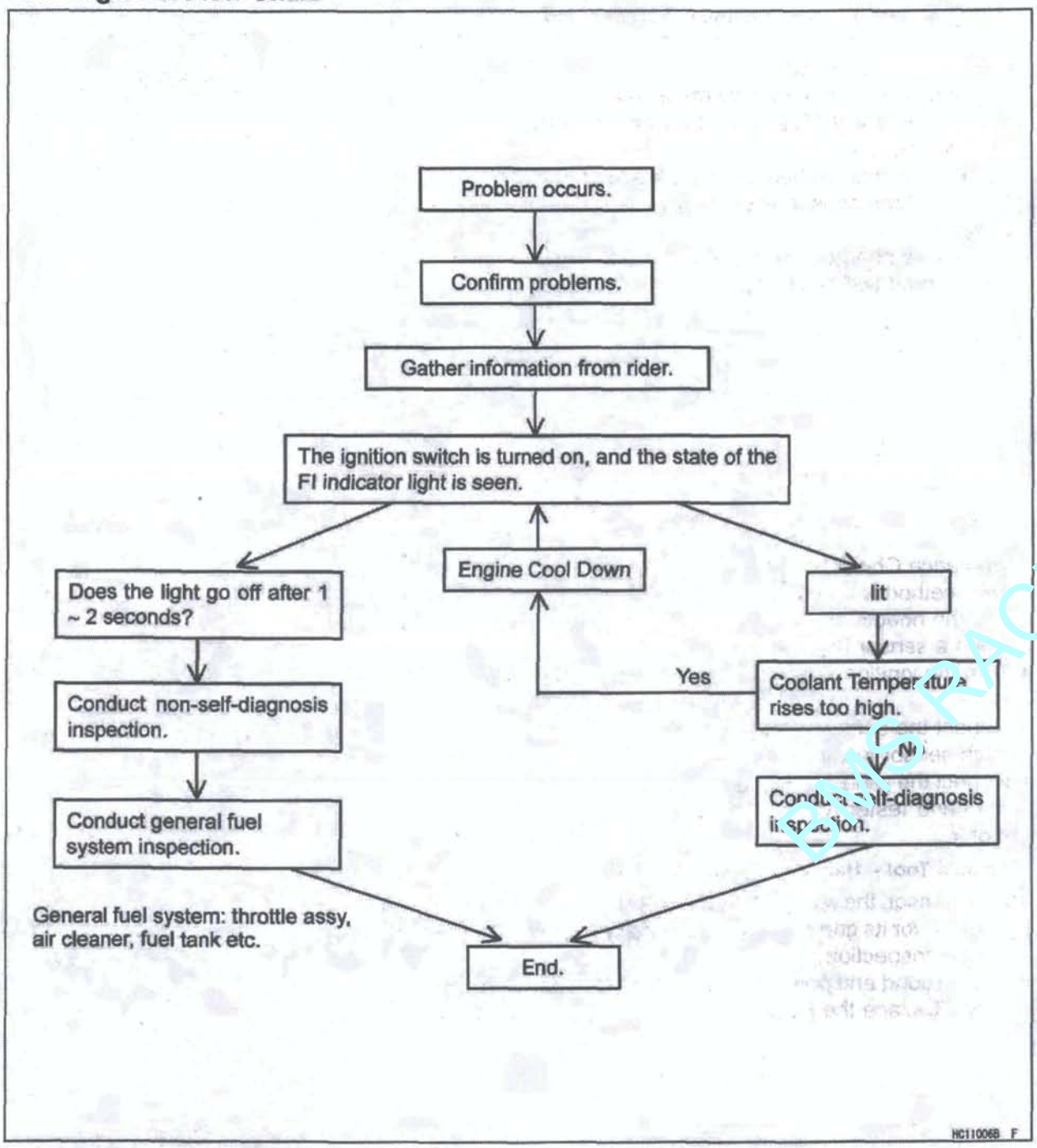
★If the sensor, the wiring and connections are good, inspect the ECU for its ground and power supply (see ECU Power Supply Inspection).

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



Troubleshooting the DFI System

DFI Diagnosis Flow Chart



Inquiries to Rider

Inquiries to Rider

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

Troubleshooting the DFI System

Sample Diagnosis Sheet

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

Troubleshooting the DFI System

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

DFI System Troubleshooting Guide

NOTE

- *This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*
- *The ECU may be involved in the DFI electrical and ignition system troubles. If these parts and circuits are checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.*

Engine Doesn't Start, Starting Difficulty

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

DFI System Troubleshooting Guide

Symptoms or possible Causes	Actions (chapter)
Clutch lever not pulled in and gear not in neutral	Pull the lever in and shift the gear in neutral.
Vehicle-down sensor coming off	Reinstall (see chapter 3).
Vehicle-down sensor trouble	Inspect (see chapter 3).
ECU ground or power supply trouble	Inspect (see chapter 3).
Battery voltage low	Inspect and charge (see chapter 16).
Spark plug dirty, broken or gap maladjusted	Replace (see chapter 2).
Ignition coil trouble	Inspect ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Neutral or starter lockout switch trouble	Inspect each switch (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
Ignition switch shorted	Inspect and replace (see chapter 16).
Engine stop switch shorted	Inspect and repair or replace (see chapter 2).
Starter system wiring shorted or open	Inspect and repair or replace (see chapter 16).
Main 30A fuse blown	Inspect and replace (see chapter 16).
Fuel/air mixture incorrect:	
Air cleaner clogged, poorly sealed or missing	Clean or reinstall (see chapter 3).
Leak from oil filler cap, crankcase breather hose or air cleaner drain plug	Inspect and repair or replace (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Fuel pressure may be low	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 3).
Compression low:	
Spark plug loose	Reinstall (see chapter 16).
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
No valve clearance	Adjust (see chapter 2).
Valve guide worn	Inspect and replace (see chapter 5).

DFI System Troubleshooting Guide

Symptoms or possible Causes	Actions (chapter)
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent, worn or carbon accumulating on seating surface)	Inspect and repair or replace (see chapter 5).

Poor Running at Low Speed

Symptoms or Possible Causes	Actions (chapter)
Spark weak:	
Battery voltage low	Inspect and charge (see chapter 16).
Spark plug dirty, broken or gap maladjusted	Replace (see chapter 2).
Ignition coil trouble	Inspect the ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
Fuel/air mixture incorrect:	
Little fuel in tank	Supply fuel (see Owner's Manual).
Air cleaner clogged, poorly sealed, or missing	Clean element or inspect sealing (see chapter 2, 3).
Air cleaner duct loose	Reinstall (see chapter 3).
Air cleaner O-ring damaged	Replace (see chapter 3).
Fuel tank air vent obstructed	Inspect and repair (see chapter 3).
Throttle body assy loose	Reinstall (see chapter 3).
Throttle body assy O-ring damage	Replace (see chapter 3).
Fuel filter or pump screen clogged	Inspect and replace fuel pump (see chapter 3).
Fuel pressure regulator clogged	Inspect fuel pressure and replace fuel pump (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Unstable (rough) idling:	
Fuel injector trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 3).
Throttle valves not synchronizing	Inspect (see chapter 2).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Battery voltage low	Inspect and charge (see chapter 16).
Incorrect idle speed:	
Water temperature sensor trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Engine stalls easily:	
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Main throttle sensor trouble	Inspect (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Fuel pressure too low or too high	Inspect (see chapter 3).
Fuel pressure regulator trouble	Inspect fuel pressure and replace fuel pump (see chapter 3).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
Compression Low:	
Spark plug loose	Reinstall (see chapter 16).
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).
No valve clearance	Adjust (see chapter 2).
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
Valve guide worn or stem seal damaged	Inspect and replace (see chapter 5).
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent, worn or carbon accumulating on seating surface)	Inspect and repair or replace (see chapter 5).
Camshaft cam worn	Inspect and replace (see chapter 5).
Hesitation:	
Too low fuel pressure	Inspect (see chapter 3).
Clogged fuel line	Inspect and repair (see chapter 3).
Cracked or obstructed inlet air pressure sensor hose	Inspect and repair or replace (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Loose injector connectors	Remedy (see chapter 3).
Crankshaft sensor trouble	Inspect or replace (see chapter 16).
Ignition coil trouble	Inspect or replace (see chapter 16).
Loose terminal of battery (–) cable or engine ground lead	Inspect and repair (see chapter 16).
Delay of ignition timing	Inspect crankshaft sensor and IC igniter in ECU (see chapter 16).
Poor acceleration:	
Too low fuel pressure	Inspect (see chapter 3).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Clogged fuel filter or pump screen	Inspect and replace fuel pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Ignition coil trouble	Inspect and replace (see chapter 16).
Engine oil level to high	Repair (see chapter 7).
Spark plug dirty, broken or gap maladjusted	Replace (see chapter 2).
Stumble:	
Too low fuel pressure	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Main throttle sensor malfunction	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Surge:	
Unstable fuel pressure	Fuel pressure regulator trouble (Inspect and replace fuel pump) or kinked fuel line (Inspect and repair fuel line) (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Backfiring when deceleration:	
Spark plug dirty, broken or gap maladjusted	Replace (see chapter 2).
Too low fuel pressure	Inspect (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
After fire:	
Crankshaft sensor trouble	Inspect (see chapter 16).
Spark plug burned or gap maladjusted	Replace (see chapter 2).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Fuel injector trouble	Inspect (see chapter 3).
Run-on (dieseling):	
Ignition switch trouble	Inspect and replace (see chapter 16).
Engine stop switch trouble	Inspect and repair or replace (see chapter 2).
Fuel injector trouble	Inspect (see chapter 3).
Loose terminal of battery (–) cable or ECU ground lead	Inspect and repair (see chapter 16).
Carbon accumulating on valve seating surface	Repair (see chapter 5).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Engine overheating	(see Overheating of Troubleshooting Guide, see chapter 17)
Other:	
Engine oil viscosity too high	Change (see chapter 2).
Drive train trouble	Inspect drive chain (see chapter 2) and sprocket (see chapter 11).
Brake dragging	Inspect caliper fluid seal damage or clogging of master cylinder relief and supply ports (see chapter 12).
Clutch slipping	Inspect friction plates for wear (see chapter 6).
Engine overheating	(see Overheating of Troubleshooting Guide, see chapter 17)
Intermittent any DFI fault and its recovery	Check that DFI connectors are clean and tight, and examine wires for signs of burning or fraying (see chapter 3).

Poor Running or No Power at High Speed:

Symptoms or Possible Causes	Actions (chapter)
Firing incorrect:	
Spark plug dirty, broken or maladjusted	Replace (see chapter 2).
Ignition coil trouble	Inspect ignition coil (see chapter 16).
Ignition coil shorted or not in good contact	Reinstall or inspect ignition coil (see chapter 16).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Crankshaft sensor trouble	Inspect (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
Fuel/air mixture incorrect:	
Air cleaner clogged, poorly sealed, or missing	Clean element or inspect sealing (see chapter 3).
Air cleaner duct loose	Reinstall (see chapter 3).
Air cleaner O-ring damaged	Replace (see chapter 3).
Water or foreign matter in fuel	Change fuel. Inspect and clean fuel system (see chapter 3).
Throttle body assy loose	Reinstall (see chapter 3).
Throttle body assy O-ring damaged	Replace (see chapter 3).
Fuel tank air vent obstructed	Inspect and repair (see chapter 3).
Fuel line clogged	Inspect and repair (see chapter 3).
Fuel pump operates intermittently and often DFI fuse blows.	Pump bearings may wear. Replace the pump (see chapter 3).
Fuel pump trouble	Inspect (see chapter 3).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Main throttle sensor trouble	Inspect (see chapter 3).
Inlet air pressure sensor trouble	Inspect (see chapter 3).
Cracked or obstructed inlet air pressure sensor hose	Inspect and repair or replace (see chapter 3).
Injector clogged	Visually inspect and replace (see chapter 3).
Compression low:	
Spark plug loose	Reinstall (see chapter 16).

DFI System Troubleshooting Guide

Symptoms or Possible Causes	Actions (chapter)
Cylinder head not sufficiently tightened down	Tighten (see chapter 5).
No valve clearance	Adjust (see chapter 2).
Cylinder, piston worn	Inspect and replace (see chapter 5).
Piston ring bad (worn, weak, broken or sticking)	Inspect and replace (see chapter 5).
Piston ring/groove clearance excessive	Inspect and replace (see chapter 5).
Cylinder head gasket damaged	Replace (see chapter 5).
Cylinder head warped	Inspect and replace (see chapter 5).
Valve spring broken or weak	Inspect and replace (see chapter 5).
Valve not seating properly (valve bent , worn or carbon accumulating on the seating surface)	Inspect and repair or replace (see chapter 5).
Knocking:	
Carbon built up in combustion chamber	Repair (see chapter 5).
Fuel poor quality or incorrect (Use the gasoline recommended in the Owner's Manual)	Change fuel (see chapter 3).
Spark plug incorrect	Replace it with the correct plug (see chapter 16).
Ignition coil trouble	Inspect (see chapter 16).
IC igniter in ECU trouble	Inspect (see chapter 16).
Inlet air temperature sensor trouble	Inspect (see chapter 3).
Miscellaneous:	
Throttle valve won't fully open	Inspect throttle cable and lever linkage (see chapter 3).
Brake dragging	Inspect caliper fluid seal damage or clogging of master cylinder relief and supply ports (see chapter 12).
Clutch slipping	Inspect friction plates for wear (see chapter 6).
Engine overheating - Water temperature sensor or crankshaft sensor trouble	(see Overheating of Troubleshooting Guide in chapter 17).
Engine oil level too high	Repair (see chapter 7).
Engine oil viscosity too high	Change (see chapter 2).
Drive train trouble	Inspect drive chain (see chapter 2) and sprockets (see chapter 11).
Camshaft cam worn	Inspect and replace (see chapter 5).
Exhaust Smokes Excessively:	
(White smokes)	
Piston oil ring worn	Inspect and replace (see chapter 5).
Cylinder worn	Inspect and replace (see chapter 5).
Valve oil seal damaged	Replace (see chapter 5).
Valve guide worn	Replace the guide (see chapter 5).
Engine oil level too high	Repair (see chapter 7).
(Black smoke)	
Air cleaner clogged	Clean (see chapter 3).
Too high fuel pressure	Inspect (see chapter 3).
Injector stuck open	Inspect (see chapter 3).
Water temperature sensor trouble	Inspect and replace (see chapter 3).
Inlet air temperature sensor trouble	Inspect and replace (see chapter 3).

DFI System Troubleshooting Guide

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

Self-Diagnosis

Self-diagnosis Outline

Self-diagnosis Outline

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

User Mode

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

Dealer Mode

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

Self-diagnosis Procedures

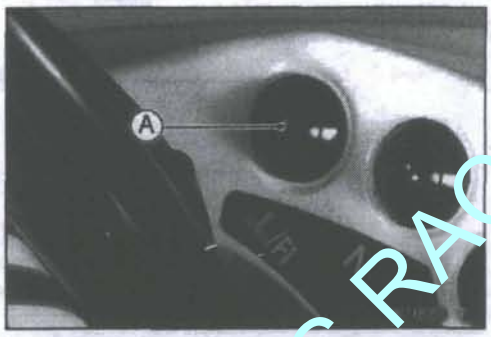
Self-diagnosis Procedures

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

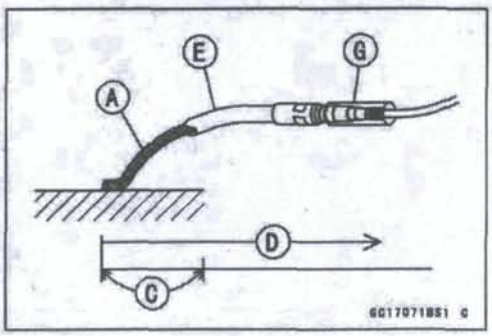
NOTE

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

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



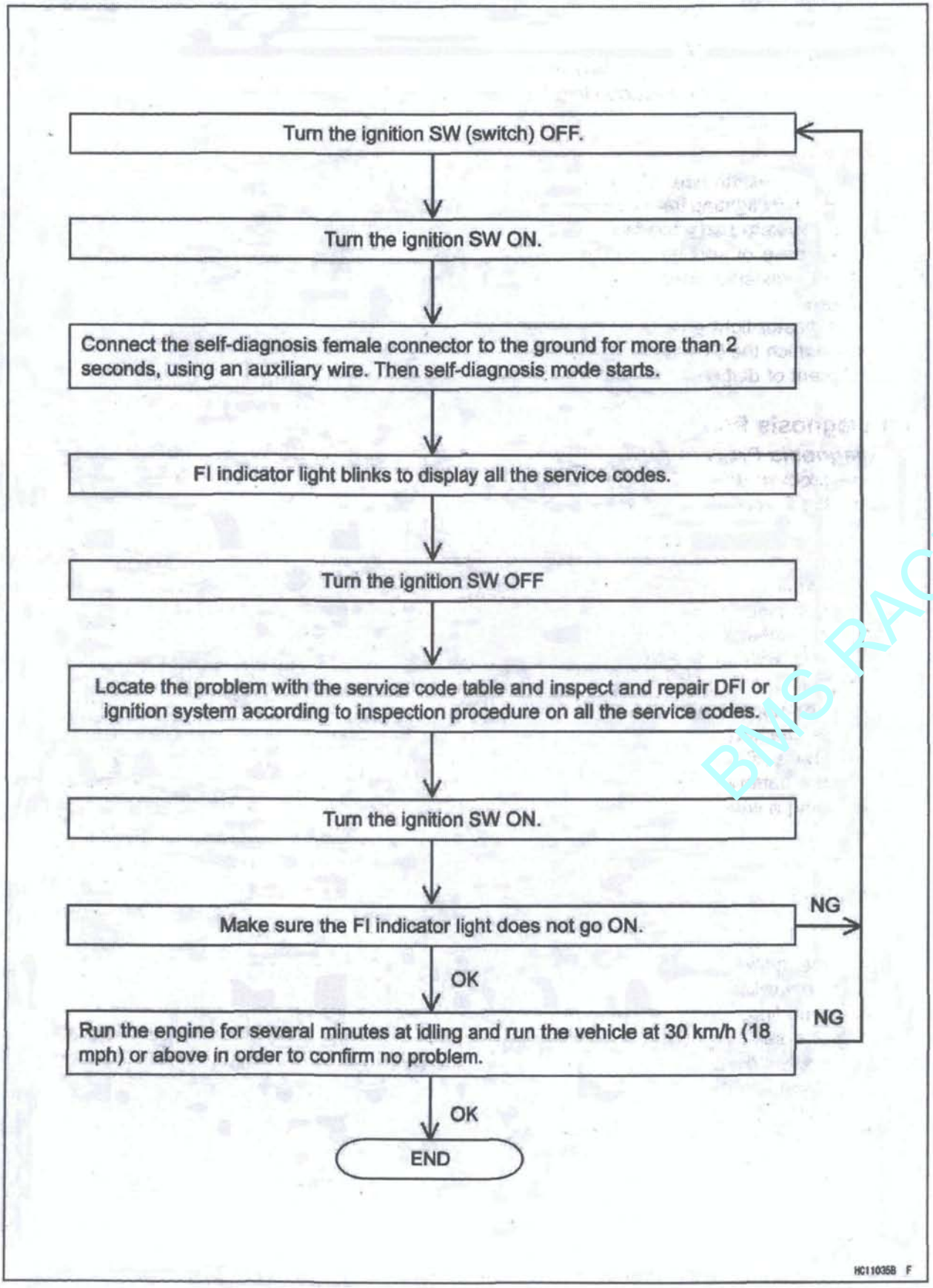
- Remove the upper cover (see Upper Cover Removal in the Frame chapter).
- Ground the self-diagnosis terminal [A] (Orange/Black lead) to the battery (–) terminal or battery (–) lead connector, using a wire.



- Turn on the ignition switch.
- Connect an auxiliary lead [E] to the self-diagnosis terminal [G] for grounding.
- To enter the self-diagnosis dealer mode, ground [A] the self-diagnosis indicator terminal to the battery (–) terminal for more than 2 seconds [C], and then keep it grounded continuously [D].

○Count the blinks of the light to read the service code. Keep the auxiliary lead ground until you finish reading the service code.

Self-Diagnosis

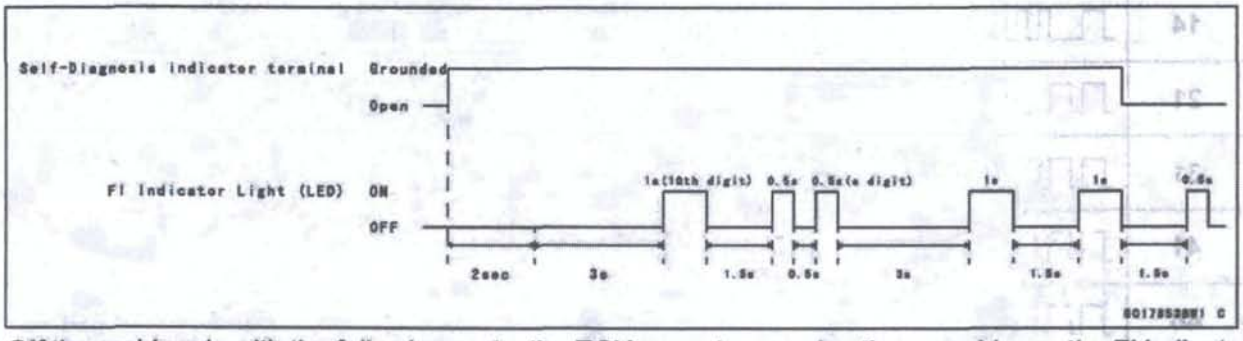


Self-Diagnosis

How to Read Service Codes

How to Read Service Codes

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



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

How to Erase Service Codes

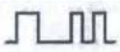
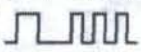
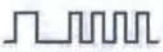
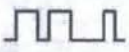
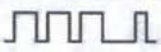
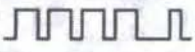
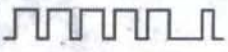
How to Erase Service Codes

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

Self-Diagnosis

Service Code Table

Service Code Table

Service Code	FI Indicator Light	Problems
11		Main throttle sensor malfunction, wiring open or short
12		Inlet air pressure sensor malfunction, wiring open or short
13		Inlet air temperature sensor malfunction, wiring open or short
14		Water temperature sensor malfunction, wiring open or short
21		Crankshaft sensor malfunction, wiring open or short
31		Vehicle-down sensor, malfunction, wiring open or short
41		Injector malfunction, wiring open or short
46		Fuel pump relay malfunction, relay is stuck
51		Ignition coil malfunction, wiring open or short

Notes:

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

Self-Diagnosis

Backups

Backups

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

Service Codes	Parts	Output Signal Usable Range or Criteria	Backups by ECU
11	Main Throttle Sensor	Main Throttle Sensor Output Voltage 0.2 ~ 4.8 V	If the main throttle sensor system fails (the signal is out of the usable range, wiring short or open), the ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the D-J method. Also, the main throttle sensor system and inlet air pressure sensor fails, the ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the α-N method.
12	Inlet Air Pressure Sensor	Inlet Air Pressure (absolute) Pv = 150 ~ 800 mmHg	If the inlet air pressure sensor system fails (the signal Pv is out of the usable range, wiring short or open), the ECU sets the DFI in the α - N method.
13	Inlet Air Temperature Sensor	Inlet Air Temperature Ta = –30°C ~ +120°C	If the inlet air temperature sensor fails (the signal is out of the usable range, wiring short or open), the ECU sets Ta at 30°C.
14	Water Temperature Sensor	Water Temperature Tw = –30°C ~ +120°C	If the water temperature sensor system fails (the signal is out of the usable range, wiring short or open), the ECU sets Tw at 80°C.
21	Crankshaft Sensor	Crankshaft sensor must send 22 signals (output signal) to the ECU at the one cranking.	If crankshaft sensor generates other than 22 signals, the engine stops running.
31	Vehicle-down Sensor	Vehicle-down Sensor Output Voltage (signal) Vd = 0.2 ~ 4.6 V	If the vehicle-down sensor system has failures (the output voltage Vd is more than usable range, wiring open), the ECU shuts off the fuel pump, the fuel injectors and the ignition system.
41	Fuel Injector	The injector must send signals (output voltage) continuously to the ECU.	If the injector fails (no signals, wiring short or open), the ECU shuts off the signal to the injector. Fuel is not supplied to the cylinder.
46	Fuel Pump Relay	When the relay ON condition, battery monitor voltage 5 V or more	If the relay fails, battery monitor voltage 12 V.
51	Ignition Coil	The ignition coil primary winding must send signals (output voltage) continuously to the ECU.	If the ignition primary winding has failures (no signal, wiring short or open), the ECU shuts off the injector to stop fuel to the cylinder, though the engine keeps running.

Note:

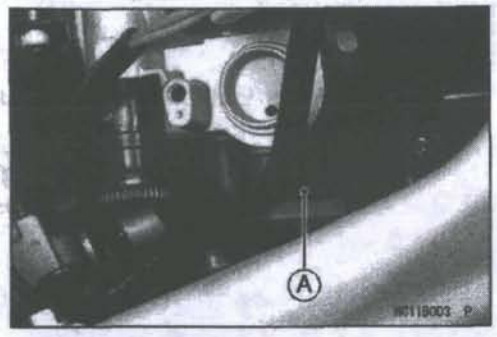
(1) D-J Method and α - N Method: When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (inlet air pressure sensor output voltage) and engine speed (crankshaft sensor output voltage). This method is called D-J method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

Main Throttle Sensor (Service Code 11)

Main Throttle Sensor Removal/Adjustment

CAUTION

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



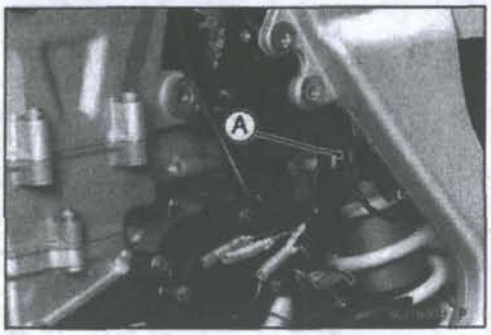
Main Throttle Sensor Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Turn the ignition switch OFF.
- Remove the left upper engine bracket.
- Disconnect the main throttle sensor connector with the needle nose pliers and connect the harness adapter [A] between these connectors.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1538



- Connect a digital meter to the harness adapter lead.

Main Throttle Sensor Input Voltage
Connections to Adapter
Meter (+) → BK (sensor LB) lead
Meter (–) → W (sensor BR/BK) lead

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

Input Voltage at Sensor
Standard: DC 4.75 ~ 5.25 V

- Turn the ignition switch OFF.

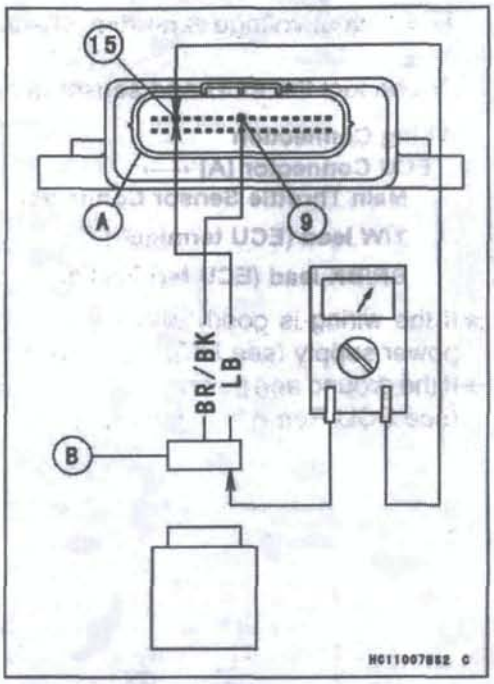
★If the input voltage is normal, check the output voltage.

Main Throttle Sensor (Service Code 11)

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

Wiring Connection
ECU Connector [A] ⟷
Main Throttle Sensor Connector [B]
LB lead (ECU terminal 15)
BR/BK lead (ECU terminal 9)

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

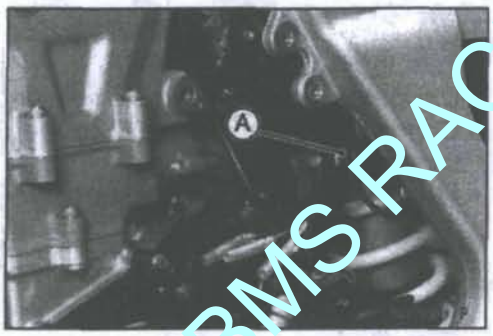


Main Throttle Sensor Output Voltage Inspection

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

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

Special Tool - Throttle Sensor Setting Adapter: 57001 -1538



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

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

Idle Speed
Standard: 1 800 ±100 r/min (rpm)

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

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

Output Voltage at Sensor
Standard: DC 0.58 ~ 0.62 V (at idle throttle opening)
DC 3.7 ~ 4.1 V (at full throttle opening)

- Turn the ignition switch OFF.

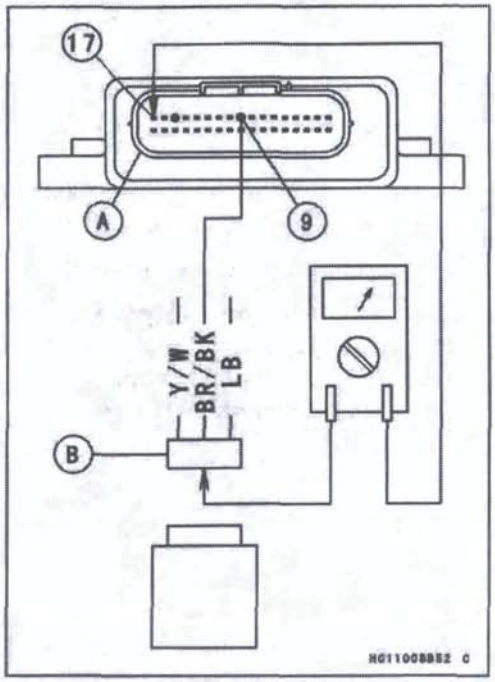
★If the output voltage is out of the standard, inspect the main throttle sensor resistance (see Main Throttle Sensor Resistance Inspection).

Main Throttle Sensor (Service Code 11)

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

Wiring Connection
ECU Connector [A] ←→
Main Throttle Sensor Connector [B]
Y/W lead (ECU terminal 17)
BR/BK lead (ECU terminal 9)

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

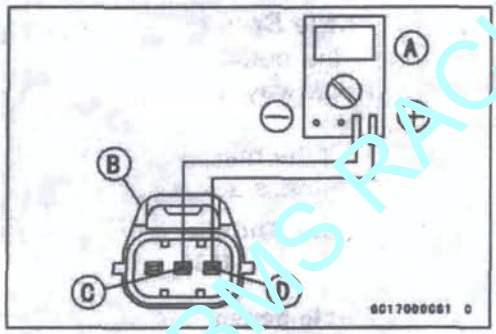


Main Throttle Sensor Resistance Inspection

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

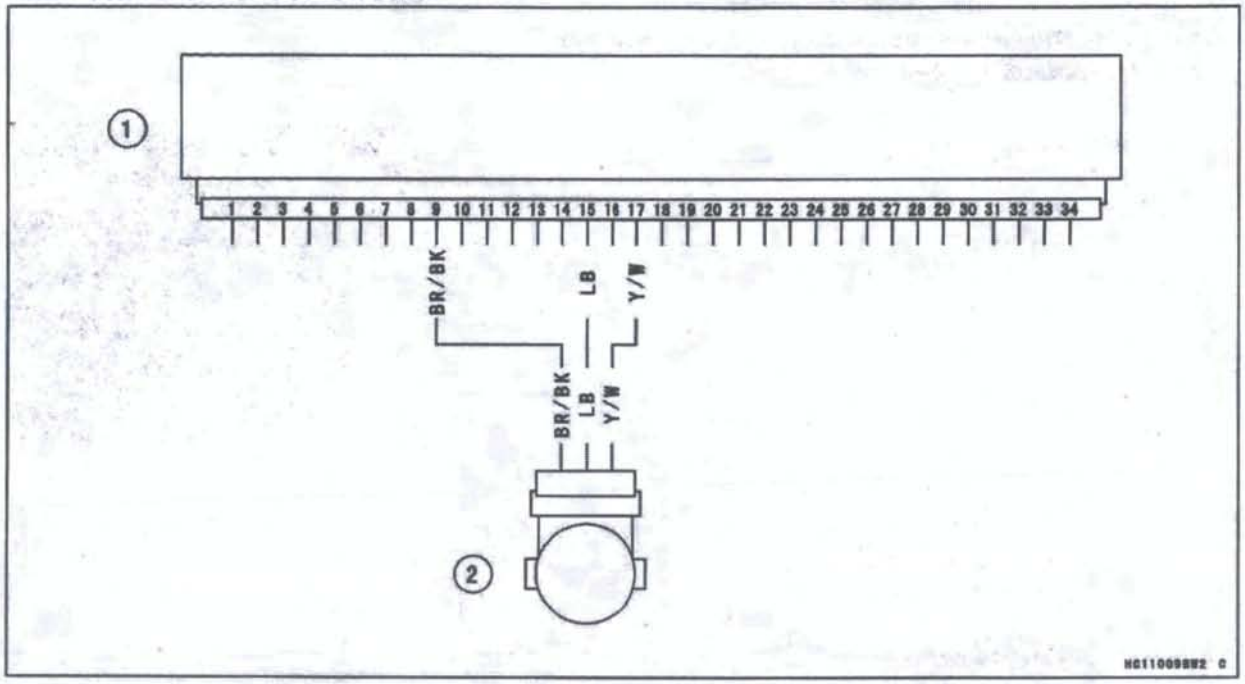
Main Throttle Sensor Resistance
Connections: **LB lead [C] ←→ BR/BK lead [D]**
Standard: **4 ~ 6 kΩ**

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



Main Throttle Sensor (Service Code 11)

Main Throttle Sensor Circuit



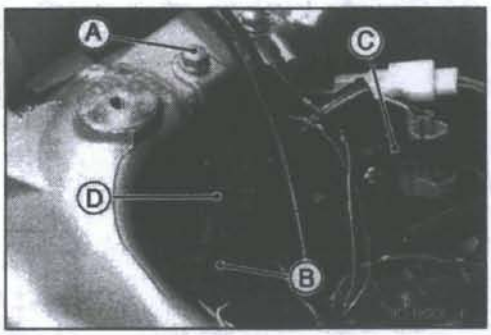
1. ECU (Electronic Control Unit)
2. Main Throttle Sensor

Inlet Air Pressure Sensor (Service Code 12)

CAUTION

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

Inlet Air Pressure Sensor Removal



- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Fuel Tank (see Fuel Tank Removal)
  Bolt [A]
- Disconnect the inlet air pressure sensor connector [B] and the vacuum hose [C].
- Pull out the inlet air pressure sensor [D] from the bracket.

Inlet Air Pressure Sensor Installation

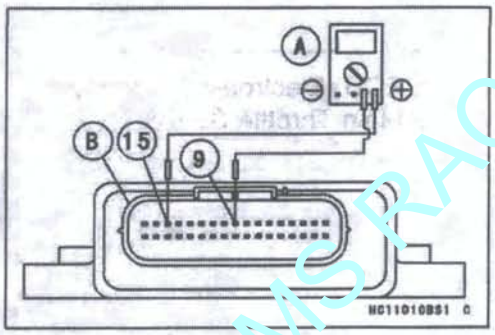
- Installation is the reverse of removal.

Torque - Inlet Air Pressure Sensor Bracket Mounting Bolt: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Inlet Air Pressure Sensor Input Voltage Inspection

NOTE

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



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

○Do not disconnect the ECU connectors.

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

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Pressure Sensor Input Voltage
Connections to ECU Connector
Meter (+) → LB lead (terminal 15)
Meter (–) → BR/BK lead (terminal 9)

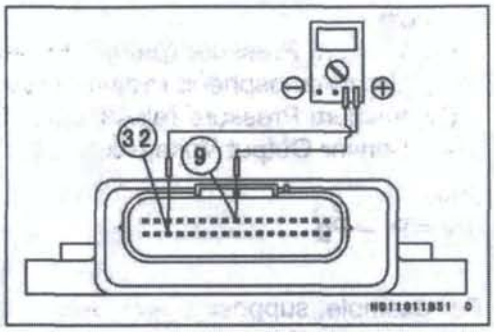
- Measure the input voltage with the engine stopped, and with the connectors joined.
- Turn the ignition switch ON.

Input Voltage at ECU
Standard: DC 4.75 ~ 5.25 V

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

Inlet Air Pressure Sensor (Service Code 12)

Inlet Air Pressure Sensor Output Voltage Inspection



NOTE

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

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

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Pressure Sensor Output Voltage Connections to ECU Connector

Meter (+) → Y/BL lead (terminal 32)

Meter (–) → BR/BK lead (terminal 9)

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

- Turn the ignition switch OFF.

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

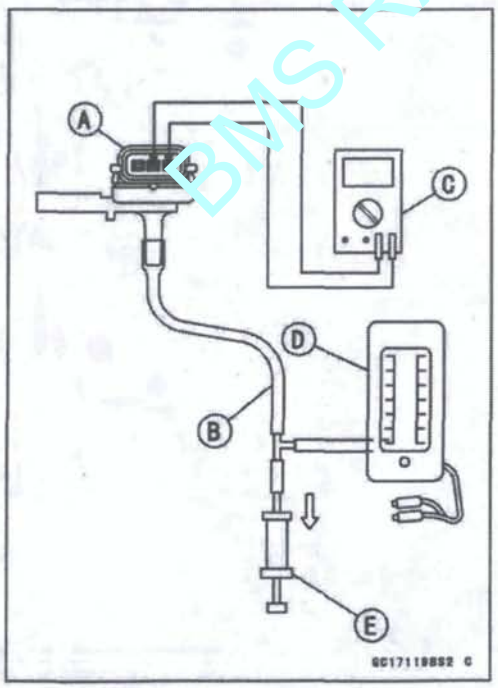
★If the ground and power supply are good, replace the ECU (see ECU Removal/Installation).

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

★If the wiring is good, check the sensor for various vacuum.

- Remove the inlet air pressure sensor [A] and disconnect the vacuum hose from the sensor.
- Connect an auxiliary hose [B] to the inlet air pressure sensor.
- Temporarily install the inlet air pressure sensor.
- Connect a digital meter [C], vacuum gauge [D], the fork oil level gauge [E] and the harness adapter to the inlet air pressure sensor.

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



Inlet Air Pressure Sensor Output Voltage Connections to Adapter

Meter (+) → G/W (sensor Y/BL) lead

Meter (–) → BK (sensor BR/BK) lead

- Turn the ignition switch ON.
- Measure the output voltage from various vacuum readings, while pulling the handle of the fork oil level gauge.

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

- Check the output voltage, using the following formula and chart.

Inlet Air Pressure Sensor (Service Code 12)

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

then
Pv = Pl – Pg

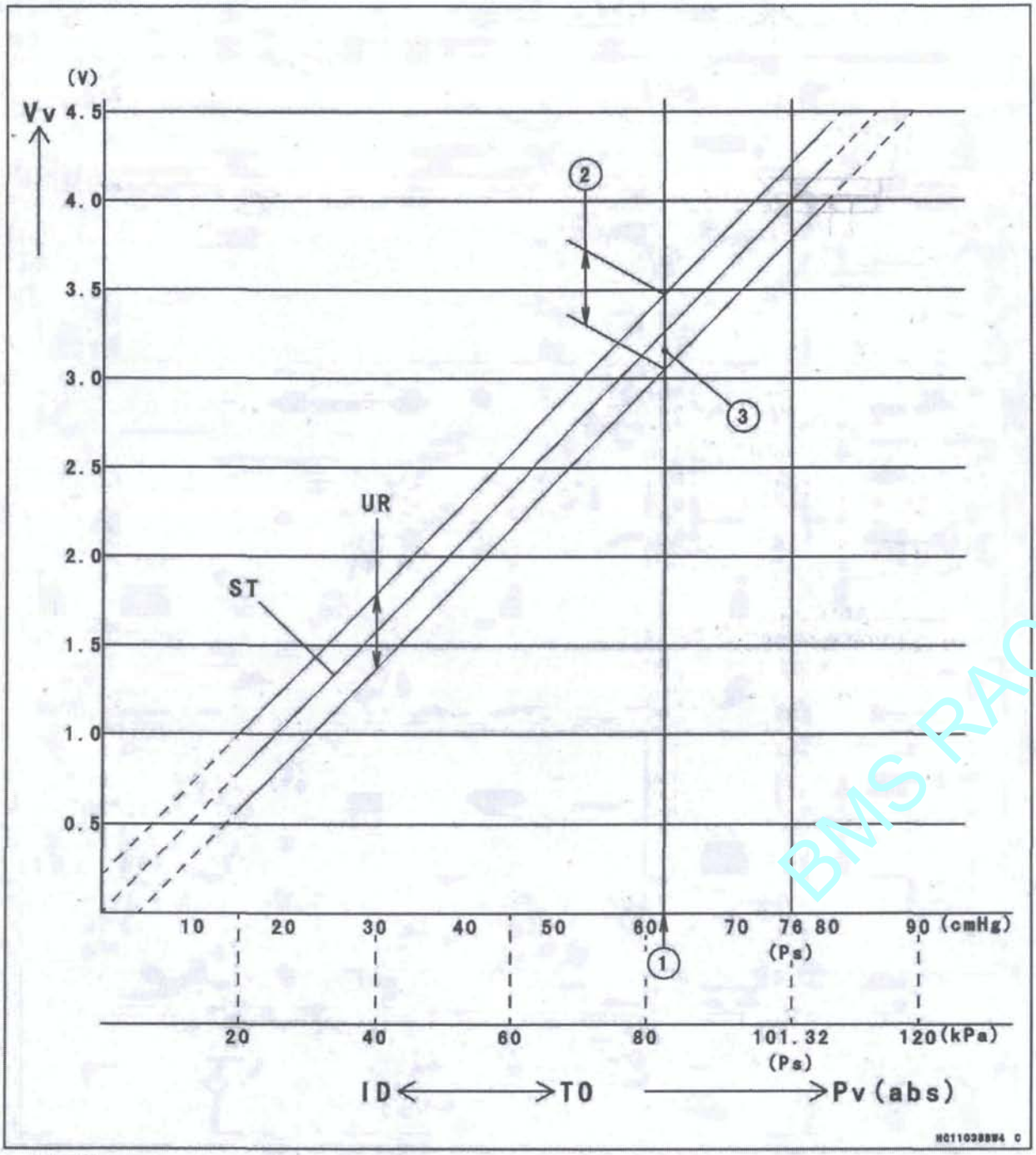
For example, suppose the following data is obtained:
Pg = 8 cmHg (Vacuum gauge reading)
Pl = 70 cmHg (Varometer reading)
Vv = 3.2 V (Digital meter reading)

then
Pv = 70 – 8 = 62 cmHg (Abs.)

Plot this Pv (62 cmHg) at a point [1] on the chart and draw a vertical line through the point. Then, you can get the usable range [2] of the sensor output voltage.
Usable range = 3.04 ~ 3.49 V

Plot Vv (3.2 V) on the vertical line. → Point [3].
Results: In the chart, Vv is within the usable range and the sensor is normal.

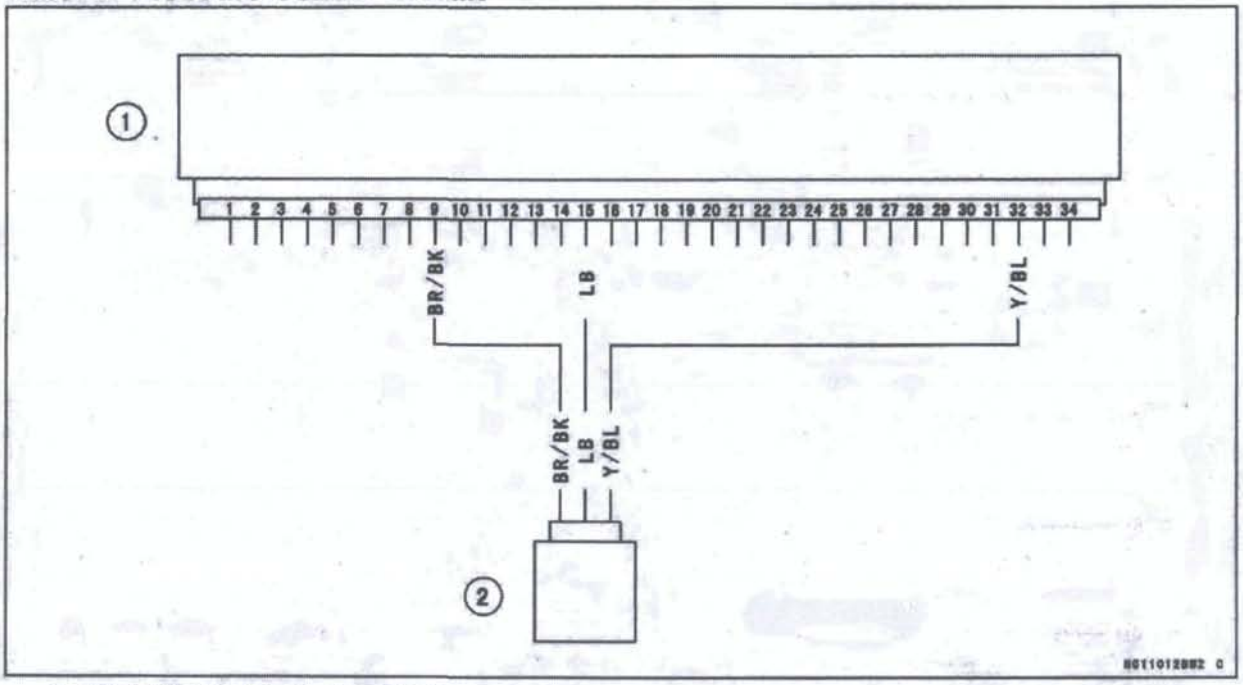
Inlet Air Pressure Sensor (Service Code 12)



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

Inlet Air Pressure Sensor (Service Code 12)

Inlet Air Pressure Sensor Circuit



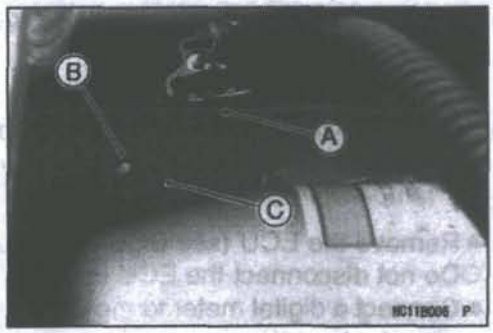
1. ECU (Electronic Control Unit)
2. Inlet Air Pressure Sensor

Inlet Air Temperature Sensor (Service Code 13)

Inlet Air Temperature Sensor Removal/Installation

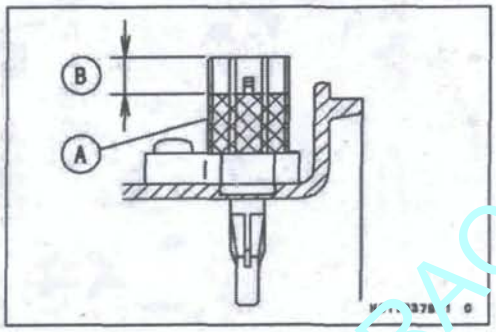
CAUTION

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



- Remove the seat (see Seat Removal in the Frame chapter).
- Disconnect the connector [A].
- Remove the screw [B].
- Pull out the inlet air temperature sensor [C].
- Put the inlet air temperature sensor into the air cleaner housing.
- Tighten:

Torque - Inlet Air Temperature Sensor Mounting Screw: 4.9 N·m (0.50 kgf·m, 43 in·lb)

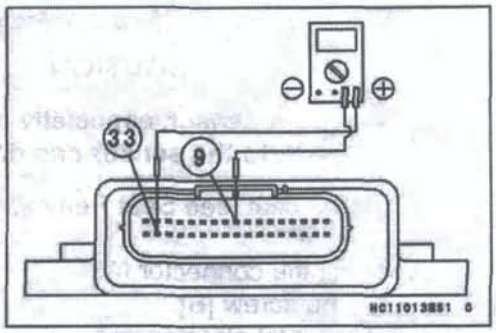


- Apply silicone sealant (Three Bond TB1221C) [A] to the air temperature sensor as shown.
  [B] about 7 mm (0.28 in.)
- Connect the sensor and harness connector.

○After finishing the application of the sealant, connect the harness connector within 15 minutes.

Inlet Air Temperature Sensor (Service Code 13)

Inlet Air Temperature Sensor Output Voltage Inspection



NOTE

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

- Remove the ECU (see ECU Removal).

○Do not disconnect the ECU connectors.

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

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Temperature Sensor Output Voltage Connections to ECU Connector

Meter (+) → Y lead (terminal 33)

Meter (–) → BR/BK lead (terminal 9)

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

Output Voltage at ECU

Standard: About 2.26 ~ 2.50 V at inlet air temperature 25°C (77°F)

- Turn the ignition switch OFF.

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

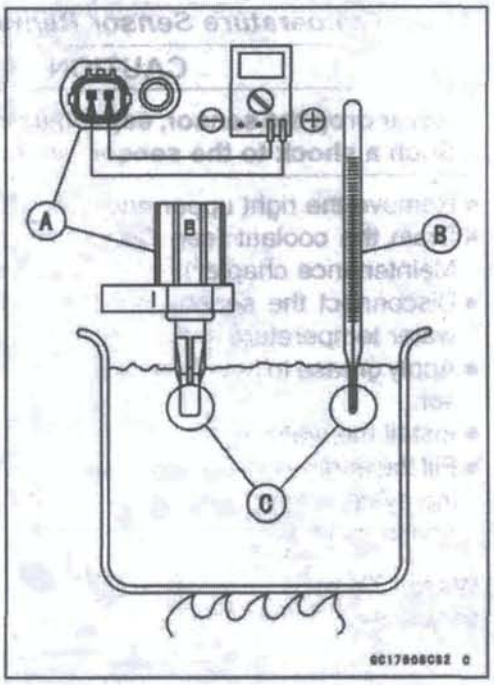
★If the wiring is good, check the sensor resistance (see Inlet Air Temperature Sensor Resistance).

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

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

Inlet Air Temperature Sensor (Service Code 13)

Inlet Air Temperature Sensor Resistance Inspection



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

NOTE

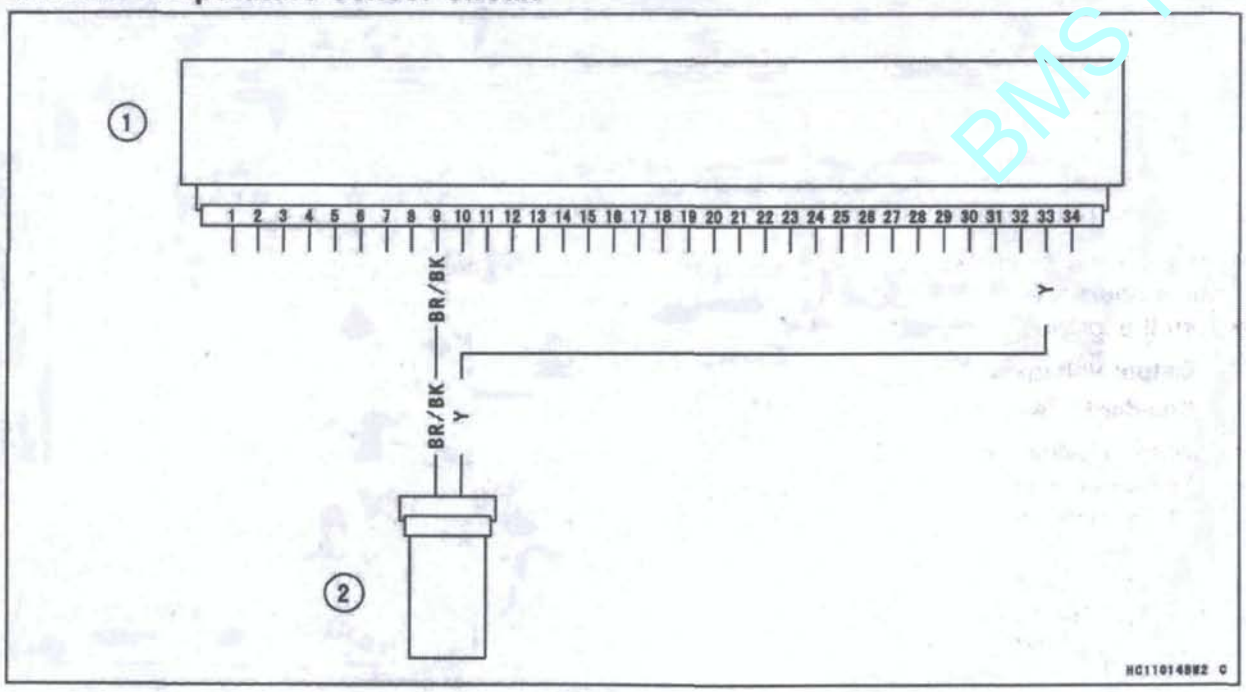
○*The sensor and thermometer must not touch the container side or bottom.*

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

Inlet Air Temperature Sensor Resistance
Standard: 5.4 ~ 6.6 kΩ at 0°C (32°F)
0.29 ~ 0.39 kΩ at 80°C (176°F)

★If the measurement is out of the range, replace the sensor.
★If the measurement is within the specified, replace the ECU (see ECU Removal/Installation).

Inlet Air Temperature Sensor Circuit



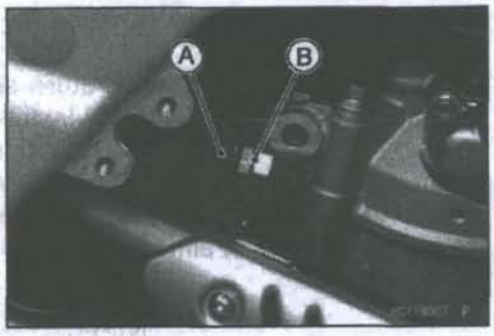
1. ECU (Electronic Control Unit)
2. Inlet Air Temperature Sensor

Water Temperature Sensor (Service Code 14)

Water Temperature Sensor Removal/Installation

CAUTION

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

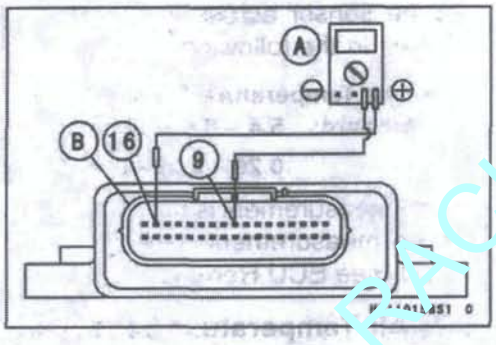


- Remove the right upper engine bracket.
- Drain the coolant (see Coolant Change in the Periodic Maintenance chapter).
- Disconnect the sensor connector [A], and unscrew the water temperature sensor [B].
- Apply grease to new O-ring on the water temperature sensor.
- Install the water temperature sensor.
- Fill the engine with coolant and bleed the air from the cooling system (see Coolant Change in the Periodic Maintenance chapter).

Water Temperature Sensor Output Voltage Inspection

NOTE

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



- Remove the ECU (see ECU Removal).

○Do not disconnect the connectors.

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

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage
Connections to ECU Connector
Meter (+) → O lead (terminal 16)
Meter (–) → BR/BK lead (terminal 9)

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

Output Voltage at ECU

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

- Turn the ignition switch OFF.

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

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

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

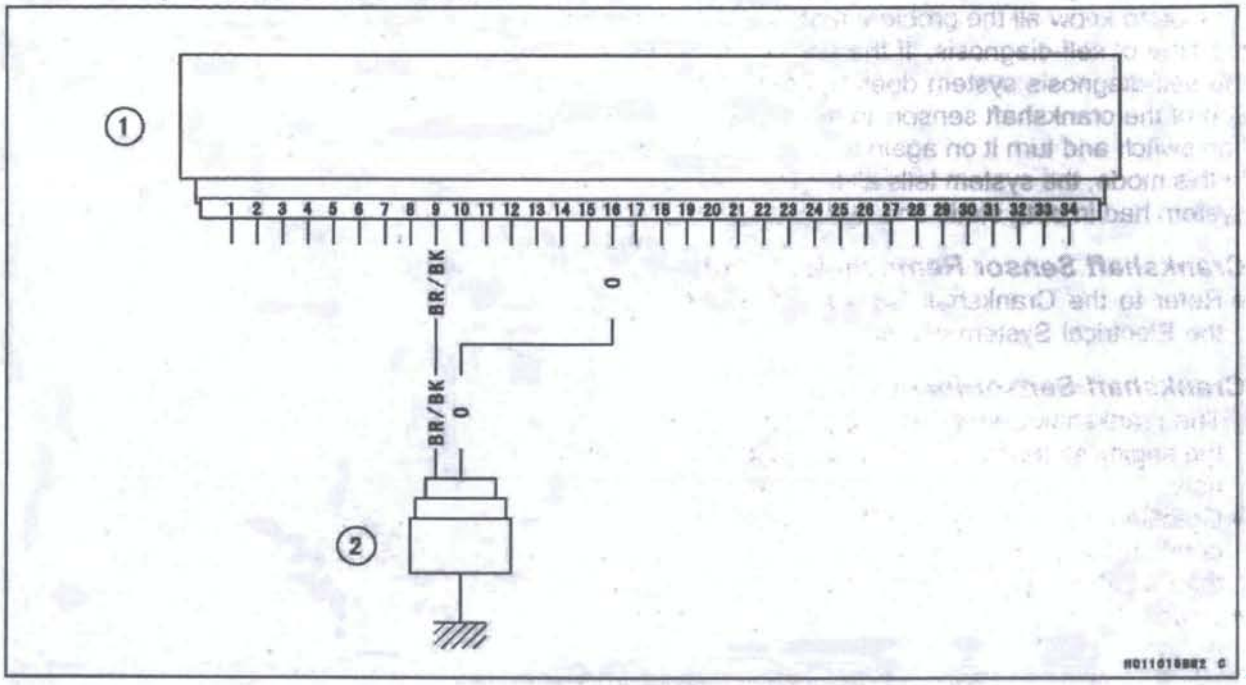
★If the wiring is good, check the water temperature sensor resistance (see Water Temperature Sensor Resistance Inspection in the Electrical System chapter).

Water Temperature Sensor Resistance Inspection

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

Water Temperature Sensor (Service Code 14)

Water Temperature Sensor Circuit



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

Crankshaft Sensor (Service Code 21)

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

Crankshaft Sensor Removal/Installation

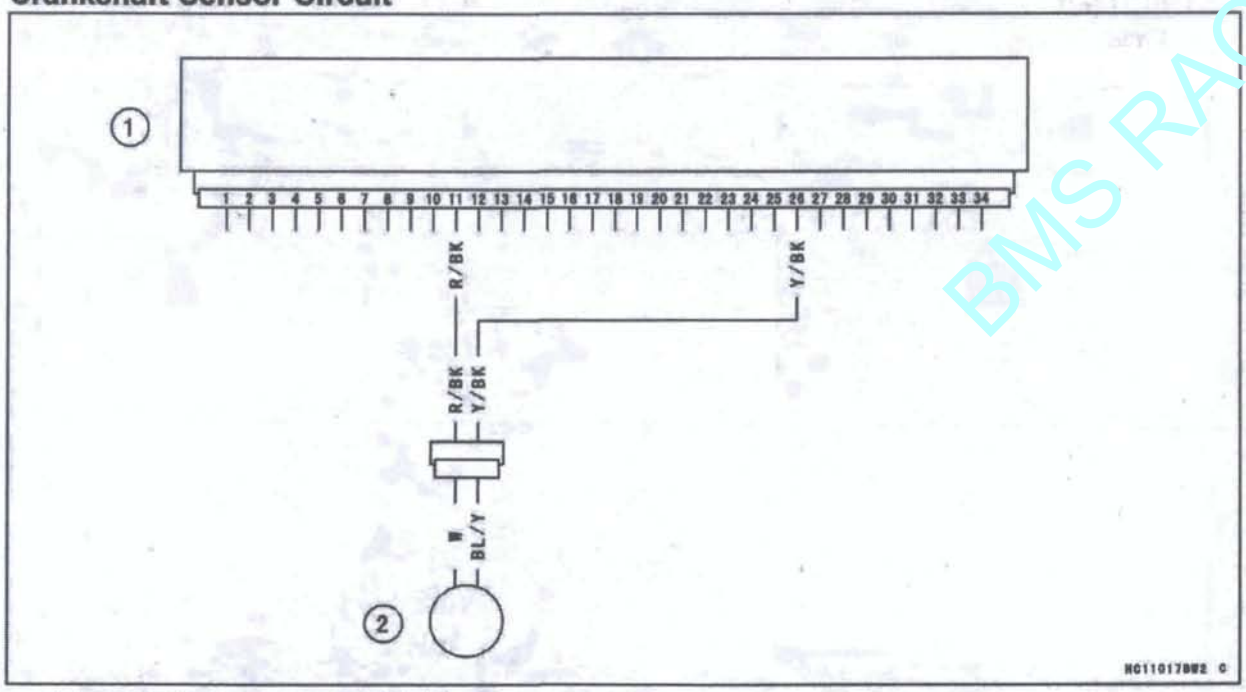
- Refer to the Crankshaft Sensor Removal/Installation in the Electrical System chapter.

Crankshaft Sensor Inspection

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

- Cranking the engine and measure the peak voltage of the crankshaft sensor (see Crankshaft Sensor Inspection in the Electrical System) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.

Crankshaft Sensor Circuit



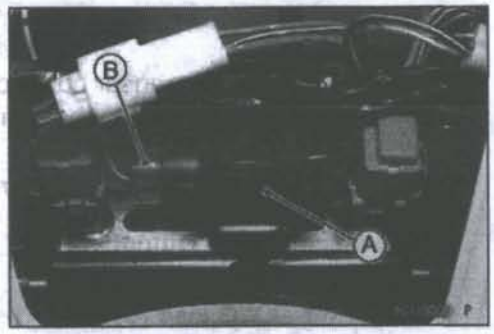
1. ECU (Electronic Control Unit)
2. Crankshaft Sensor

Vehicle-down Sensor (Service Code 31)

Vehicle-down Sensor Removal

CAUTION

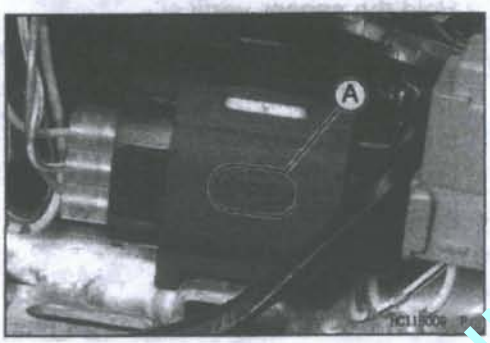
Never drop the vehicle-down sensor, especially on a hard surface. Such a shock to the sensor can damage it.



- Remove:
  Upper Cover (see Upper Cover Removal in the Frame chapter)
  Vehicle-down Sensor [A]
  Connector [B]

Vehicle-down Sensor Installation

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



⚠ WARNING

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

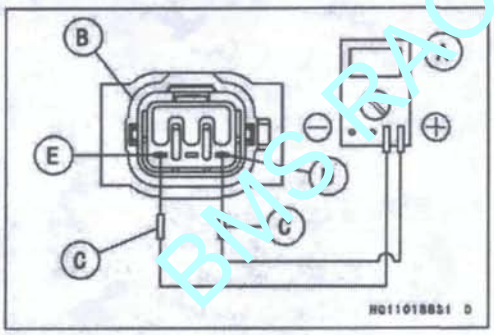
Vehicle-down Sensor Inspection

NOTE

○*Be sure the battery is fully charged.*

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

Special Tool - Needle Adapter Set: 57001-1457



Vehicle-down Sensor Power Source Voltage
Connections to Sensor Connector
Meter (+) → LB lead [D]
Meter (–) → BR/BK lead [E]

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

Input Voltage at Sensor
Standard: DC 4.75 ~ 5.25 V

- Turn the ignition switch OFF.

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

Vehicle-down Sensor (Service Code 31)

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

Special Tool - Needle Adapter Set: 57001-1457

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

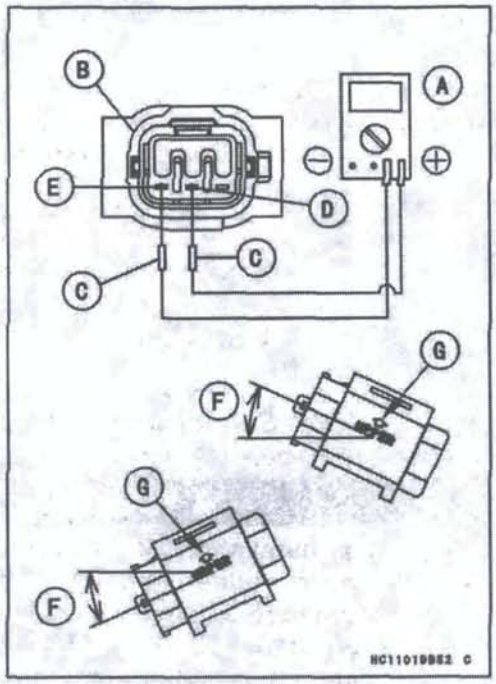
● Hold the sensor vertically.
● Turn the ignition switch ON, and measure the output voltage with the connector joined.
○Tilt the sensor 15 ~ 35° or more [F] right or left, then hold the sensor almost vertical with the arrow mark [G] pointed up, and measure the output voltage.

Output Voltage at Sensor
Standard: with sensor tilted 15 ~ 35° or more right or left: 0.4 ~ 1.4 V
with sensor arrow mark pointed up: 3.7 ~ 4.4 V

NOTE

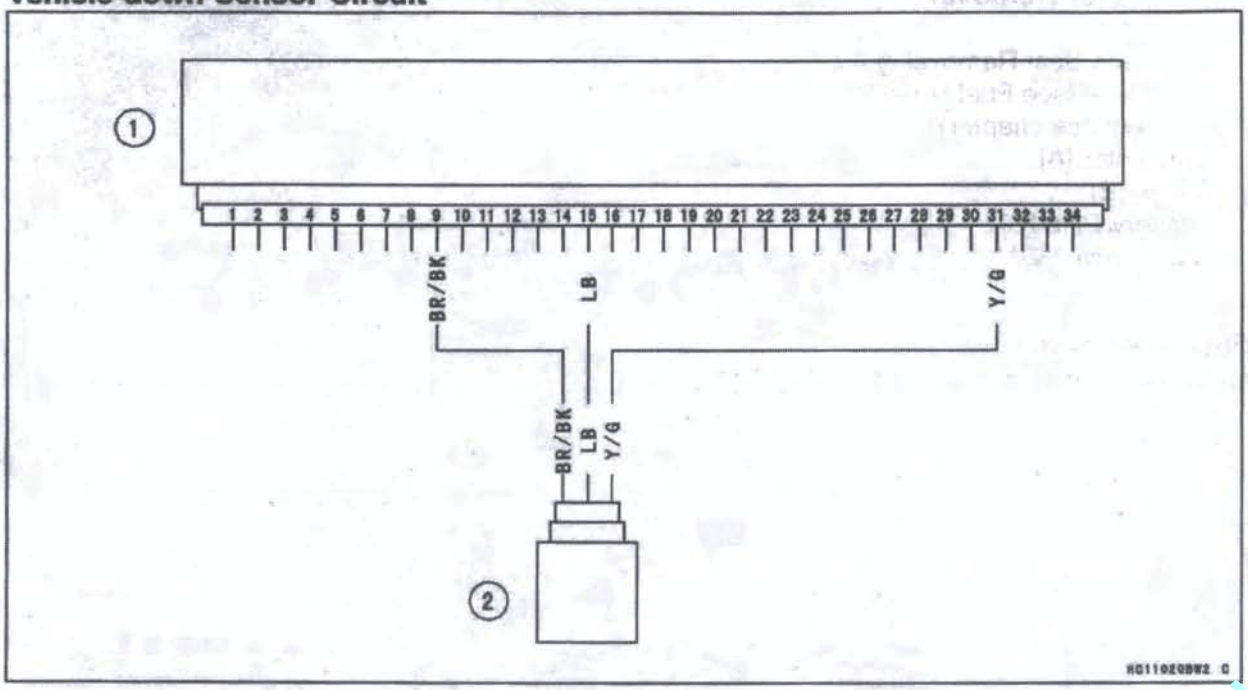
○*If you need to test again, turn the ignition switch OFF, and then ON.*

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



Vehicle-down Sensor (Service Code 31)

Vehicle-down Sensor Circuit

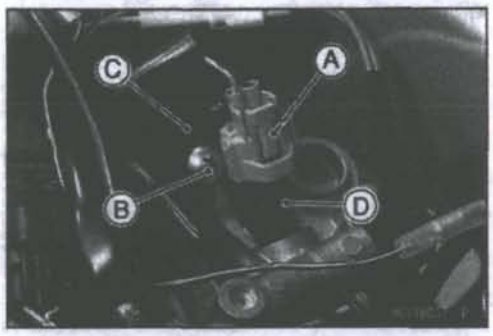


1. ECU (Electronic Control Unit)
2. Vehicle-down Sensor

Fuel Injector (Service Code 41)

Fuel Injector Removal

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
  Connector [A]
  Screw [B]
  Delivery Pipe [C]
  Fuel Injector [D]

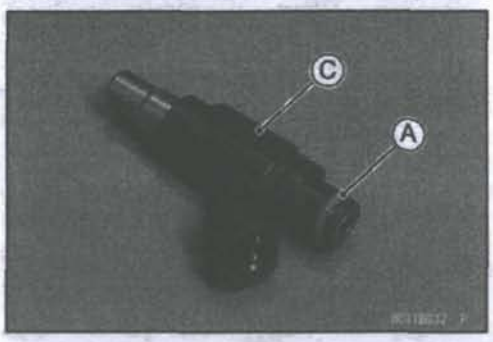


Fuel Injector Installation

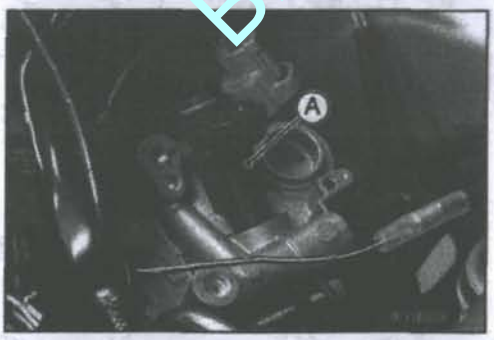
- Replace the O-ring [A] and seal [B] with a new one.

○Before installation, blow away dirt or dust from the delivery pipe by applying compressed air.

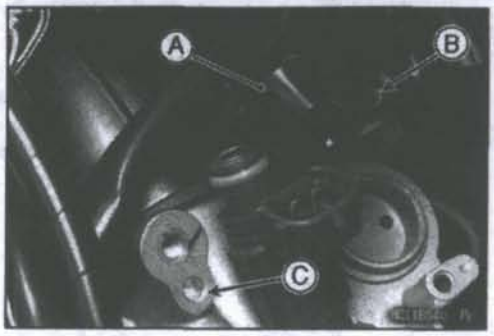
- Apply grease to the O-ring of the injector [C].



- Install the injector [A] to the throttle body assy.



- Install the delivery pipe [A] so that the projection [B] fit to the hollow [C] on the throttle body assy.
- Tighten the screw securely.



Fuel Injector (Service Code 41)

Audible Inspection

- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [B]. Put the grip end onto your ear, and listen whether the injector is clicking or not.

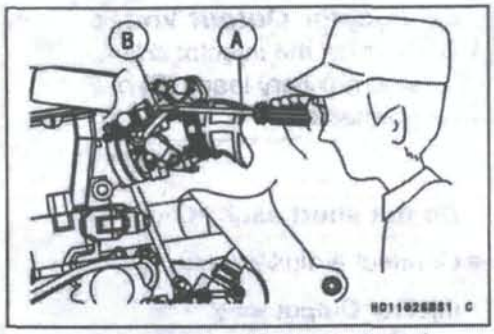
○A sound scope [C] can also be used.

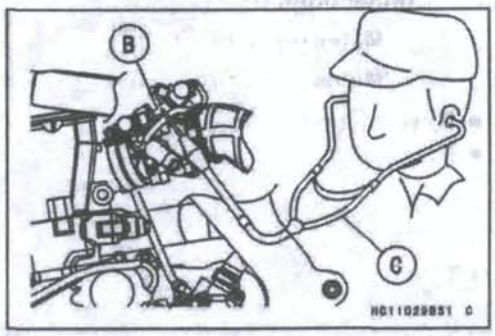
- Do the same for the other injectors.

★If all the injectors click at a regular intervals, the injectors are good. The trouble may be related to the fuel line, requiring fuel pressure inspection (see Fuel Pressure Inspection).

○The click interval becomes shorter as the engine speed rises.

★If any injector(s) doesn't click, the DFI circuit or the injector is suspect. Perform "Fuel Injector Power Source Voltage Inspection", first.





Fuel Injector Power Source Voltage Inspection

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

CAUTION
Do not short each terminals.

- Connect a digital meter [D] as shown.

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

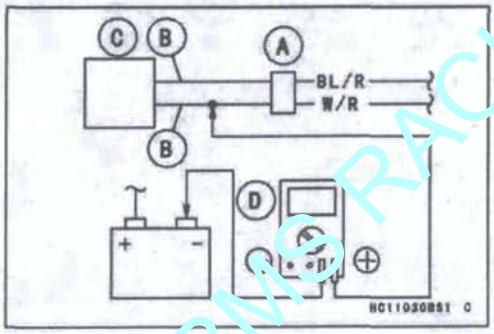
- Measure the power source voltage with the engine stopped, and with the connector joined.
- Turn the engine stop switch to run position.
- Turn the ignition switch ON.

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

- Turn the ignition switch OFF.

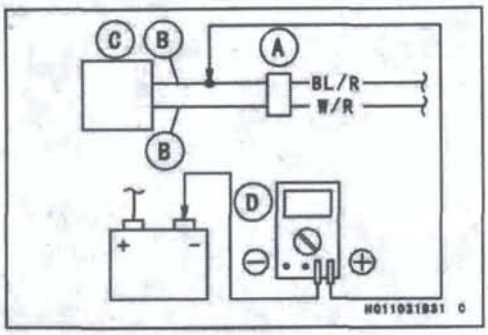
★If the meter doesn't read as specified, check the following.
Main Fuse 30 A (see Fuse Inspection in the Electrical System chapter)
Fuel Pump Relay (see Relay Circuit Inspection in the Electrical System chapter)
Power Source Wiring (see wiring diagram below)

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



Fuel Injector (Service Code 41)

Fuel Injector Output Voltage Inspection



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

CAUTION

Do not short each terminals.

- Connect a digital meter [D] as shown.

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

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

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

- Turn the ignition switch OFF.

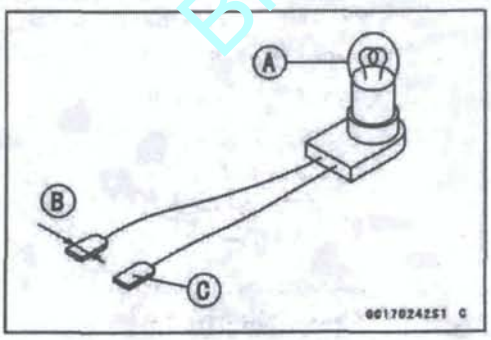
★If the output voltage is normal, perform "Injector Signal Test".
★If the output voltage is out of the standard, remove the ECU (see ECU Removal/Installation), and check the injector wiring for continuity.

Injector Wiring Inspection

ECU Connector		Injector Connectors
Terminal 18	→	Injector Terminal (BL/R)

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

Injector Signal Test

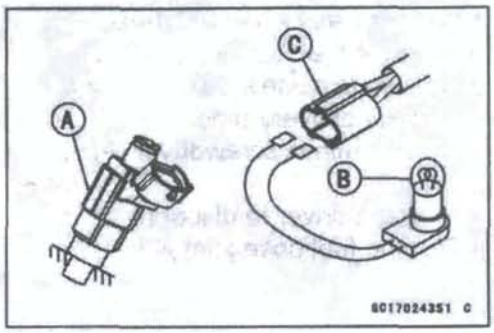


- Prepare two test light sets with terminals as shown.
  Rating of Bulb [A]: 12 V × 3 ~ 3.4 W
  Terminal Width [B]: 1.8 mm (0.071 in.)
  Terminal Thickness [C]: 0.8 mm (0.031 in.)

CAUTION

Do not use larger terminals than specified above. A larger terminal could damage the injector main harness connector, leading to harness repair or replacement.
Be sure to connect bulbs in series. The bulb works as a current limiter to protect the solenoid in the injector from excessive current.

Fuel Injector (Service Code 41)



- Remove:
  Fuel Tank (see Fuel Tank Removal)
- Disconnect the connectors for injector [A].
- Connect each test light set [B] to the injector sub harness connector [C].
- Turn the ignition switch ON.
- While cranking the engine with the starter motor, watch the test lights.

★If the test lights flicker at regular intervals, the injector circuit in the ECU, and the wiring are good. Perform the "Injector Resistance Inspection".

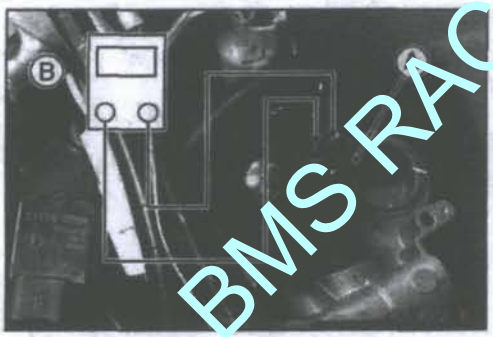
○Injector signals can be also confirmed by connecting the hand tester (× AC 10 V) instead of the test light set to the injector main harness connector. Crank the engine with the starter motor, and check to see if the hand oscillates at regular intervals.

Special Tool - Hand Tester: 57001-1394

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

★If the wiring is good, replace the ECU (see ECU Removal/Installation).

Injector Resistance Inspection



- Remove:
  Fuel Tank (see Fuel Tank Removal)
- Disconnect the connector from the injector [A].
- Measure the injector resistance with the hand tester [B].

Special Tool - Hand Tester: 57001-1394

Injector Resistance
Connections to Injector Connector

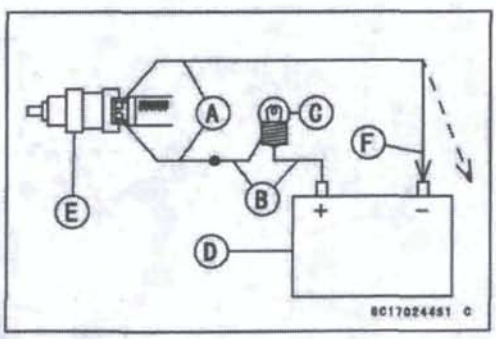
Meter (+)	Meter (–)
W/R ⟷	BL/R Terminal

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

★If the reading is out of the range, perform the "Injector Unit Test".

★If the reading is normal, perform the "Injector Unit Test" for confirmation.

Injector Unit Test



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

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

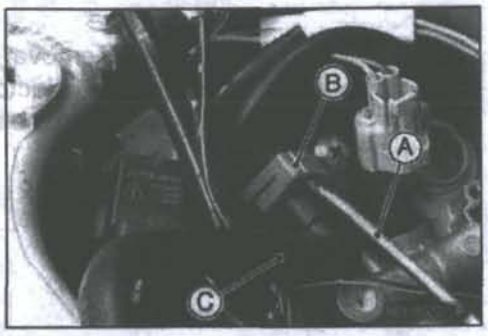
- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the lead to the battery (–) terminal repeatedly. The injector should click.

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

Fuel Injector (Service Code 41)

Injector Fuel Line Inspection

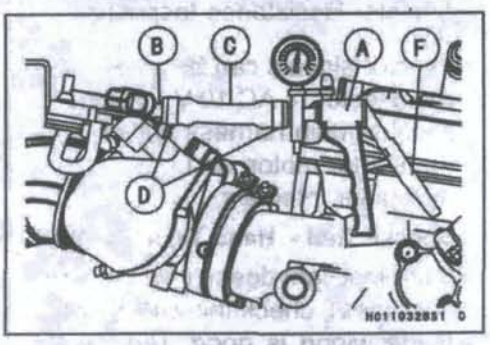
- Remove the fuel tank (see Fuel Tank Removal).
- Be sure to place a piece of cloth around the fuel hose joint and the delivery pipe.
- Insert a minus screwdriver [A] into the slit on the joint lock [B].
- Turn the driver to disconnect the joint lock.
- Pull the fuel hose joint [C] out of the delivery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



- Check the injector fuel line for leakage as follows.

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

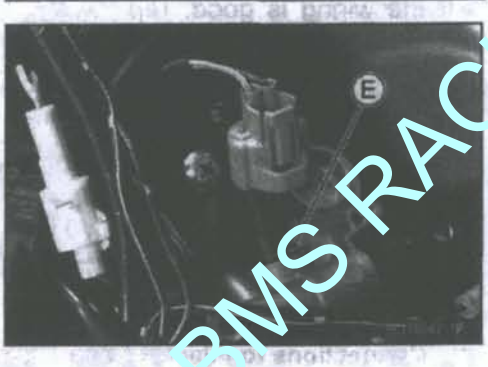
Torque - Fuel Hose Clamp Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)



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

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

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



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

- Watch the gauge for at least 6 seconds.

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

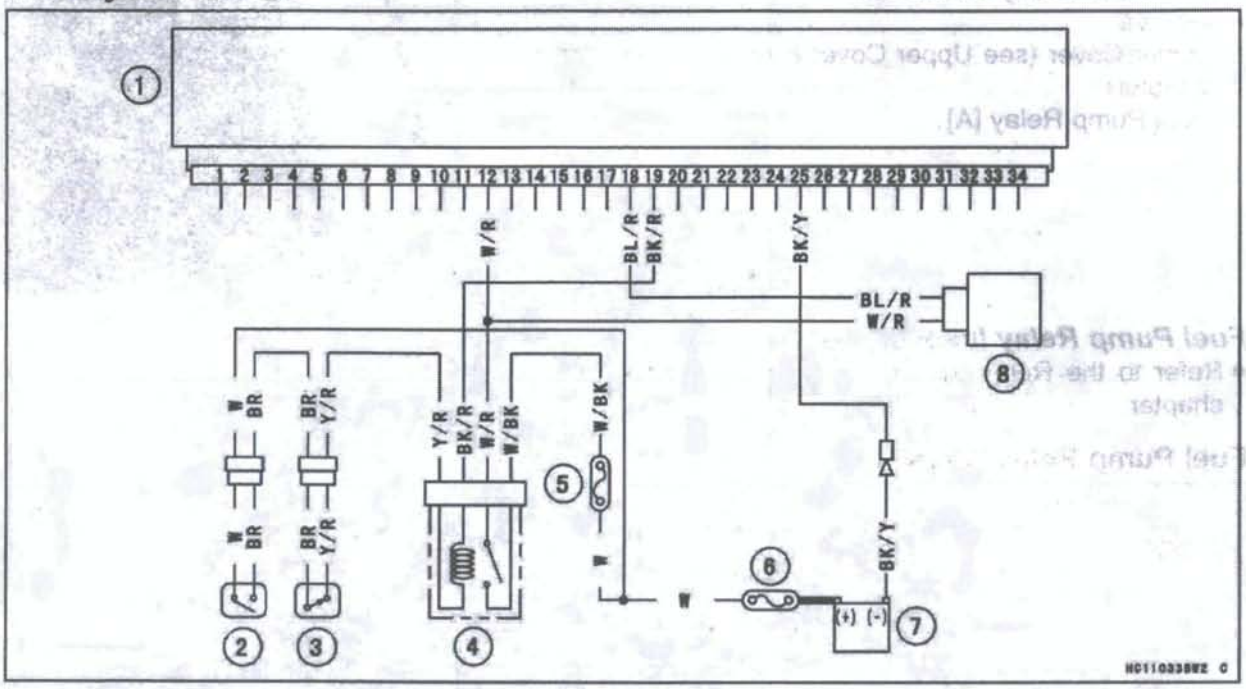
★If the pressure drops at once or if bubbles are found in the area, the line is leaking. Replace the delivery pipe, injectors and related parts.

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

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

Fuel Injector (Service Code 41)

Fuel Injector Circuit

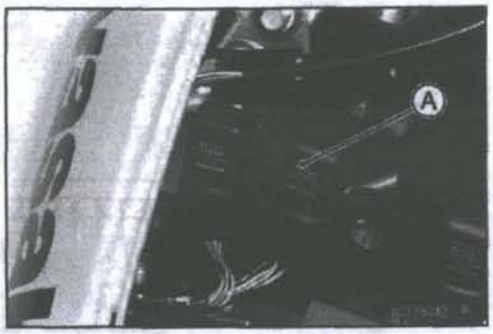


1. ECU (Electronic Control Unit)
2. Ignition Switch
3. Engine Stop Switch
4. Fuel Pump Relay
5. Fuel Pump Fuse 10 A
6. Main Fuse 30 A
7. Battery 12 V 6 Ah
8. Fuel Injector

Fuel Pump Relay (Service Code 46)

Fuel Pump Relay Removal

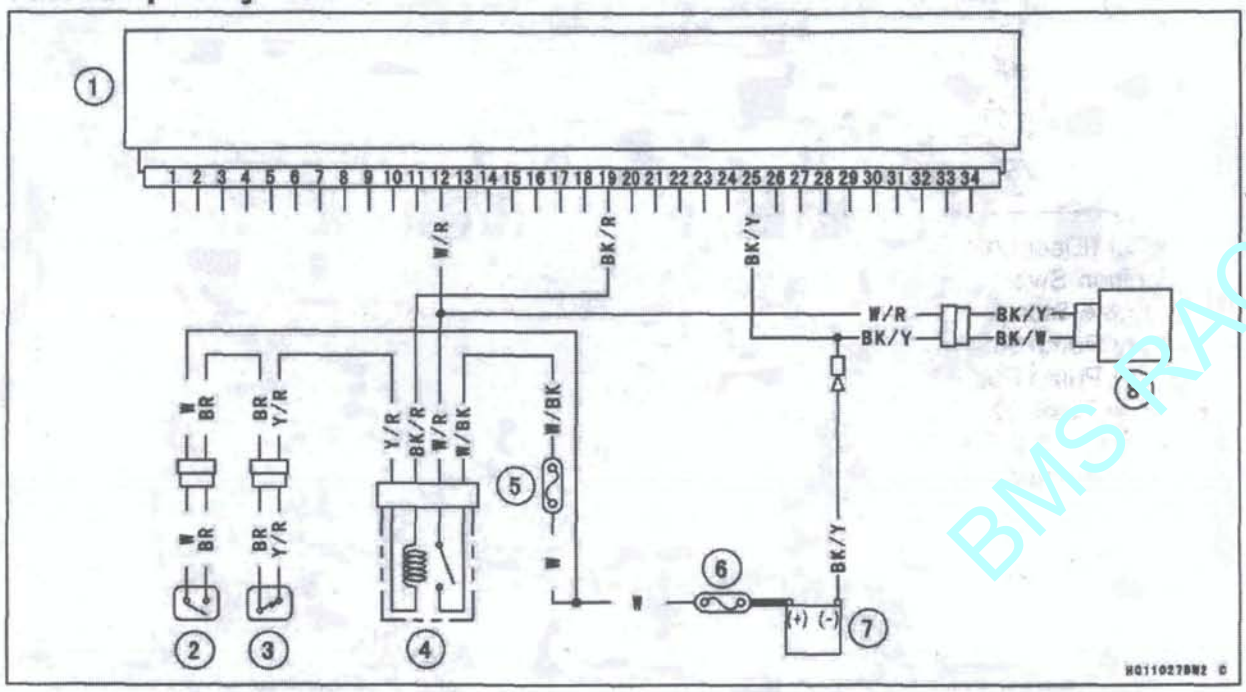
- Remove:
  Upper Cover (see Upper Cover Removal in the Frame chapter)
  Fuel Pump Relay [A]



Fuel Pump Relay Inspection

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

Fuel Pump Relay Circuit

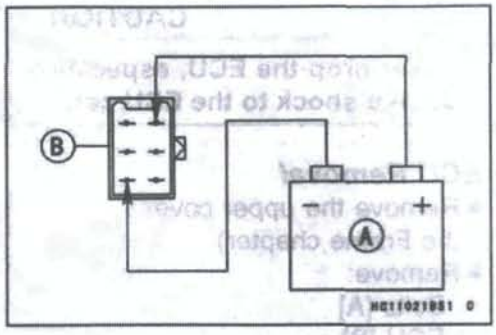


1. ECU (Electronic Control Unit)
2. Ignition Switch
3. Engine Stop Switch
4. Fuel Pump Relay
5. Fuel Pump Fuse 10 A
6. Main Fuse 30 A
7. Battery 12 V 6 Ah
8. Fuel Pump

FI Indicator Light

FI Indicator Light Inspection

- Remove the upper cover (see Upper Cover Removal in the Frame chapter).
- Using two auxiliary leads, supply battery power to the FI indicator light.
  12 V Battery [A]



FI Indicator Light Check

Connector: **Indicator Unit Connector [B] (disconnected)**

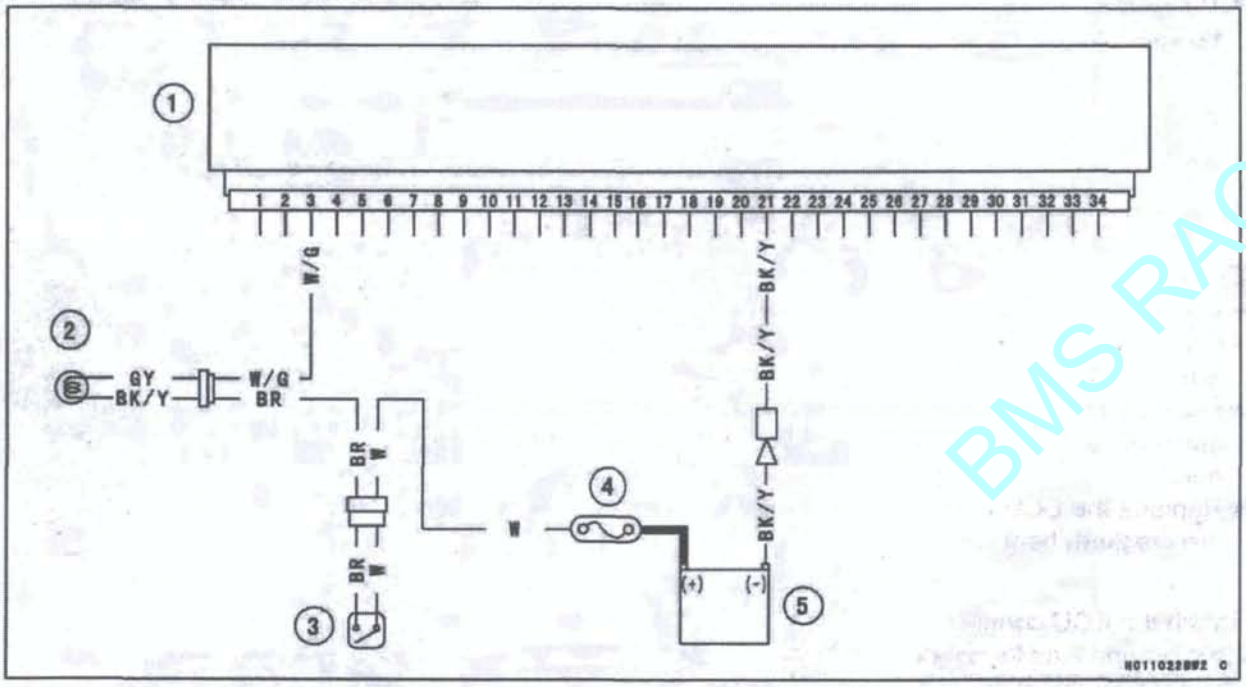
Connection: **GY Lead Terminal of the Indicator Unit → Battery (+) Terminal**

BK/Y Lead Terminal of the Indicator Unit → Battery (–) Terminal

Criterion: **The light should light.**

★If the light does not go on, replace the indicator unit .

FI Indicator Light Circuit



1. ECU (Electronic Control Unit)
2. Water Temperature Warning/FI Indicator Light
3. Ignition Switch
4. Main Fuse 30 A
5. Battery 12 V 6 Ah

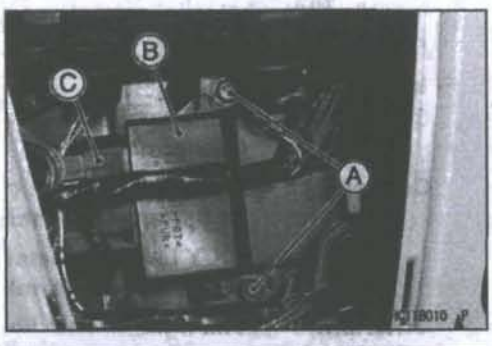
ECU

CAUTION

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

ECU Removal

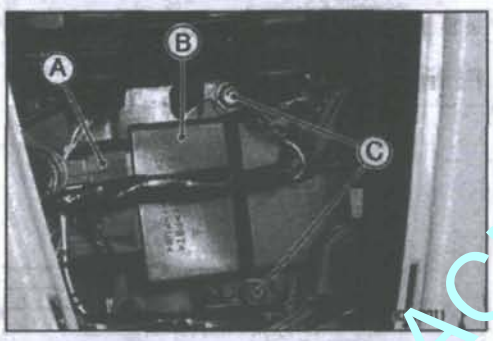
- Remove the upper cover (see Upper Cover Removal in the Frame chapter).
- Remove:
  Bolts [A]
  ECU [B]
- Disconnect the ECU connector [C].



ECU Installation

- Connect the ECU connector [A] to the ECU [B].
- Tighten:

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



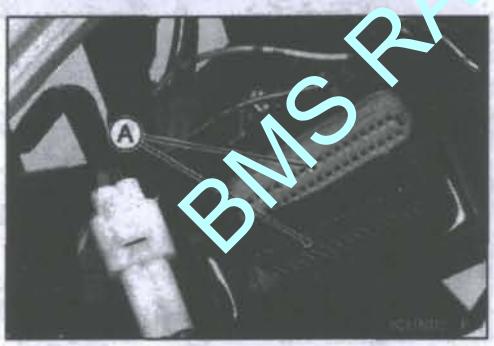
ECU Power Supply Inspection

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

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

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

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



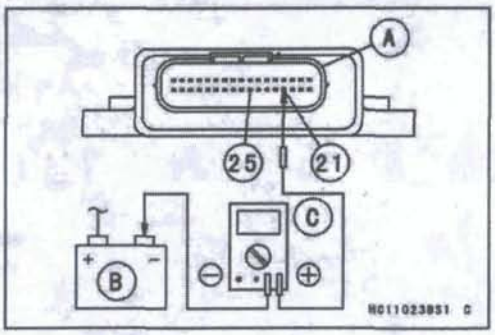
- With the ECU connector [A] connected, check the following ground lead for continuity with the ignition switch OFF, using a digital meter and needle adapter set.
  Battery [B]
  Digital Meter [C]

Special Tool - Needle Adapter Set: 57001-1457

ECU Grounding Inspection

21 or 25 (BK/Y) Terminal ⟷ Battery (–) Terminal: 0 Ω

Engine Ground ⟷ Battery (–) Terminal: 0 Ω



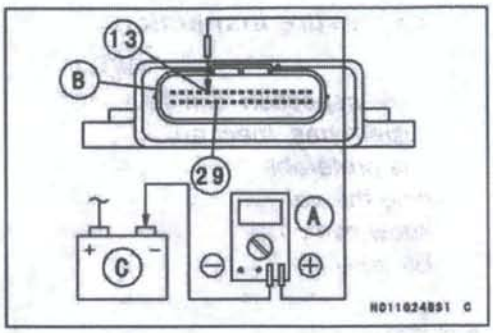
★If no continuity, check the connector, the engine ground lead, or main harness, and repair or replace them if necessary.

ECU

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

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

Battery [C]



ECU Power Source Inspection

Meter Connections:

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

Between Terminal 29 (BR) and Battery (–) Terminal

Ignition Switch OFF:

Terminal 13 (W): 0 V

Terminal 29 (BR): Battery Voltage

Ignition Switch ON:

Both: Battery Voltage

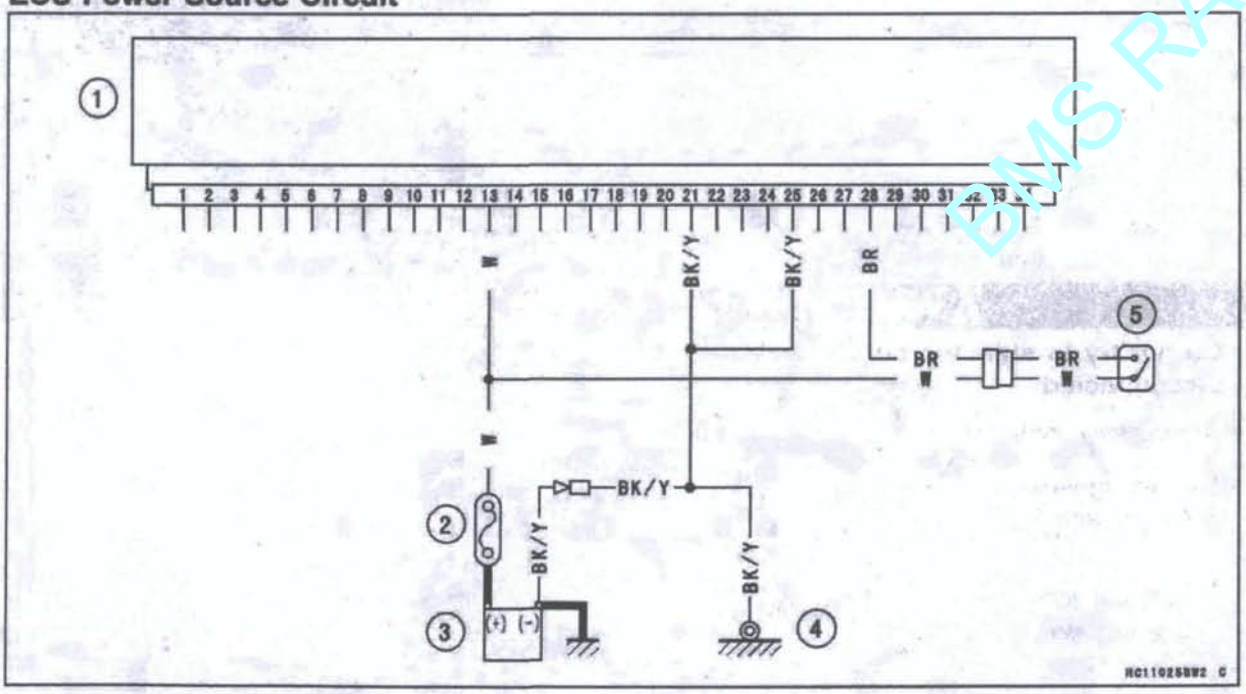
★If the meter does not read as specified, check the following.

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

Power Source Wiring (see wiring diagram in this section)

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

ECU Power Source Circuit



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

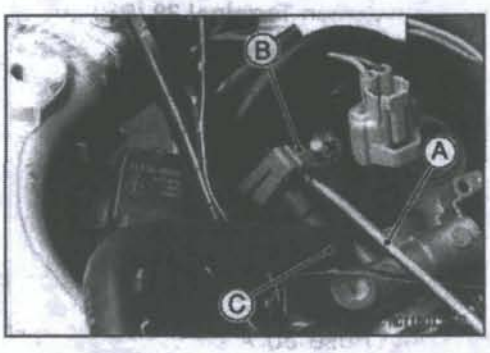
Fuel Line

Fuel Pressure Inspection

NOTE

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

- Remove the fuel tank (see Fuel Tank Removal).
- Be sure to place a piece of cloth around the fuel hose joint and the delivery pipe.
- Insert a minus screwdriver [A] into the slit on the joint lock [B].
- Turn the driver to disconnect the joint lock.
- Remove the fuel hose [C].

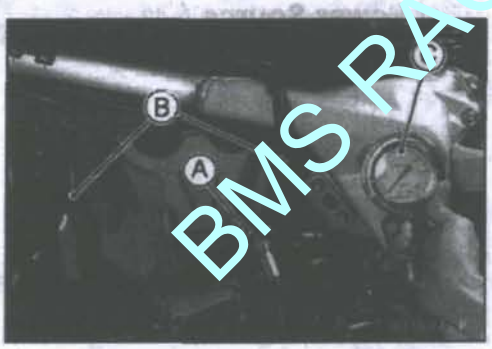


⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.
When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

- Install the fuel pressure gauge adapter [A] and fuel hoses (Special Tool: 57001-1607) [B] between the fuel pump outlet pipe and the delivery pipe.
- Connect the pressure gauge [C] to the fuel pressure gauge adapter.

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



⚠ WARNING

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

- Temporarily, install the fuel tank.
- Turn the ignition switch ON. The fuel pump will turn for 3 seconds, and then stop.

NOTE

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

CAUTION

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

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

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

Fuel Line

NOTE

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

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

★If the fuel pressure is much lower than specified, check the following.
Fuel Line Leakage
Amount of Fuel Flow (see Fuel Flow Rate Inspection)

★If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the throttle body assy, or the fuel pump and measure the fuel pressure again (see appropriate sections).

- Remove the fuel pressure gauge, hoses and adapter.
- Install:
  Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
  Fuel Tank (see Fuel Tank Installation)

Fuel Flow Rate Inspection

NOTE

○Be sure the battery is fully charged.

⚠ WARNING

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

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

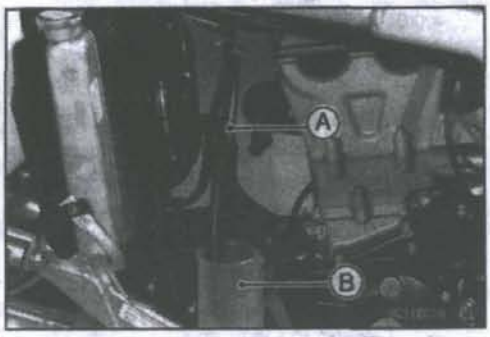
Special Tool - Fuel Hose: 57001-1607

- Remove the fuel tank bolts (see Fuel Tank Removal).
- Open the fuel tank cap [A] to lower the pressure in the tank.
- Be sure to place a piece of cloth around the fuel pump outlet pipe.
- Remove the fuel hose from the fuel pump (see Fuel Tank Removal).

Fuel Line

⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.
When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.



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

⚠ WARNING

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

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

CAUTION

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

- Measure the discharge for 3 seconds.

○Repeat this operation several times.

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

★If the fuel flow is much less than the specified, check the battery condition (see Charging Condition Inspection in the Electrical System chapter).

★If the battery is good, replace the fuel pump (see Fuel Pump Removal/Installation).

- After inspection, connect the fuel hose (see Fuel Tank Installation).
- Start the engine and check for fuel leakage.

Fuel Pump

Fuel Pump Removal

CAUTION

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

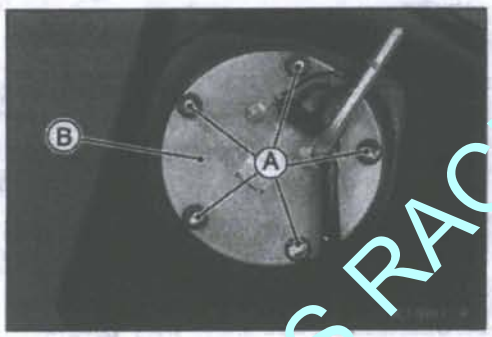
⚠ WARNING

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.

- Draw the fuel out from the fuel tank with a commercially available electric pump.
- Remove the fuel tank (see Fuel Tank Removal).

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

- Turn the fuel tank upside down.
- Remove:
  Fuel Pump Bolts [A]
  Fuel Pump [B] and O-ring
- Discard the fuel pump O-ring.

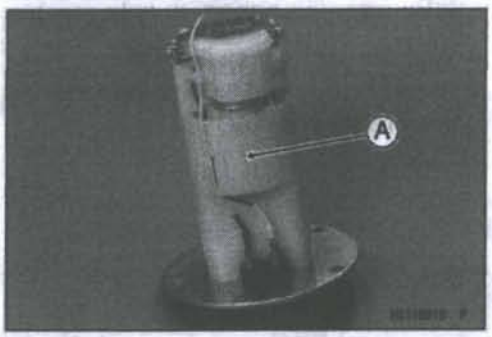


CAUTION

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

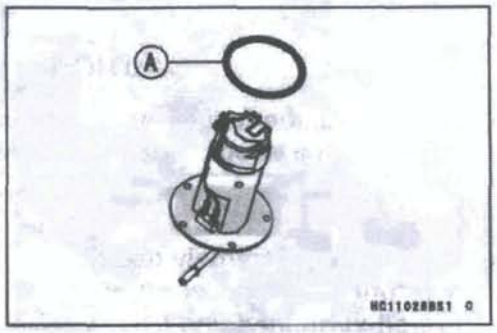
Fuel Pump Installation

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



Fuel Pump

- Replace the O-ring [A] with a new one.



- Apply a non-permanent locking agent to the threads of the fuel pump bolts.
- Tighten the fuel pump bolts to a snug fit, tighten them alternating diagonally.

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

- Tighten the pump bolts again alternating diagonally to check the tightness.

Fuel Pump Operation Inspection

NOTE

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

- Turn the ignition switch ON and make sure that the fuel pump operates (make light sounds) for 3 seconds, and then stops.
- Turn the ignition switch OFF.

★If the pump does not work as described above, inspect the operating voltage.

Fuel Pump Operating Voltage Inspection

NOTE

○Be sure the battery is fully charged.

- Turn the ignition switch OFF.
- Remove the right side cover (see Side Cover Removal in the Frame chapter).

Fuel Pump

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

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

Pump Operating Voltage at Pump Connections to Pump Connectors
Tester (+) → W/R Lead
Tester (–) → BK/Y Lead

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

○The tester needle should indicate battery voltage for 3 seconds, and then 0 V.

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

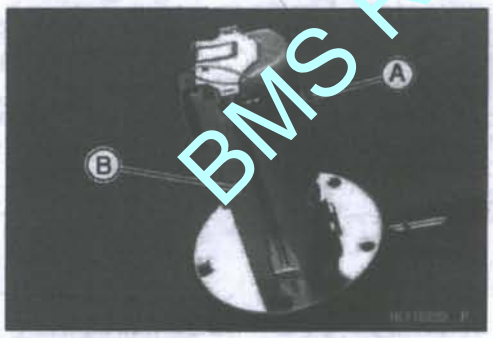
★If the reading stays on battery voltage, and never shows 0 V. Check the ECU for its ground and power supply (see ECU Power Supply Inspection) and fuel pump relay.

★If the voltage is in specification, but the pump doesn't work, replace the pump (see Fuel Pump Removal/Installation).

★If there is still no battery voltage, check the pump relay (see Relay Inspection in the Electrical System chapter).

Pressure Regulator Removal

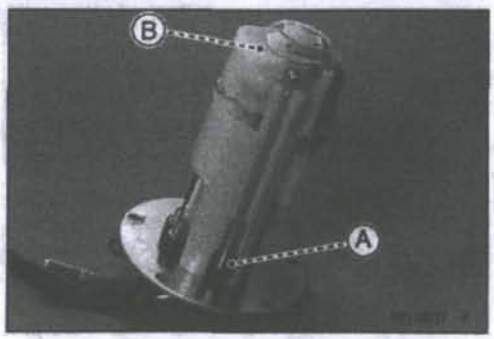
○The pressure regulator [A] is built into the fuel pump [B] and cannot be removed.



Pump Screen, Fuel Filter Cleaning

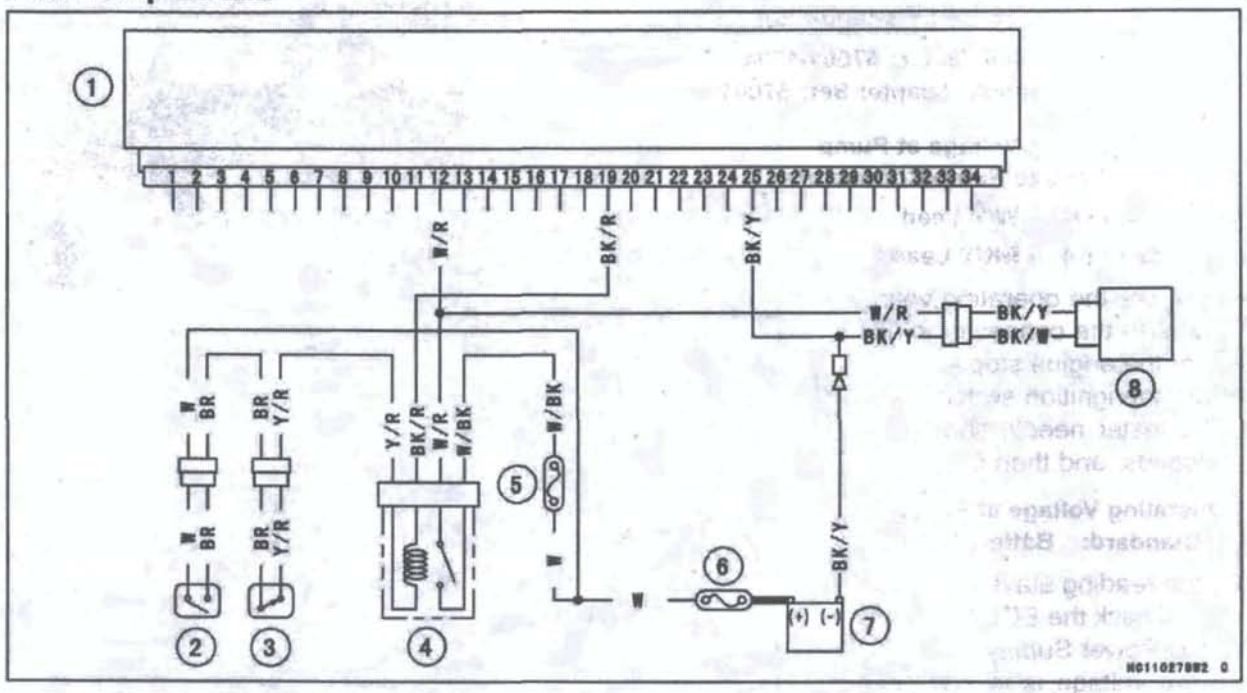
○The pump screen [A] and fuel filter [B] are built into the pump and cannot be cleaned or checked.

★If the fuel filter is suspected of clogging or being damaged, replace it with the fuel pump.



Fuel Pump

Fuel Pump Circuit



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

Throttle Lever and Cable

Throttle Lever Free Play Inspection

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

Throttle Lever Free Play Adjustment

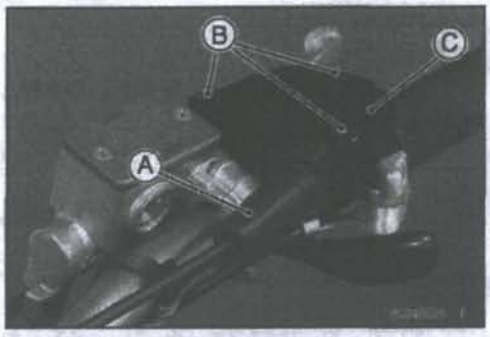
- Refer to the Throttle Lever Free Play Adjustment in the Periodic Maintenance chapter.

Throttle Cable Lubrication

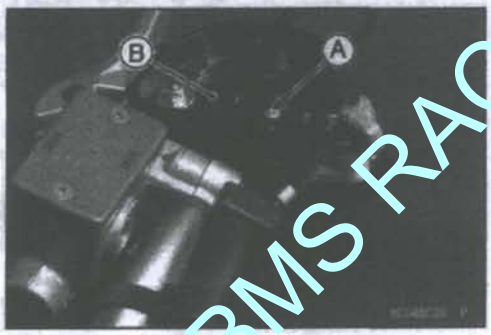
- Refer to the Lubrication in the Periodic Maintenance chapter.

Throttle Cable Removal

- Remove the throttle cable lower end from the throttle body assy (see Throttle Body Assy Removal).
- Slide the rubber cover [A] at the throttle case.
- Remove:
  Screws [B]
  Throttle Case Cover [C]



- Clear the cable upper end [A] from the throttle lever [B] to remove the throttle cable.



Throttle Cable Installation

- Install the throttle cables in accordance with Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the lower ends of the throttle cable in the cable bracket on the throttle body assy after installing the upper ends of the throttle cable in the lever.
- After installation, adjust each cable properly.

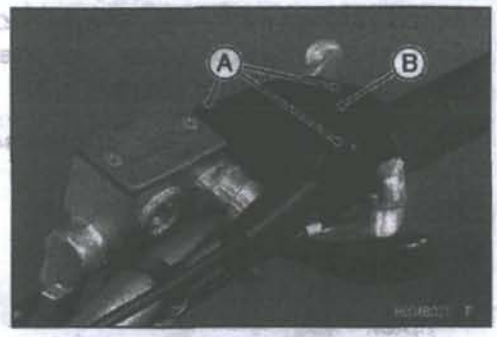
⚠ WARNING

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

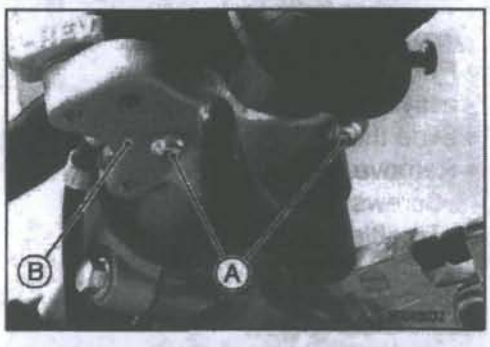
Throttle Lever and Cable

Throttle Case Removal/Disassembly

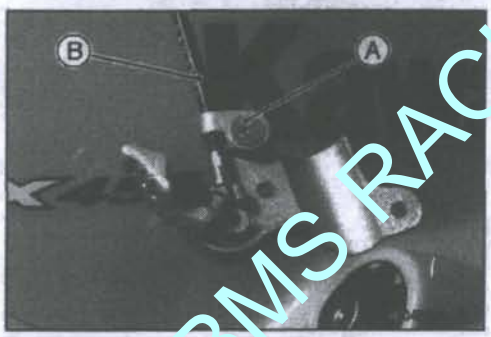
- Remove:
  Screws [A]
  Cover [B]



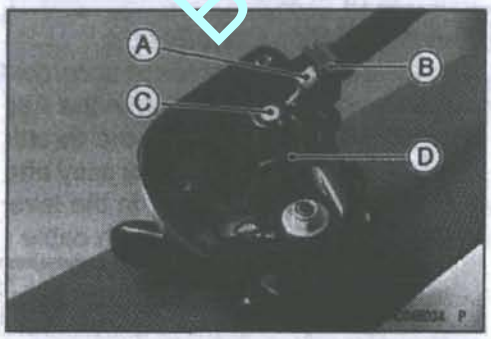
- Remove:
  Bolts [A]
- Separate the reverse cable bracket [B] and throttle lever assy.



- Remove the screw [A] to free the reverse cable [B].

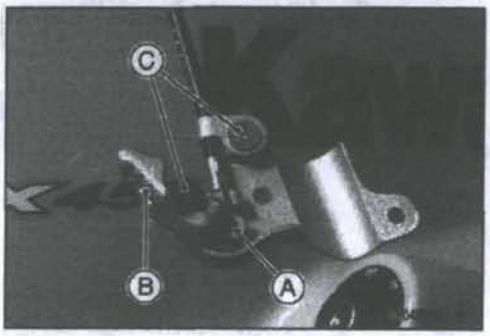


- Remove the throttle cable guide [A] and grommet [B] from the throttle lever assy.
- Clear the throttle cable upper end [C] from the throttle lever [D].



Throttle Case Assembly/Installation

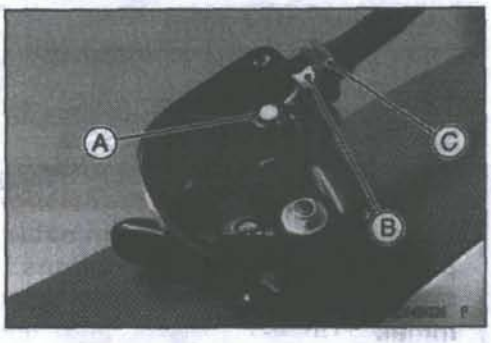
- Install the parking brake cable end [A] to the lever [B].
- Tighten the screws [C].



Throttle Lever and Cable

- Lubricate the throttle cable (see Lubrication in the Periodic Maintenance chapter).
- Apply grease to the throttle cable end [A].
- Install the throttle cable end to the throttle lever.
- Install the cable guide [B] and grommet [C] to the throttle case.
- Install the reverse cable bracket and throttle cable assy to the handlebar.
- Tighten:

Torque - Throttle Lever Assy Mounting Bolts: 3.8 N·m (0.39 kgf·m, 34 in·lb)
Throttle Case Cover Screws: 2.0 N·m (0.20 kgf·m, 18 in·lb)

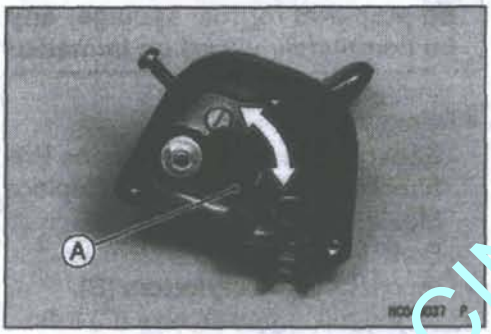


Throttle Case Inspection

- With the throttle cable disconnected from the throttle lever [A], 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 Body Assy

Idle Speed Inspection

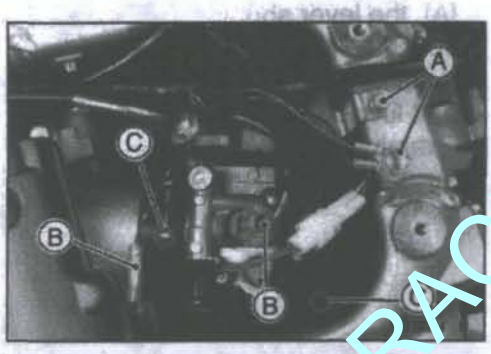
- Refer to the Idle Speed Inspection in the Periodic Maintenance chapter.

Throttle Body Assy Removal

⚠ WARNING

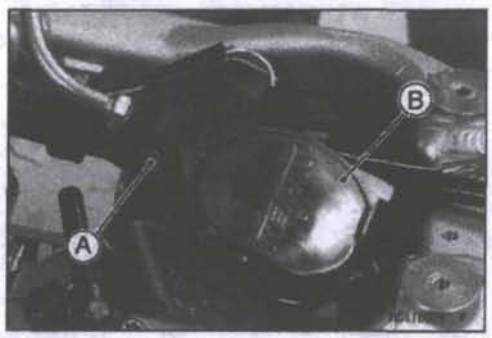
Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Disconnect the battery (–) cable terminal. Do not smoke. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.
Be prepared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

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Fuel Hose (see Fuel Hose Replacement in the Periodic Maintenance chapter)
  Bolts [A]
- Disconnect the connectors [B].
- Loosen the clamp screws [C] fully.
- Remove the throttle body assy from the duct and holder.



- Remove:
  Main Throttle Sensor Connector [A]
  Vacuum Hose [B]

- Remove:
  Screw [A]
  Throttle Pulley Cover [B]



Throttle Body Assy

- Loosen the nut [A].
- Remove the throttle cable lower end [B] from the throttle pulley.
- Pull off the throttle body assy.
- After removing the throttle body assy, stuff pieces of lint -free, clean cloths into the throttle body assy holders.

CAUTION

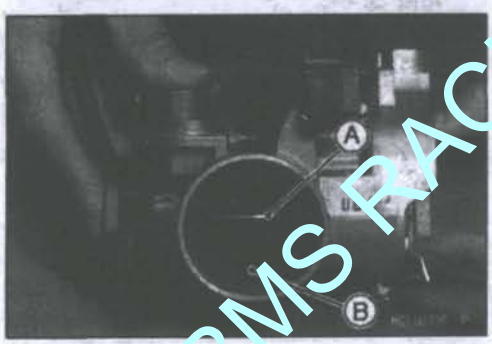
If dirt gets into the engine, excessive engine wear and possible engine damage will occur.

Throttle Body Assy Installation

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

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

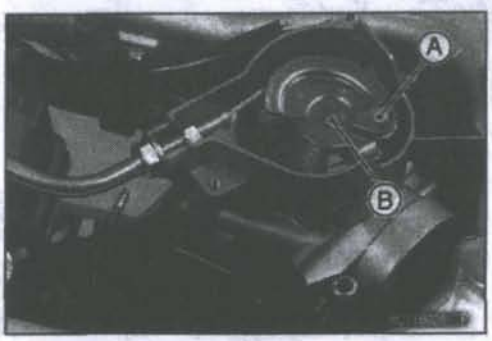
- Open the butterfly valve [A], and wipe any carbon off the throttle bore [B] around the valve, using a piece of lint-free cloth penetrated with a high-flash point solvent.
- Blow away dirt or dust from the throttle body by applying compressed air.



CAUTION

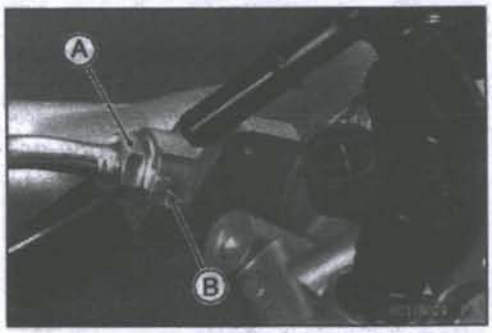
Do not immerse the throttle body in a high-flash point solvent for cleaning. This could damage the throttle sensor on the throttle body.

- Run the leads and hoses as shown in the Cable, Wire, and Hose Routing section of the Appendix chapter.
- Apply a thin coating of grease to the throttle cable lower ends.
- Fit the throttle cable lower end [A] into the throttle pulley [B].



Throttle Body Assy

- Tighten the throttle cable nut [A] securely so that the claw [B] of the washer faces as shown.



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

⚠ WARNING

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

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

Throttle Body Assy Disassembly

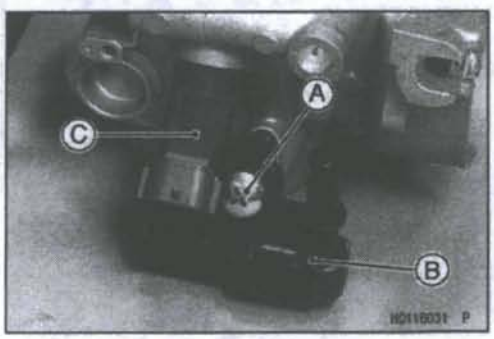
CAUTION

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

CAUTION

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

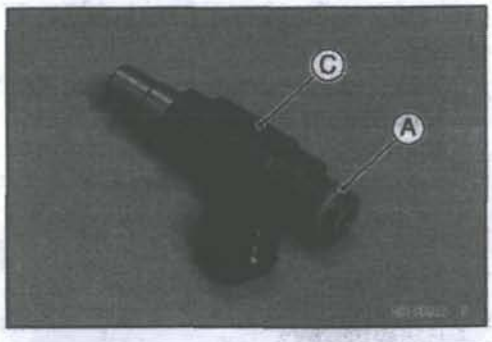
- Remove:
  Throttle Body Assy (see Throttle Body Assy Removal)
  Screw [A]
  Delivery Pipe [B]
  Fuel Injector [C]

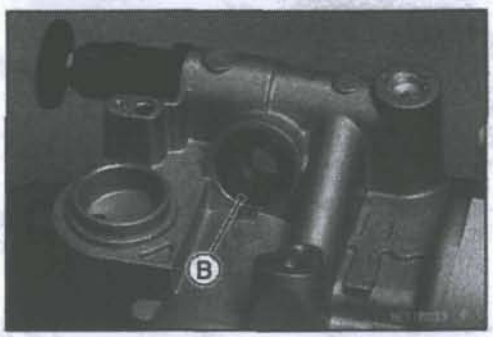


Throttle Body Assy

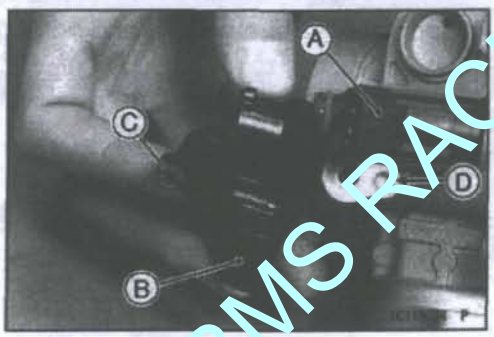
Throttle Body Assy Assembly

- Replace the O-ring [A] and seal [B] with a new one.
- Before assembling, blow away dirt or dust from the throttle body and delivery pipe by applying compressed air.
- Apply grease to the new O-ring of the injector [C], and insert it into the delivery pipe and confirm whether the injector turn smoothly or not.





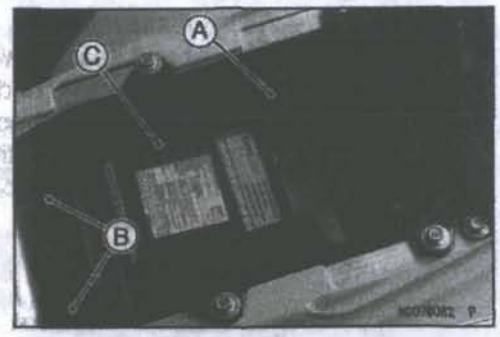
- Install the injector [A].
- Install the delivery pipe [B] so that the projection [C] fit to the hollow [D] on the throttle body assy.
- Tighten the screw securely.
- Install the throttle body assy (see Throttle Body Assy Installation).



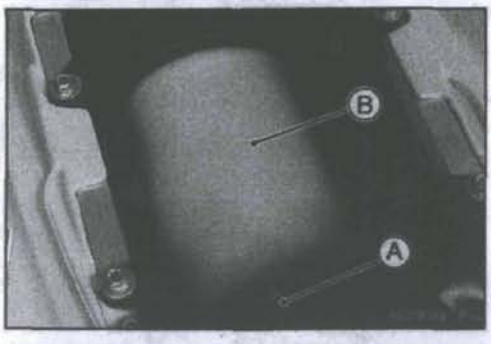
Air Cleaner

Air Cleaner Element Removal

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



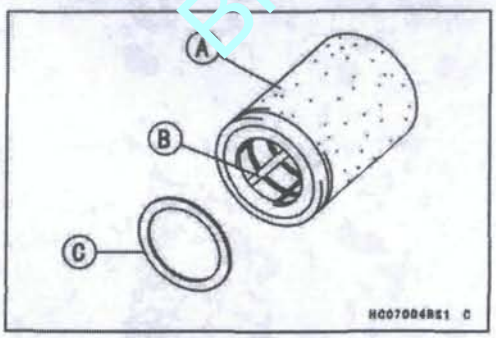
- Loosen the thumb screw [A] to remove the element [B].



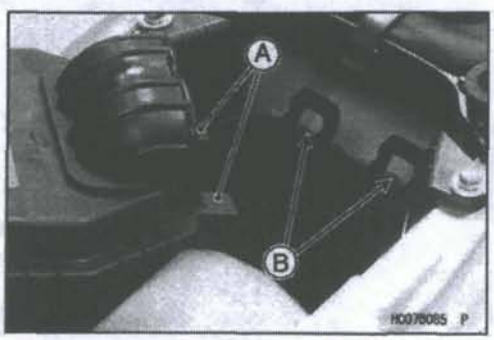
- Separate the element [A] and holder [B].

Air Cleaner Element Instalation

- Assemble the element [A] and holder [B].
- Install the element and seal [C].
- Tighten the thumb screw securely.

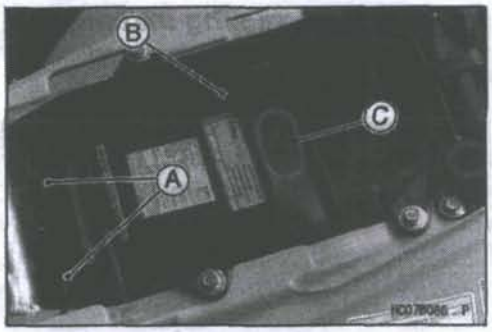


- Insert the claws [A] on the housing cap into the guide [B].



Air Cleaner

- Hook the clips [A].
- Install the mud guard plate [B] so that the "UP Mark" [C] faces upward.



Air Cleaner Element Cleaning and Inspection

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

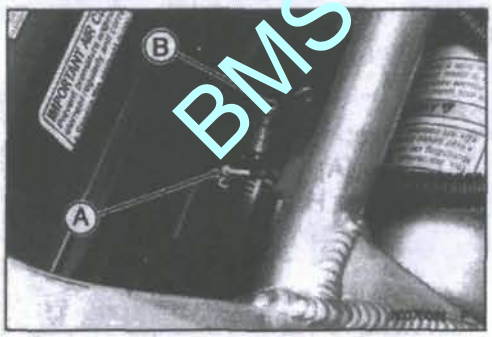
Air Cleaner Draining

- Refer to the Air Cleaner Draining in the Periodic Maintenance chapter.

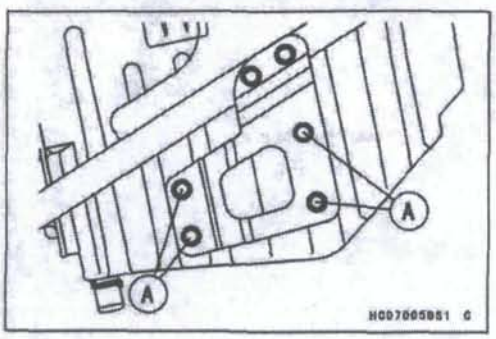
Air Cleaner Housing Removal

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Bolts [A]
  Tool Box [B]

- Disconnect the inlet temperature sensor connector [A].
- Loosen the clamp screw [B] fully.



- Remove the bolts [A].
- While pulling up the air cleaner housing, remove it.

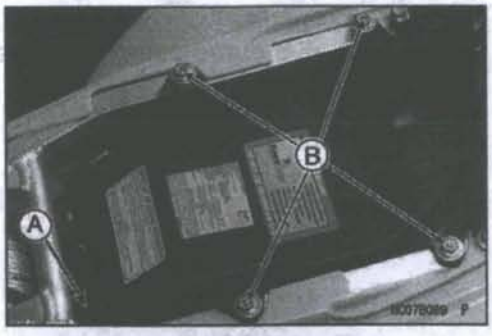


Air Cleaner

Air Cleaner Housing Installation

- Install the air cleaner housing.
- Tighten:

Torque - Rear Air Cleaner Duct Clamp Screw [A]: 1.4 N·m (0.14 kgf·m, 12 in·lb)
Air Cleaner Housing Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

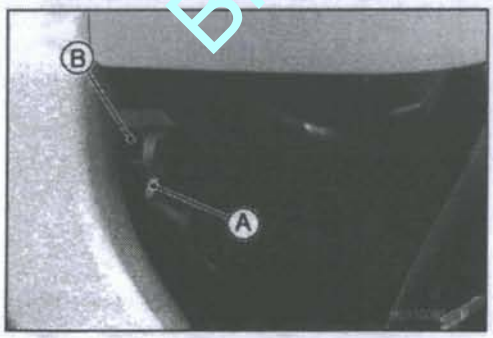


Air Cleaner Duct and Resonator Tank Removal

- Loosen the duct clamp screw [A] fully.

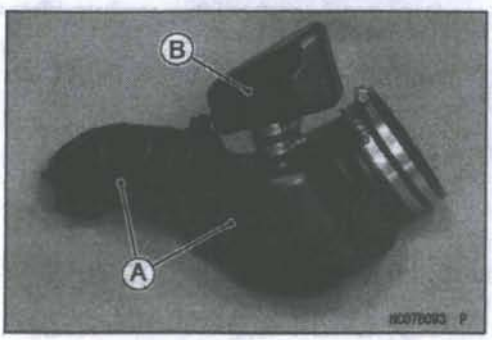
- Loosen the duct clamp screw [A] fully.

- Remove:
  Clamp [A]
  Breather Hose [B]



- Remove the air cleaner ducts [A] together with the resonator tank [B].

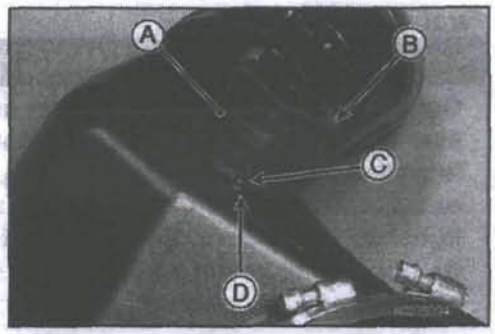
○Disassemble the air cleaner ducts and resonator tank.



Air Cleaner

Air Cleaner Duct and Resonator Tank Installation

- Install the resonator tank holder [A] so that the "UPPER" mark [B] faces tank side and slit [C] on the holder fit to the projection [D] on the duct.



- Install the resonator tank so that the projection [A] fit to the slit [B] on the holder.
- Tighten the clamp screws securely.

OInstall the air cleaner duct between throttle body assy and air cleaner housing.

- Tighten:

Torque - Air Cleaner Duct Clamp Screws: 1.4 N·m (0.14 kgf·m, 12 in·lb)

Fuel Tank

Fuel Tank Removal

⚠ WARNING

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

- Turn the ignition switch and engine stop switch OFF.
- Wait until the engine cools down.
- Disconnect the battery (–) cable terminal (see Battery Removal in the Electrical System chapter).
- Open the fuel tank cap [A] to lower the pressure in the tank.

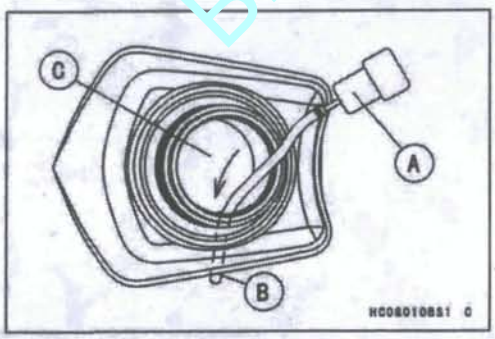
○During tank removal, keep the tank cap open to release pressure in the tank. This makes fuel spillage less.

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Side Covers (see Side Cover Removal in the Frame chapter)
  Fuel Tank Bolts [A]

- Draw the fuel out from the fuel tank with a commercially available pump [A].

○Use a soft plastic hose [B] as a pump inlet hose in order to insert the hose smoothly.

○Put the hose through the fill opening [C] into the tank and draw the fuel out.



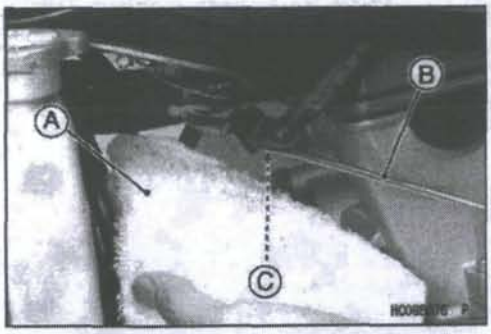
⚠ WARNING

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

- Disconnect:
  Fuel Pump Lead Connector [A]

Fuel Tank

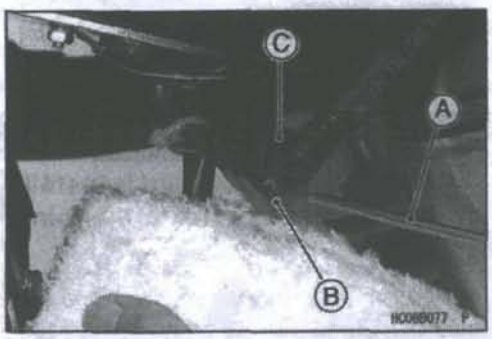
- Be sure to place a piece of cloth [A] around the fuel hose joint.
- Insert a minus screwdriver [B] into the slit [C] on the joint lock.



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

⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.
When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

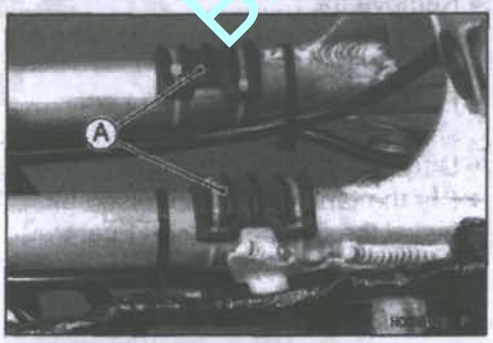


- Close the fuel tank cap.
- While pulling up the fuel tank [A], remove the fuel tank together with the heat guard plate [B].

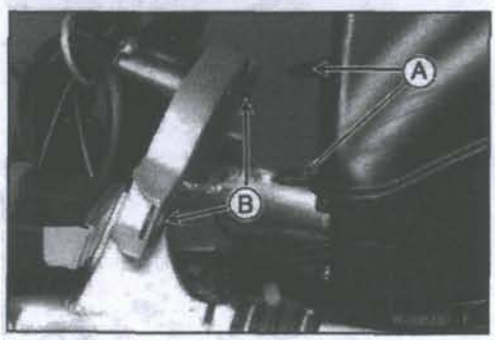
○Do not apply the load to the fuel pump outlet portion.

Fuel Tank Installation

- Note the above WARNING (see Fuel Tank Removal).
- Check that the rubber dampers [A] are on the frame.

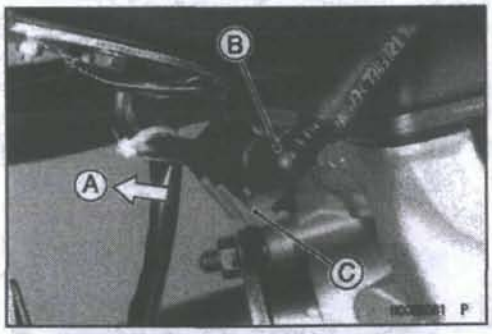


- Install the fuel tank together with the heat guard plate so that the projections [A] fit the damper [B] on the frame.

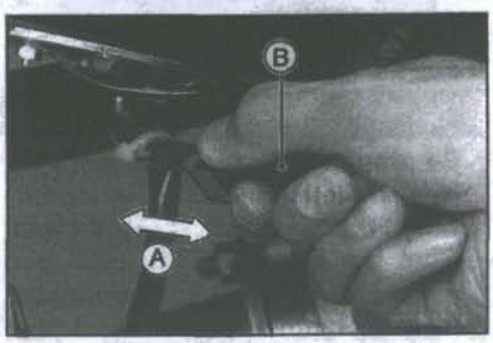


Fuel Tank

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



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



⚠ WARNING

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

★If it comes off, reinstall the hose joint.

- Connect the fuel pump connector and the battery (–) cable terminal.

Fuel Tank Cleaning

⚠ WARNING

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

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

Cooling System

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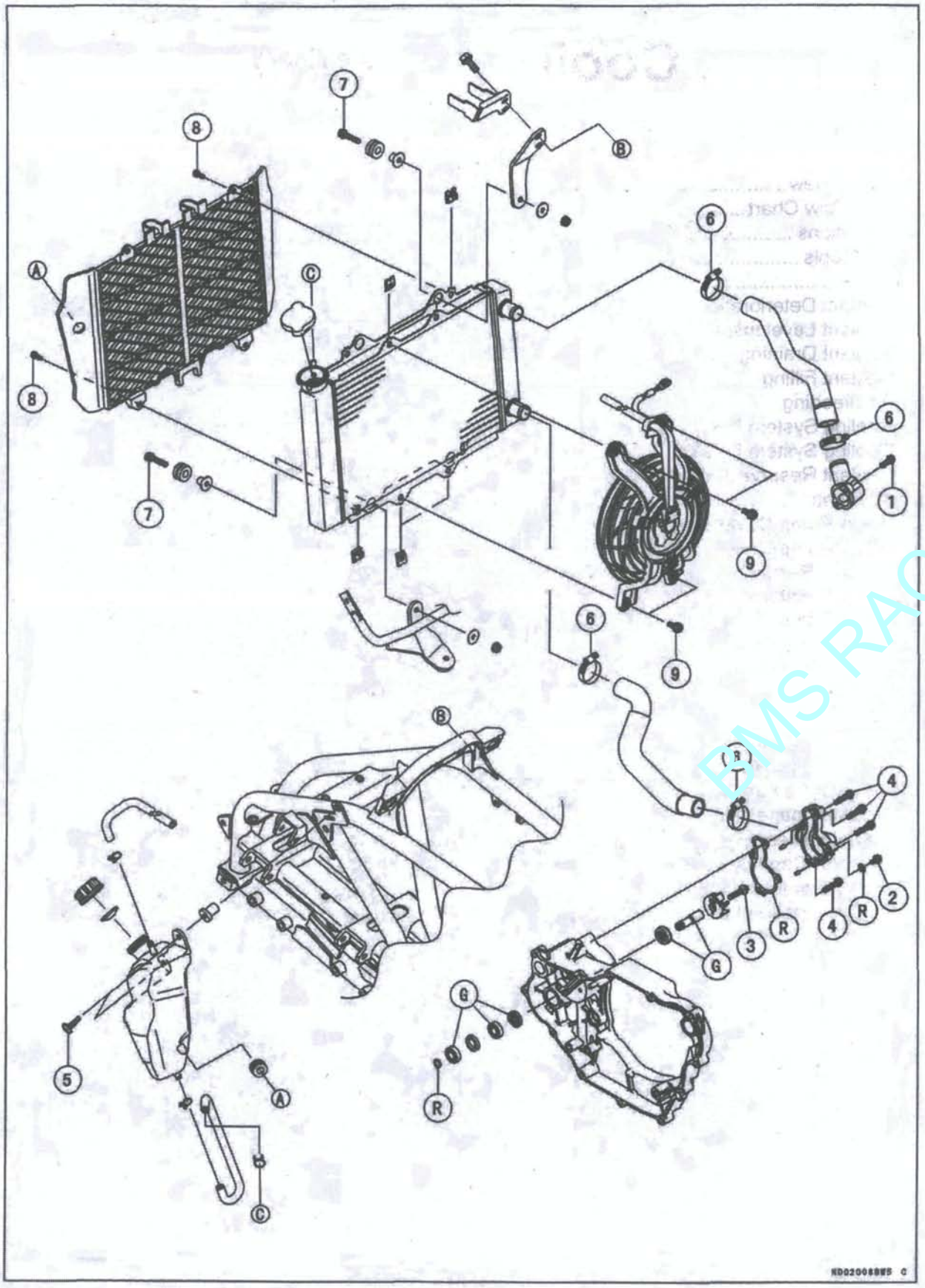
Exploded View

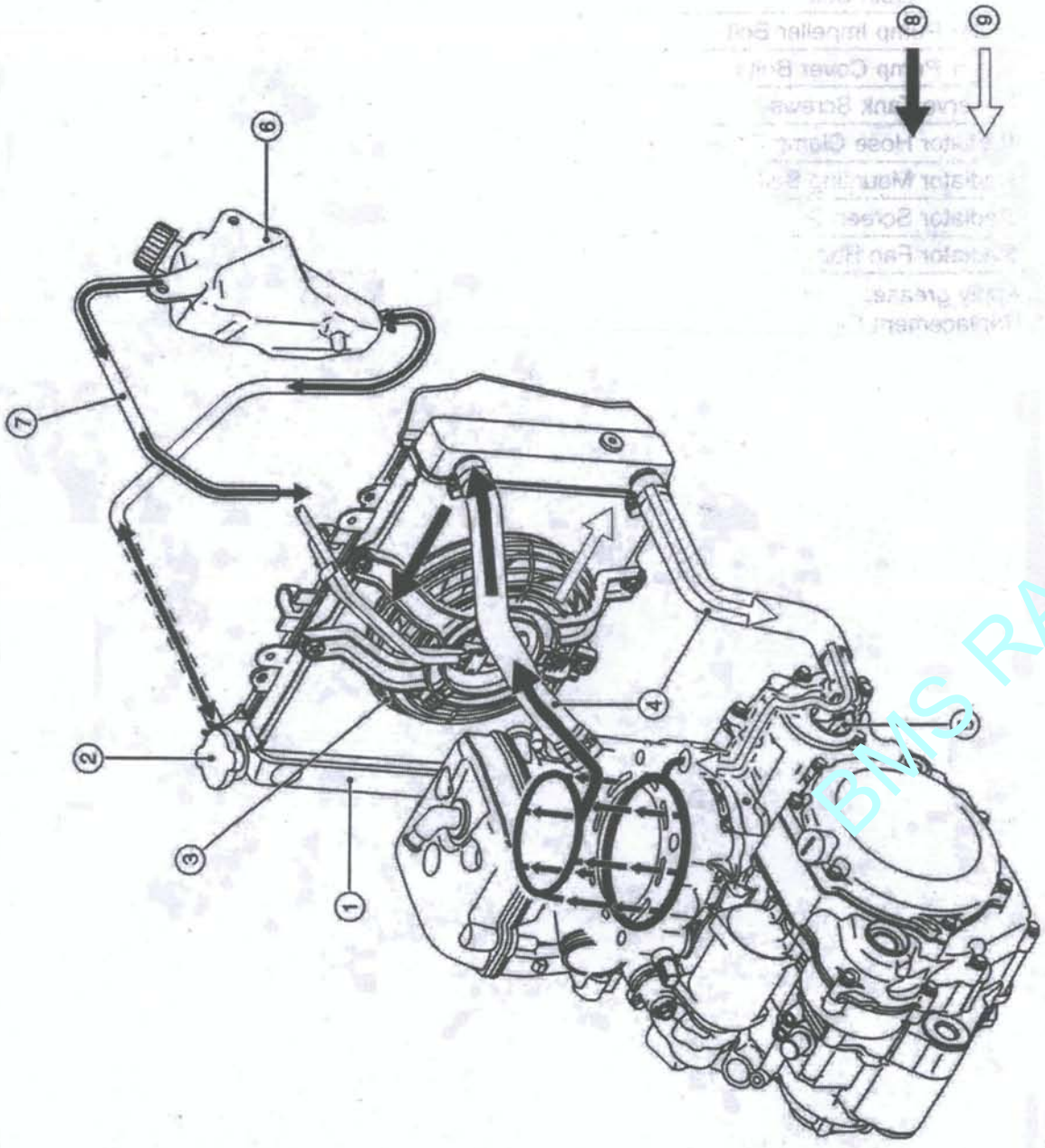


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Radiator Hose Fitting Bolts	9.8	1.0	87 in·lb	
2	Coolant Drain Bolt	7.0	0.71	62 in·lb	
3	Water Pump Impeller Bolt	9.8	1.0	87 in·lb	
4	Water Pump Cover Bolts	9.8	1.0	87 in·lb	
5	Reserve Tank Screws	3.5	0.36	31 in·lb	
6	Radiator Hose Clamp Screws	2.0	0.20	18 in·lb	
7	Radiator Mounting Bolts	8.8	0.90	78 in·lb	
8	Radiator Screen Screws	3.5	0.36	31 in·lb	
9	Radiator Fan Bolts	8.3	0.85	73 in·lb	

G: Apply grease.
R: Replacement Parts

Coolant Flow Chart



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Coolant Flow Chart

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

When the coolant temperature goes up beyond 100°C (212°F), the radiator fan relay conducts to operate the radiator fan. The radiator fan draws air through the radiator core when there is not sufficient air flow such as at low speeds. This increases up the cooling action of the radiator. When the temperature is below 90°C (194°F) ~ temperature less than ON temperature, the fan relay opens and the radiator fan stops.

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

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

The radiator cap has two valves. One is a pressure valve which holds the pressure in the system when the engine is running. When the pressure exceeds 97 ~ 118 kPa (0.99 ~ 1.20 kgf/cm², 14.1 ~ 17.1 psi), the pressure valve opens and releases the pressure to the reserve tank. As soon as pressure escapes, the valve closes, and keeps the pressure at 97 ~ 118 kPa (0.99 ~ 1.20 kgf/cm², 14.1 ~ 17.1 psi). When the engine cools down, another small valve (vacuum valve) in the cap opens. As the coolant cools, the coolant contracts to form a vacuum in the system. The vacuum valve opens and allows the coolant from the reserve tank to enter the radiator.

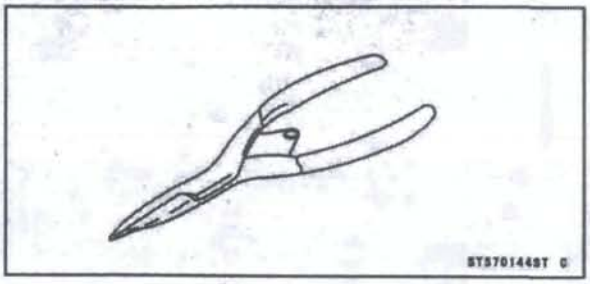
1. Radiator
2. Radiator Cap
3. Radiator Fan
4. Radiator Hoses
5. Water Pump
6. Reserve Tank
7. Coolant Overflow Hose
8. Hoot Coolant
9. Cold Coolant

Specifications

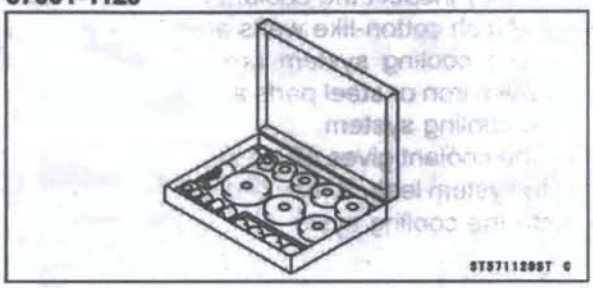
Item	Service Limit
Coolant	
Type	Permanent type antifreeze for aluminum engines and radiators
Color	Green
Mixed Ratio	Soft water 50%, antifreeze 50%
Freezing Point	-35°C (-31°F)
Total Amount	1.4 L (1.5 US qt.) (reserve tank full level, including radiator and engine)
Radiator	
Cap Relief Pressure	97 ~ 118 kPa (0.99 ~ 1.20 kgf/cm², 14.1 ~ 17.1 psi)

Special Tools

Outside Circlip Pliers:
57001-144



Bearing Driver Set:
57001-1129



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.

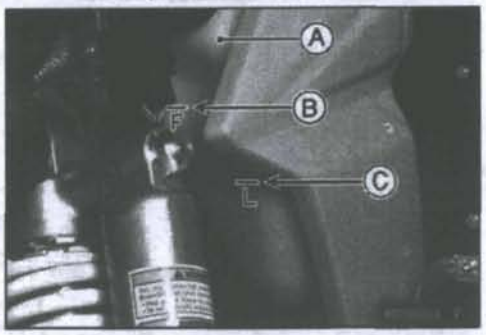
Coolant Level Inspection

NOTE

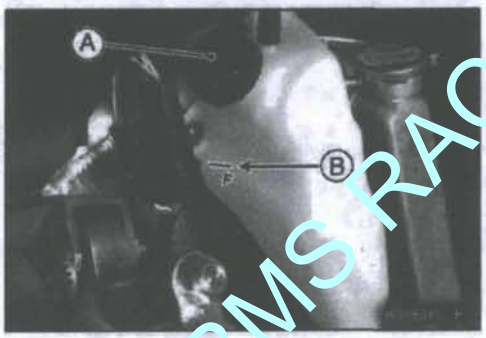
○*Check the level when the engine is cold (room or ambient temperature).*

- 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 left side cover and 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

- The coolant should be changed periodically to ensure long engine life.

⚠ 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 wipe up or wash away any coolant that spills on the frame, engine or other painted parts. Since coolant is harmful to the human body, do not use for drinking.

- Remove the left side cover (see Side Cover Removal in the Frame chapter).

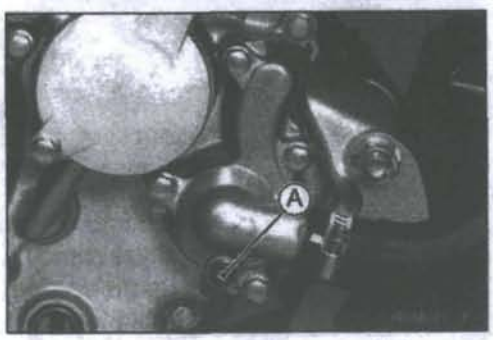
Coolant

- Remove the radiator cap [A].

NOTE

○Remove the radiator cap in two steps. First turn the cap counterclockwise to the first stop and wait there for a few seconds. Then push down and turn it further in the same direction and remove the cap.

- Place a container under the coolant drain plug [A], and drain the coolant from the radiator and engine by removing the drain plug on the water pump cover. Immediately wipe or wash out any coolant that spills on the frame, or engine.
- Inspect the old coolant for visual evidence of corrosion and abnormal smell (see Coolant Deterioration Inspection).



Coolant Filling

CAUTION

Use coolant containing corrosion inhibitors made specifically for aluminum engines and radiators in accordance with the instruction of the manufacture's. Soft or distilled water must be used with the antifreeze (see below for antifreeze) in the cooling system. If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system.

Recommended Coolant

Type:	**Permanent type antifreeze (soft water and ethylene glycol plus corrosion and rust inhibitor chemicals for aluminum engines and radiators)**
Color:	**Green**
Mixed ratio:	**Soft water 50%, Coolant 50%**
Freezing point:	**−35°C (−31°F)**
Total amount	**1.4 L (1.5 US qt.)**

- Install the drain plug.

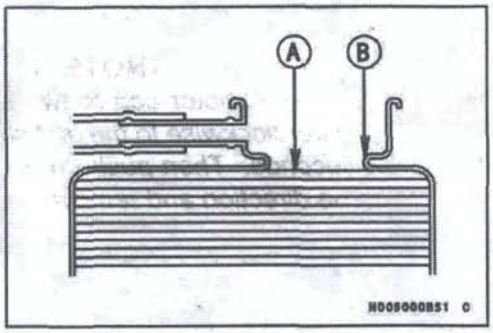
○Replace the gasket with a new one.

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

Coolant

- Fill the radiator up to the bottom of the radiator filler neck [B] with coolant [A], and install the cap, turning it clockwise about 1/4 turn.

○Lean the vehicle slightly to the right until the radiator filler neck is level to the ground so that the filler neck is located uppermost in order to exhaust the air accumulated in the radiator.



NOTE

○*Pour in the coolant slowly so that it can expel the air from the engine and radiator. The radiator cap must be installed in two steps. First turn the cap clockwise to the first stop. Then push down on it and turn it the rest of the way.*

- Check the cooling system for leaks.

Air Bleeding

Before putting the vehicle into operation, any air trapped in the cooling system must be removed as follows.

- Start the engine, warm up the engine thoroughly, and then stop the engine. Wait until the engine cools down.
- Remove the radiator cap.
- Check the coolant level (see Coolant Level Inspection in the Periodic Maintenance chapter).

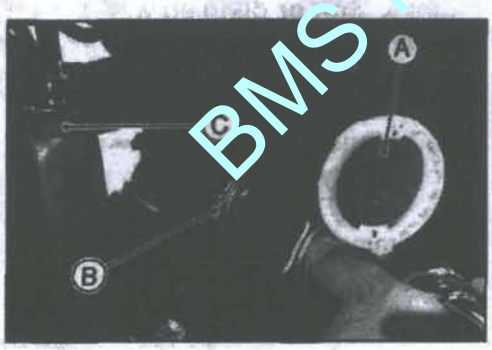
★If the coolant level is low, add coolant up to the bottom of the filler neck.

- Install the radiator cap.
- Check the cooling system for leaks.

Cooling System Pressure Testing

CAUTION

During pressure testing, do not exceed the pressure for which the system is designed to work. The maximum pressure is 196 kPa (2.00 kgf/cm², 28.4 psi).



- Remove the left side cover (see Side Cover Removal in the Frame chapter).
- Remove the radiator cap, and install a cooling system pressure tester [A] and adapter [B] on the radiator filler neck [C].

NOTE

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

- Build up pressure in the system carefully until the pressure reaches 196 kPa (2.00 kgf/cm², 28.4 psi).
- Watch the gauge for at least 6 seconds. If the pressure holds steady, the cooling system is all right.
- Remove the pressure tester, replenish the coolant, and install the radiator cap.

★If the pressure drops and no external source is found, check for internal leaks. Check the cylinder head gasket for leaks.

Coolant

Cooling System Flushing

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

- Drain the cooling system.
- Fill the cooling system with fresh water mixed with a flushing compound.

CAUTION
Avoid the use of a flushing compound which is harmful to the aluminum engine and radiator. Carefully follow the instructions supplied by the manufacture of the cleaning product.

- Warm up the engine, and run it at normal operating temperature for about ten minutes.
- Stop the engine, and drain the cooling system after the coolant cools down.
- Fill the system with fresh water.
- Warm up the engine and drain the system after the coolant cools down.
- Repeat the previous two steps once more.
- Fill the system with a permanent type coolant, and bleed the air from the system (see Air Bleeding).

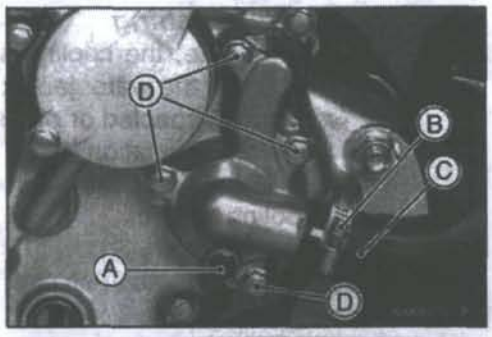
Coolant Reserve Tank Removal/Installation

- The coolant reserve tank is removed and installed during coolant change (see Coolant Change in the Periodic Maintenance chapter).

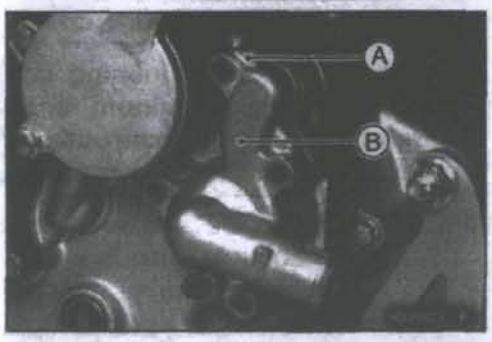
Water Pump

Water Pump Cover Removal

- Unscrew the drain bolt [A], and drain the coolant (see Coolant Draining).
- Loosen the clamp screw [B], and remove the radiator hose [C] from the water pump cover.
- Unscrew the cover bolts [D].



- Using the pry point [A], remove the pump cover [B].



Water Pump Cover Installation

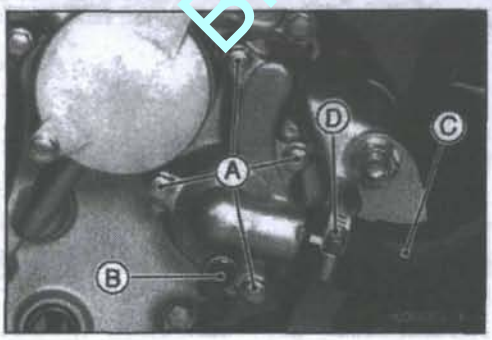
- Replace the pump cover gasket [A] with a new one.
- Check to see that dowel pins [B] are in place in the mating surfaces of the right engine cover.

- Install the water pump cover.

○Replace the drain bolt washer with a new one.

- Tighten:

Torque - Water Pump Cover Bolts [A]: 9.8 N·m (1.0 kgf·m, 87 in·lb)
Coolant Drain Bolt [B]: 7.0 N·m (0.71 kgf·m, 62 in·lb)



- Insert the radiator hose [C] into the water pump cover.
- Tighten:

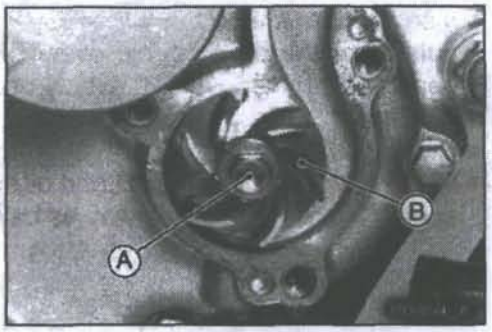
Torque - Radiator Hose Clamp Screw [D]: 2.0 N·m (0.20 kgf·m, 18 in·lb)

- Fill the cooling system (see Coolant Filling).
- Bleed the air from the cooling system.

Water Pump

Impeller Removal

- Drain:
  Coolant (see Coolant Draining)
- Remove:
  Water Pump Cover (see Water Pump Cover Removal)
  Impeller Bolt [A]
  Impeller [B]

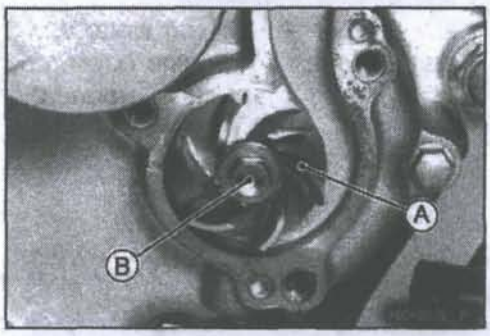


Impeller Installation

- Install:
  Impeller [A]
- Tighten:

Torque - Water Pump Impeller Bolt [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

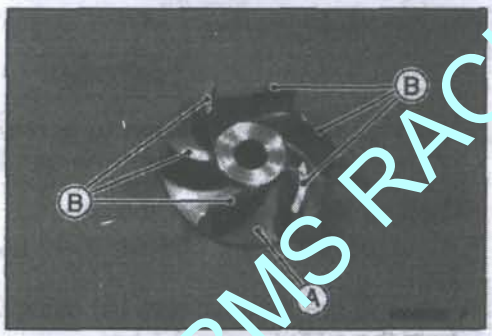
- Install:
  Water Pump Cover (see Water Pump Cover Installation)



Water Pump Inspection

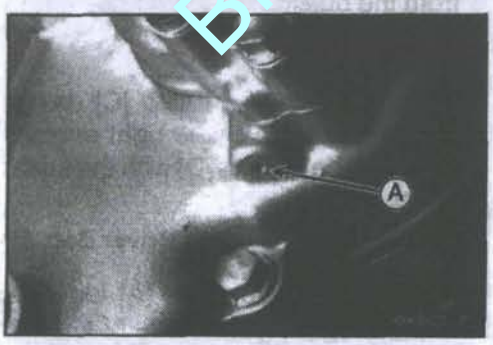
- Visually check the impeller [A].

★If the surface is corroded, or if the blades [B] are damaged, replace the impeller.



- Check the drainage outlet passage [A] at the bottom of the right engine cover for coolant leaks.

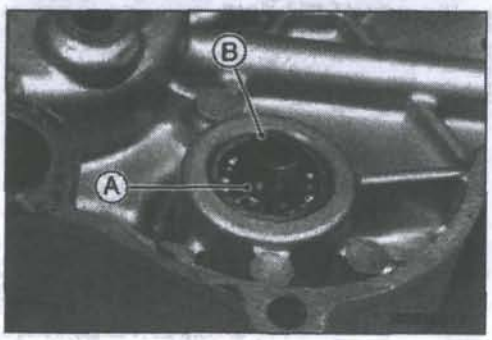
★If the oil seal is damaged, the coolant leaks through the seal and drains through the passage. Replace the oil seals.



Oil Seal and Bearing Removal

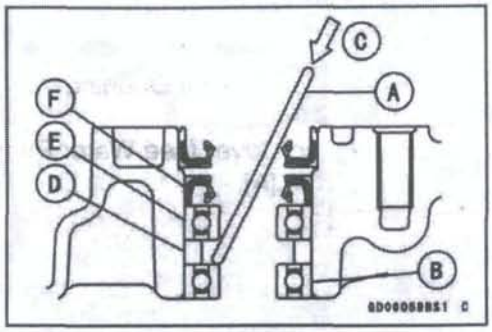
- Remove:
  Impeller (see Impeller Removal)
  Right Engine Cover (see Right Engine Cover Removal in the Engine Right Side chapter)
  Circlip [A]
  Water Pump Shaft [B]

Special Tool - Outside Circlip Pliers: 57001-144

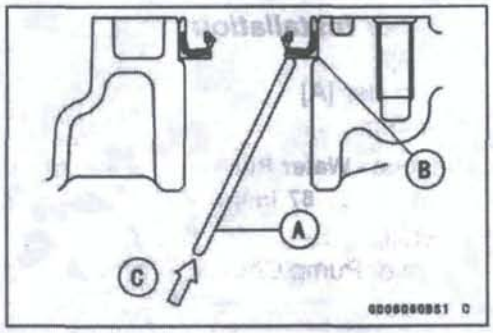


Water Pump

- Insert a bar [A] into the water pump shaft hole from the outside of the right engine cover, and remove the ball bearing [B] by tapping [C] evenly around the bearing inner race.
- Remove the spacer [D].
- Remove the ball bearing [E] and oil seal [F] from the right engine cover in the same way as ball bearing removal.



- Insert a bar [A] into the water pump shaft hole from the inside of the right engine cover, and remove the oil seal [B] by tapping [C] evenly around the seal lips.



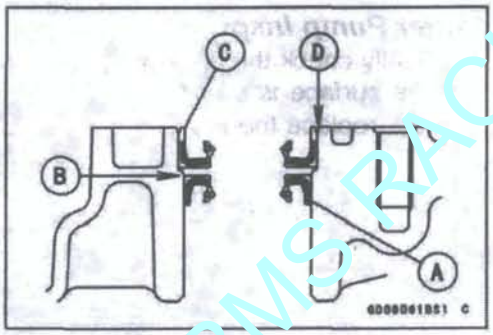
Oil Seal Installation

CAUTION

If the oil seal or ball bearing is removed, replace all of them with new ones at the same time

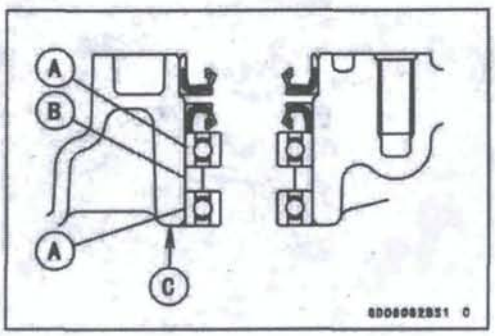
- Be sure to replace the oil seals.
- Apply plenty of high temperature grease to the oil seal lips.
- Press in the new oil seal [A] using a bearing driver set from the outside of the right engine cover so that the seal bottom surface is flush with the end face [B] of the right engine cover.
- Press in the new oil seal [C] using a bearing driver set from the outside of the right engine cover so that the oil seal surface is flush [D] with the surface of the right engine cover.

Special Tool - Bearing Driver Set: 57001-1129



- Press the ball bearings [A] together with the spacer [B] into the hole until the face of the bearing is even [C] with the end of the hole.

Special Tool - Bearing Driver Set: 57001-1129

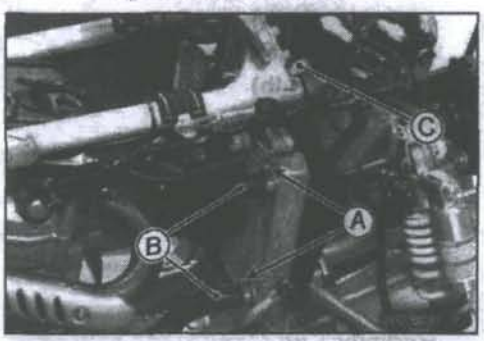


Radiator

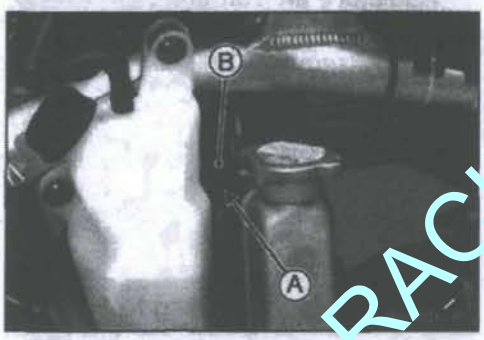
Radiator Removal

- Drain the coolant (see Coolant Draining)
- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter
  Battery Case

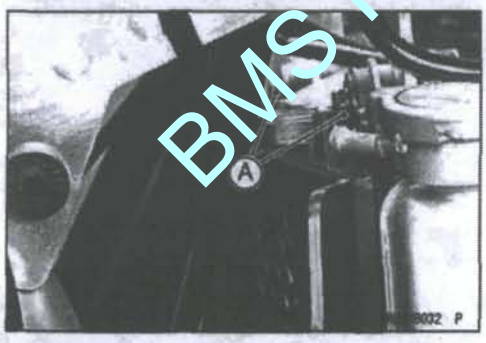
- Loosen:
  Clamp Screws [A]
- Remove:
  Radiator Hoses [B]
  Radiator Fan Connection [C] (Disconnect)



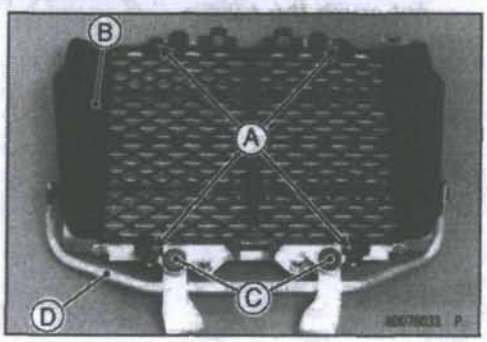
- Remove:
  Clamp [A]
  Hose [B]



- Remove the bolts [A].
- Remove the radiator together with the screen and radiator fan assembly.



- Remove:
  Screws [A]
  Radiator Screen [B]
  Bolts [C]
  Radiator Bracket [D]



Radiator

Radiator Installation

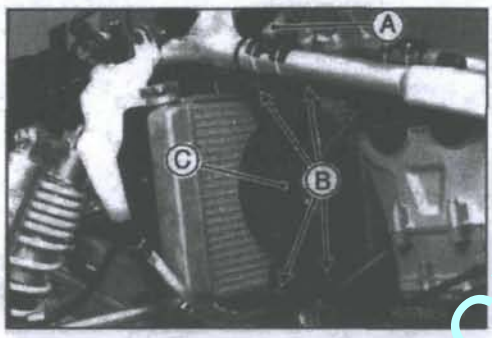
- Assemble the radiator, and install it.
- Tighten:

Torque - Radiator Hose Clamp Screws: 2.0 N·m (0.20 kgf·m, 18 in·lb)
Radiator Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)
Radiator Screen Screws: 3.5 N·m (0.36 kgf·m, 31 in·lb)

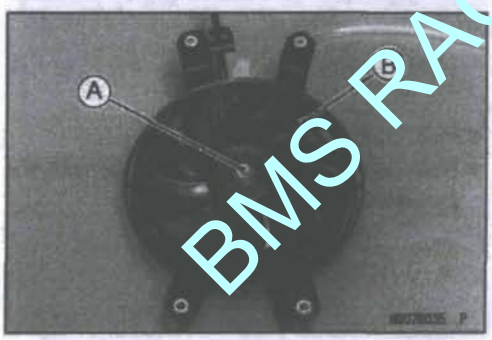
- Route the radiator hoses and fan motor tube correctly (see Cable, Wire and Hose Routing section in the Appendix chapter).
- Fill the cooling system with a permanent type coolant.

Radiator Fan Removal

- Remove:
  Radiator Fan Connector [A] (Disconnect)
  Radiator Fan Bolts [B]
  Fan Assembly [C]



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



NOTE

○*When removing and installing the fun motor tube [A], do not crush the tube.*

Radiator Fan Installation

- Install:
  Radiator Fan
- Tighten:

Torque - Radiator Fan Bolts: 8.3 N·m (0.85 kgf·m, 73 in·lb)

Radiator

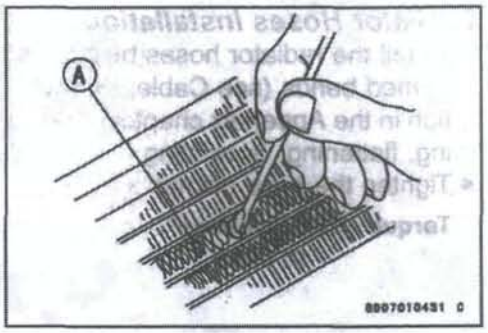
Radiator Inspection

- Check the radiator core.

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

★If the corrugated fins [A] are deformed, carefully straighten them.

★If the air passages of the radiator core are blocked more than 20% by unremovable obstructions or irreparably deformed fins, replace the radiator with a new one.



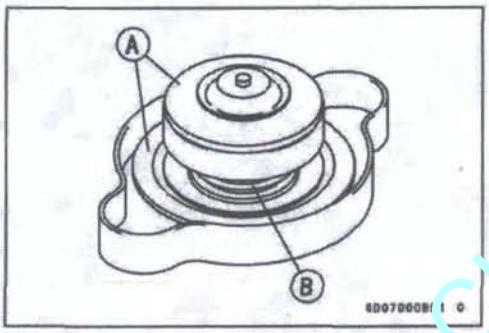
Radiator Cleaning

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

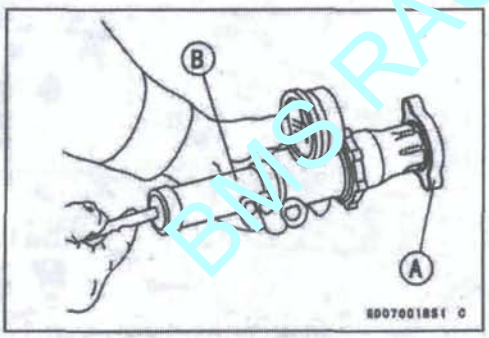
Radiator Cap Inspection

- Check the condition of the valve seals [A], and the top and bottom valve spring [B] of the radiator cap.

★If any one of them shows visible damage, replace the cap.



- Wet the top and bottom valve seals with water or coolant to prevent pressure leaks.
- Install the cap [A] on a cooling system pressure tester [B].
- Watching the pressure gauge, slowly pump the pressure tester to build up the pressure. The gauge hand must remain within the relief pressure range in the table below at least 6 seconds. Continue to pump the tester until the relief valve opens, indicated by the gauge hand flicking downward. The relief valve must open within the specified range.



Radiator Cap Relief Pressure
Standard: 97 ~ 118 kPa (0.99 ~ 1.20 kgf/cm², 14.1 ~ 17.1 psi)

★If the cap cannot hold the pressure, or if the relief pressure is too high or too low, replace the cap with a new one.

Filler Neck Inspection

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

Radiator Hoses Inspection

- Refer to the Radiator Hoses and Connections Inspection in the Periodic Maintenance chapter.

Radiator

Radiator Hoses Installation

- Install the radiator hoses being careful to follow the performed bends (see Cable, Wire, and Hose Routing section in the Appendix chapter). Avoid sharp bending, kinking, flattening, or twisting.
- Tighten the hose clamps securely.

Torque - Radiator Hose Clamp Screws: 2.0 N·m (0.20 kgf·m, 18 in·lb)

Engine Top End

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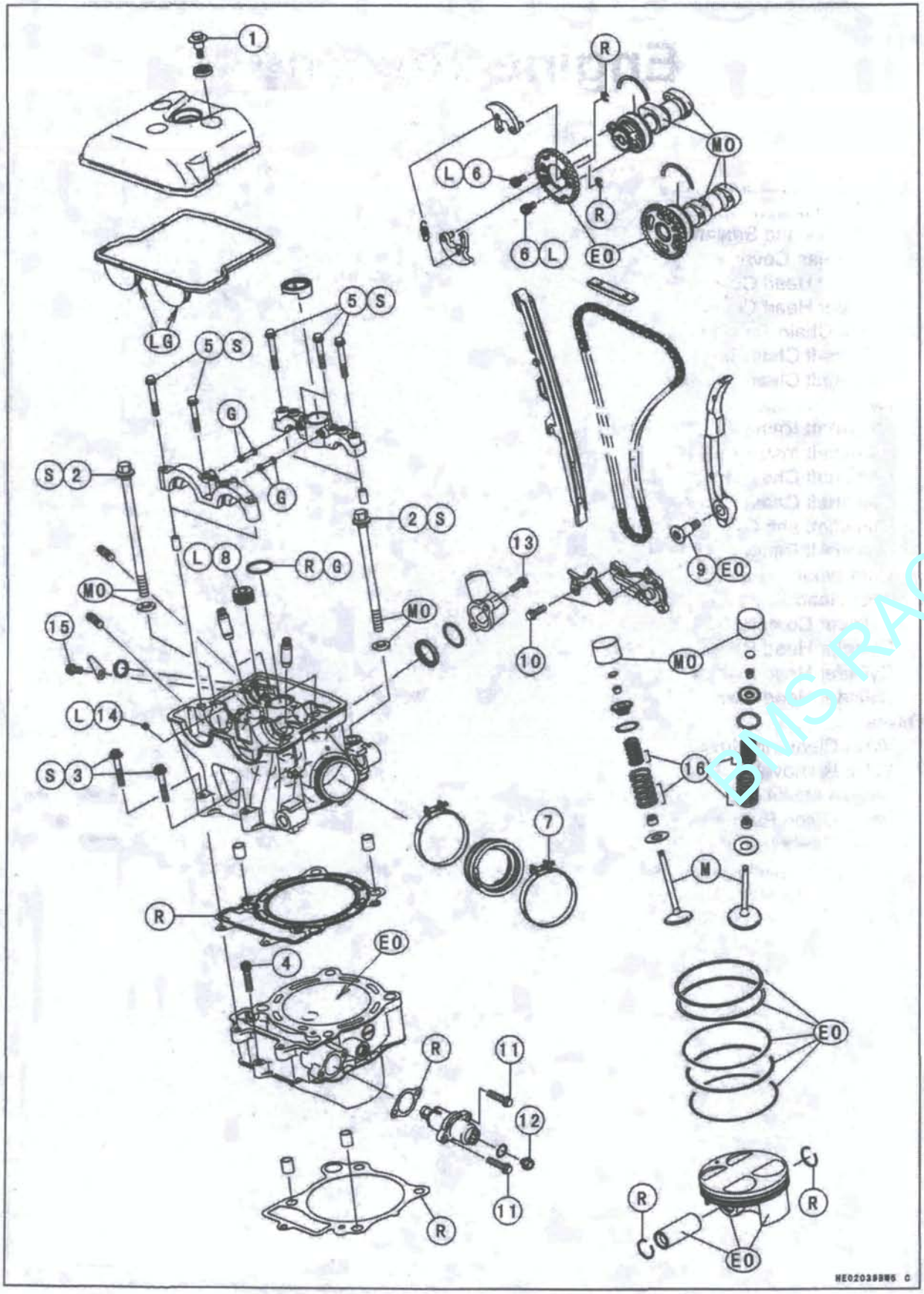
Exploded View

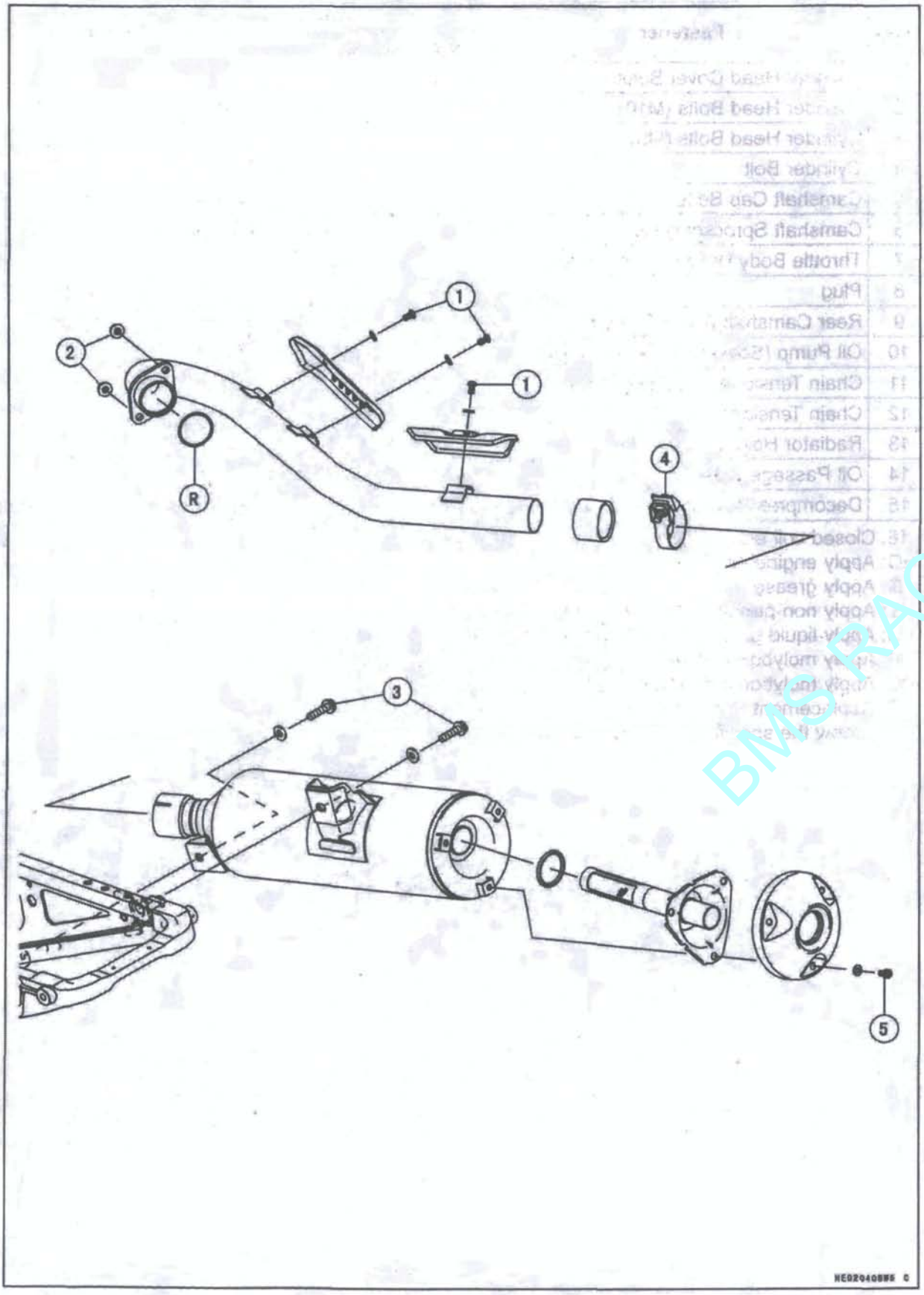


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
2	Cylinder Head Bolts (M10)	59	6.0	44	S, MO
3	Cylinder Head Bolts (M6)	12	1.2	106 in·lb	S
4	Cylinder Bolt	12	1.2	106 in·lb	
5	Camshaft Cap Bolts	12	1.2	106 in·lb	S
6	Camshaft Sprocket Bolts	12	1.2	106 in·lb	L
7	Throttle Body Holder Clamp Screw	2.0	0.20	18 in·lb	
8	Plug	20	2.0	15	L
9	Rear Camshaft Chain Guide Bolt	15	1.5	11	EO
10	Oil Pump (Scavenge) Cover Bolts	9.8	1.0	87 in·lb	
11	Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	
12	Chain Tensioner Cap Bolt	5.0	0.51	44 in·lb	
13	Radiator Hose Fitting Bolts	9.8	1.0	87 in·lb	
14	Oil Passage Plug	3.0	0.31	27 in·lb	L
15	Decompressor Plug Plate Bolt	9.8	1.0	87 in·lb	

16. Closed coil end faces down.
EO: Apply engine oil.
G: Apply grease.
L: Apply non-permanent locking agent.
LG: Apply liquid gasket (Kawasaki Bond: 92104-1063)
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil.
R: Replacement Parts
S: Follow the specified tightening sequence.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Pipe Cover Bolts	12	1.2	106 in·lb	
2	Exhaust Pipe Holder Nuts	20	2.0	15	
3	Muffler Mounting Bolts	35	3.6	26	
4	Muffler Joint Clamp Bolt	20	2.0	15	
5	Muffler Body End Cover Bolts	8.8	0.90	78 in·lb	

R: Replacement Parts

Specifications

Item	Standard	Service Limit
Camshafts		
Cam Height:		
Exhaust	35.546 ~ 35.654 mm (1.3994 ~ 1.4037 in.)	35.45 mm (1.396 in.)
Inlet	35.946 ~ 36.054 mm (1.4152 ~ 1.4194 in.)	35.85 mm (1.411 in.)
Camshaft Journal Clearance	0.020 ~ 0.062 mm (0.00079 ~ 0.0024 in.)	0.15 mm (0.0059 in.)
Camshaft Journal Diameter	22.959 ~ 22.980 mm (0.90390 ~ 0.90472 in.)	22.93 mm (0.9028 in.)
Camshaft Bearing Inside Diameter	23.000 ~ 23.021 mm (0.90551 ~ 0.90634 in.)	23.08 mm (0.9086 in.)
Camshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.004 in.)
Cylinder Head		
Cylinder Compression	(Usable range) 338 ~ 564 kPa (3.45 ~ 5.75 kg/cm², 49.0 ~ 81.8 psi) @ 900 r/min (rpm)	– – –
Cylinder Head Warp	– – –	0.05 mm (0.002 in.)
Valve		
Valve Clearance:		
Exhaust	0.17 ~ 0.22 mm (0.0067 ~ 0.0087 in.)	– – –
Inlet	0.10 ~ 0.15 mm (0.0039 ~ 0.0059 in.)	– – –
Valve Head Thickness:		
Exhaust	1.0 mm (0.04 in.)	0.5 mm (0.02 in.)
Inlet	1.0 mm (0.04 in.)	0.5 mm (0.02 in.)
Valve Stem Bend	TIR 0.01 mm (0.0004 in.) or less	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	5.455 ~ 5.470 mm (0.2148 ~ 0.2154 in.)	5.44 mm (0.214 in.)
Inlet	5.465 ~ 5.480 mm (0.2152 ~ 0.2157 in.)	5.46 mm (0.215 in.)
Valve Guide Inside Diameter:		
Exhaust	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)	5.58 mm (0.220 in.)
Inlet	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)	5.58 mm (0.220 in.)
Valve/valve Guide Clearance (wobble method):		
Exhaust	0.09 ~ 0.16 mm (0.0035 ~ 0.0063 in.)	0.36 mm (0.014 in.)
Inlet	0.06 ~ 0.14 mm (0.0024 ~ 0.0055 in.)	0.33 mm (0.013 in.)
Valve Seat Cutting Angle	45°, 32°, 60°	– – –
Valve Seat Surface Outside Diameter:		
Exhaust	30.4 ~ 30.6 mm (1.197 ~ 1.205 in.)	– – –
Inlet	35.4 ~ 35.6 mm (1.39 ~ 1.40 in.)	– – –
Valve Seat Surface Width:		
Exhaust	0.8 ~ 1.2 mm (0.031 ~ 0.047 in.)	– – –
Inlet	0.5 ~ 1.0 mm (0.020 ~ 0.039 in.)	– – –
Valve Spring Free Length:		
Exhaust		
Outer	38.92 mm (1.532 in.)	37.4 mm (1.47 in.)
Inner	35.63 mm (1.404 in.)	34.2 mm (1.35 in.)

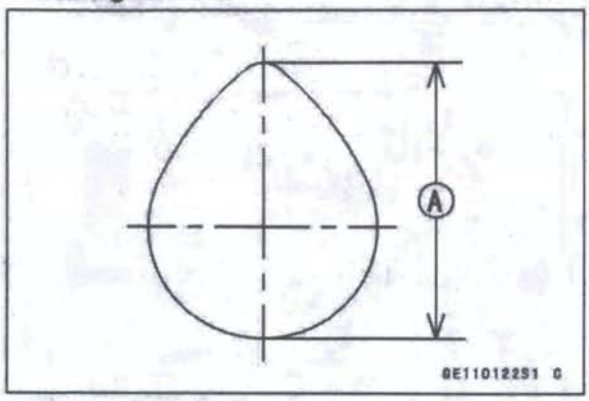
Specifications

Item	Standard	Service Limit
Inlet		
Outer	39.28 mm (1.546 in.)	37.8 mm (1.49 in.)
Inner	36.05 mm (1.419 in.)	34.5 mm (1.36 in.)
Cylinder and Pistons		
Cylinder Inside Diameter	96.000 ~ 96.012 mm (3.7795 ~ 3.7800 in.)	96.10 mm (3.783 in.)
Piston Diameter	95.964 ~ 95.979 mm (3.7781 ~ 3.7787 in.)	95.81 mm (3.772 in.)
Piston/Cylinder Clearance	0.021 ~ 0.048 mm (0.00083 ~ 0.0019 in.)	– – –
Piston Ring/Ring Groove Clearance:		
Top	0.04 ~ 0.08 mm (0.002 ~ 0.003 in.)	0.18 mm (0.0071 in.)
Second	0.03 ~ 0.05 mm (0.001 ~ 0.002 in.)	0.15 mm (0.0059 in.)
Piston Ring Groove Width:		
Top	1.03 ~ 1.05 mm (0.0406 ~ 0.0413 in.)	1.13 mm (0.0445 in.)
Second	1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.)	1.12 mm (0.0441 in.)
Piston Ring Thickness:		
Top	0.97 ~ 0.99 mm (0.038 ~ 0.039 in.)	0.90 mm (0.035 in.)
Second	0.97 ~ 0.99 mm (0.038 ~ 0.039 in.)	0.90 mm (0.035 in.)
Piston Ring End Gap:		
Top	0.25 ~ 0.35 mm (0.0098 ~ 0.014 in.)	0.6 mm (0.02 in.)
Second	0.35 ~ 0.50 mm (0.014 ~ 0.020 in.)	0.8 mm (0.03 in.)
Oil	0.20 ~ 0.70 mm (0.0079 ~ 0.028 in.)	1.0 mm (0.04 in.)
Piston Pin Diameter	20.991 ~ 21.000 mm (0.82642 ~ 0.82677 in.)	20.96 mm (0.8252 in.)
Piston Pin Hole Diameter	21.004 ~ 21.010 mm (0.82693 ~ 0.82716 in.)	21.08 mm (0.8300 in.)
Connecting Rod Small End Inside Diameter	21.016 ~ 21.027 mm (0.82740 ~ 0.82783 in.)	21.06 mm (0.8291 in.)

TIR: Total Indicator Readings.

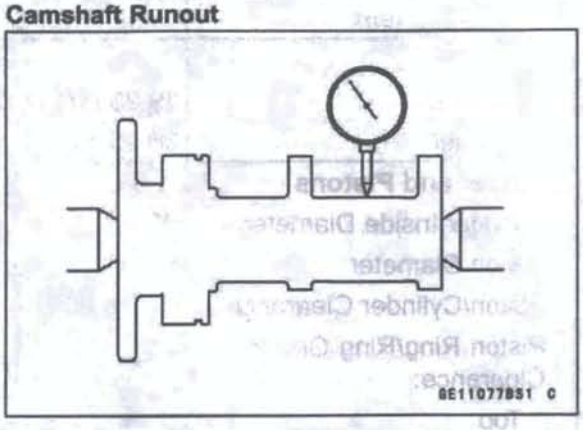
Specifications

Cam Height

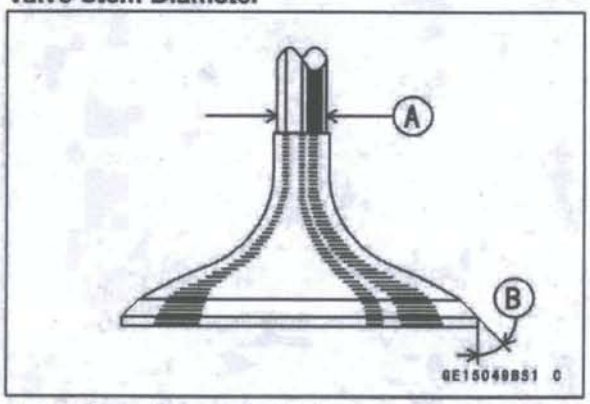


Cam Height [A]

Camshaft Runout

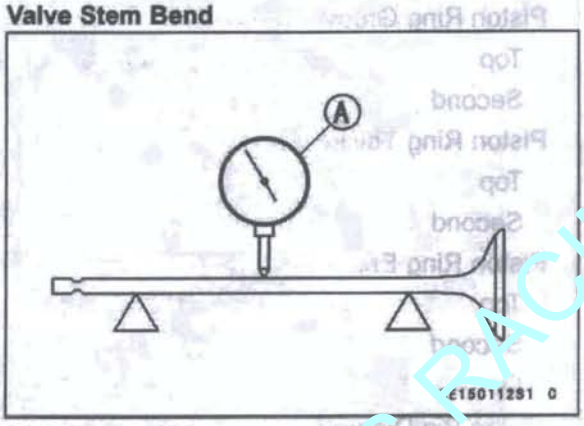


Valve Stem Diameter



Valve Stem Diameter [A]
45° [B]

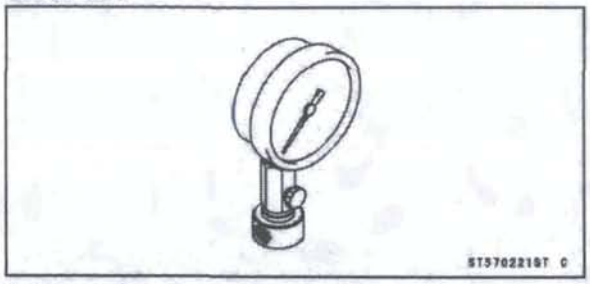
Valve Stem Bend



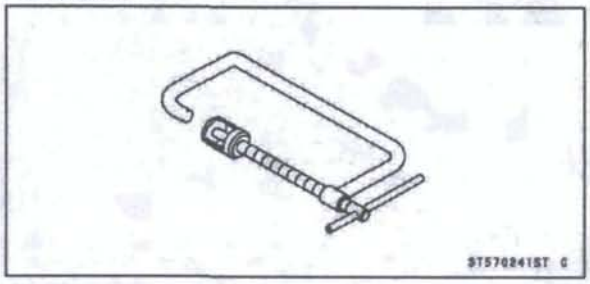
Dial Gauge [A]

Special Tools and Sealant

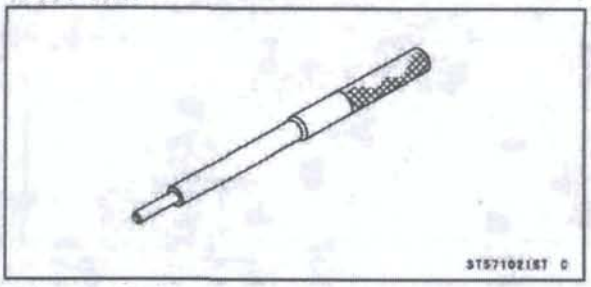
Compression Gauge, 20 kgf/cm²:
57001-221



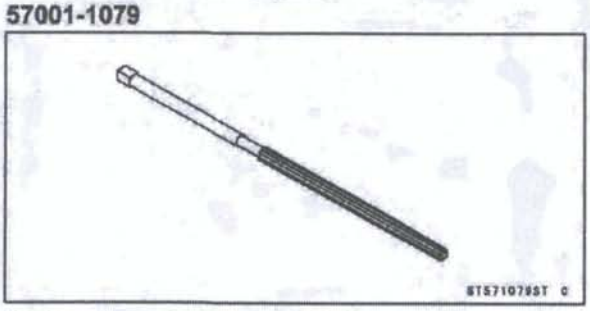
Valve Spring Compressor Assembly:
57001-241



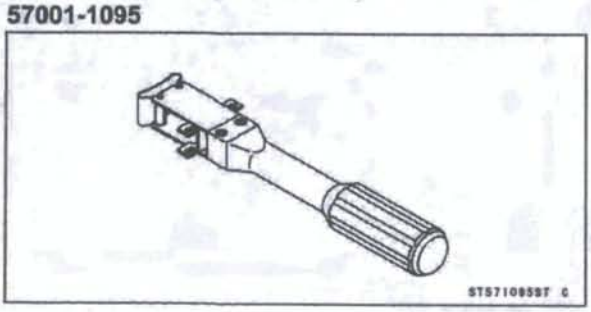
Valve Guide Arbor, φ5.5:
57001-1021



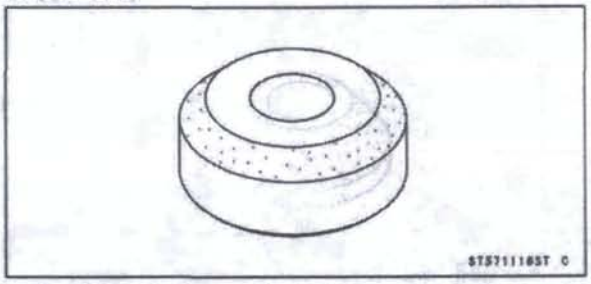
Valve Guide Reamer, φ5.5:
57001-1079



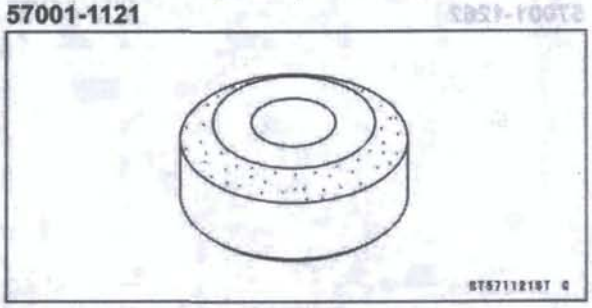
Piston Ring Compressor Grip:
57001-1095



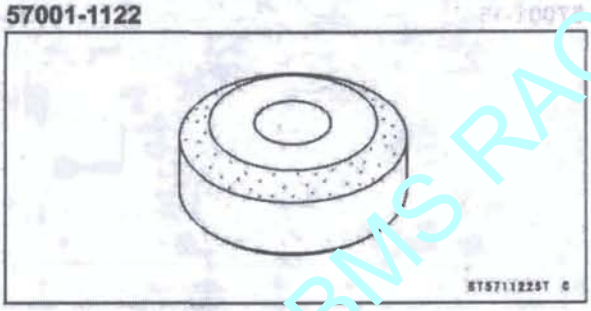
Valve Seat Cutter, 45° - φ35:
57001-1116



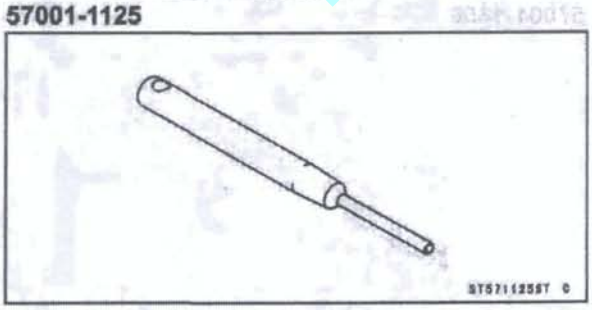
Valve Seat Cutter, 32° - φ35:
57001-1121



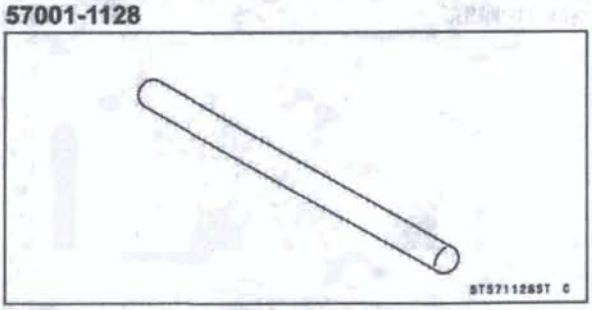
Valve Seat Cutter, 32° - φ38.5:
57001-1122



Valve Seat Cutter Holder, φ5.5:
57001-1125

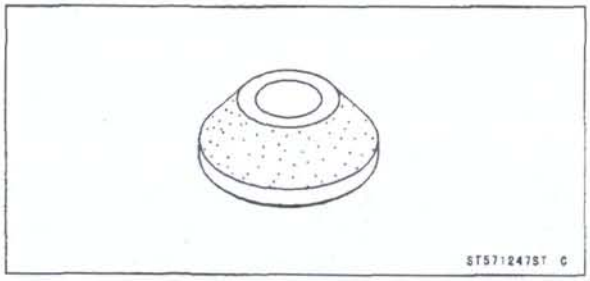


Valve Seat Cutter Holder Bar:
57001-1128

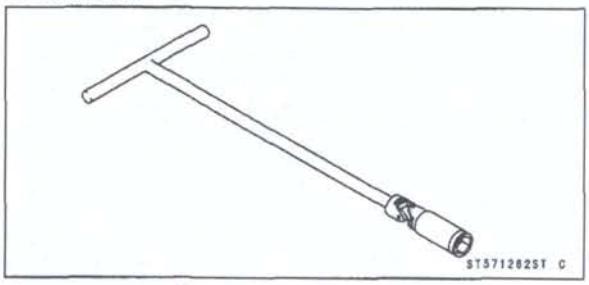


Special Tools and Sealant

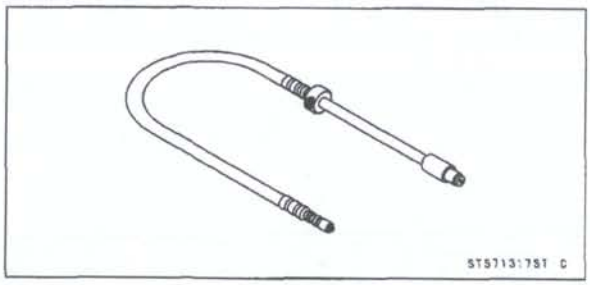
Valve Seat Cutter, 55° - φ35:
57001-1247



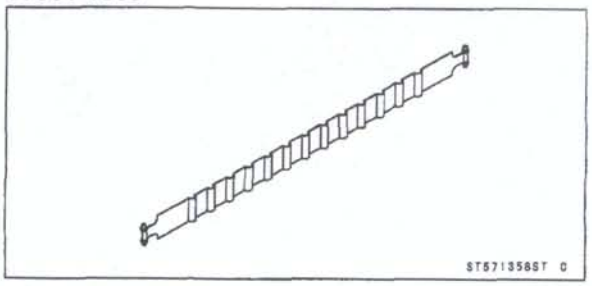
Spark Plug Wrench, Hex 16:
57001-1262



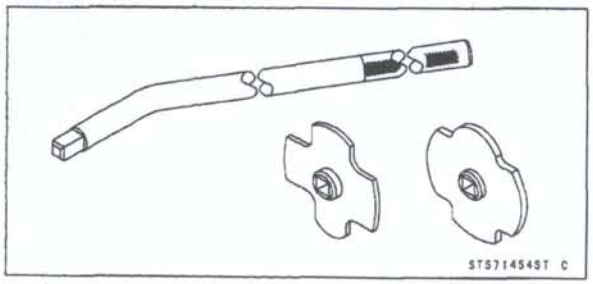
Compression Gauge Adapter, M10 × 1.0:
57001-1317



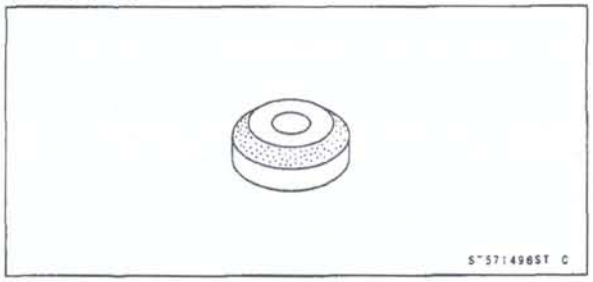
Piston Ring Compressor Belt, φ95 ~ φ108:
57001-1358



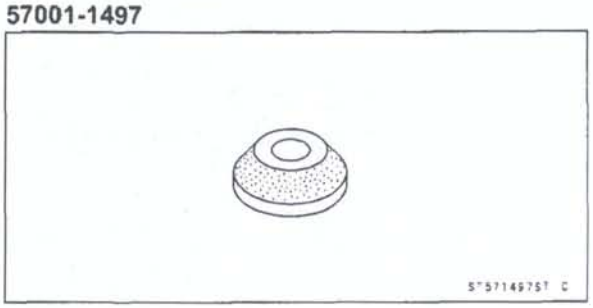
Filler Cap Driver:
57001-1454



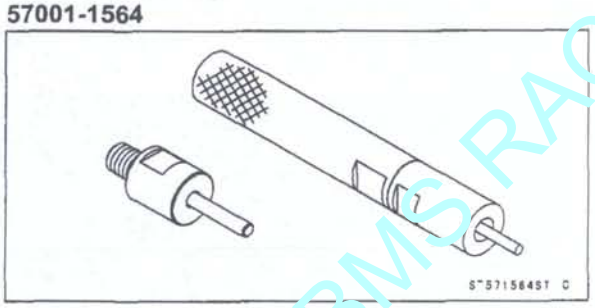
Valve Seat Cutter, 45° - φ40:
57001-1496



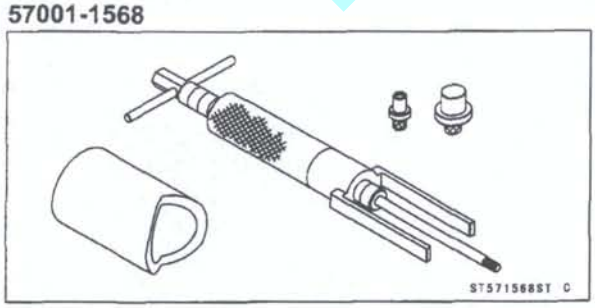
Valve Seat Cutter, 55° - φ38.5:
57001-1497



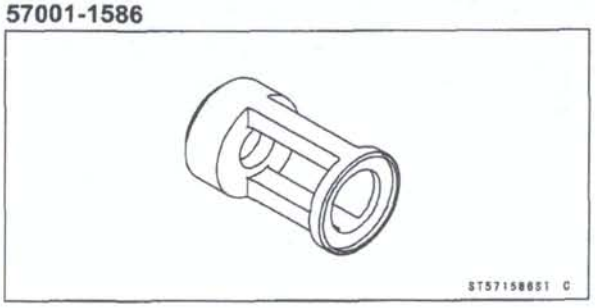
Valve Guide Driver:
57001-1564



Piston Pin Puller:
57001-1568

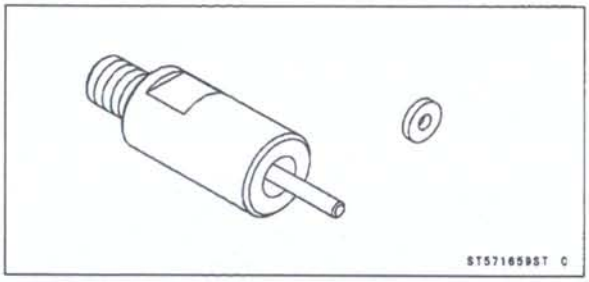


Valve Spring Compressor Adapter, φ24:
57001-1586

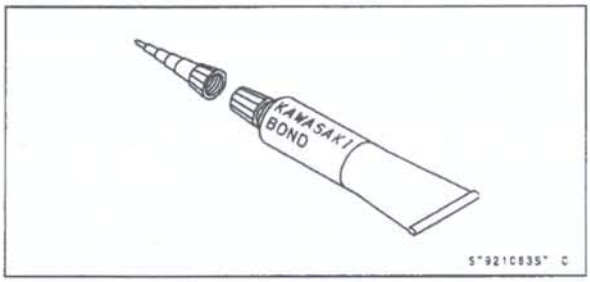


Special Tools and Sealant

Valve Guide Driver Attachment D:
57001-1659



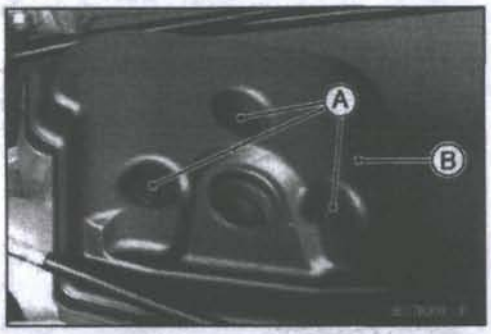
Kawasaki Bond (Liquid Gasket-Gray):
92104-1063



Cylinder Head Cover

Cylinder Head Cover Removal

- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  Spark Plug Cap
- Remove the cylinder head cover bolts [A] and remove the cylinder head cover [B].



Cylinder Head Cover Installation

- Make sure that the upper chain guide [A] is bottomed.

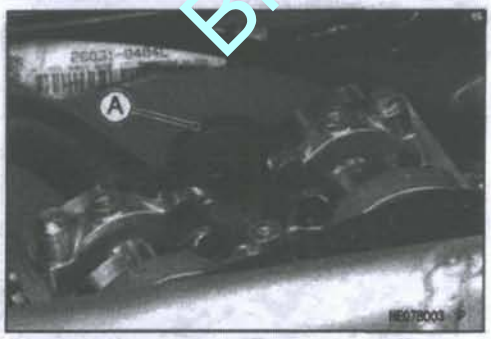
CAUTION

Unless the upper chain guide is bottomed, the camshaft chain could push the cylinder head cover upward, leading to an oil leak.

- Replace the head cover gasket [A] with a new one.
- Assemble the gasket and head cover.
- Apply liquid gasket [B] to the cylinder head cover gasket as shown.

Sealant - Kawasaki Bond (Liquid Gasket-Gray): 92104 -1063

- Install the spark plug hole gasket [A].
- Install the head cover together with the gasket.

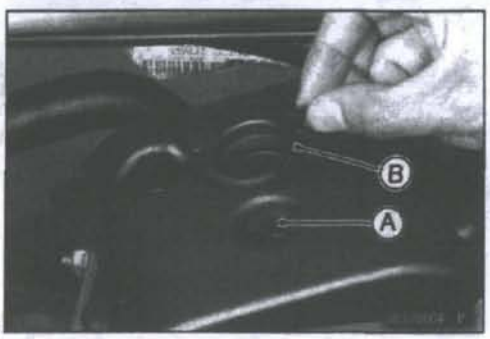


- Install the head cover bolt washers [A] with the metal side upwards.
- Tighten the cover bolt [B].

Torque - Cylinder Head Cover Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the spark plug cap.

○Pull up the spark plug cap lightly to make sure of the installation of the spark plug cap.



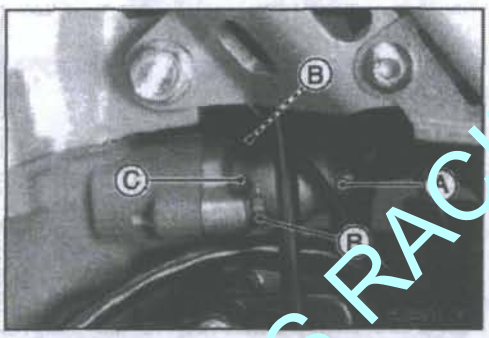
Camshaft Chain Tensioner

Camshaft Chain Tensioner Removal

CAUTION

This is a non-return type camshaft chain tensioner. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below:
When removing the tensioner, do not take out the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner Installation".
Do not turn over the crankshaft while the tensioner is removed. This could upset the camshaft chain timing and damage the valves.

- Loosen the cap bolt [A]
- Remove the tensioner mounting bolts [B], and remove the chain tensioner body [C].



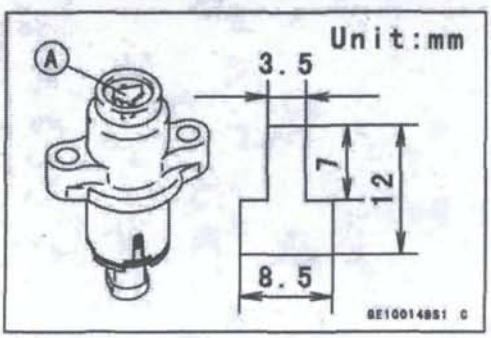
Camshaft Chain Tensioner Installation

- Remove the tensioner cap bolt and O-ring.
- While compressing the push rod [A], turn it clockwise with a suitable screwdriver until the rod stopped.

CAUTION

Do not turn the rod counterclockwise at installation. This could detach the rod and the tensioner cannot be reinstalled.

- While holding the rod in position with a suitable push rod holder plate [A] install the tensioner on the cylinder block.



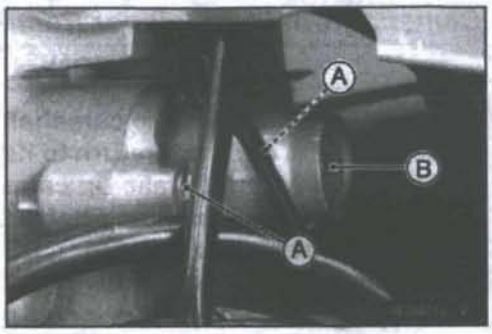
Camshaft Chain Tensioner

- Replace the chain tensioner gasket with a new one.
- Tighten:

Torque - Chain Tensioner Mounting Bolts [A]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Take out the holder plate [B].
- Install the O-ring and tighten the cap bolt.

Torque - Chain Tensioner Cap Bolt: 5.0 N·m (0.51 kgf·m, 44 in·lb)

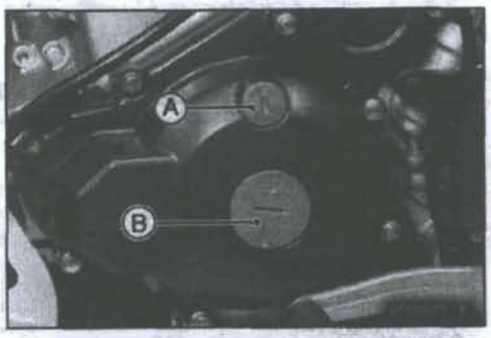


Camshaft

Camshaft Removal

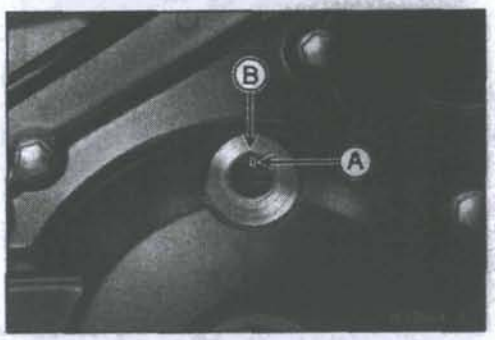
- Remove:
  Cylinder Head Cover (see Cylinder Head Cover Removal)
  Timing Inspection Cap [A]
  Alternator Rotor Nut Cap [B]

Special Tool - Filler Cap Driver: 57001-1454



- First, bring the piston to the TDC (of either the compression or exhaust stroke).

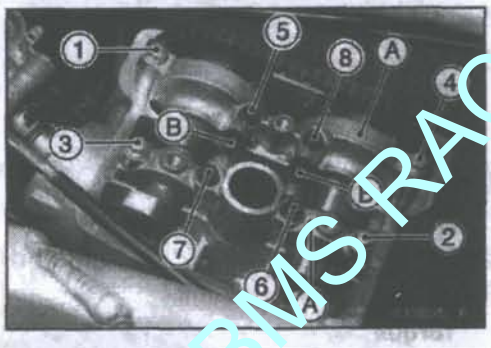
○Turn the alternator rotor nut counterclockwise to align the TDC mark [A] with the center of the groove [B] of the inspection hole.



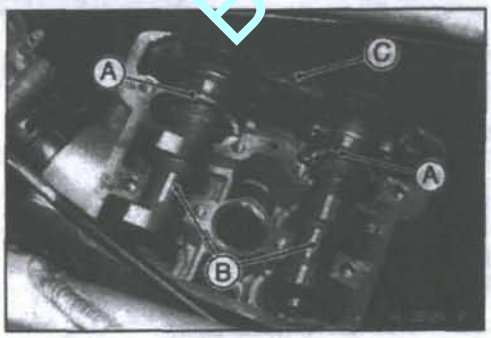
- Remove:
  Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal).
  Camshaft Cap Bolts [1 ~ 8] (sequence numbers)
  Camshaft Caps [A] (together with the oil pipes [B])

○Plug the oil passage and camshaft chain tunnel with a clean cloth for prevent the oil pipe from dropping into the crankcase.

○While keeping parallel, remove the camshaft caps and oil pipes.



- Remove:
  Positioning Rings [A]
- Disengage the camshafts [B] from camshaft chain [C].



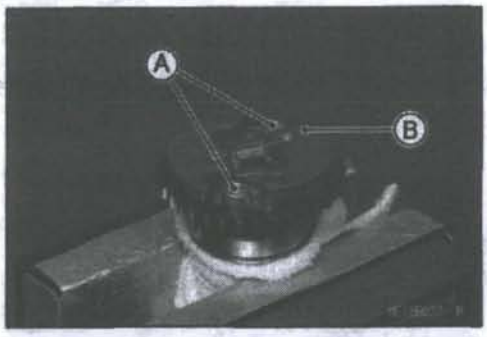
- Staff a clean cloth into the camshaft chain tunnel to keep any parts from dropping into the crankcase.

CAUTION

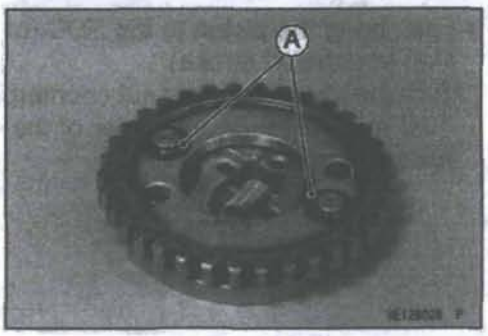
The crankshaft may be turned while the camshafts are removed.
Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.

Camshaft

- Remove:
  Bolt [A]
  Auto-Decompressor [B] (with the sprocket)



- Remove:
  Circlips [A]

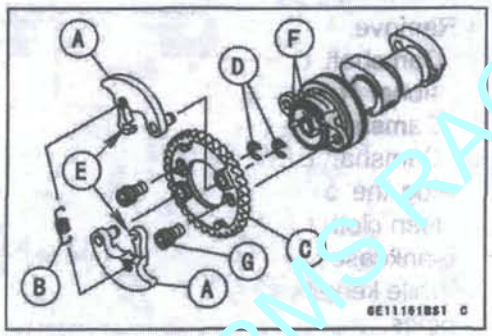


Camshaft Installation

- Assemble the auto-decompressor weights [A] and spring [B] to install it to the sprocket [C].
- Replace the circlips [D] with new ones, and install them so that the opening faces outside.
- Apply a non-permanent locking agent to camshaft sprocket bolts.
- Fit the recess [E] of the weight and projection [F] of the camshaft, and install it.

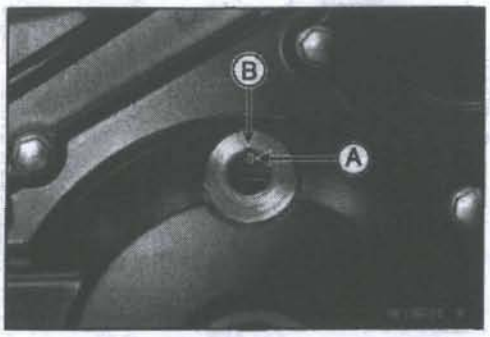
  Torque - Camshaft Sprocket Bolt [G]: 12 N·m (1.2 kgf·m, 106 in·lb)

- Apply molybdenum disulfide oil to the, all cam and journal surfaces of the camshaft.



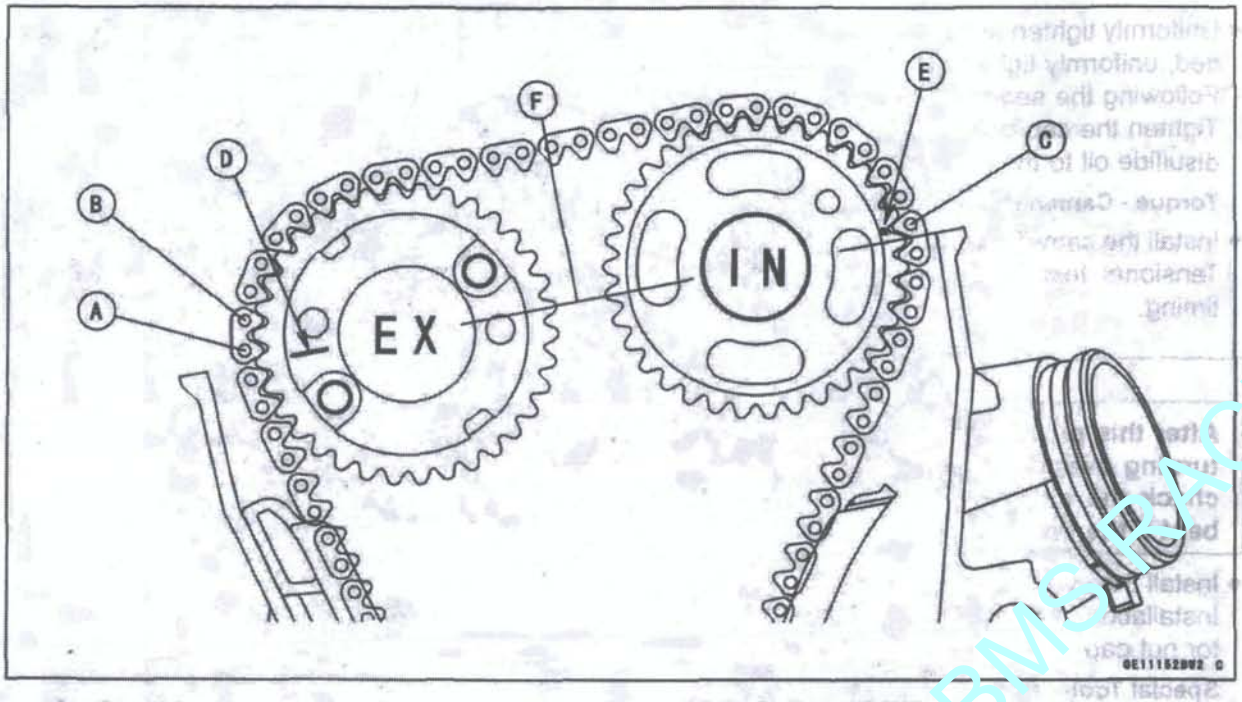
- First, bring the crankshaft to the TDC (of either the compression or exhaust stroke).

○Turn the alternator rotor nut counterclockwise to align the TDC mark [A] with the center of the groove [B] of the inspection hole.



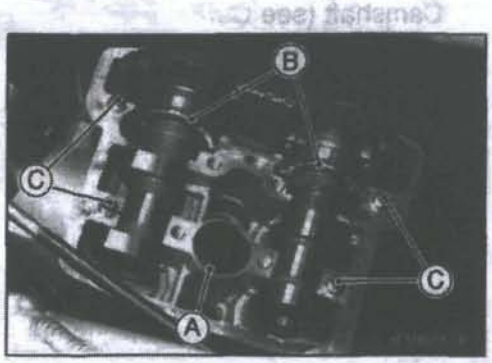
Camshaft

- Engage the camshaft chain with the camshaft sprockets.
  - Pull the tension side (exhaust side) of the chain taut to install the chain.
  - The timing marks on the sprocket must be aligned with the cylinder head upper surface.
- Pull the chain taut and fit it onto the camshaft sprocket.
- Starting with the timing mark on the front of the exhaust sprocket, count to the 1st pin. Feed the exhaust camshaft thought the chain and align the 29th pin with the timing mark on the inlet camshaft sprocket.



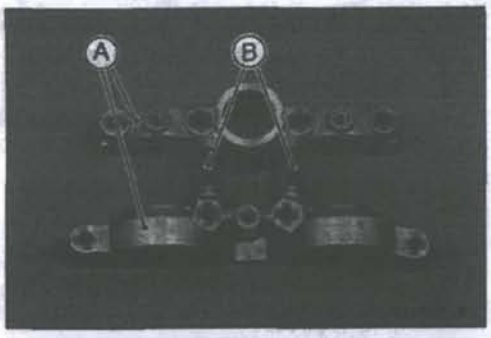
1st Pin [A]
2nd Pin [B]
29th Pin [C]
Mark (exhaust) [D]
Punch Mark (inlet) [E]
Upper Cylinder Head Surface [F]

- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring, and install it.
- Be sure to install the positioning rings [B] and dowel pins [C].
- Plug the oil passage and camshaft chain tunnel with a clean cloth for prevent the any parts from dropping in the crankcase.



Camshaft

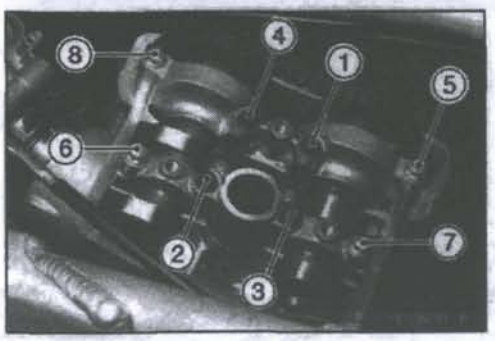
- Apply grease to the rubber portions of the oil pipes.
- Assemble:
  Camshaft Caps [A]
  Oil Pipes [B]
- While keeping parallel, install them.



- Uniformly tighten all bolts and after the camshaft has settled, uniformly tighten all the bolts.

○Following the sequence numbers on the camshaft caps. Tighten the cap bolts [1 ~ 8] after applying molybdenum disulfide oil to the thread of them.

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)



- Install the camshaft chain tensioner (see Camshaft Chain Tensioner Installation), then, check the camshaft chain timing.

CAUTION

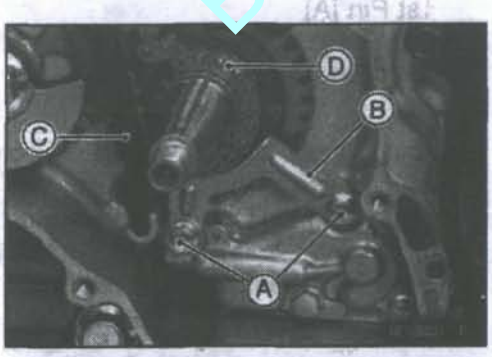
After this procedure, if any resistance is felt while turning over the crankshaft, stop immediately, and check the camshaft chain timing. Valves will be bent if the timing is not properly set.

- Install the cylinder head cover (see Cylinder Head Cover Installation), timing inspection cap, and the alternator rotor nut cap.

Special Tool - Filler Cap Driver: 57001-1454

Camshaft Chain Removal

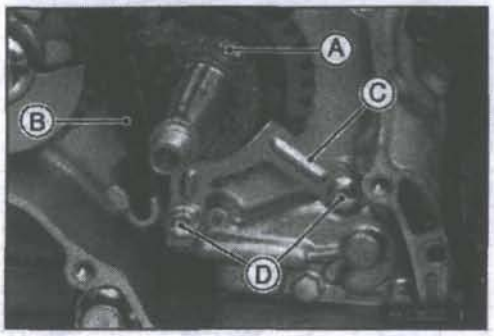
- Remove:
  Camshaft (see Camshaft Removal)
  Alternator Rotor (see Alternator Rotor Removal in the Electrical System)
  Lower Camshaft Chain Guide Bolt [A]
  Lower Chain Guide [B]
  Front Chain Guide [C]
- Remove the camshaft chain [D] from the crankshaft sprocket.



Camshaft Chain Installation

- Hang the camshaft chain [A] to the crankshaft sprocket.
- Install:
  Front Chain Guide [B]
  Lower Chain Guide [C]
- Tighten:

Torque - Lower Camshaft Chain Guide Bolts [D] (Oil Pump (Scavenge) Cover Bolts): 9.8 N·m (1.0 kgf·m, 87 in·lb)



- Install:
  Alternator Rotor (see Alternator Rotor Installation in the Electrical System chapter)
  Camshaft (see Camshaft Installation)

Camshaft

Camshaft and Camshaft Cap Wear

- Measure each clearance between the camshaft journal and camshaft cap using plastigauge (press gauge) [A].
- Install the camshaft caps (see Camshaft Installation)

NOTE

○Do not turn the camshaft when the plastigauge is between the journal and camshaft cap.

★If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

Camshaft Bearing Clearance

Standard: 0.020 ~ 0.062 mm (0.00079 ~ 0.0024 in.)

Service Limit: 0.15 mm (0.0059 in.)

★If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again.

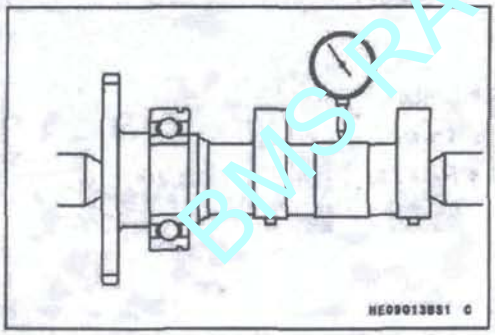
Camshaft Journal Diameter

Standard: 22.959 ~ 22.980 mm (0.90390 ~ 0.90472 in.)

Service Limit: 22.93 mm (0.9028 in.)

★If the clearance still remains out of the service limit, replace the cylinder head unit.

Camshaft Runout



- Remove the camshaft (see Camshaft Removal).
- Set the camshaft in a camshaft alignment jig or on V blocks.
- Measure the runout with a dial gauge at the specified place as shown.

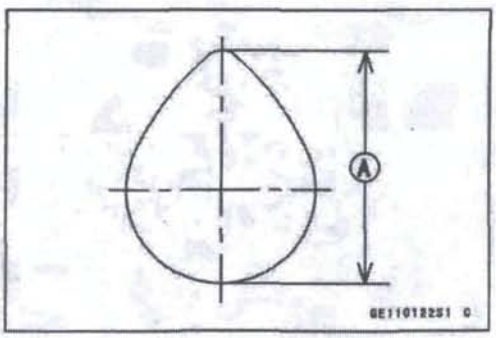
★If the runout exceeds the service limit, replace the camshaft.

Camshaft Runout

Standard: TIR 0.02 mm (0.0008 in.) or less

Service Limit: TIR 0.1 mm (0.004 in.)

Cam Wear



- Remove the camshaft (see Camshaft Removal).
- Measure the height [A] of each cam with a micrometer.

★If the cams are worn down past the service limit, replace the camshaft.

Cam Height

Standard:

Exhaust 35.546 ~ 35.654 mm (1.3994 ~ 1.4037 in.)

Inlet 35.946 ~ 36.054 mm (1.4152 ~ 1.4194 in.)

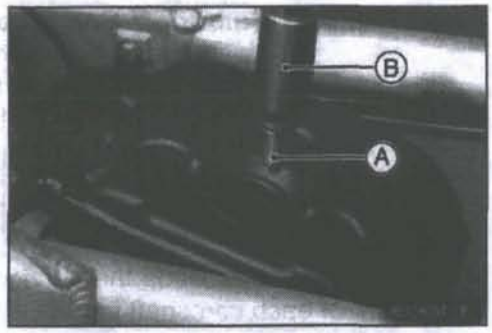
Service Limit:

Exhaust 35.45 mm (1.396 in.)

Inlet 35.85 mm (1.411 in.)

Cylinder Head

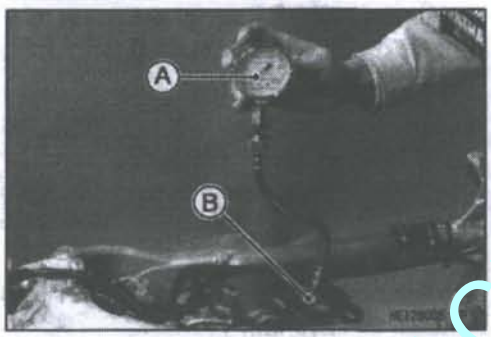
Cylinder Compression Measurement



- Start the engine.
- Thoroughly warm up the engine so that the engine oil between the piston and cylinder wall will help seal compression as it does during normal running.
- Stop the engine.
- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
- Remove the spark plug [A] with spark plug wrench [B] (or owner's tool).

Special Tool - Spark Plug Wrench, Hex 16: 57001-1262

Owner's Tool - Spark Plug Wrench: 92110-0002



- Attach the compression gauge [A] and the adapter hose [B] firmly into the spark plug hole.

Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221
Compression Gauge Adapter, M10 × 1.0: 57001-1317

- Hold the throttle wide open and crank the engine with the electric starter several times. When the gauge stops ring, stop cranking and read the gauge.

Cylinder Compression
Service Range: 338 ~ 564 kPa (3.45 ~ 5.75 kg/cm², 49.0 ~ 81.8 psi) @900 r/min (rpm)

- Install the spark plug.

Torque - Spark Plug: 13 N·m (1.3 kgf·m, 115 in·lb)

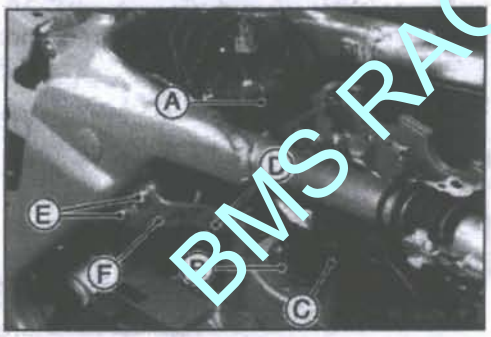
- Pull the spark plug cap lightly to make sure the installation of the spark plug cap.

Cylinder Head

Problem	Diagnosis	Remedy (Action)
The cylinder compression is higher than the usable range	Carbon accumulation on piston and in cylinder head (combustion chamber) is suspected due to damaged valve stem or piston oil rings.	Remove the carbon deposits and replace damaged parts if necessary.
	Incorrect cylinder head gasket thickness.	Replace the gasket with a standard one.
	Damaged auto-decompressor spring or decompressor do not move smoothly.	Replace the spring or auto -decompressor.
The cylinder compression is lower than the usable range	Exhaust gas leakage around cylinder head.	Replace the damaged gasket and check cylinder head warp.
	Incorrect seating surface of valve.	Repair seating surface if possible.
	Valve clearance is too narrow.	Adjust the valve clearance.
	Piston/cylinder clearance is too wide.	Replace the piston and/or cylinder
	Piston seizure.	Inspect the cylinder and piston; repair or replace them if necessary.
	Bad condition of piston ring and/or piston ring grooves.	Replace the piston and/or the piston rings.
	Auto-decompressor do not move smoothly.	Replace the auto-decompressor.

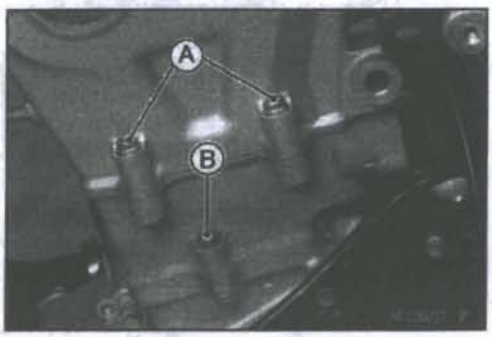
Cylinder Head Removal

- Remove:
  Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Cylinder Head Cover (see Cylinder Head Cover Removal)
  Camshaft (see Camshaft Removal)
  Throttle Body Holder Clamp [A] (Loosen)
  Exhaust Pipe (see Muffler Removal)
  Clamp Screw [B]
  Radiator Hose [C]
  Upper Engine Mounting Bolts [D] (Left and Right)
  Upper Engine Bracket Bolts [E] (Left and Right)
  Upper Engine Brackets [F] (Left and Right)



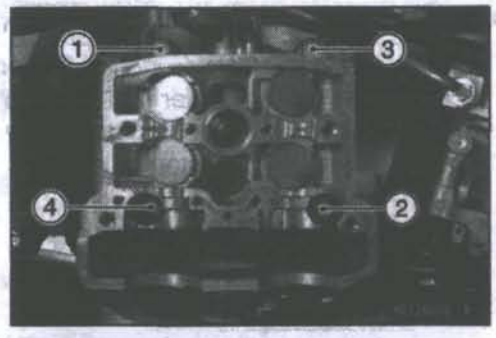
- Remove the 6 mm cylinder head bolts [A] and loosen the cylinder bolt [B].

○This prevents the 6 mm bolts from becoming damaged.

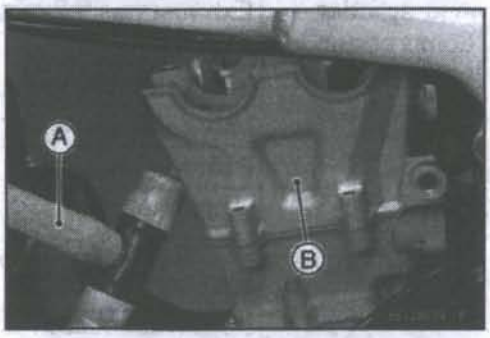


Cylinder Head

- Remove the 10 mm cylinder head bolts following the tightening sequence as shown.



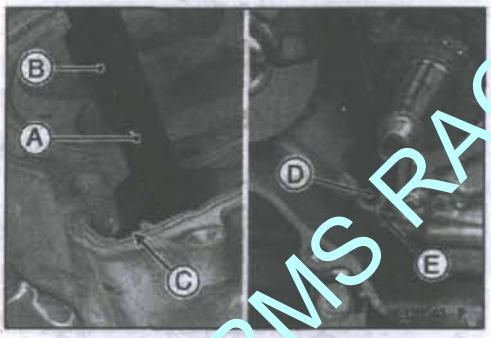
- Tap lightly up with a plastic mallet [A] to separate the cylinder head [B] from the cylinder.
- Pull the cylinder head forward to separate the throttle body holder from the throttle body.
- Remove the cylinder head gasket.



Cylinder Head Installation

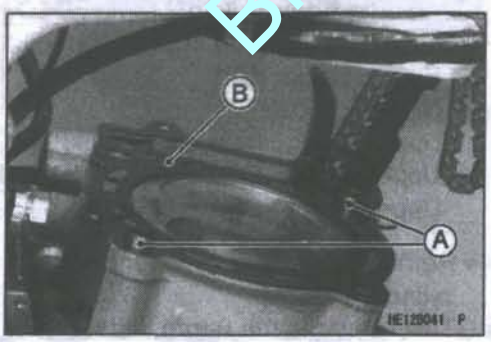
- Fit the projection [A] of the front camshaft chain guide [B] in the groove [C] of the cylinder.

OInsert the guide end [D] into the recess [E] of the crankcase securely.



- Install:
  Dowel Pins [A]
  New Cylinder Head Gasket [B]
- Install the cylinder head.

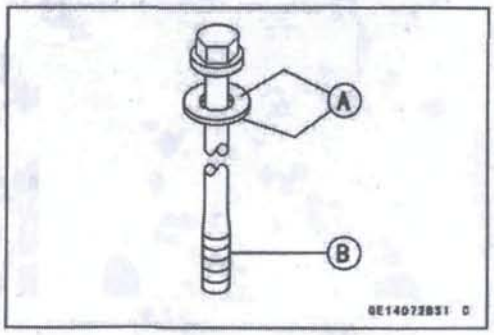
OThe camshaft caps are machined with the cylinder head; therefore, if a new cylinder head is installed, use the caps that are supplied with the new head.



- Replace all the 10 mm cylinder head bolt washers with new ones.

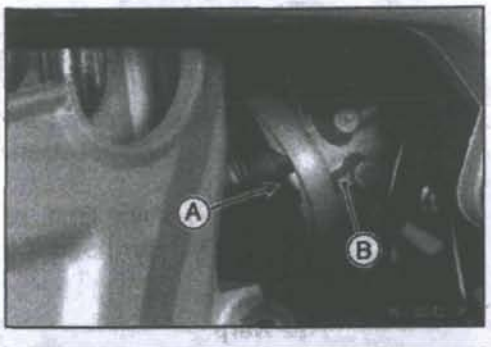
OThe 10 mm cylinder head bolt washers are copper-plated, and they could leak oil if reused.

- Apply molybdenum disulfide oil to the both sides [A] of the 10 mm cylinder head bolt washer and thread [B] of the 10 mm cylinder head bolts.



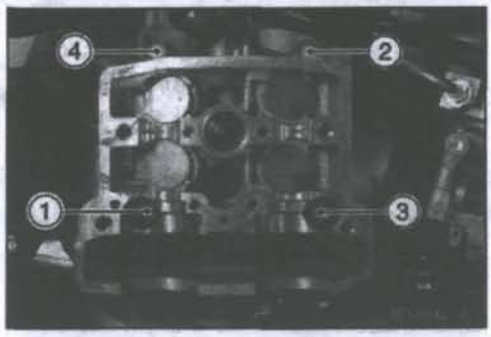
Cylinder Head

- Install the cylinder head so that the throttle body holder recess [A] fit the throttle body projection [B].



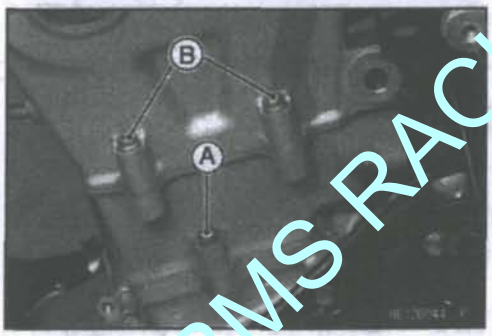
- Tighten the 10 mm cylinder head bolts in the numbered sequence [1 ~ 4].

Torque - Cylinder Head Bolts (M10): 59 N·m (6.0 kgf·m, 44 ft·lb)



- Tighten:

Torque - Cylinder Bolt [A]: 12 N·m (1.2 kgf·m, 106 in·lb)
Cylinder Head Bolts (M6) [B]: 12 N·m (1.2 kgf·m, 106 in·lb)



- Install:
  Camshaft (see Camshaft Installation)
  Cylinder Head Cover (see Cylinder Head Cover Installation)
  Engine Bracket (see Engine Installation in the Engine Removal/Installation chapter)
- Connect the radiator hose, and tighten the hose clamp screw.

Torque - Radiator Hose Clamp: 2.0 N·m (0.20 kgf·m, 18 in·lb)

- Install:
  Exhaust Pipe (see Muffler Installation)

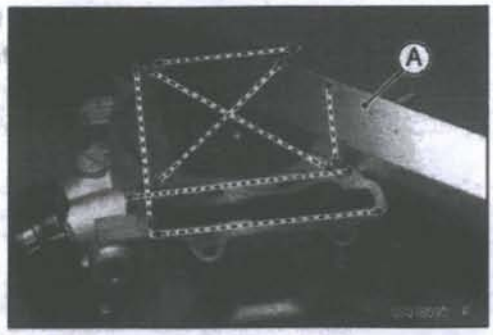
Cylinder Head

Cylinder Head Warp Inspection

- Remove the cylinder head (see Cylinder Head Removal).
- Lay a straightedge [A] across the lower surface of the head at several different points, and measure warp by inserting a thickness gauge between the straightedge and the head.

★If warp exceeds the service limit, repair the mating surface. Replace the cylinder head if the mating surface is badly damaged.

Cylinder Head Warp
Service Limit: 0.05 mm (0.002 in.)



- Remove the valves (see Valve Removal).
- Scrape the carbon out of the combustion chamber and exhaust port with a scraper [A] or a suitable tool.
- Clean the cylinder head, using high-flash point solvent.
- Blow out any particles which may obstruct the oil passage in the cylinder head using compressed air.
- Install the valves (see Valve Installation).

Valves

Valve Clearance Inspection

- Refer to the Valve Clearance Inspection in the Periodic Maintenance chapter.

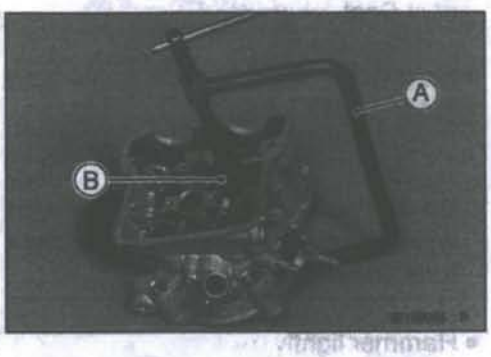
Valve Removal

- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valve lifter and the shim from the valve.

NOTE

○*Use the valve spring compressor assembly and the adapter to press down the valve spring retainer.*

Special Tools - Valve Spring Compressor Assembly: 57001 -241 [A]
Valve Spring Compressor Adapter, ϕ24: 57001-1586 [B]



Valve Installation

CAUTION

Do not lap the valve to the valve seat, using the grinding compound. It will come off oxide film treated surface of the valve.

- Visually inspect the valve surface.

★If the surface is damaged, replace it.

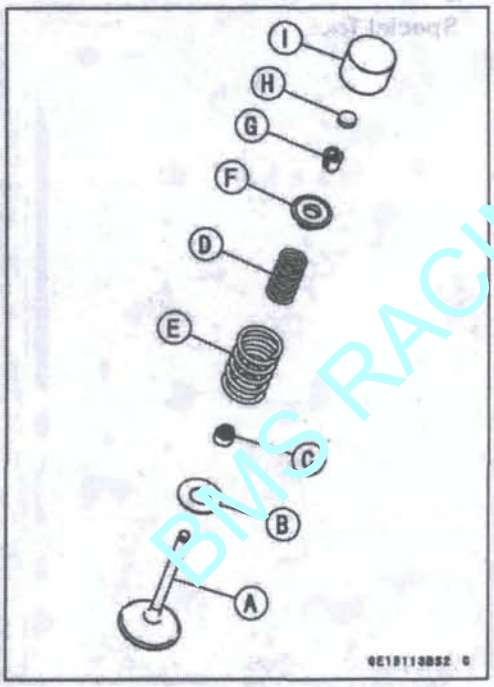
- Replace the oil seal [C] with a new part.
- Apply a thin coat of molybdenum disulfide grease to the valve stem [A] before installing the valve.
- Check to make sure that the valve moves up and down smoothly.
- Check to make sure that the valve and the valve seat are making proper contact.
- Install the inner valve spring [D] and outer valve spring [E] so that the closed coil end faces the spring seat [B].
- Compress the valve spring to install the split keepers [G] in order to secure the spring retainer [F] in place.

Special Tools - Valve Spring Compressor Assembly: 57001 -241
Valve Spring Compressor Adapter, ϕ24: 57001-1586

- The shim [H] must be installed with its thickness indication facing up towards the retainer.

○Apply high temperature grease to the shim or to the retainer to prevent the shim from falling off when the camshaft is being installed.

- Apply engine oil to the valve lifter [I] surface; then install the lifter.



Valves

Valve Guide Removal

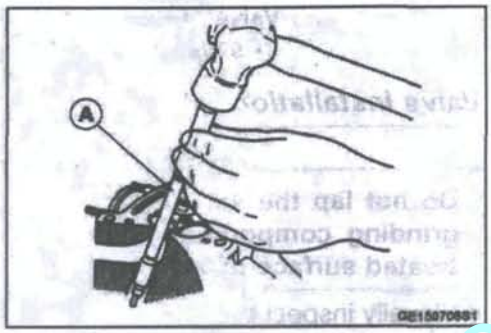
- Remove:
  Valve (see Valve Removal)
  Oil Seal
  Spring Seat
- Heat the area around the valve guide up to 120 ~ 150°C (248 ~ 302°F).

CAUTION

Do not heat the cylinder head with a torch. This will warp the cylinder head. Soak the cylinder head and heat the oil.

- Hammer lightly on the valve guide arbor [A] to remove the guide.

Special Tool - Valve Guide Arbor, ϕ5.5: 57001-1021



Valve Guide Installation

- Apply a thin coat of oil to the outer surface of the valve guide.
- Heat the area around the valve guide up to 120 ~ 150°C (248 ~ 302°F).

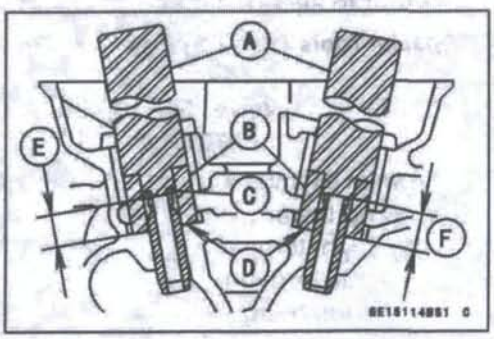
CAUTION

Do not heat the cylinder head with a torch. This will warp the cylinder head. Soak the cylinder head and heat the oil.

- Assemble the valve guide driver [A] and valve guide driver attachment D [B].

Special Tools - Valve Guide Driver: 57001-1564
Valve Guide Driver Attachment D: 57001 -1659

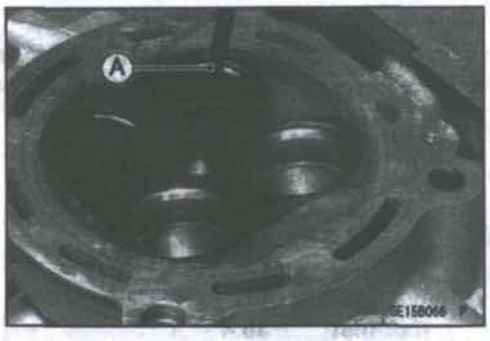
- When install the exhaust valve guide, using the attached washer (t = 2.0) [C].
- Using the valve guide driver, press and insert the valve guide in until the valve guide driver surface [D] touches the head surface.
  [E] Exhaust: 11.1 ~ 11.3 mm (0.437 ~ 0.445 in.)
  [F] Inlet: 13.1 ~ 13.3 mm (0.516 ~ 0.524 in.)



Valves

- Ream the valve guide with valve guide reamer [A], even if the old guide is reused.

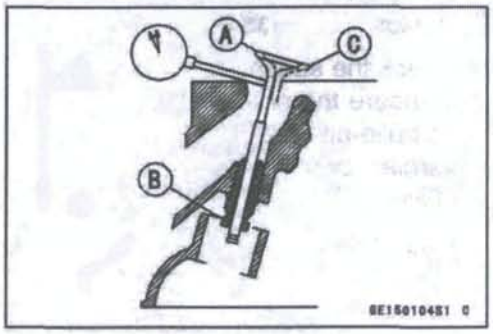
Special Tool - Valve Guide Reamer, φ5.5: 57001-1079



Valve/Valve Guide Clearance Measurement (Wobble Method)

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

- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
- Move the stem back and forth [C] to measure the valve wobble.



- Repeat the measurement in a direction at a 90° angle to the first measurement.

★If the reading exceeds the service limit, replace the guide.

NOTE

○*The reading is greater than the actual valve/valve guide clearance because the measurement is taken outside of the guide.*

Valve/Valve Guide Clearance Measurement (Wobble Method)

Standard:	
Exhaust	**0.09 ~ 0.16 mm (0.0035 ~ 0.0063 in.)**
Inlet	**0.06 ~ 0.14 mm (0.0024 ~ 0.0055 in.)**
Service Limit:	
Exhaust	**0.36 mm (0.014 in.)**
Inlet	**0.33 mm (0.013 in.)**

Valves

Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].
- Measure the outside diameter [D] of the seating pattern on the valve seat.

★If the outside diameter is too large or too small, repair the seat. (see Seat Repair)

Valve Seating Surface Outside Diameter

Exhaust	**30.4 ~ 30.6 mm (1.197 ~ 1.205 in.)**
Inlet	**35.4 ~ 35.6 mm (1.39 ~ 1.40 in.)**

- Check the seating surface width of the valve seat.

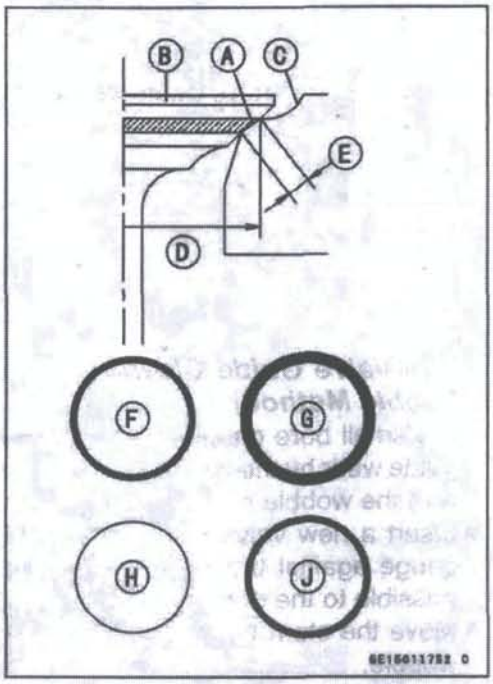
OMeasure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with a vernier caliper.

Good [F]

Valve Seating Surface Width Standard

Exhaust	**0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)**
Inlet	**0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)**

★If the width is too wide [G] , too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).



Valve Seat Repair

- For the instructions on how to use the valve seat cutter [A], follow the operation manual provided by the to manufacturer.

Special Tools - Valve Seat Cutter Holder, φ5.5: 57001-1125 [B]
Valve Seat Cutter Holder Bar: 57001-1128

Exhaust: Valve Seat Cutter, 45° - φ35: 57001- 1116
Valve Seat Cutter, 32° - φ35: 57001-1121
Valve Seat Cutter, 55° - φ35: 57001-1247
Inlet: Valve Seat Cutter, 45° - φ40: 57001-1496
Valve Seat Cutter, 32° - φ38.5: 57001-1122
Valve Seat Cutter, 55° - φ38.5: 57001-1497

★If the tool manufacturer's instructions are not available, operate in accordance with the following procedure.

Valves

Seat Cutter Operation Care

1. This valve seat cutter is developed to grind the vale for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

○*Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.*

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

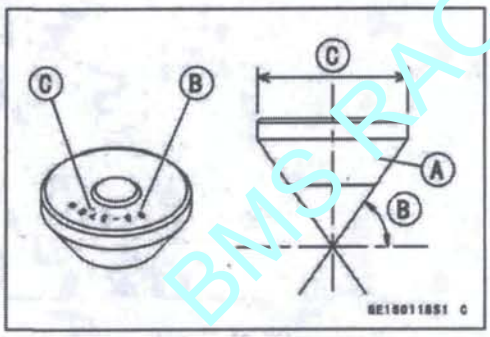
○*Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.*

5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter

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

60° ..... Cutter Angle [B]
37.5ϕ ..... Cutter Outer Diameter [C]

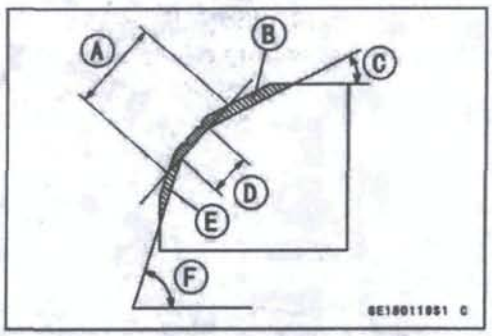


Repair Operating Procedures

- 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

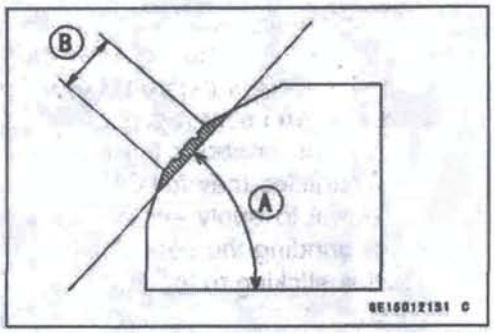
Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.



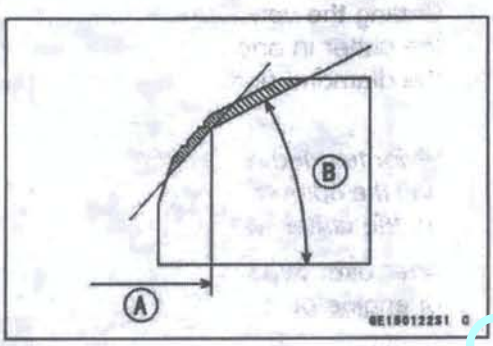
Widened Width [A] of engagement by machining with 45° cutter
Ground Volume [B] by 32° cutter
32° [C]
Correct Width [D]
Ground Volume [E] by 55° cutter
55° [F]

Valves

• Measure the outside diameter of the seating surface with a vernier caliper.
★If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.
Original Seating Surface [B]
○Remove all pittings of flaws from 45° ground surface.
○Alter grinding with 45° cutter, apply thin coat of machinist's dye to 45° [A] seating surface. This makes seating surface distinct and 32° and 55° grinding operation easier.
○When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.



★If the 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.

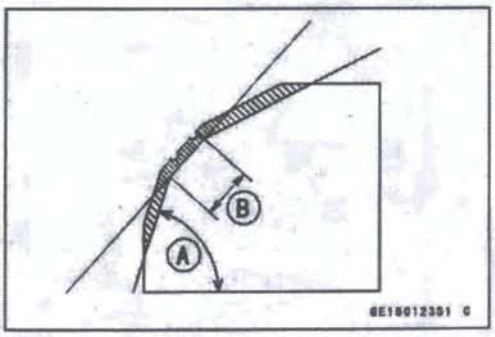


CAUTION

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 a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.
★If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.

★If the seat width is too wide, make the 55° [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 55° angle until the seat width is within the specified range.
○To make the 55° grind, fit a 55° cutter into the holder, and slide it into the valve guide.
○Turn the holder, while pressing down lightly.
○After making the 55° grind, return to the seat width measurement step above.
Correct Width [B]



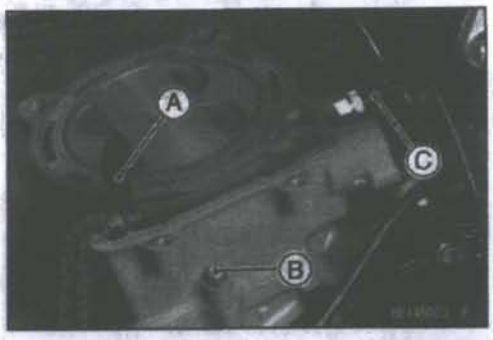
Valves

- 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.
- When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Adjustment in the Periodic Maintenance chapter).

Cylinder and Piston

Cylinder Removal

- Remove:
  Cylinder Head (see Cylinder Head Removal)
  Front Camshaft Chain Guide [A]
  Cylinder Bolt [B]
- Disconnect the water temperature sensor connector [C].
- Tap lightly up with a plastic mallet to separate the cylinder from the crankcase.
- Remove the cylinder base gasket.

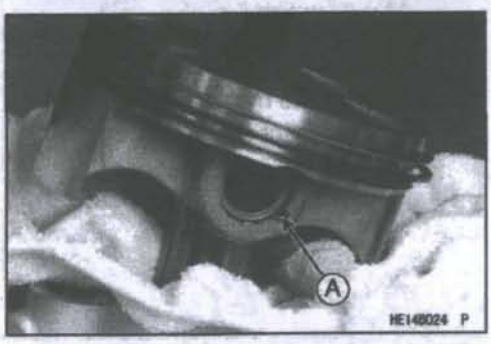


Piston Removal

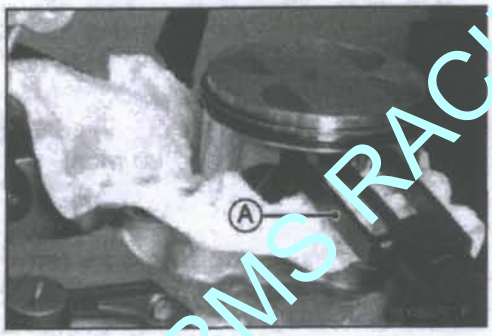
- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the piston and remove the piston snap ring [A] from one end of the piston pin.

CAUTION

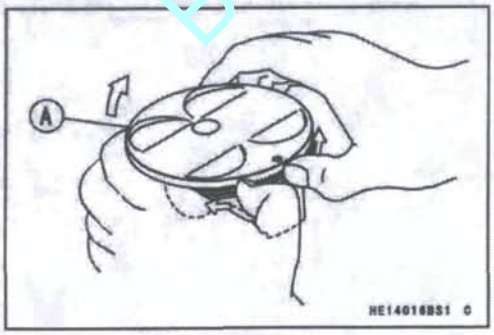
Do not reuse snap rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.



- Remove the piston pin, using a piston pin puller.
  Special Tool - Piston Pin Puller: 57001-1568 [A]
- 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 oil ring in the same procedure.



Cylinder and Piston Installation

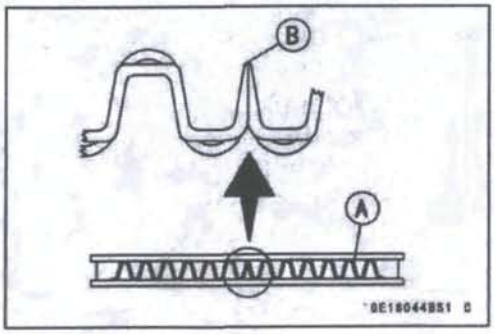
NOTE

○The oil ring rails have no "top" or "bottom".

- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.

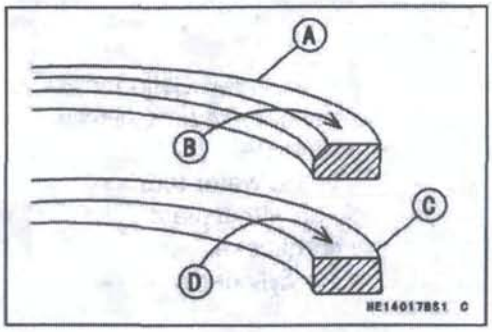
○Spread the rail with your thumbs, but only enough to fit the rail over the piston.

○Release the rail into the bottom piston ring groove.



Cylinder and Piston

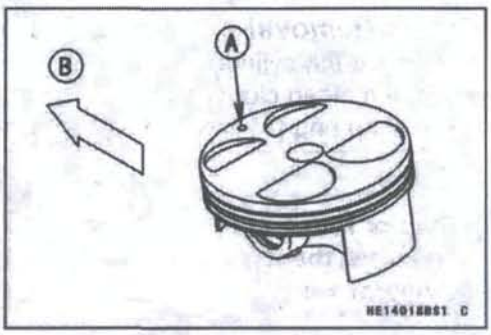
- Do not mix up the top ring and second ring.
- Install the top ring [A] so that the "**R**" mark [B] faces up.
- Install the second ring [C] so that the "**RN**" mark [D] faces up.



NOTE

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

- Apply engine oil to the inside wall of the small end of the connecting rod.
- Face the circle mark [A] on the top of the piston must point toward the front [B] of the engine.

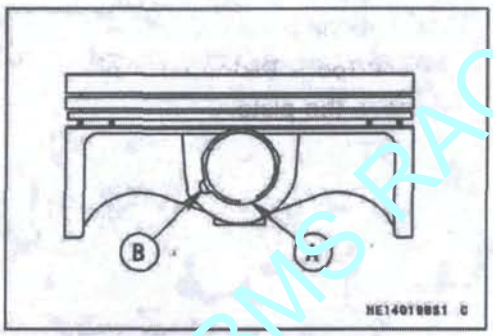


- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.

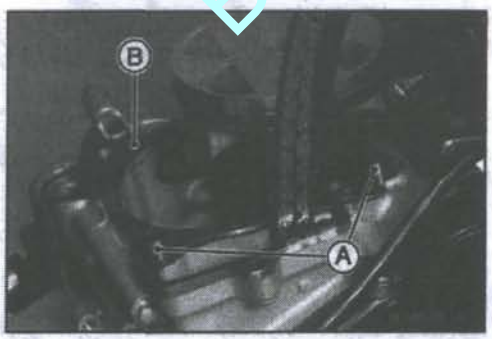
○When installing the piston pin snap ring, compress it only enough to install it and no more.

CAUTION

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



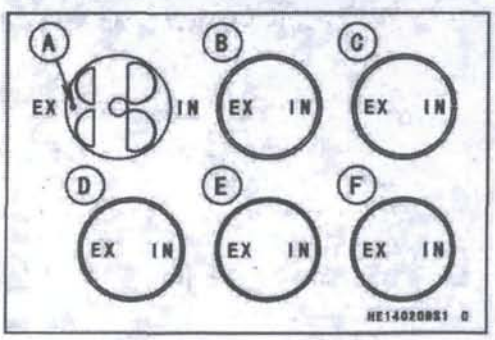
- Install:
  Dowel Pins [A]
  New Cylinder Base Gasket [B]



- The piston ring openings must be positioned as shown.

○Direction of the oil ring expander opening is arbitrary.

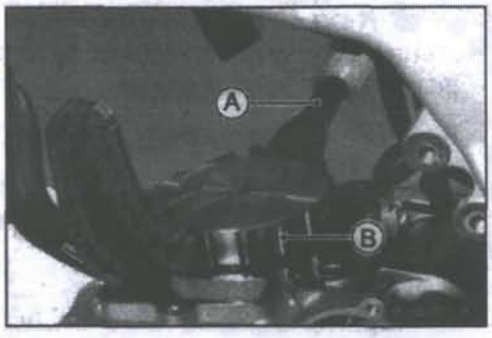
  Circle Mark [A]
  Top Ring [B]
  Second Ring [C]
  Upper Oil Ring Steel Rails [D]
  Oil Ring Expander [E]
  Lower Oil Ring Steel Rail [F]



Cylinder and Piston

- Apply engine oil to the cylinder bore.
- Determine the position of the piston ring ends.
- Install the cylinder while compressing the piston rings with your fingers or the special tools.

Special Tools - Piston Ring Compressor Grip [A]: 57001 -1095
Piston Ring Compressor Belt, ϕ95 ~ ϕ108 [B]: 57001-1358



- Install the removed parts.

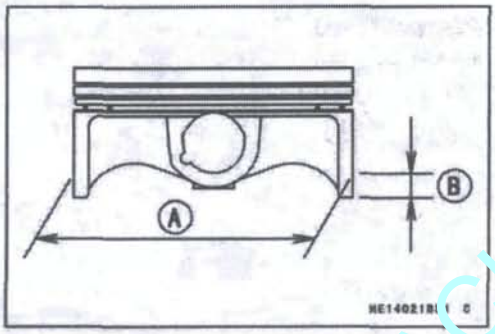
Cylinder Wear

- Refer to the Cylinder Wear Inspection in Periodic Maintenance chapter.

Piston Wear

- Using a micrometer, measure the outside diameter [A] of each piston 8.5 mm (0.33 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★If the pistons outside diameter is smaller than the service limit, replace the piston.



Piston Diameter
Standard: 95.964 ~ 95.979 mm (3.7781 ~ 3.7787 in.)
Service Limit: 95.81 mm (3.772 in.)

Piston/Cylinder Clearance

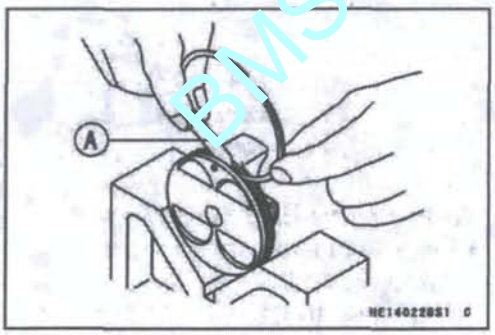
- Refer to the Piston/Cylinder Clearance in the Periodic Maintenance chapter.

Piston Ring/Ring Groove Clearance

- 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/Ring Groove Clearance
Standard:

Top	**0.04 ~ 0.08 mm (0.002 ~ 0.003 in.)**
Second	**0.03 ~ 0.05 mm (0.001 ~ 0.002 in.)**

Service Limit:

Top	**0.18 mm (0.0071 in.)**
Second	**0.15 mm (0.0059 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.

Cylinder and Piston

Piston Ring Groove Width

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

Piston Ring Groove Width

Standard:

Top	**1.03 ~ 1.05 mm (0.0406 ~ 0.0413 in.)**
Second	**1.02 ~ 1.04 mm (0.0402 ~ 0.0409 in.)**

Service Limit:

Top	**1.13 mm (0.0445 in.)**
Second	**1.12 mm (0.0441 in.)**

★If any of the groove widths exceeds the service limit, replace the piston.

Piston Ring Thickness

- Measure the thickness at several points around ring with a micrometer.

Piston Ring Thickness

Standard:

Top	**0.97 ~ 0.99 mm (0.038 ~ 0.039 in.)**
Second	**0.97 ~ 0.99 mm (0.038 ~ 0.039 in.)**

Service Limit:

Top	**0.90 mm (0.035 in.)**
Second	**0.90 mm (0.035 in.)**

★If any of the measurements is less than the service limit on either of the rings, replace the rings as a set.

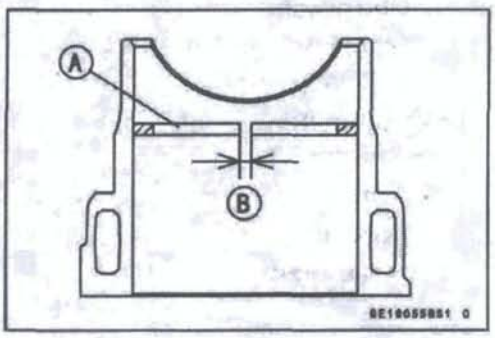
NOTE

○*When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.*

Piston Ring End Gap Measurement

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

★If the ring end gap exceeds the service limit, replace the ring.



Piston Ring End Gap

Standard:

Top	**0.25 ~ 0.35 mm (0.0098 ~ 0.014 in.)**
Second	**0.35 ~ 0.50 mm (0.014 ~ 0.020 in.)**
Oil	**0.20 ~ 0.70 mm (0.0079 ~ 0.028 in.)**

Service Limit:

Top	**0.6 mm (0.02 in.)**
Second	**0.8 mm (0.03 in.)**
Oil	**1.0 mm (0.04 in.)**

Cylinder and Piston

Piston, Piston Pin, Connecting Rod Wear Inspection

- Visually inspect the snap rings [A] still fitted in place.

★If the ring shows weakness or deformation, replace the ring. Also if the pin hole groove shows excessive wear, replace the piston.

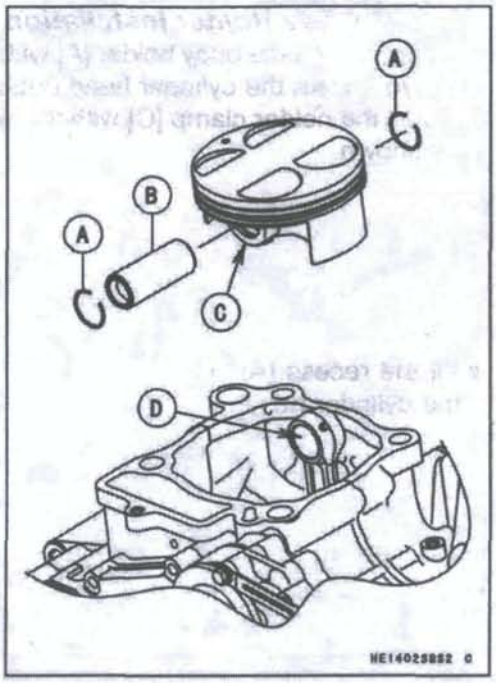
- Measure the diameter of the piston pin [B] with a micrometer.

★If the piston pin diameter is less than the service limit at any point, replace the piston pin.

- Using a cylinder gauge, measure the diameter of both of piston pin holes [C] in the piston and the inside diameter of the connecting rod small end [D].

★If either piston pin hole diameter exceeds the service limit, replace the piston.

★If the connecting rod small end inside diameter exceeds the service limit, replace the connecting rod.



Piston Pin Diameter

Standard: 20.991 ~ 21.000 mm (0.82642 ~ 0.82677 in.)

Service Limit: 20.96 mm (0.8252 in.)

Piston Pin Hole Diameter

Standard: 21.004 ~ 21.010 mm (0.82693 ~ 0.82716 in.)

Service Limit: 21.08 mm (0.8300 in.)

Connecting Rod Small End Inside Diameter

Standard: 21.016 ~ 21.027 mm (0.82740 ~ 0.82783 in.)

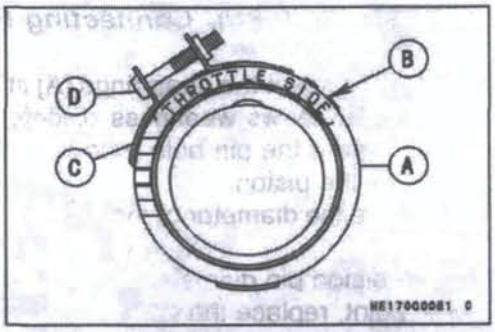
Service Limit: 21.06 mm (0.8291 in.)

Throttle Body Holder

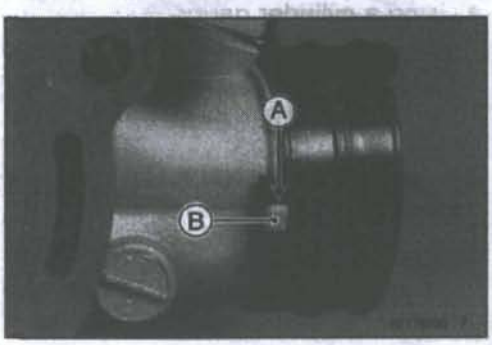
Throttle Body Holder Installation

- Install the throttle body holder [A] with the marked [B] side facing toward the cylinder head outside.

○Install the holder clamp [C] with its screw head [D] facing as shown.



- Fit the recess [A] of the holder into the projection [B] of the cylinder head.



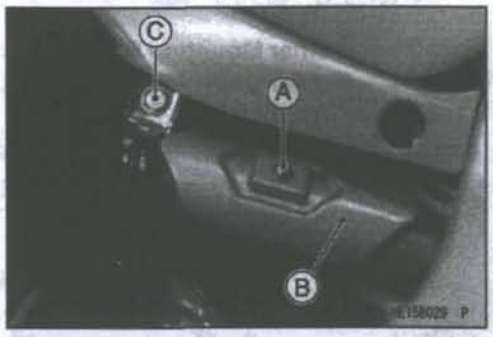
Muffler

⚠ WARNING

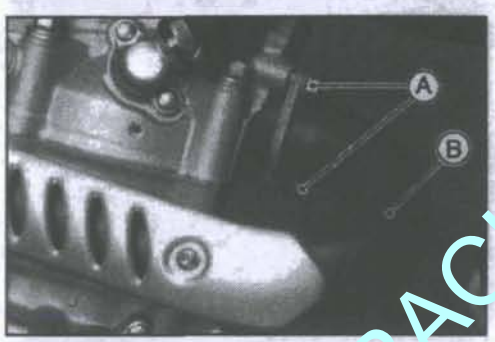
To avoid a serious burn, do not remove the muffler when the engine is still hot. Wait until the muffler cools down.

Muffler Removal

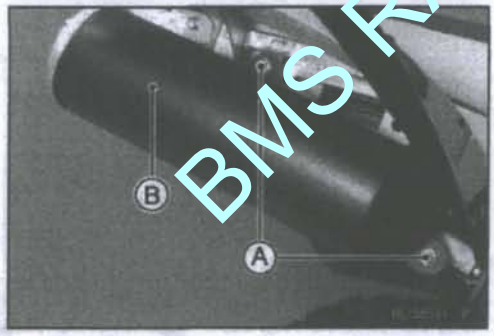
- Remove the rear exhaust cover bolt [A] and cover [B].
- Loosen the muffler joint clamp bolt [C].



- Remove:
  Exhaust Pipe Holder Nut [A]
  Exhaust Pipe [B]

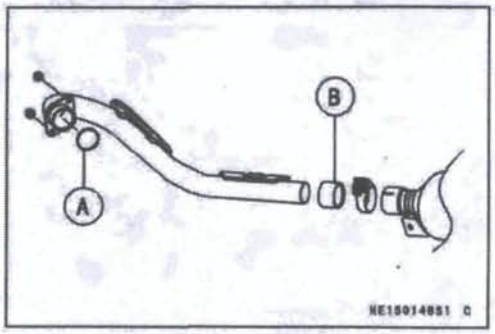


- Remove:
  Muffler Mounting Bolts [A]
  Muffler [B]



Muffler Installation

- Replace the holder gasket [A] with a new one.
- Check the gasket [B] at the clamp and replace it if it is damaged. Make sure that the gasket is placed securely outside the exhaust pipe.



Muffler

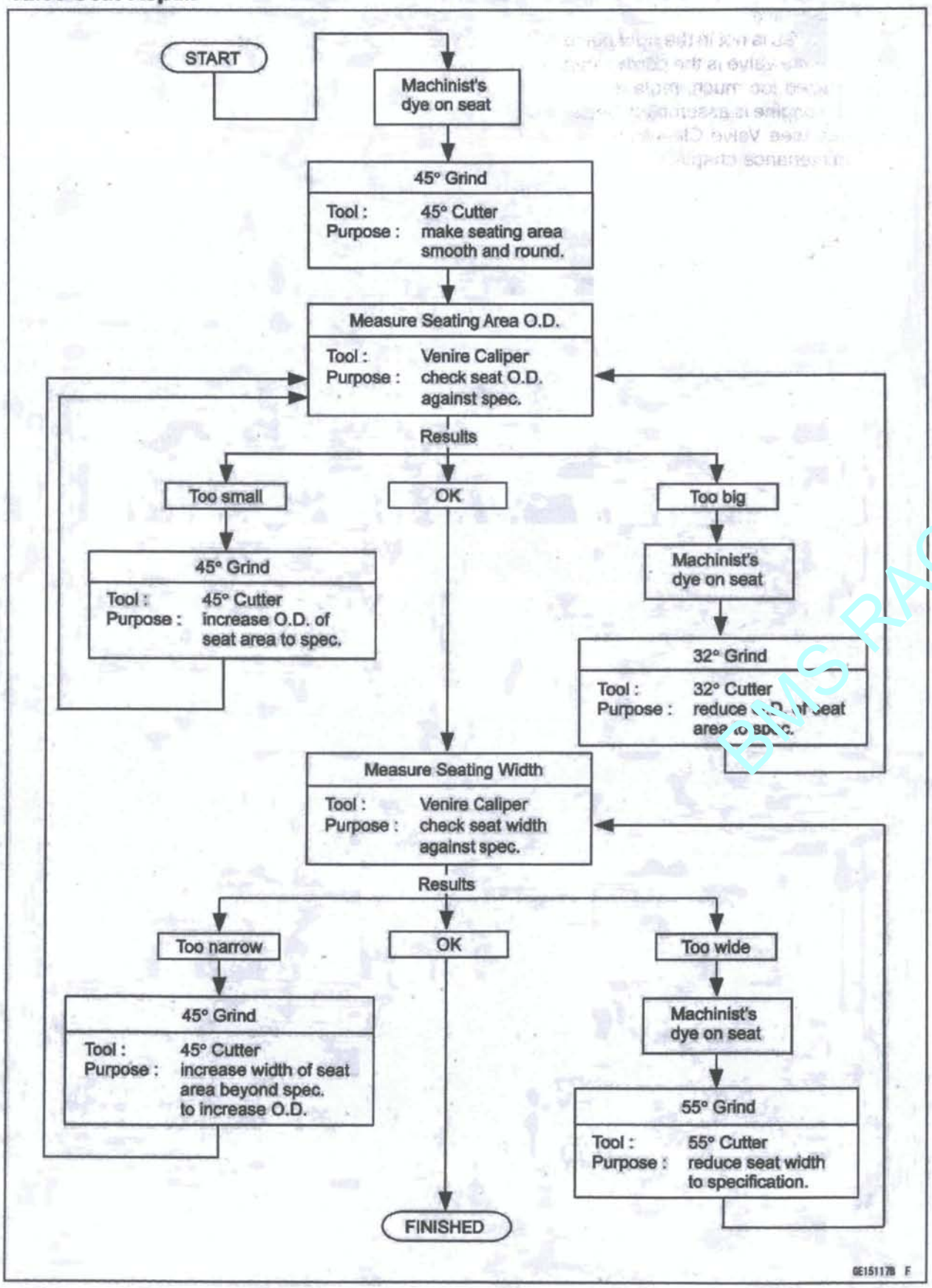
- First tighten all the bolts and nuts to a snug fit.
- Next tighten the exhaust pipe holder nuts evenly to avoid exhaust leaks.
- Lastly, tighten the rest of the bolts and clamp bolt.

Torque - Exhaust Pipe Holder Nuts: 20 N·m (2.0 kgf·m, 15 ft·lb)
Muffler Mounting Bolts: 35 N·m (3.6 kgf·m, 26 ft·lb)
Muffler Joint Clamp Bolt: 20 N·m (2.0 kgf·m, 15 ft·lb)

- Thoroughly warm up the engine, wait until the engine cools down, and then retighten the exhaust pipe holder nuts, and the joint clamp bolt securely.

Valves

Valve Seat Repair



Engine Right Side

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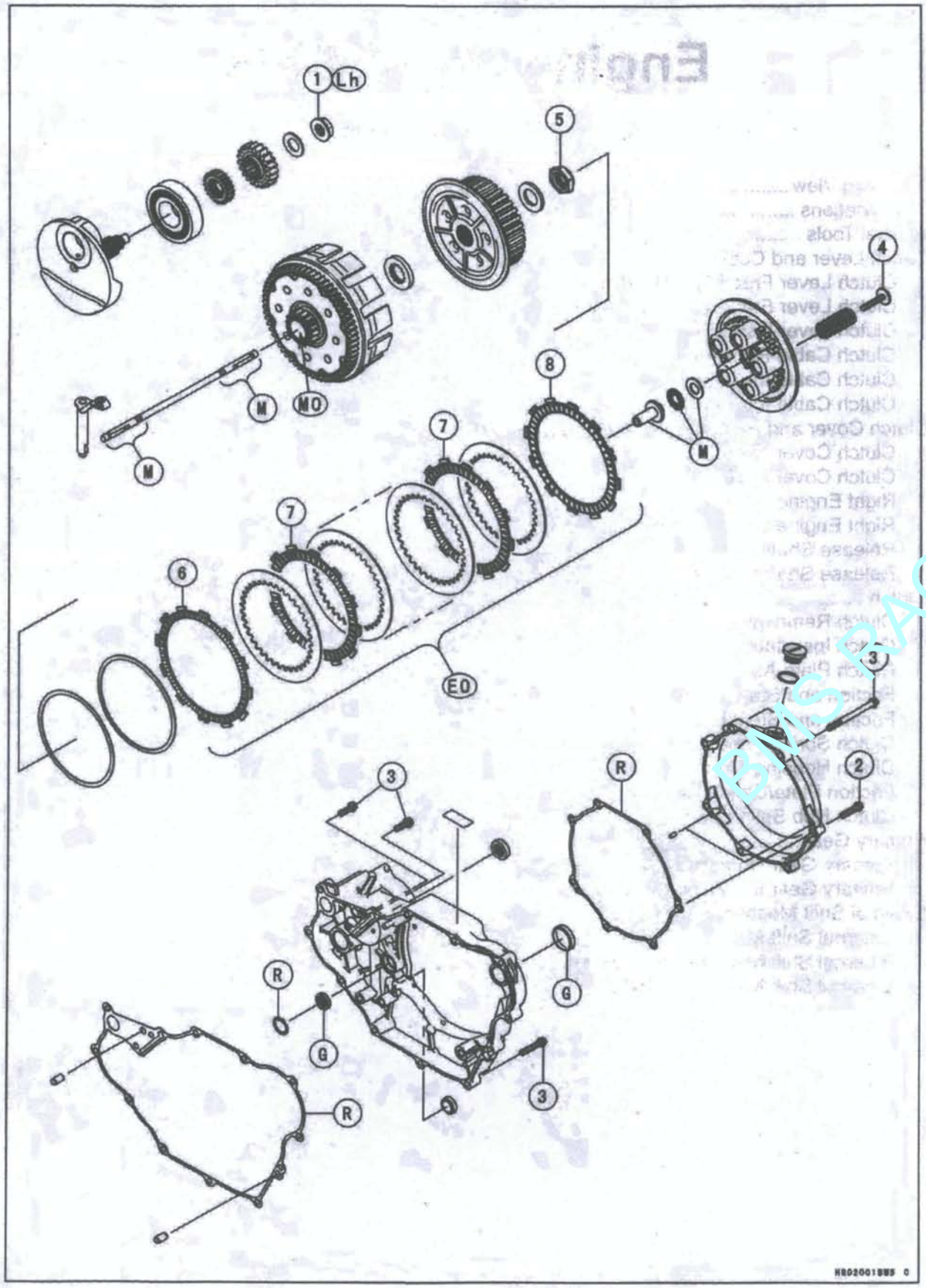
Exploded View



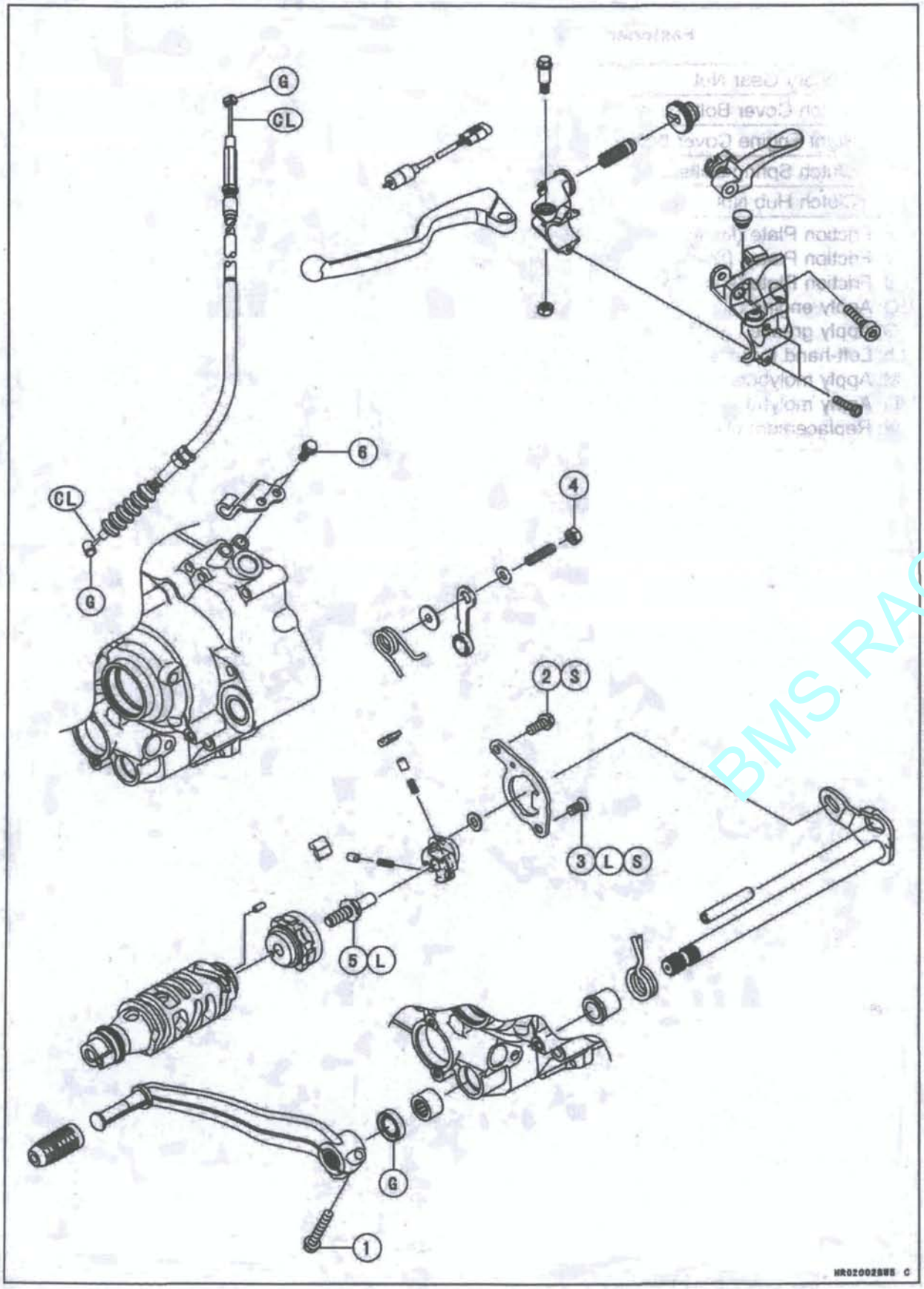
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Primary Gear Nut	98	10	72	Lh
2	Clutch Cover Bolts	9.8	1.0	87 in·lb	
3	Right Engine Cover Bolts	9.8	1.0	87 in·lb	
4	Clutch Spring Bolts	8.8	0.90	78 in·lb	
5	Clutch Hub Nut	98	10	72	

6. Friction Plate (lining block: 45 slots)
7. Friction Plates (lining block: 48 slots, 6 pieces)
8. Friction Plate (lining block: 48 slots)

EO: Apply engine oil.
G: Apply grease.
Lh: Left-hand threads
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil.
R: Replacement Parts

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Shift Pedal Bolt	9.8	1.0	87 in·lb	
2	Upper Ratchet Plate Mounting Bolt	9.8	1.0	87 in·lb	S
3	Lower Ratchet Plate Mounting Bolt	6.4	0.65	56 in·lb	L, S
4	Gear Positioning Lever Nut	8.8	0.90	78 in·lb	
5	Shift Drum Cam Bolt	29	3.0	21	L
6	Clutch Cable Holder Mounting Bolts	9.8	1.0	87 in·lb	

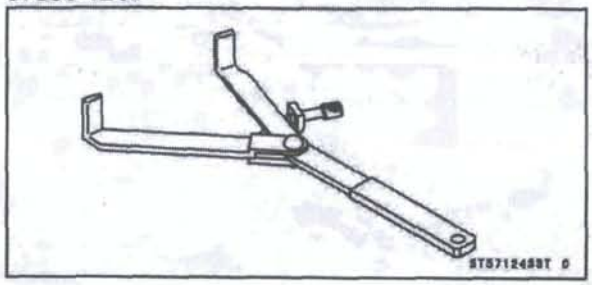
CL: Apply cable lubricant.
G: Apply grease.
L: Apply a non-permanent locking agent.
S: Follow the specified tightening sequence.

Specifications

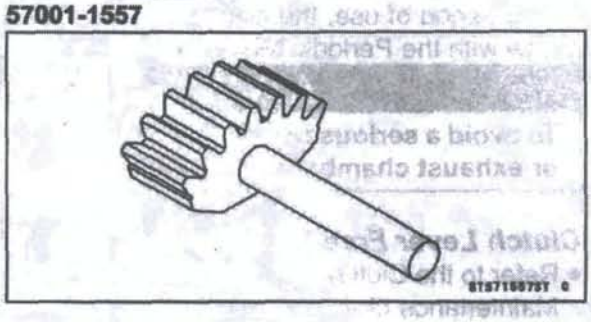
Item	Standard	Service Limit
Clutch Lever		
Clutch Lever Free Play	5 ~ 10 mm (0.2 ~ 0.4 in.)	– – –
Clutch		
Friction Plate Thickness	2.92 ~ 3.08 mm (0.115 ~ 0.121 in.)	2.7 mm (0.11 in.)
Friction Plate Warp	0.15 mm (0.0059 in.) or less	0.3 mm (0.01 in.)
Steel Plate Warp	0.2 mm (0.008 in.) or less	0.3 mm (0.01 in.)
Clutch Spring Free Length	45.0 mm (1.77 in.)	42.9 mm (1.69 in.)
Friction Plate/Clutch Housing Clearance	0.20 ~ 0.60 mm (0.0079 ~ 0.024 in.)	0.8 mm (0.03 in.)
Clutch Plate Assembly Length	34.9 ~ 35.5 mm (1.37 ~ 1.40 in.)	– – –

Special Tools

Clutch Holder:
57001-1243



Gear Holder, m2.0:
57001-1557



Clutch Lever and Cable

Due to friction plate wear and clutch cable stretch over a long period of use, the clutch must be adjusted in accordance with the Periodic Maintenance Chart.

⚠ WARNING

To avoid a serious burn, never touch the hot engine or exhaust chamber during clutch adjustment.

Clutch Lever Free Play Inspection

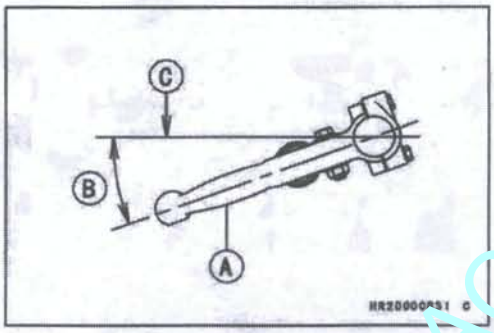
- Refer to the Clutch Lever Free Play Check in the Periodic Maintenance chapter.

Clutch Lever Free Play Adjustment

- Refer to the Clutch Lever Free Play Adjustment in the Periodic Maintenance chapter.

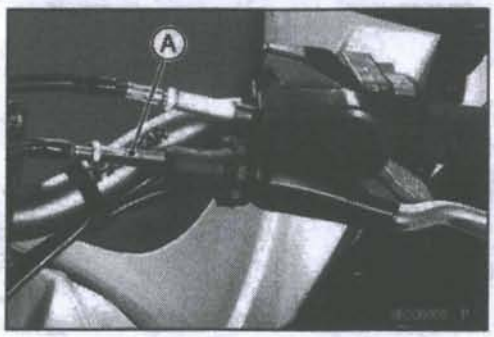
Clutch Lever Installation

- Install the clutch lever [A] so that it incline 20° ±5° [B] more than the horizontal line [C] and open the 3 to 4 mm [D] from the left handlebar switch housing [E].



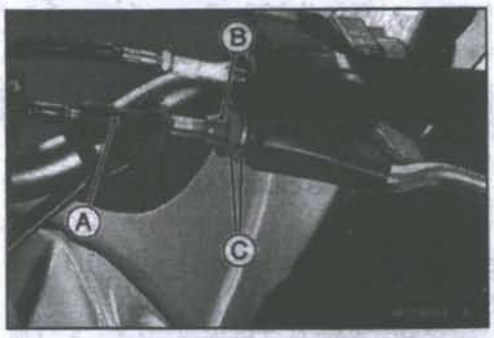
Clutch Cable Removal

- Turn in the adjuster fully [A].



Clutch Lever and Cable

- Slide the dust cover [A] out of place.
- Screw the adjuster [B] at the clutch lever fully.
- Line up the slots [C] in the clutch lever and adjuster and then free the cable from the lever.



- Remove the clutch cable holder mounting bolts [A].
- Free the clutch inner cable tip [B] from the clutch release lever [C].

CAUTION

Do not remove the clutch release shaft unless it is absolutely necessary. If removed, release shaft oil seal must be replaced with a new one.

- Pull the clutch cable out of the frame.

Clutch Cable Installation

- Run the clutch cable correctly (see Cable Wire and Hose Routing section in the Appendix chapter).
- Adjust the clutch cable (see Clutch Lever Free Play Adjustment in the Periodic Maintenance chapter).

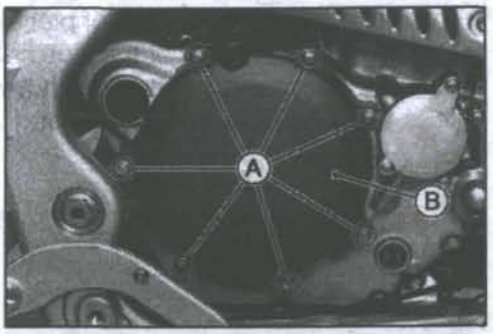
Clutch Cable Inspection and Lubrication

- During a periodic inspection or when the cable has been removed, inspect and lubricate the cable (see Lubrication in the Periodic Maintenance chapter).

Clutch Cover and Right Engine Cover

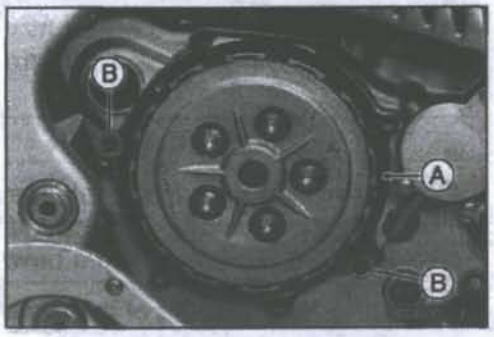
Clutch Cover Removal

- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove the brake pedal (from the return spring and brake light switch spring).
- Remove the clutch cover bolts [A] and remove the clutch cover [B].



Clutch Cover Installation

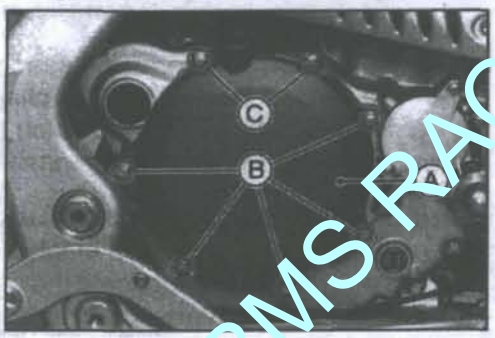
- Replace the clutch cover gasket [A] with a new one.
- Be sure to install the dowel pins [B].



- Install the clutch cover [A].

Torque - Clutch Cover Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 ft·lb)
Right Engine Cover Bolts [C]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the brake pedal (see Brake Pedal Installation in the Brakes chapter).

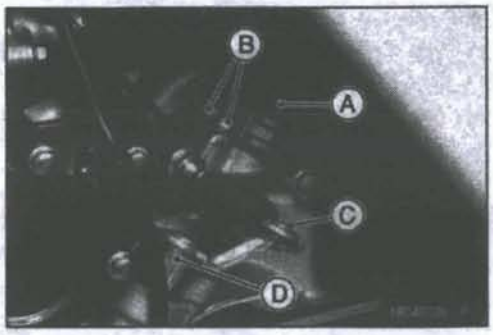


Right Engine Cover Removal

- Drain:
  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
  Coolant (see Coolant Draining in the Cooling System chapter)
- Remove:
  Clutch (see Clutch Removal)
  Brake Pedal (see Brake Pedal Removal in the Brakes chapter)
  Brake Light Switch (see Brake Light Switch Removal in the Electrical System chapter)
  Engine Bottom Guard (see Engine Bottom Guard Removal in the Frame chapter)

Clutch Cover and Right Engine Cover

Release Shaft Removal



- Remove the clutch (see Clutch Removal).
- Remove the clutch cable upper end (see Clutch Cable Removal).
- Remove the breather hose [A] and clutch cable holder mounting bolts [B].
- Remove the tips [C] of the clutch cable (see Clutch Cable Removal).
- Pull the release shaft [D] out of the crankcase.

Release Shaft Installation

- Apply grease to the oil seal lips.
- Apply engine oil to the bearing in the hole of the crankcase.
- Apply grease to the part where the push rod comes in contact.
- Insert the release shaft straight into the upper hole of the crankcase.

CAUTION
When inserting the release shaft, be careful not to remove the spring of the oil seal.

- Install the clutch cable (see Clutch Cable Installation).
- Tighten:

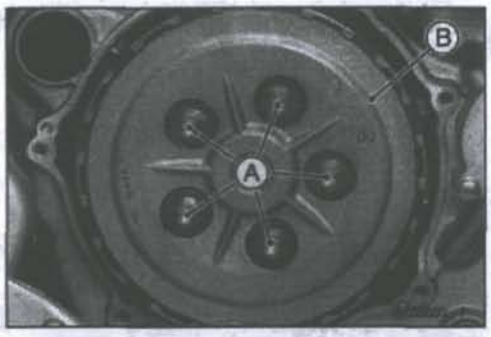
Torque - Clutch Cable Holder Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the breather hose.

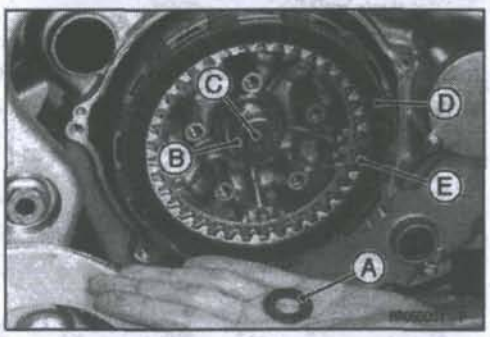
Clutch

Clutch Removal

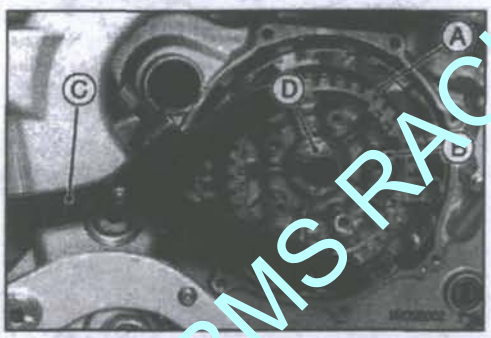
- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Remove the clutch cover (see Clutch Cover Removal).
- Remove:
  Clutch Spring Bolts [A]
  Clutch Spring
  Clutch Spring Plate [B]



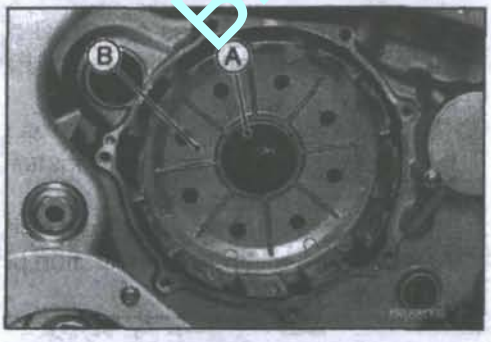
- Remove:
  Adjusting Washer [A]
  Needle Bearing [B]
  Push Rod Holder [C]
  Push Rod
  Friction Plates [D]
  Steel Plates [E]



- Remove the spring [A] and spring seat.
- Fix the clutch hub [B] with the clutch holder [C].
  Special Tool - Clutch Holder: 57001-1243
- Loosen the clutch hub nut [D] counterclockwise.

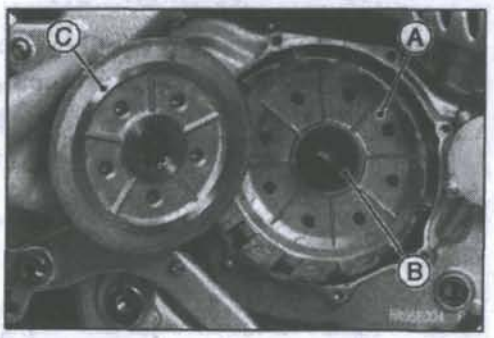


- Remove:
  Washer
  Clutch Hub
  Toothed Washer [A]
  Clutch Housing [B]



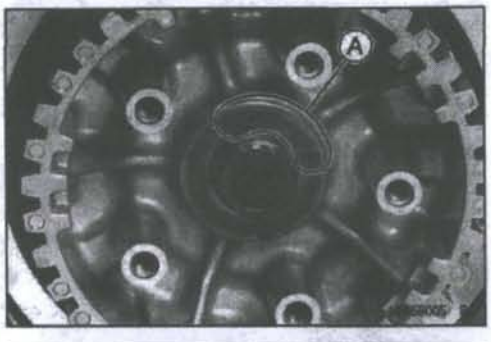
Clutch Installation

- Check the clutch plate assembly free play (see Clutch Plate Assembly Free Play Inspection/Adjustment).
- Apply molybdenum disulfide oil to the inside of the clutch housing gear.
- Install the clutch housing [A].
- Do not forget to install the toothed washer [B] before installing the clutch hub [C].

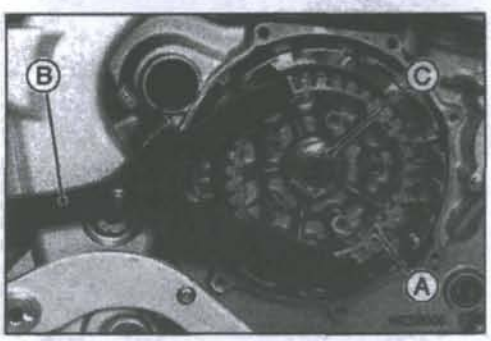


Clutch

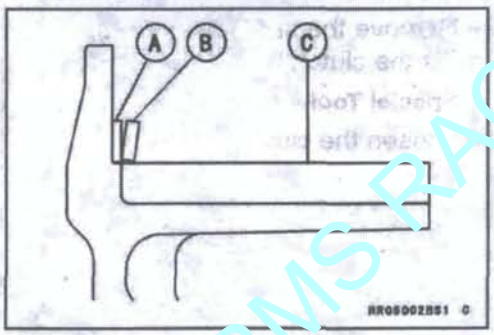
- Install the washer so that stamp mark [A] facing the outside.



- Hold the clutch hub [A] with the clutch holder [B].
  Special Tool - Clutch Holder: 57001-1243
- Tighten
  Torque - Clutch Hub Nut [C]: 98 N·m (10 kgf·m, 72 ft·lb)



- Install the spring seat [A] and spring [B] as shown.
  [C] Clutch Hub



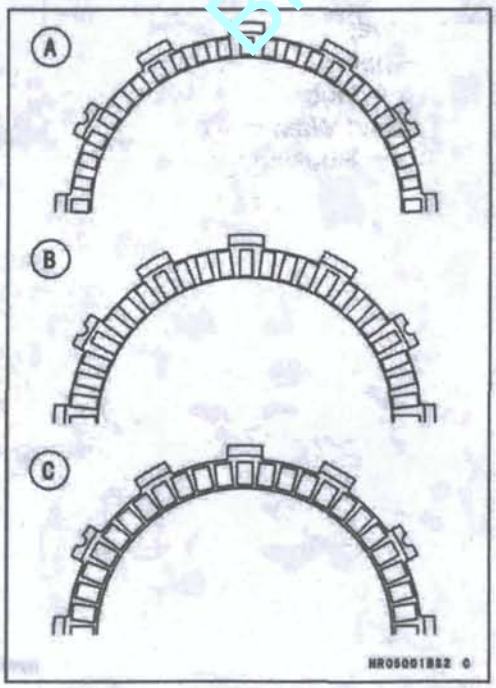
- Install the friction plates and steel plates, starting with a friction plate and alternating them. Finishing with a friction plate.

○There are three type friction plates in this model. Install the friction plate [A] first, and install the friction plate [C] lastly.
[B]: Six friction plate other than both ends friction plates

○Apply engine oil to the new friction plates when it shall be installed.

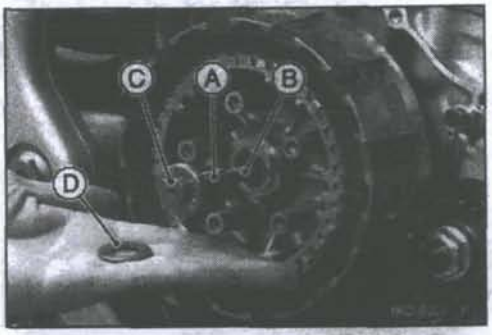
CAUTION

If dry steel plates and friction plates are installed, apply engine oil to the surfaces of each plate to avoid clutch plate seizure.



Clutch

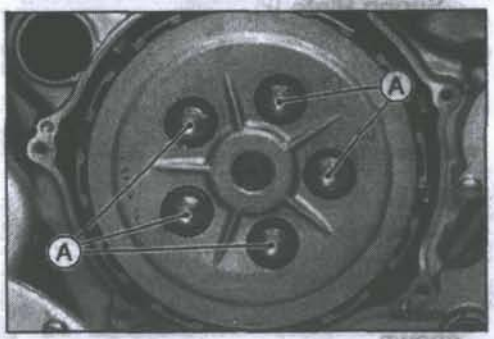
- Apply molybdenum disulfide grease to the rubbing portion [A] of the push rod holder.
- Install the push rod [B] and push rod holder.
- Apply molybdenum disulfide grease to the needle bearing [C] and adjusting washer [D], and install them.



- Tighten:

Torque - Clutch Spring Bolts [A]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Install the clutch cover (see Clutch Cover Installation).



- Check the release shaft lever positions [A].

○Pushing [B] the release shaft lever [C] lightly frontward measure the distance between the lever and cable bracket [D].

Release Shaft Lever Position

Standard: 83.4 ~ 91.6 mm (3.28 ~ 3.61 in.)

★*If the lever position is not within the standard, select the correct thickness of adjusting washer(s) according to the tables shown.*

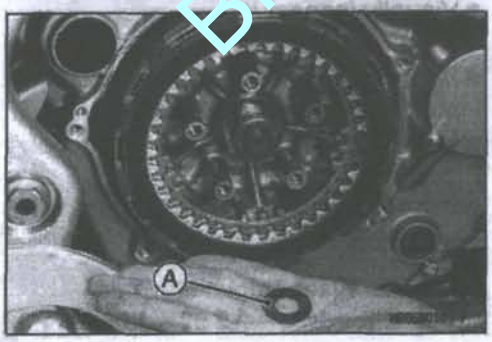
Adjusting Washers

Thickness	Part Number
1.5 mm	92200-1548
1.0 mm	92200-0045

Release Shaft Lever Position and Adjusting Washer Selection

Position Distance	Judgment	Washers Thickness	Qty
83.4 mm to 91.6 mm	Standard	1.5 mm	1
More than 91.6 mm	Too big	1.0 mm	1
Less than 83.4 mm	Too small	1.0 mm	2

★Remove the clutch spring plate as necessary, and replace the adjusting washer [A] with a selected it.



Clutch Plate Assembly Free Play Inspection/Adjustment

- Assemble the following parts.
  - Clutch Hub [A]
  - Spring Seat [B]
  - Spring [C]
  - Friction Plate [D]
  - Steel Plate [E]
  - Friction Plates [F]
  - Friction Plate [G]
  - Spring Plate [H]
  - Springs [I]
  - Bolts [J]

Torque - Clutch Spring Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

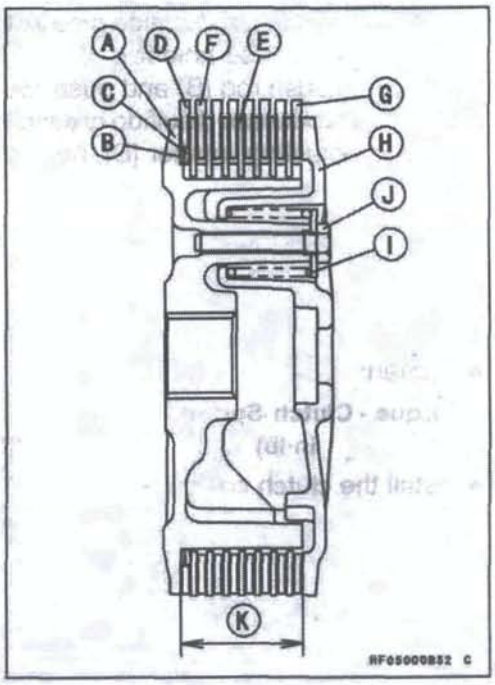
- Measure the clutch plate assembly length [K].

Clutch Plate Length
Standard: 34.9 ~ 35.5 mm (1.37 ~ 1.40 in.)

★If clutch plate length is not within the standard, select the correct length of adjusting plates according to the table shown.

Thickness	Part Number
1.2 mm (0.047 in.)	13089-1010
1.6 mm (0.063 in.)	13089-1095
2.0 mm (0.079 in.)	13089-1005

○Do not use the steel plate of 1.2 mm (0.047 in.) and 2.0 mm (0.079 in.). Thickness at the same time.



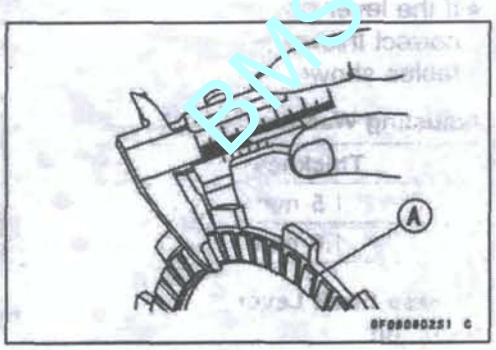
Friction and Steel Plates Wear, Damage Inspection

- Remove the clutch plates (see Clutch Removal).
- Visually inspect the friction and steel plates to see if they show any signs of seizure, or uneven wear.

★If any plates show signs of damage, replace the friction plates and steel plates as a set.

- Measure the thickness of the friction plates [A] with vernier calipers.

★If they have worn past the service limit, replace them with new ones.



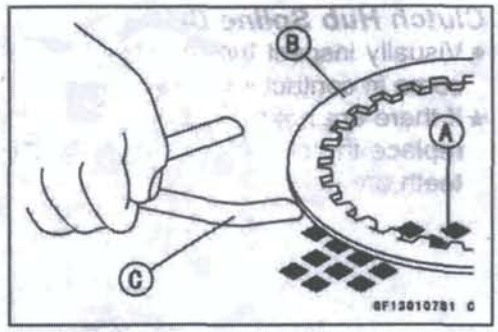
Friction Plate Thickness
Standard: 2.92 ~ 3.08 mm (0.115 ~ 0.121 in.)
Service Limit: 2.7 mm (0.11 in.)

Clutch

Friction and Steel Plate Warp Inspection

- Remove the clutch plate (see Clutch Removal).
- Place each friction plate or steel plate on a surface plate, and measure the gap between the surface plate [A] and each friction plate or steel plate [B] with a thickness gauge [C]. The gap is the amount of friction or steel plate warp.

★If any plate is warped over the service limit, replace it with a new one.



Friction and Steel Plates Warp

Standard:

Friction Plate	**0.15 mm (0.0059 in.) or less**
Steel Plate	**0.2 mm (0.008 in.) or less**

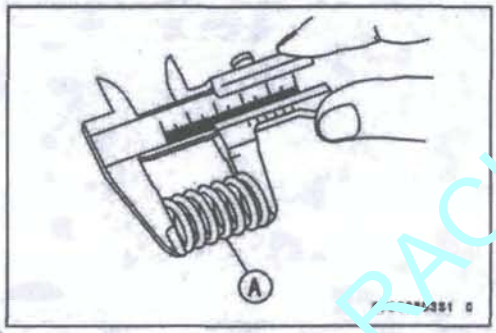
Service Limit:

Friction Plate	**0.3 mm (0.01 in.)**
Steel Plate	**0.3 mm (0.01 in.)**

Clutch Spring Free Length Inspection

- Measure the free length [A] of the clutch springs.

★If any clutch spring is shorter than the service limit, it must be replaced.



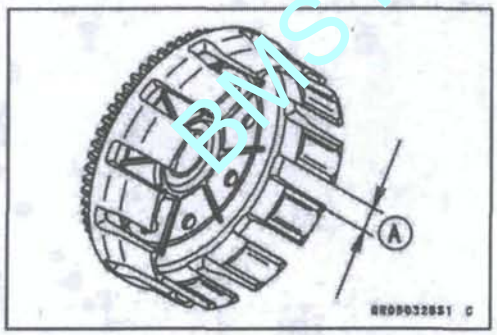
Clutch Spring Free Length

Standard:	**45.0 mm (1.77 in.)**
Service Limit:	**42.9 mm (1.69 in.)**

Clutch Housing Finger Damage

- Visually inspect the clutch housing fingers [A] that come in contact with the friction plate tangs.

★If they are damaged or if there are groove cuts in the areas that come in contact with the tangs, replace the housing. Replace the friction plates if their tangs are damaged as well.

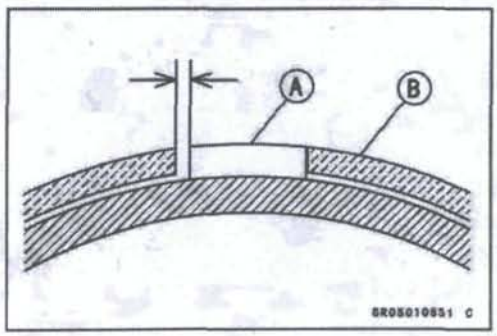


Friction Plate/Clutch Housing Clearance

- Measure the clearance between the tangs [A] on the friction plate and the fingers [B] of the clutch housing.

★If this clearance is excessive, the clutch will be noisy.

★If the clearance exceeds the service limit, replace the friction plates.



Friction Plate/Clutch Housing Clearance

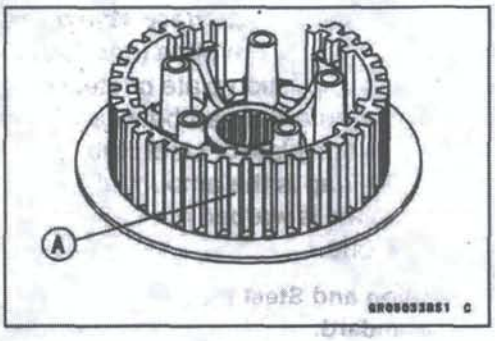
Standard:	**0.20 ~ 0.60 mm (0.0079 ~ 0.024 in.)**
Service Limit:	**0.8 mm (0.03 in.)**

Clutch

Clutch Hub Spline Damage

- Visually inspect the areas of the clutch hub splines that come in contact with the teeth of the steel plates.

★If there are notches worn into the clutch hub splines [A], replace the clutch hub. Replace the steel plates if their teeth are damaged as well.



Primary Gear

Primary Gear Removal

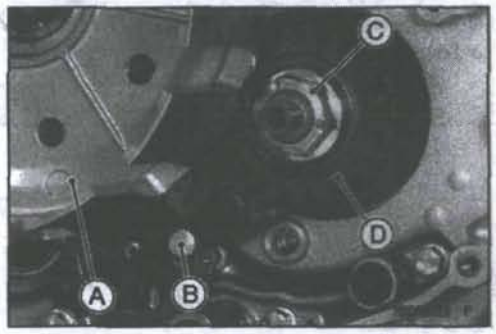
- Remove:
  Right Engine Cover (see Right Engine Cover Removal)
  Oil Pump Idle Shaft and Gear
- Temporarily install the clutch housing [A].
- Using the gear holder [B], secure the primary gear.

Special Tool - Gear Holder, m2.0: 57001-1557

- Loosen the primary gear nut [C]

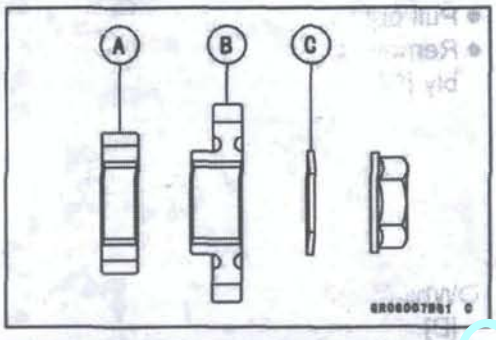
○Primary gear nut is left-hand threads.

- Remove the clutch housing.
- Remove the primary gear nut, washer and primary gear [D].



Primary Gear Installation

- Insert the oil pump drive gear [A] and primary gear [B] to the crankshaft.
- Install the washer [C] as shown.



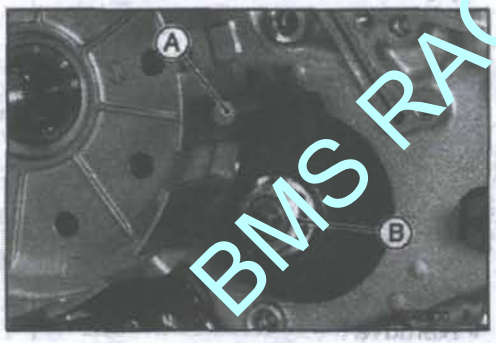
- Using the gear holder [A], secure the clutch gear and the primary gear; then, tighten the primary gear nut [B].

○Primary gear nut is left-hand threads.

Torque - Primary Gear Nut: 98 N·m (10 kgf·m, 72 ft·lb)

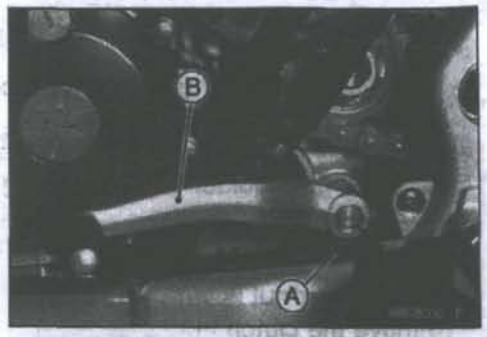
Special Tool - Gear Holder, m2.0: 57001-1557

- Install:
  Oil Pump Idle Gear
  Clutch (see Clutch Installation)
  Right Engine Cover (see Right Engine Cover Installation)

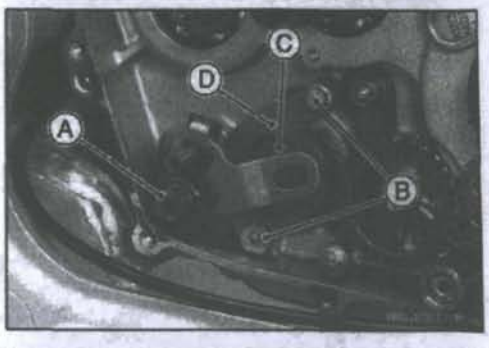


External Shift Mechanism Removal

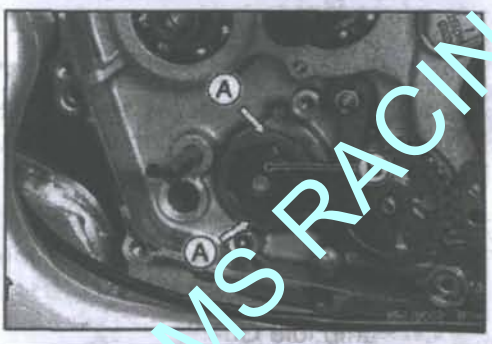
- Remove:
  Shift Pedal Bolt [A]
  Shift Pedal [B]



- Remove:
  Right Engine Cover (see Right Engine Cover Removal)
- Pull out the shift shaft [A].
- Remove the bolts [B] and take off the shift ratchet assembly [C] with ratchet plate [D].



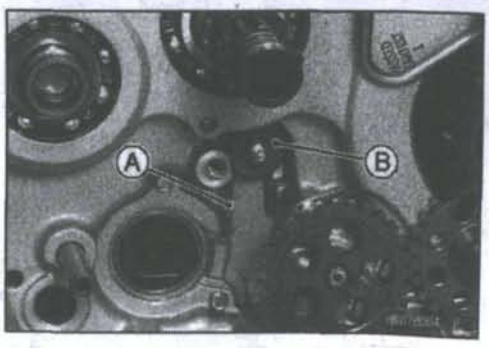
○While pushing [A] the pins, remove the ratchet assembly [B].



- Remove the bolt [A] and shift dram cam [B].
- Remove the nut [C], and take off the gear positioning lever [D].

External Shift Mechanism Installation

- Install the spring [A] and spacer [B] as shown.



External Shift Mechanism

- Install the gear positioning lever [A].
- Tighten the gear positioning lever nut [B].

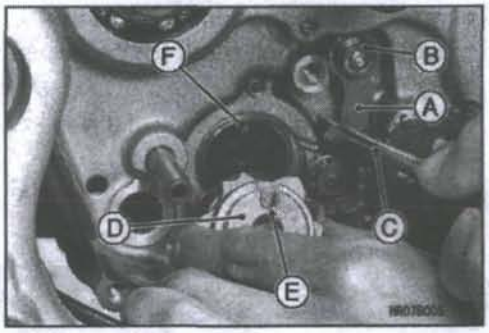
Torque - Gear Positioning Lever Nut: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Holding the gear positioning lever with the screwdriver [C] and install the shift drum cam [D].
- Apply a non-permanent locking agent to the shift drum cam bolt.

○Fit the groove [E] on the pin [F].

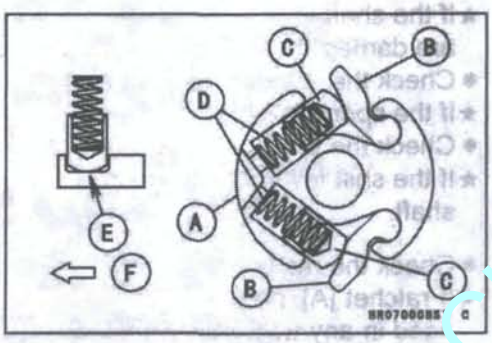
- Align the roller of the gear positioning lever with the slot of the shift drum cam.
- Tighten:

Torque - Shift Drum Cam Bolt: 29 N·m (3.0 kgf·m, 21 ft·lb)



- Set up the shift ratchet assembly as shown.
  Ratchet [A]
  Pawls [B]
  Pins [C]
  Springs [D]

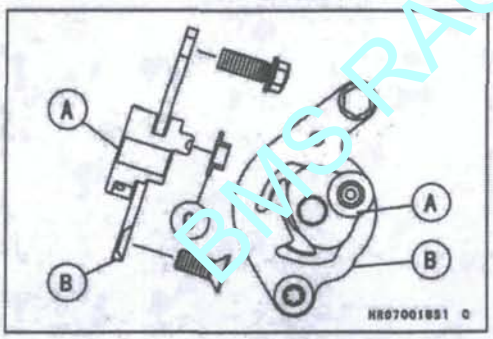
○Assembly the shift ratchet so that groove [E] of the pawl facing the crankcase side [F].



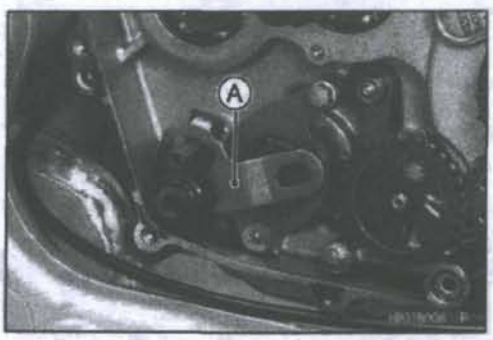
- Then install the ratchet assembly [A] to the ratchet plate [B] as shown.
- Install the ratchet assembly to the shift drum cam.
- Apply a non-permanent locking agent to the lower ratchet plate mounting bolt.
- Tighten the lower bolt first, and tighten the upper bolt.
- Tighten:

Torque - Ratchet Plate Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the collar [C].



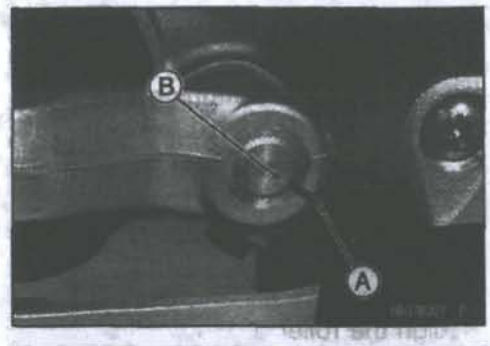
- Before installing the shift shaft, apply grease to the oil seal lips.
- Insert the shift shaft [A].
- Install:
  Clutch (see Clutch Installation)
  Right Engine Cover (see Right Engine Cover Installation)



External Shift Mechanism

- Install the shift pedal so that the split portion [A] on the pedal and punch mark [B] on the shift align.
- Tighten:

Torque - Shift Pedal Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)



External Shift Mechanism Inspection

- Check the shift shaft [A] for bending or damage to the splines.

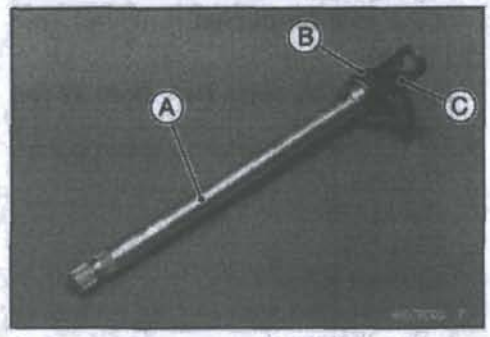
★If the shaft is bent, straighten or replace it. If the splines are damaged, replace the shift mechanism.

- Check the return spring [B] for cracks or distortion.

★If the spring is damaged in any way, replace it.

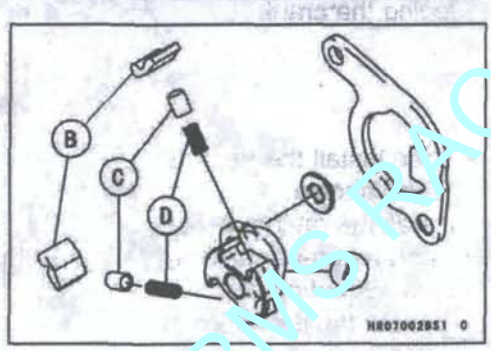
- Check the shift lever [C] for distortion.

★If the shift lever is damaged in any way, replace the shift shaft.



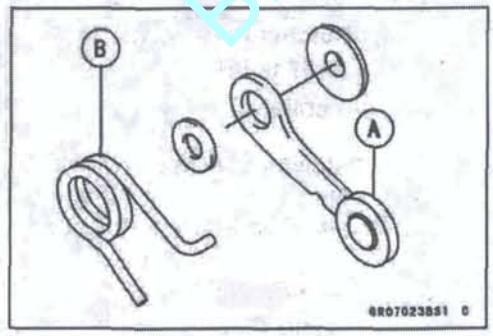
- Check the ratchet assembly for damage.

★If ratchet [A], pawls [B], pins [C] or springs [D] are damaged in any way, replace them.



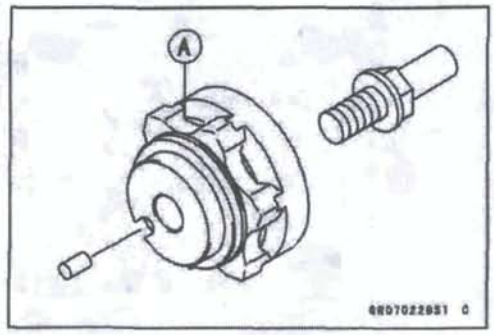
- Check the gear positioning lever [A] and its spring [B] for cracks or distortion.

★If the lever or spring is damaged in any way, replace them.



- Visually inspect the shift drum cam [A].

★If it is badly worn or if it shows any damage, replace it.



Engine Lubrication System

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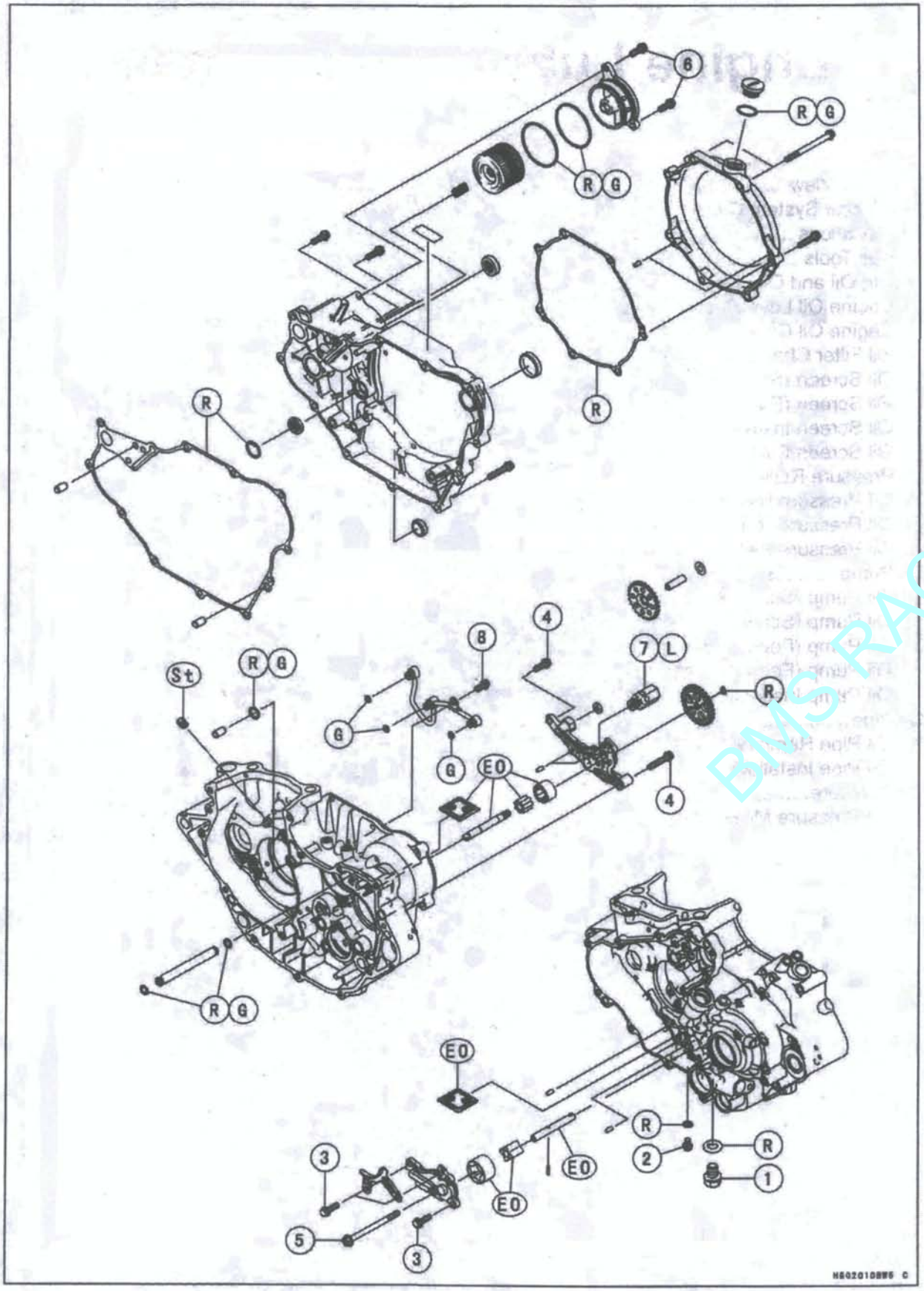
Exploded View

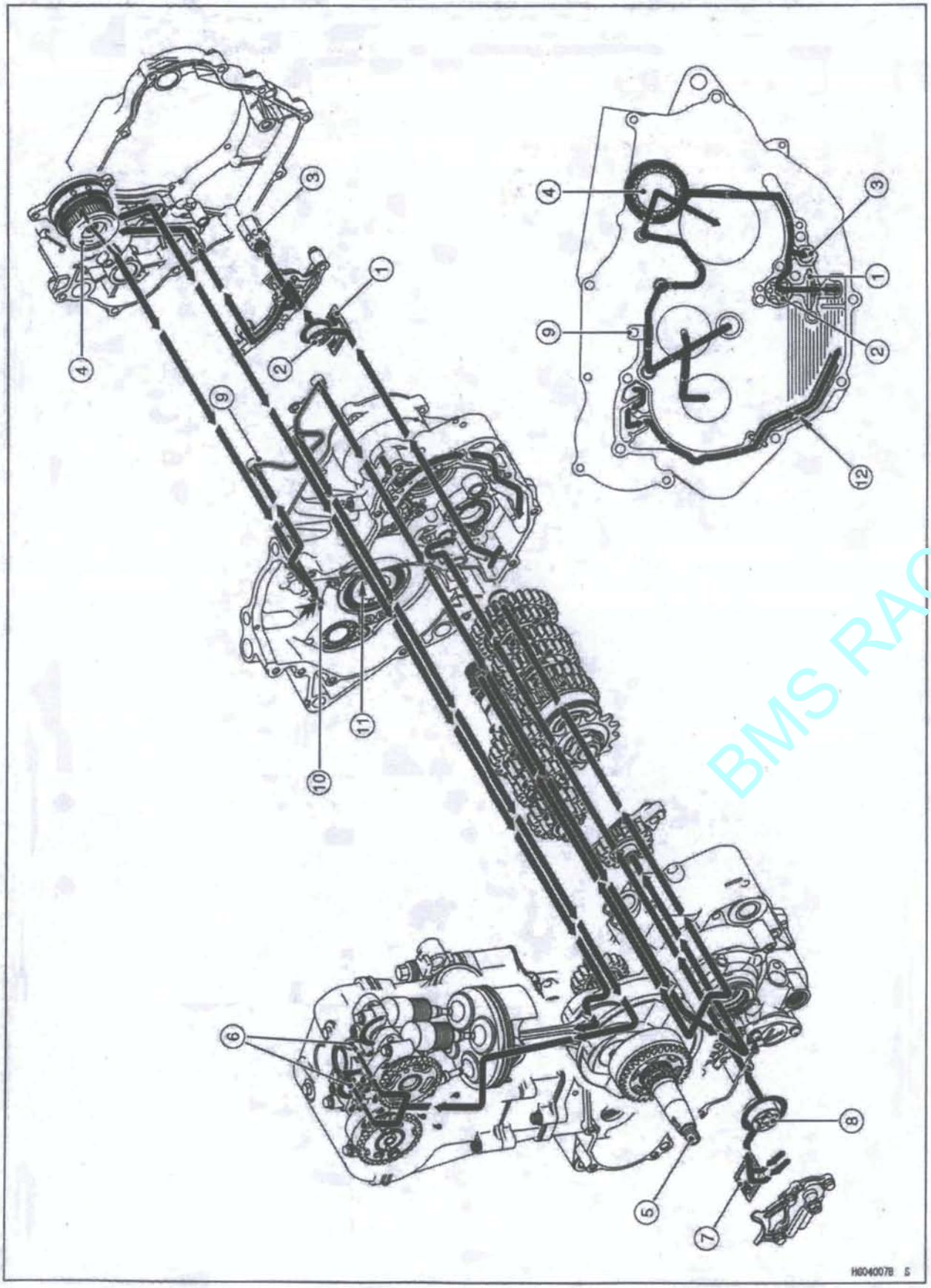


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Oil Drain Bolt (M12)	15	1.5	11	
2	Engine Oil Drain Bolt (M6)	7.0	0.71	62 in·lb	
3	Oil Pump (Scavenge) Cover Bolts	9.8	1.0	87 in·lb	
4	Oil Pump (Feed) Cover Bolts	8.8	0.90	78 in·lb	
5	Crankcase Bolt	9.8	1.0	87 in·lb	
6	Oil Filter Cover Bolt	9.8	1.0	87 in·lb	
7	Oil Pressure Relief Valve	15	1.5	11	L
8	Oil Pipe Mounting Bolt	9.8	1.0	87 in·lb	

EO: Apply engine oil.
G: Apply high-temperature grease.
L: Apply a non-permanent locking agent.
R: Replacement Parts
St: Stake the fastener.

Lubrication System Chart



Lubrication System Chart

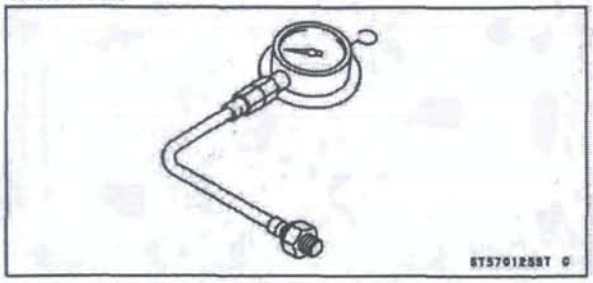
1. Oil Screen (feed)
2. Oil Pump (feed)
3. Oil Pressure Relief Valve
4. Oil Filter
5. Crankshaft
6. Oil Pipes
7. Oil Screen (scavenge)
8. Oil Pump (scavenge)
9. Oil Pipe
10. Piston Oil Nozzle
11. Oil Passage (Dowel Pin)
12. Oil Return Pipe

Specifications

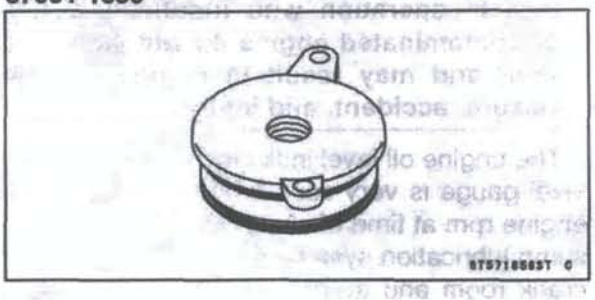
Item	Standard
Engine Oil	
Grade	API SF or SG API SH, SJ or SL with JASO MA
Viscosity	SAE 10W-40
Capacity	
Oil Change - when filter is not removed	1.15 L (1.22 US qt)
Oil Change - when filter is removed	1.20 L (1.27 US qt)
when engine is completely dry	1.35 L (1.43 US qt)
Oil Level (after warm-up or driving)	Between upper and lower level lines
Oil Pressure Measurement	
(oil temperature 90°C, engine speed 4 000 rpm)	49 ~ 69 kPa (0.5 ~ 0.7 kgf/cm², 7.1 ~ 10 psi)

Special Tools

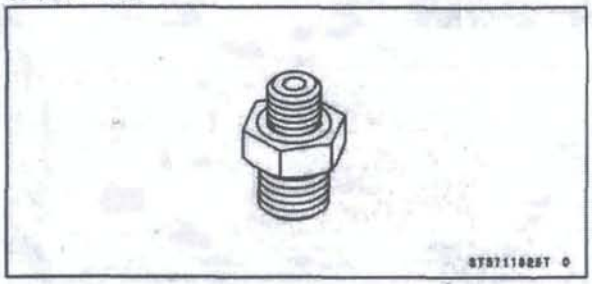
Oil Pressure Gauge, 5 kgf/cm²:
57001-125



Oil Pressure Cap:
57001-1656



Oil Pressure Gauge Adapter, M10 × 1.25:
57001-1182



Engine Oil and Oil Filter

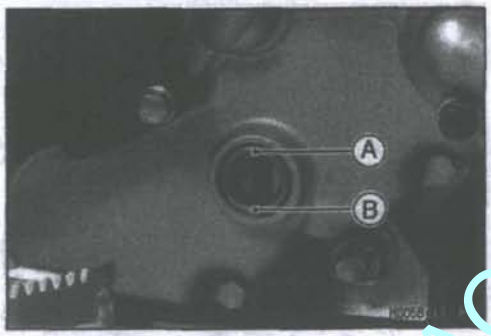
⚠ WARNING

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

The engine oil level indicated in the right engine cover oil level gauge is very sensitive to the vehicle's position and engine rpm at time of shut down. Because of the semi-dry sump lubrication system with separate oil chambers in the crank room and transmission room, under certain conditions oil can accumulate in the crank room and give a false low reading at the oil level gauge, which indicates oil volume in the transmission room.

Engine Oil Level Inspection

- Situate the vehicle so that it is vertical.
- Check that the engine oil level is between the upper [A] and lower levels [B] in the gauge.



NOTE

○*Situate the vehicle so that it is perpendicular to the ground.*

○*If no oil appears in the gauge, tip the vehicle slightly to the right until oil is visible then return to an upright position. If no oil appears even when tipped at an extreme angle, remove both drain bolts to empty any oil that may be in the transmission and crankcase, reinstall the drain bolts and refill with the specified amount of oil.*

○*If the vehicle has just been used, wait several minutes for all the oil to drain down.*

○*If the oil has just been changed, start the engine and run it for several minutes* ***at idle speed.*** *This fills the oil filter with oil.*

○***Do not run the engine at high engine speed.*** *Stop the engine, then wait several minutes until the oil settles.*

CAUTION

Racing the engine before the oil reaches every part can cause engine seizure.

★If the oil level is too high, remove the excess oil through the filler opening, using a syringe or some other suitable device.

★If the oil level is too low, add the correct amount of oil through the oil filler opening. Use the same type and make of oil that is already in the engine.

NOTE

○*If the engine oil type and make are unknown, use any brand of the specified oil to top off the level rather than running the engine with the oil level low. Then at your earliest convenience, change the oil completely.*

Engine Oil Change

- Refer to the Engine Oil Change in the Periodic Maintenance chapter.

Engine Oil and Oil Filter

Oil Filter Change

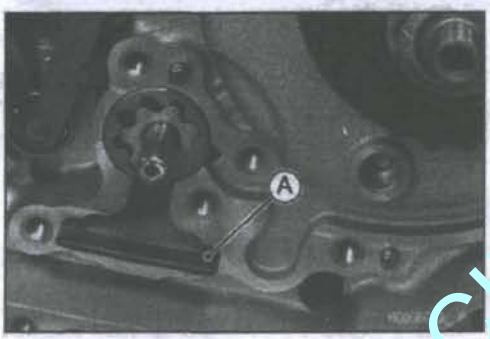
- Refer to the Oil Filter Change in the Periodic Maintenance chapter.

Oil Screen (Scavenge) Removal

- Remove the oil pump (scavenge) cover (see Oil Pump (Scavenge) Removal).
- Pull out the oil screen [A] from the left crankcase.

Oil Screen (Feed) Removal

- Remove the oil pump (feed) cover (see Oil Pump (Feed) Removal).
- Pull out the oil screen [A] from the right crankcase.



Oil Screen Installation

- Clean the oil screens thoroughly whenever it is removed for any reason.
- Clean the oil screens with a high-flash point solvent and remove any particles stuck to them.

⚠ WARNING

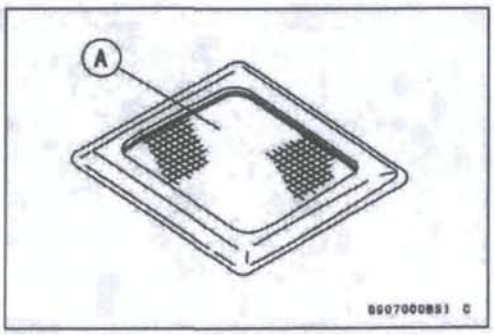
Clean the screen in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents.

NOTE

○*While cleaning the screens, check for any metal particles that might indicate internal engine damage.*

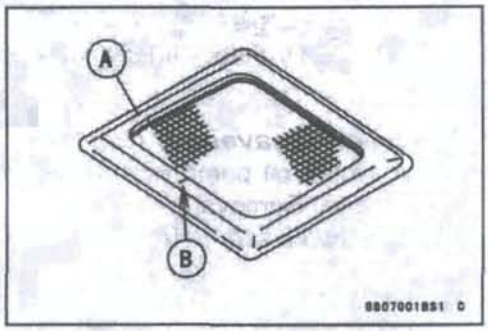
- Check the screens [A] carefully for any damage, holes, broken wires, gasket pulling off.

★If the screen is damaged, replace it.



Engine Oil and Oil Filter

- Apply engine oil to the rubber portion [A] on the oil screen.
- Install the oil screen facing the carved line [B] to the outside.
- Install the oil pump covers (see Oil Pump (Scavenge) (Feed) Installation)



Oil Screen Cleaning

- Remove the oil screen (see Oil Screen (Scavenge) (Feed) Removal).
- Clean the oil screens with a high-flash point solvent and remove any particles stuck to them.

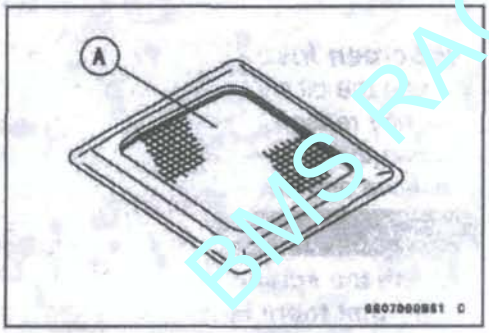
⚠ WARNING

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 solvent.

- Check the screens [A] carefully for any damage, holes, broken wires gasket pulling off.

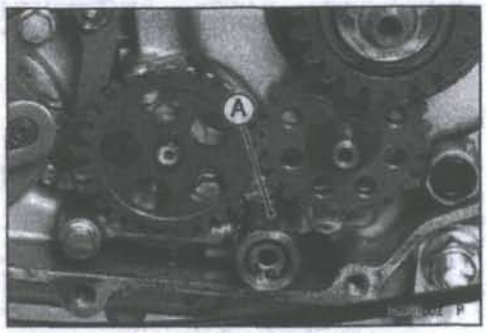
★If the screen is damaged, replace it.

- Install the oil screen (see Oil Screen (Scavenge) (Feed) Installation).



Oil Pressure Relief Valve

Oil Pressure Relief Valve Removal



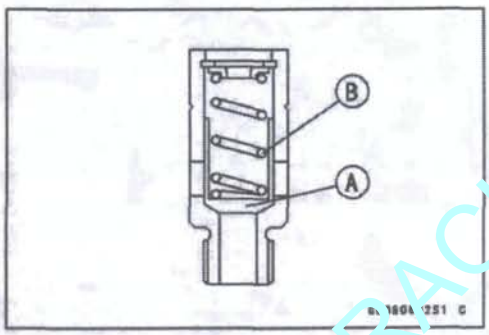
- Remove:
  Right Engine cover (see Right Engine Cover Removal in the Engine Right Side chapter)
- Remove the oil pressure relief valve [A].

Oil Pressure Relief Valve Installation

- 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 (see Oil Pressure Relief Valve Removal).
- 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

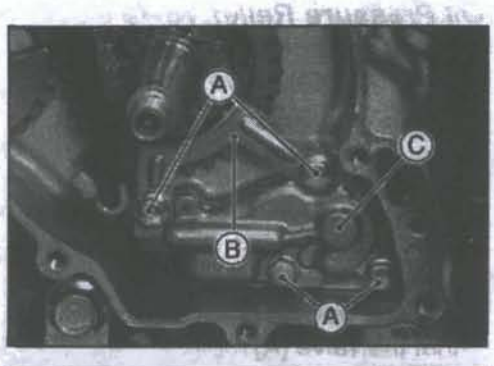
Clean the oil pressure relief valve in a well -ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents.

★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.

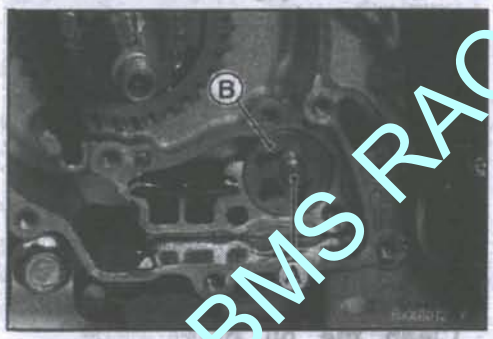
Oil Pump

Oil Pump (Scavenge) Removal

- Drain:
  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
  Coolant (see Coolant Draining in the Coolant System chapter)
- Remove:
  Shift Pedal (see External Shift Mechanism in the Engine Right Side chapter)
  Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
- Remove:
  Oil Pump Cover Bolts [A]
  Lower Camshaft Chain Guide [B]
  Oil Pump Cover [C]



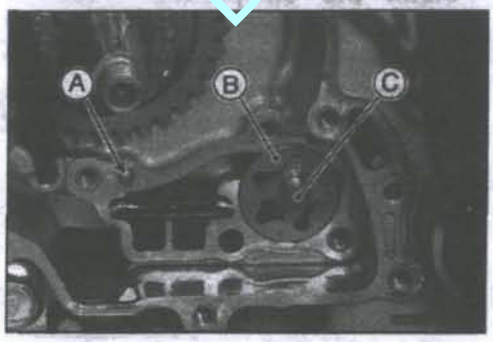
- Remove:
  Inner Rotor [A]
  Outer Rotor [B]



Oil Pump (Scavenge) Installation

- Install the oil screen (see Oil Screen (Scavenge) Installation).
- Install the dowel pin [A] to the crankcase.
- Apply engine oil to the each oil pump rotor and sliding surface of the oil pump shaft.
- Install:
  Outer Rotor [B]
  Inner Rotor [C]

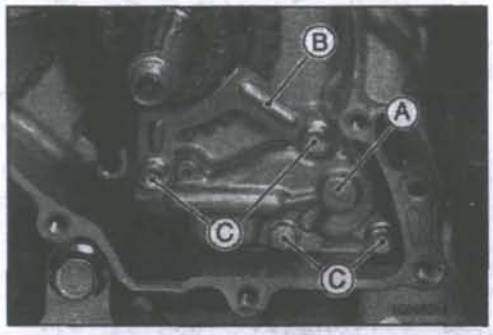
○While turn the oil pump shaft, install the oil pump so that the left and right oil pump shaft may mesh in the crankcase.



Oil Pump

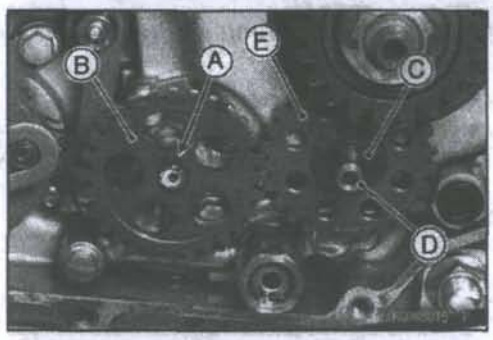
- Install:
  Oil Pump Cover [A]
  Lower Camshaft Chain Guide [B]
- Tighten:

Torque - Oil Pump (Scavenge) Cover Bolts [C]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

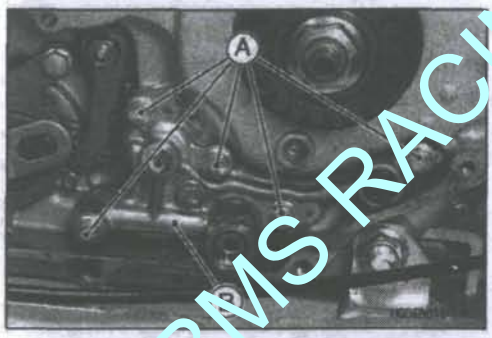


Oil Pump (Feed) Removal

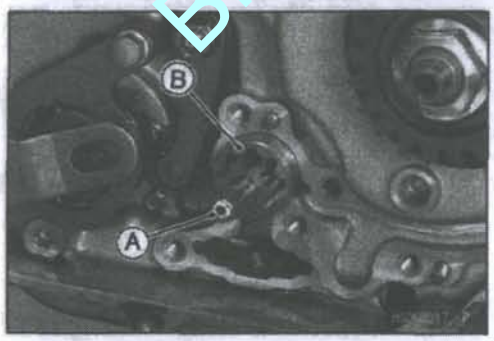
- Remove:
  Right Engine Cover (Right Engine Cover Removal in the Engine Right Side chapter)
  Circlip [A]
  Oil Pump Driven Gear [B]
  Washer [C]
  Shaft [D]
  Oil Pump Idle Gear [E]



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

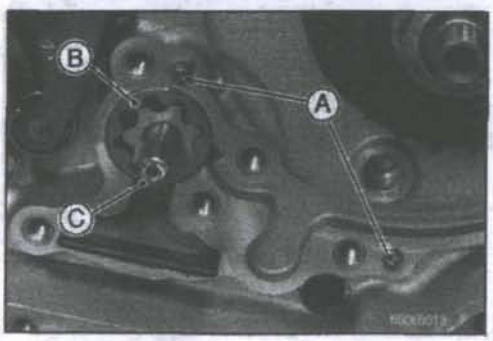


- Remove:
  Inner Rotor [A]
  Outer Rotor [B]



Oil Pump (Feed) Installation

- Install the dowel pins [A] to the crankcase.
- Apply engine oil to the each oil pump rotor and sliding surface of the oil pump shaft.
- Install:
  Outer Rotor [B]
  Inner Rotor [C]
- While turn the oil pump shaft, install the oil pump so that the left and right oil pump shaft may mesh in the crankcase.

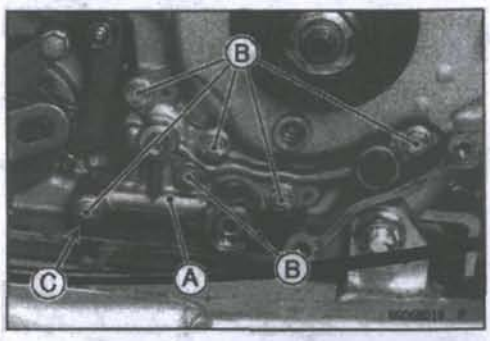


Oil Pump

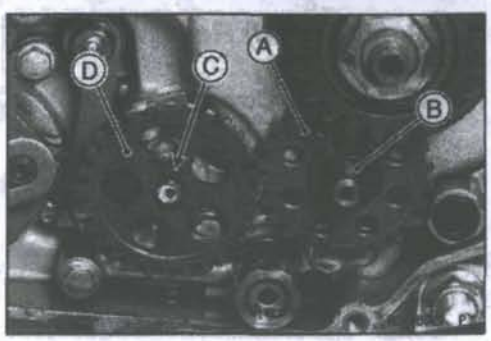
- Install the oil pump cover [A].
- Tighten:

Torque - Oil Pump (Feed) Cover Bolts [B]: 8.8 N·m (0.90 kgf·m, 78 in·lb)

○Thread length of the lower bolt [C] is 30 mm (1.2 in.) only.



- Install the oil pump idle gear [A] facing the stepped side to the outside.
- Install the washer [B].
- Replace the circlip [C] with a new one.
- Install the oil pump driven gear [D] and circlip.



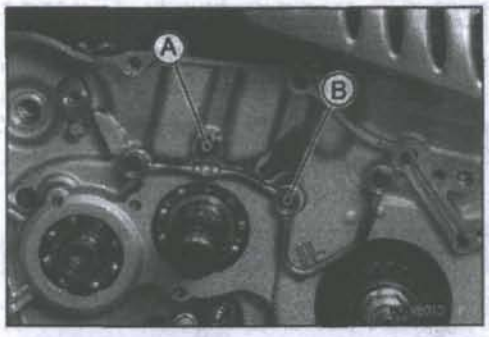
Oil Pump Inspection

- Remove the oil pump.
- Visually inspect the oil pump body, outer rotors and the inner rotors.

★If the oil pump is any damaged or unevenly worn, replace the rotors, cover, or body, or the crankcase.

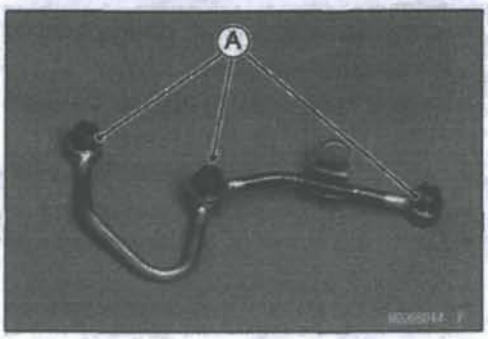
Oil Pipe

Oil Pipe Removal



- Remove:
  Right Engine Cover (see Right Engine Cover Removal in the Engine Right Side chapter)
  Bolt [A]
  Oil Pipe [B]

Oil Pipe Installation



- Replace the O-rings [A] with new ones.
- Apply grease to the O-rings.
- Tighten:

Torque - Oil Pipe Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

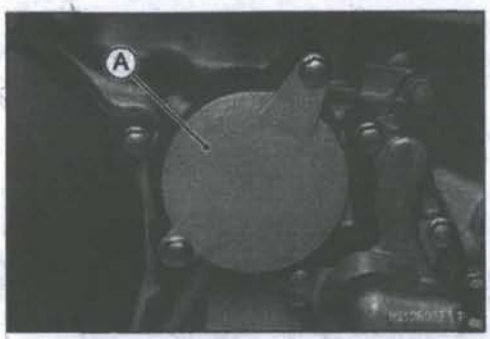
Oil Pressure

Oil Pressure Measurement

- Remove the oil filter cover [A].
- Install the O-rings to the oil pressure cap.

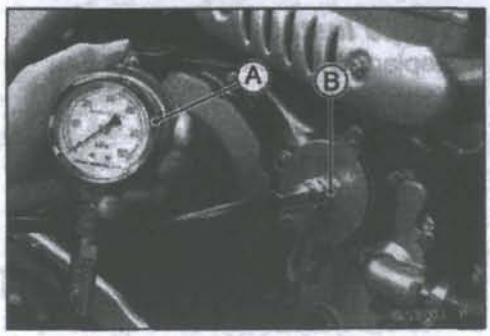
Special Tool - Oil Pressure Cap: 57001–1656

- Install the oil pressure cap.



- Attach the oil pressure gauge adapter [A] and oil pressure gauge [B].

Special Tools - Oil Pressure Gauge Adapter, M10 × 1.0: 57001-1182
Oil Pressure Gauge, 5 kgf/cm²: 57001-125



- Start the engine and warm up the engine thoroughly.
- Run the engine at the specified speed, and read the oil pressure gauge.

★If the oil pressure is much lower than the standard, check the feed oil pump.

★If the reading is much higher than the standard, check the oil filter first, and oil passages for dirt or clogging.

Oil Pump Pressure (oil temperature 90°C, @4 000 rpm)
Standard: 49 ~ 69 kPa (0.5 ~ 0.7 kgf/cm², 7.1 ~ 10 psi)

NOTE

○*Warm up the engine thoroughly before measuring the oil pressure.*

- Stop the engine and remove the oil pressure cap, oil pressure gauge adapter and gauge.

⚠ WARNING

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

- Install the oil filter cover.

Torque - Oil Filter Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Engine Removal/Installation

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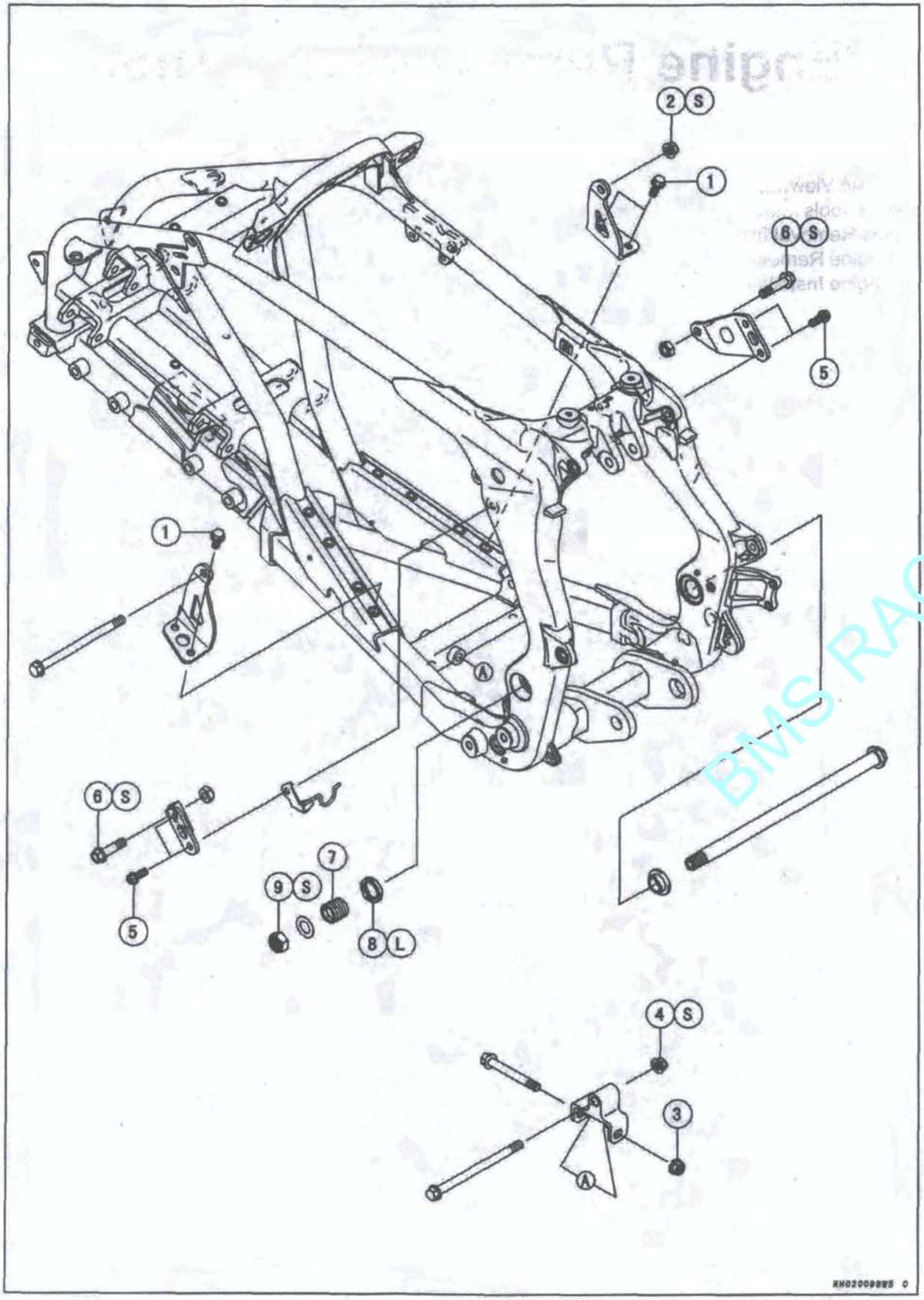
Exploded View



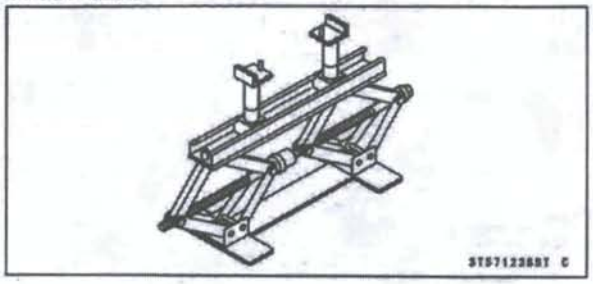
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Engine Bracket Bolts	30	3.0	22	
2	Front Engine Mounting Nut	46	4.7	34	S
3	Lower Engine Bracket Nut	46	4.7	34	
4	Lower Engine Mounting Nut	46	4.7	34	S
5	Upper Engine Bracket Bolts	30	3.0	22	
6	Upper Engine Mounting Bolts	46	4.7	34	S
7	Swingarm Adjusting Bolt	6.0	0.61	53 in·lb	
8	Swingarm Adjusting Locknut	31.5	3.2	23	L
9	Swingarm Pivot Shaft Nut	90.5	9.2	67	S

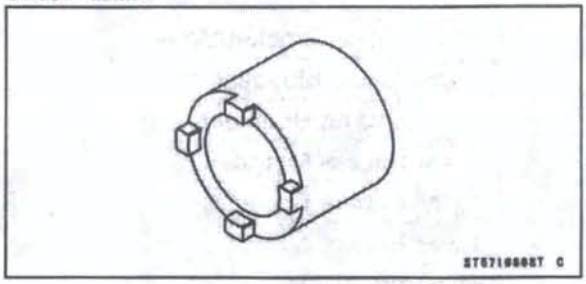
L: Apply a non-permanent locking agent.
S: Follow the specified tightening sequence.

Special Tools

Jack:
57001-1238



Swingarm Pivot Nut Wrench:
57001-1686



Engine Removal/Installation

Engine Removal

- Place the jack under the frame to support the vehicle.

Special Tool - Jack: 57001-1238

⚠ WARNING

For engine removal, the swingarm pivot shaft must be pulled out, causing the swingarm and rear wheels assembly to become detached. To prevent the vehicle from falling, make sure to support the frame with a jack.

- Squeeze the brake lever slowly and hold it with a band [A].

⚠ WARNING

Be sure to hold the front brake when removing the engine, or the vehicle may fall over. It could cause an accident and injury.

CAUTION

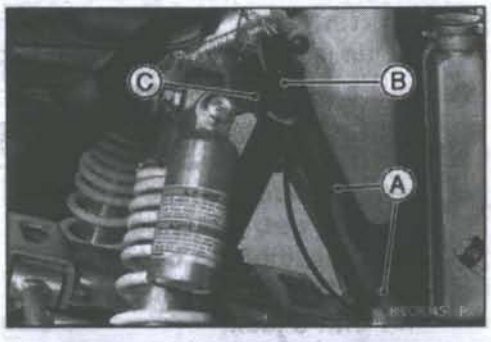
Be sure to hold the front brake when removing the engine, or the vehicle may fall over. The engine or the vehicle could be damaged.

- Drain:
  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
  Coolant (see Coolant Draining in the Cooling system chapter)

- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  Battery Case (see Battery Case Removal in the Frame chapter)
  Engine Bottom Guard (see Engine Bottom Guard Removal in the Frame chapter)
  Exhaust Pipe (see Muffler Removal in the Engine Top End chapter)
  Shift Pedal (see External Shift Mechanism Removal in the Engine Right Side chapter)
  Brake Pedal with the Rear Master Cylinder (see Brake Pedal Removal in the Brakes chapter)
  Engine Sprocket (see Engine Sprocket Removal in the Final Drive chapter)

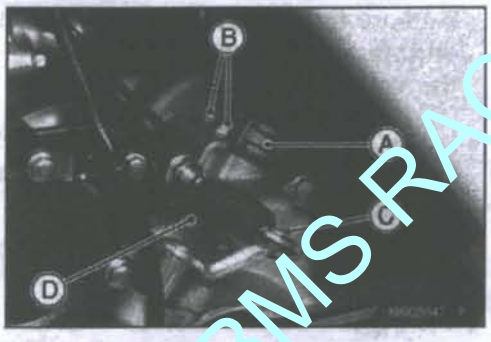
Engine Removal/Installation

- Cut the clamps [A].
- Disconnect:
  Alternator Lead Connector [B]
  Crankshaft Sensor Lead Connector [C]

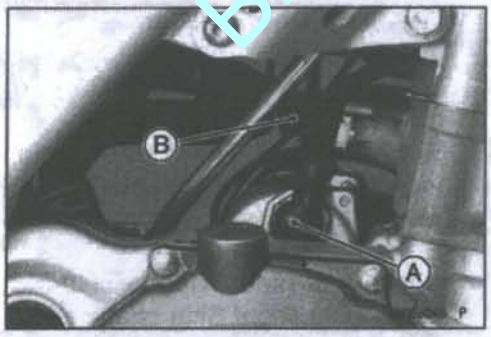


- Disconnect:
  Neutral/Reverse Switch Lead Connector [A]

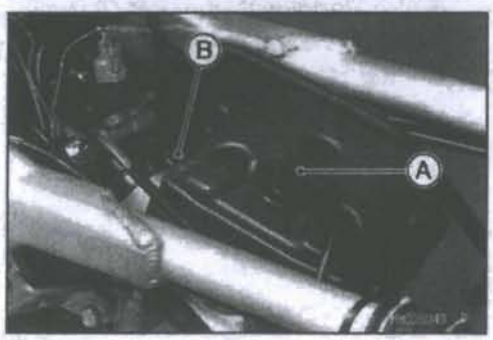
- Remove:
  Breather Hose Lower End [A]
  Clutch Cable Holder Mounting Bolts [B]
  Clutch Cable Lower End [C]
  Engine Ground Terminal Bolt [D]



- Disconnect:
  Starter Motor Cable [A]
  Water Temperature Sensor Connector [B]



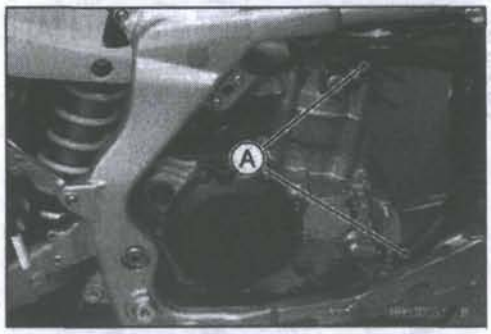
- Remove:
  Spark Plug Cap [A]
- Loosen the throttle body holder clamp screw [B] fully.



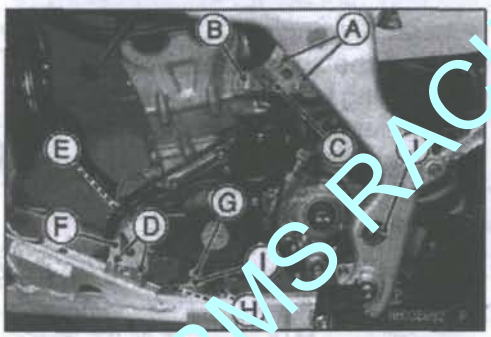
Engine Removal/Installation

- Remove:
  Rear Brake Light Switch Bracket [A]

- Remove:
  Radiator Hoses [A]



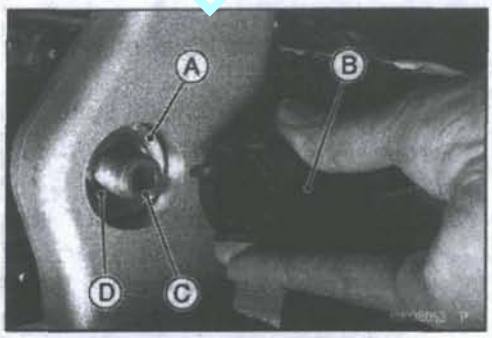
- Remove:
  Upper Engine Bracket Bolts (Left and Right) [A]
  Upper Engine Mounting Bolt and Nut (Left and Right) [B]
  Upper Engine Brackets (Left and Right) [C]
  Front Engine Bracket Bolts (Left and Right) [D]
  Front Engine Mounting Bolt and Nut [E]
  Front Engine Brackets (Left and Right) [F]
  Lower Engine Mounting Bolt and Nut [G]
  Lower Engine Bracket Bolt and Nut [H]
  Lower Engine Bracket [I]
  Swingarm Pivot Shaft Nut [J] and Washer



- Remove:
  Swingarm Adjusting Locknut [A]

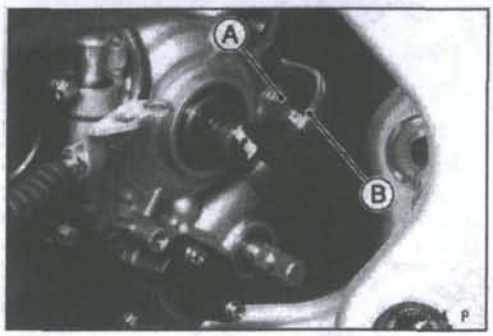
  Special Tool - Swingarm Pivot Nut Wrench [B]: 57001 -1686

- Pull out the swingarm pivot shaft [C].
- Loosen the swingarm adjusting bolt [D].



- Move the engine forward.
- Remove the reverse cable cap bolt and cable mounting bolt [A], and pull out the reverse cable [B].
- Remove the engine.

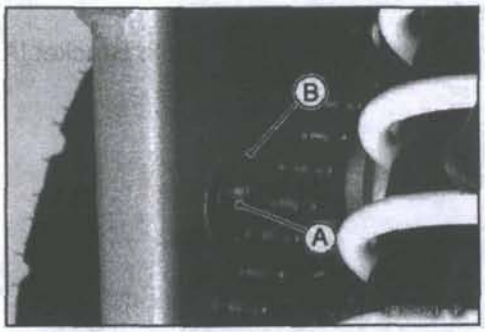
○Clear the engine rear portion from the swingarm and then remove the engine.



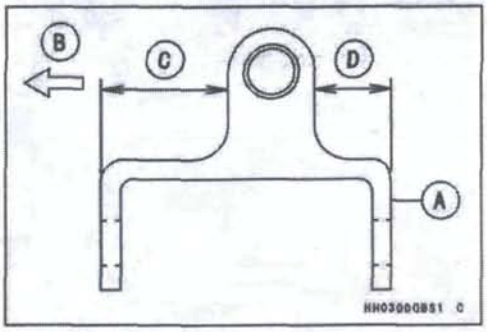
Engine Removal/Installation

Engine Installation

- Screw the swingarm adjusting bolt [A] until the surface is flush with the frame surface [B].



- Install the lower engine bracket [A] as shown.
  [B] Front
  [C] Long
  [D] Short



- Install the engine.
- Install the swingarm pivot shaft, all engine bracket and mounting bolts temporarily.

○Swingarm pivot shaft insert from the right side.

- Apply a non-permanent locking agent to the swingarm adjusting locknut.
- Tighten:

Torque - Swingarm Adjusting Bolt: 6.0 N·m (0.61 kgf·m, 53 in·lb)
Swingarm Adjusting Locknut: 31.5 N·m (3.2 kgf·m, 23 ft·lb)

○Insert the front and lower engine mounting bolts from the left side.

- Tighten the engine bracket bolts.

Torque - Front Engine Bracket Bolts: 30 N·m (3.0 kgf·m, 22 ft·lb)
Upper Engine Bracket Bolts: 30 N·m (3.0 kgf·m, 22 ft·lb)
Lower Engine Bracket Nut: 46 N·m (4.7 kgf·m, 34 ft·lb)

Engine Removal/Installation

- Firstly, tighten the swingarm pivot shaft nut [A].

  Torque - Swingarm Pivot Shaft Nut : 90.5 N·m (9.2 kgf·m, 67 ft·lb)

- Secondly, tighten the lower engine mounting nut [B].

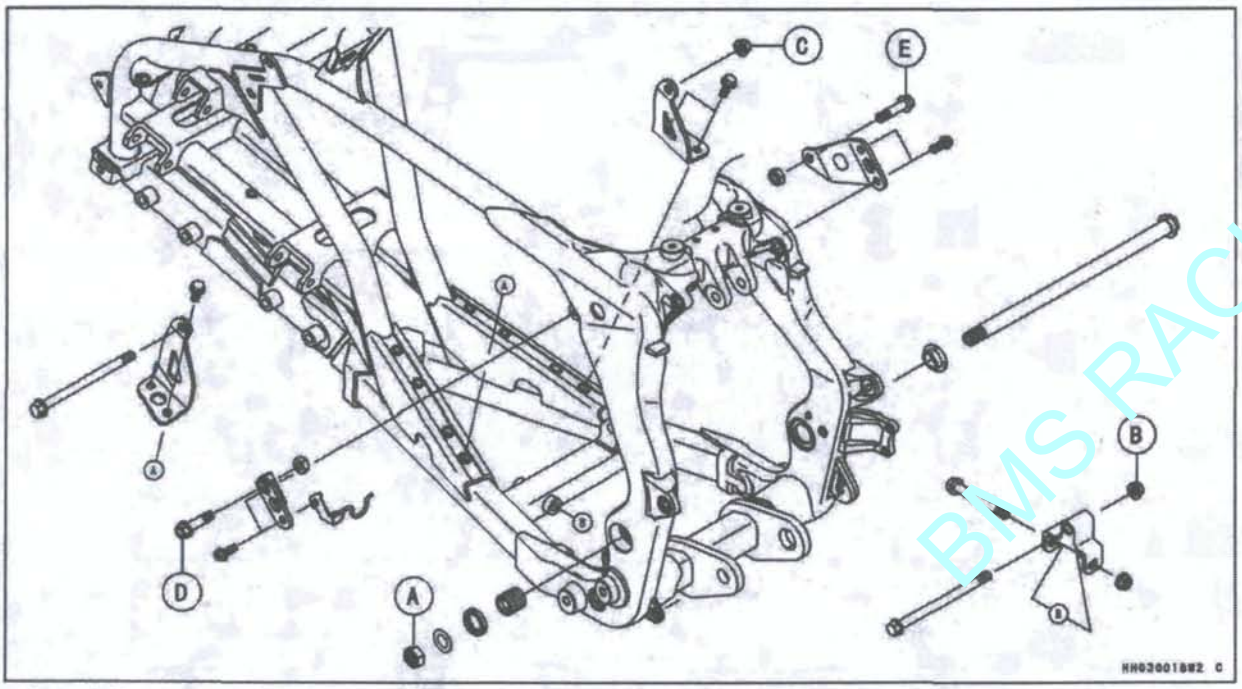
  Torque - Lower Engine Mounting Nut : 46 N·m (4.7 kgf·m, 34 ft·lb)

- Thirdly, tighten the front engine mounting nut [C].

  Torque - Front Engine Mounting Nut : 46 N·m (4.7 kgf·m, 34 ft·lb)

- Fourthly, tighten the upper left engine mounting bolt [D].
- Lastly, tighten the upper right engine mounting bolt [E].

  Torque - Upper Engine Mounting Bolts : 46 N·m (4.7 kgf·m, 34 ft·lb)



- Install the removed parts (see Appropriate chapter).
- Run the cables, hoses, and leads according to the Cable, Wire and Hose Routing section in the Appendix chapter.
- Fill:

  Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)

  Coolant (see Coolant Draining in the Cooling System chapter)
- Adjust:

  Throttle Cable (see Throttle Grip Free Play Adjustment in the Periodic Maintenance chapter)

  Clutch Cable (see Clutch Lever Free Play Adjustment in the Periodic Maintenance chapter)

  Reverse Cable (see Reverse Lock Release Lever Free Play Adjustment)

  Drive Chain (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter)
- Adjust the idling (see Idle Speed Adjustment in the Periodic Maintenance chapter).
- Check the operation of the clutch lever.
- Check the brake effectiveness.

Crankshaft/Transmission

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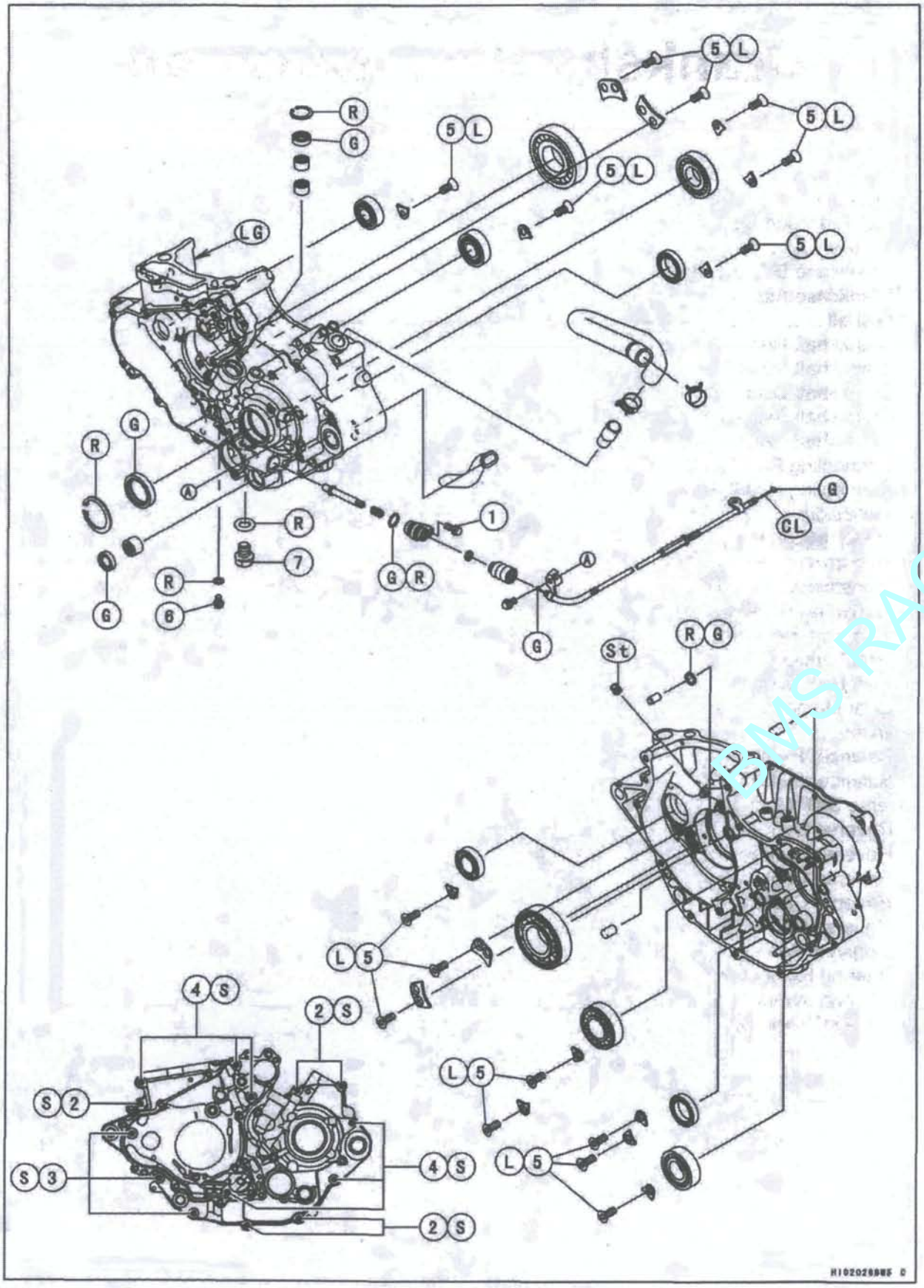
Exploded View

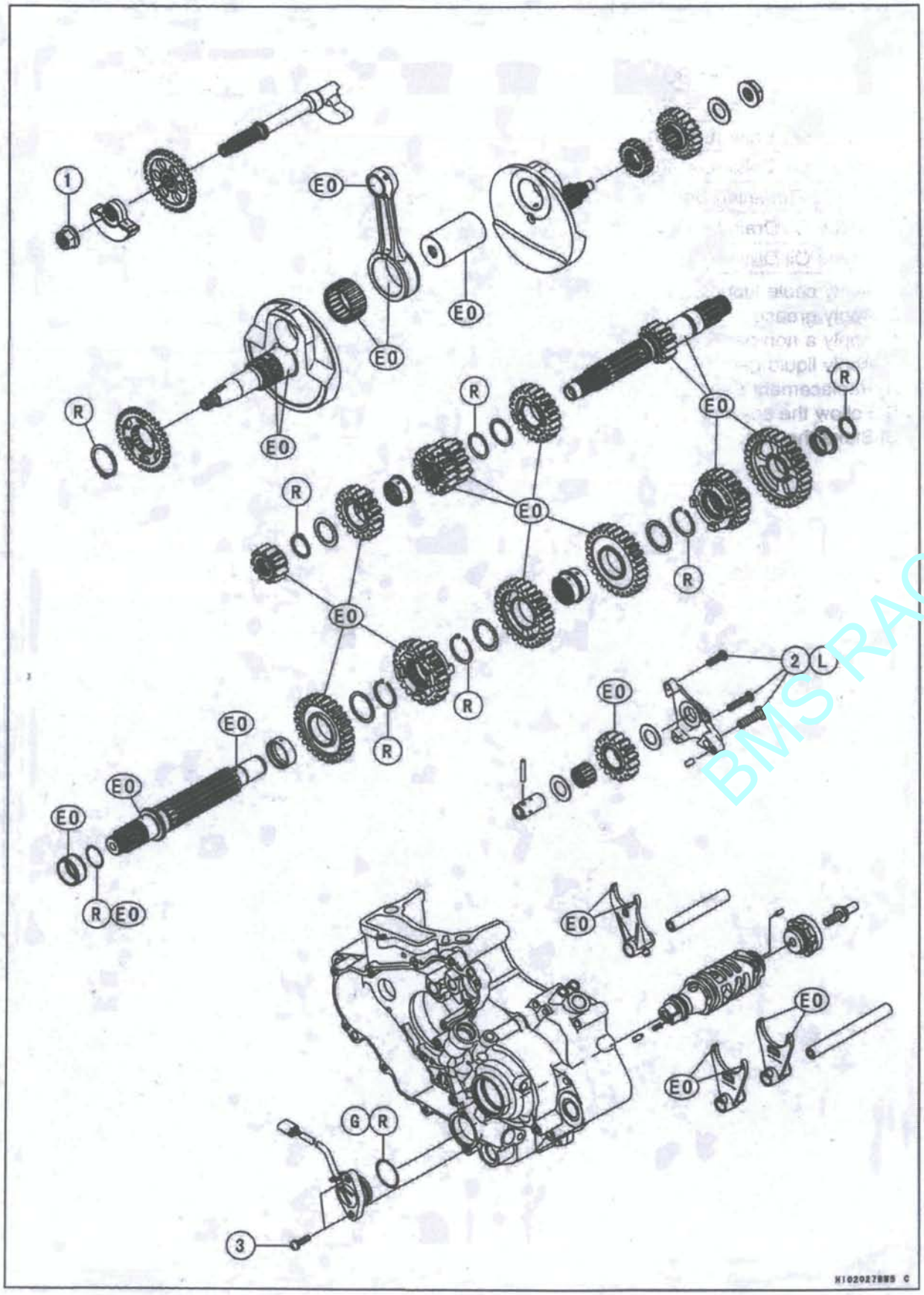


Exploded View

No.	Fastener	Torque			Re-marks
		N·m	kgf·m	ft·lb	
1	Reverse Cable Cap Bolt	8.8	0.90	78 in·lb	
2	Crankcase Bolts (L = 50)	9.8	1.0	87 in·lb	S
3	Crankcase Bolts (L = 60)	9.8	1.0	87 in·lb	S
4	Crankcase Bolts (L = 80)	9.8	1.0	87 in·lb	S
5	Bearing Retaining Bolts	19	1.9	14	L
6	Engine Oil Drain Bolts (M6)	7.0	0.71	62 in·lb	
7	Engine Oil Drain Bolts (M12)	15	1.5	11	

CL: Apply cable lubricant.
G: Apply grease.
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket (Kawasaki Bond: 92104-1063).
R: Replacement parts
S: Follow the specified tightening sequence.
St Stake the fastener

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Balancer Weight Mounting Nut	52	5.3	38	
2	Reverse Idle Gear Holder Bolts	12	1.2	106 in·lb	L
3	Neutral/Reverse Switch Screws	4.9	0.50	43 in·lb	

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
R: Replacement parts

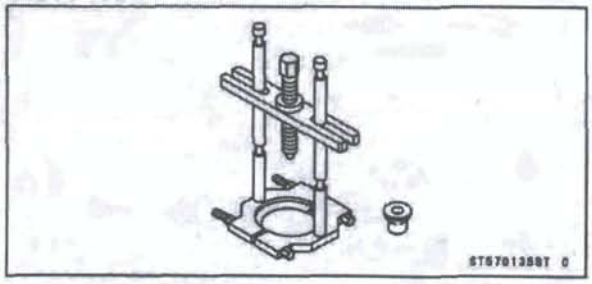
Specifications

Item	Standard	Service Limit
Connecting Rods		
Connecting Rod Big End Radial Clearance	0.002 ~ 0.014 mm (0.00008 ~ 0.0006 in.)	0.06 mm (0.002 in.)
Connecting Rod Big End Side Clearance	0.25 ~ 0.35 mm (0.0098 ~ 0.014 in.)	0.6 mm (0.02 in.)
Crankshaft Runout	TIR 0.03 mm (0.001 in.) or less	TIR 0.08 mm (0.003 in.)
Connecting Rod Bend	– – –	TIR 0.2 mm (0.08 in.)/100 mm (3.94 in.)
Connecting Rod Twist	– – –	TIR 0.2 mm (0.08 in.)/100 mm (3.94 in.)
Transmission		
Shift Fork Ear Thickness	4.9 ~ 5.0 mm (0.193 ~ 0.197 in.)	4.8 mm (0.19 in.)
Gear Shift Fork Groove Width	5.05 ~ 5.15 mm (0.199 ~ 0.203 in.)	5.25 mm (0.207 in.)
Shift Fork Guide Pin Diameter	5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)	5.8 mm (0.228 in.)
Shift Drum Groove Width	6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)	6.3 mm (0.25 in.)
Reverse Lock Release Lever		
Free Play	1 ~ 2 mm (0.04 ~ 0.08 in.)	– – –

TIR: Total Indicator Readings

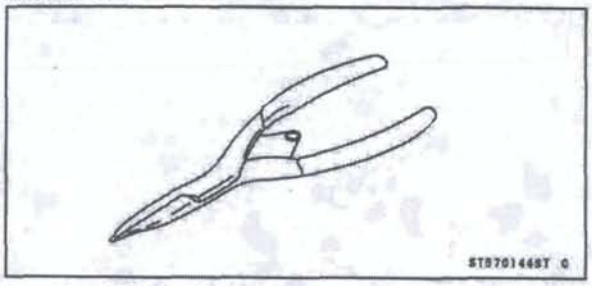
Special Tools and Sealant

Bearing Puller:
57001-135

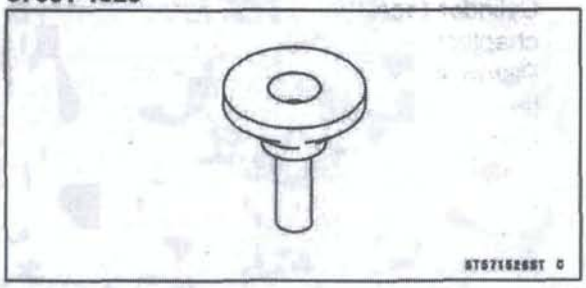


Kawasaki Bond (Liquid Gasket - Gray):
92104-1063

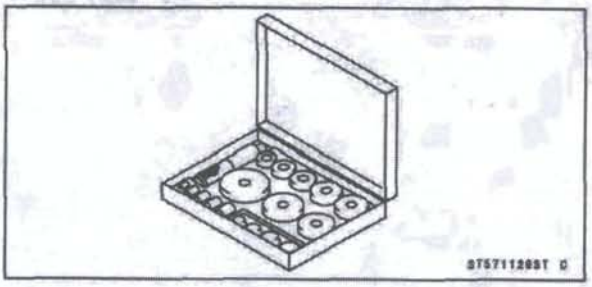
Outside Circlip Pliers:
57001-144



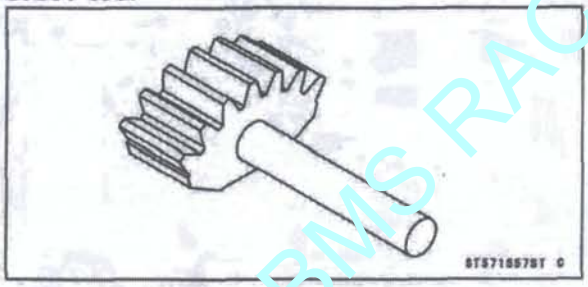
Bearing Puller Adapter:
57001-1526



Bearing Driver Set:
57001-1129



Gear Holder, m2.0:
57001-1557



Crankcase

Crankcase Disassembly

- Remove the engine from the frame (see Engine Removal in the Engine Removal/Installation chapter).
- Set the engine on clean surface while parts are being removed.
- Remove:

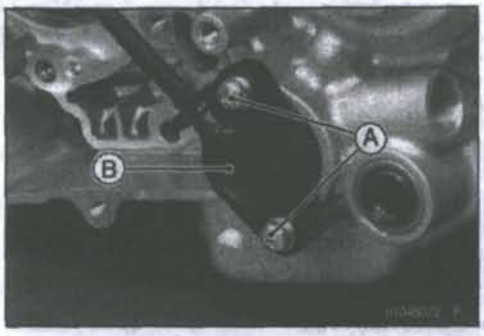
Alternator Cover (see Alternator Cover Removal in the Electrical System chapter)
Cylinder Head Cover (see Cylinder Head Cover Removal in the Engine Top End chapter)
Cylinder Head (see Cylinder Head Removal in the Engine Top End chapter)
Cylinder (see Cylinder Removal in the Engine Top end chapter)
Piston (see Piston Removal in the Engine Top End chapter)
Clutch (see Clutch Removal in the Engine Right Side chapter)
Right Engine Cover (see Right Engine Cover Removal in the Engine Right Side chapter)
Primary Gear (see Primary Gear Removal in the Engine Right Side chapter)
Starter Motor (see Starter Motor Removal in the Electrical System chapter)
Torque Limiter (see Torque Limiter Removal in the Electrical System chapter)
Starter Idle Gear (see Starter Idle Gear Removal in the Electrical System chapter)
Balancer (see Balancer Removal)
Oil Pumps (see Oil Pump (Scavenge)(Feed) Removal in the Engine Lubrication System chapter)
External Shift Mechanism (see External Shift Mechanism Removal in the Engine Right Side chapter)
Clutch Release Shaft (see Release Shaft Removal in the Engine Side chapter)
Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
Starter Clutch Gear

- Remove the output shaft sleeve [A] and the O-ring [B].

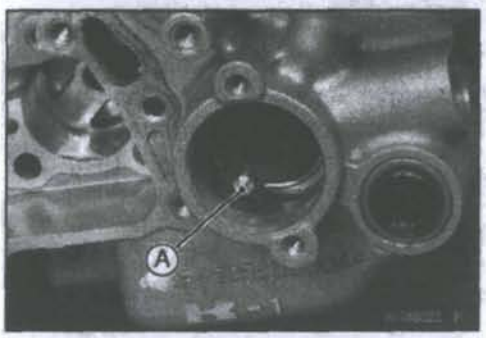
○Do not reuse the O-ring.

Crankcase

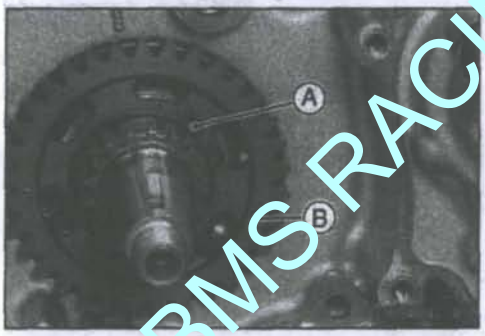
- Remove:
  Neutral/Reverse Switch Screws [A]
  Neutral/Reverse Switch [B]



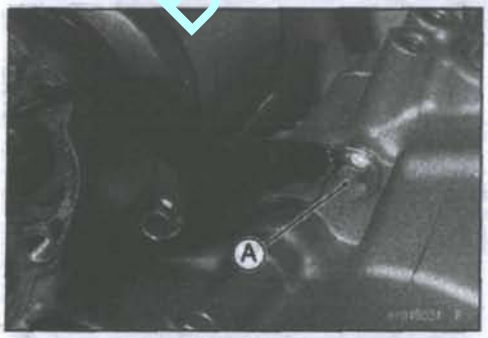
- Remove:
  Neutral/Reverse Switch Finger [A]
  Spring



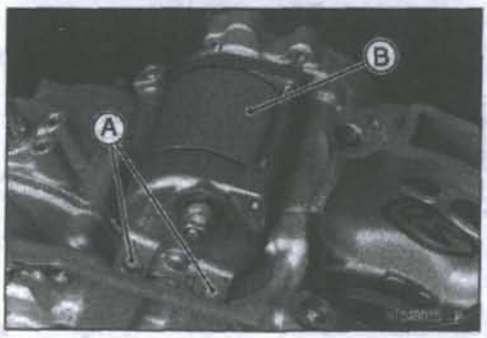
- Remove:
  Circlip [A]
  Blancer Drive Gear [B]



- Remove:
  Engine Ground Terminal Bolt [A]



- Remove:
  Stater Motor Mounting Bolts [A]
  Stater Motor [B]

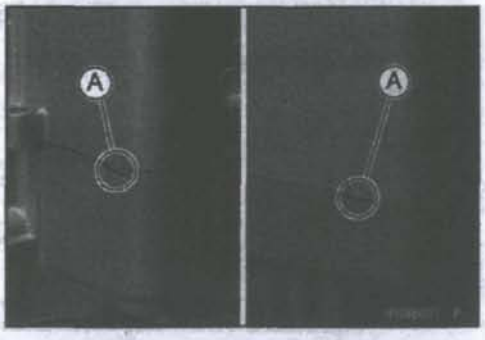


Crankcase

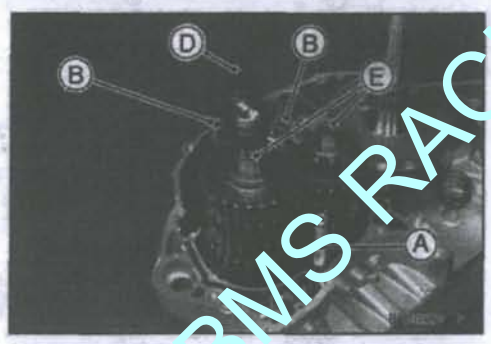
- Remove the crankcase bolts [A].

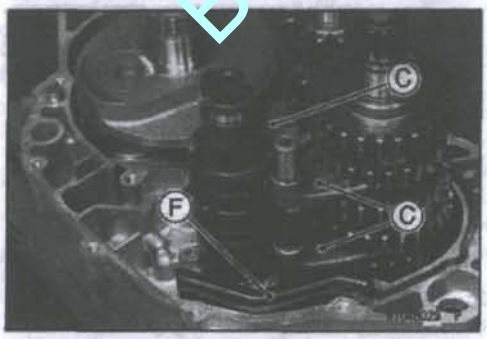
- Put the engine so that the left crankcase is down.
- Pry the points [A] to split the crankcase halves apart, and remove the right crankcase half.

○Tap lightly around the crankcase joint with a plastic mallet, and split the crankcase. Take care not to damage the crankcase.

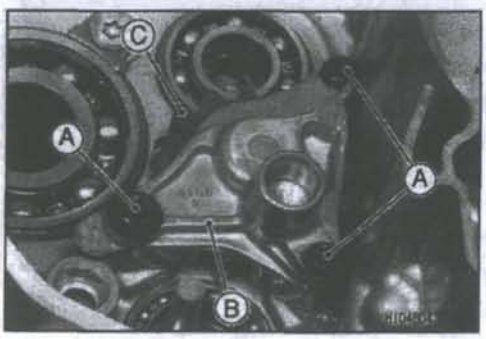


- Remove:
  Oil Pipe [A]
  Shift Rods [B] (see Transmission Shaft Removal)
  Shift Forks [C] (see Transmission Shaft Removal)
  Shift Dram [D] (see Transmission Shaft Removal)
  Transmission [E] (see Transmission Shaft Removal)
  Oil Return Tube [F]
- Remove the crankshaft from the right crankcase half (see Crankshaft Removal).



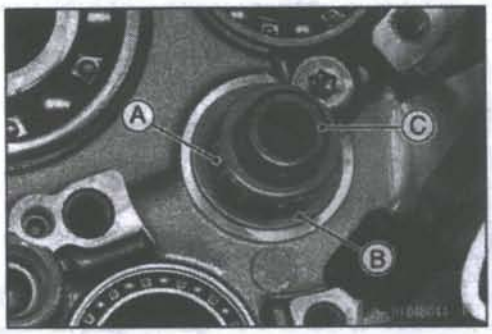


- Remove:
  Bolts [A]
  Holder [B]
  Washer
  Reverse Idle Gear [C]



Crankcase

- Remove:
  Needle Bearing [A]
  Washer [B]
  Idle Gear shaft [C]



CAUTION

Do not remove the bearings and the oil seals unless it is necessary.
Removal may damage them.

Crankcase Assembly

CAUTION

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

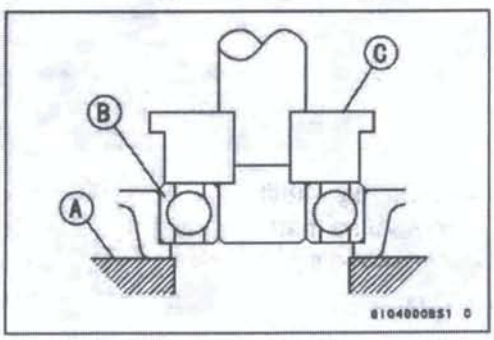
- Remove the old gasket from the mating surfaces of the crankcase halves and clean them off with a high-flash point solvent.
- Using compressed air, blow out the oil passages in the crankcase halves.

⚠ 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 a low-flash point solvent to clean parts. A fire or explosions could result.

- Support the crankcase bearing boss with a suitable retainer [A].
- Using a press and the bearing driver set [C], install a new bearing [B] until it bottoms out.

Special Tool - Bearing Driver Set: 57001-1129



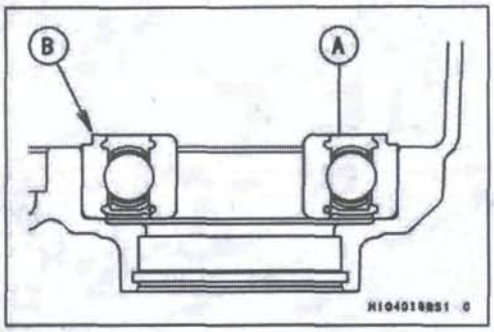
CAUTION

Support the crankcase bearing boss when the bearing is pressed, or the crankcase could be damaged.

Crankcase

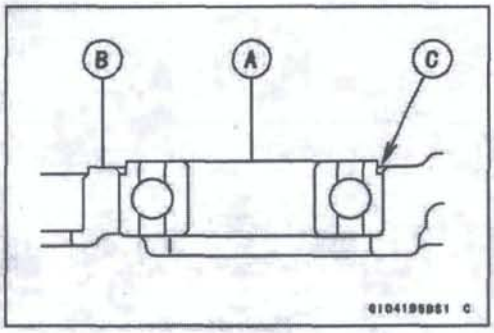
- Press the new output shaft bearing [A] in the left crankcase half, so that the stepped side [B] faces inside of the engine.

Special Tool - Bearing Driver Set: 57001-1129



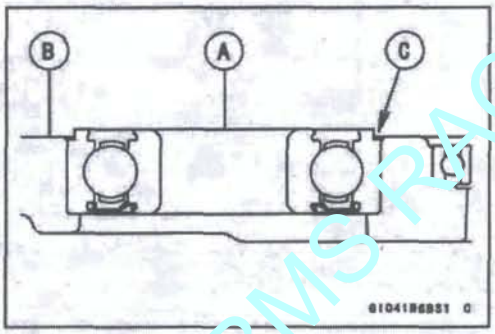
- Press the new drive shaft bearings [A] in the each crankcase [B] half, so that the stepped side [C] faces inside of the engine.

Special Tool - Bearing Driver Set: 57001-1129



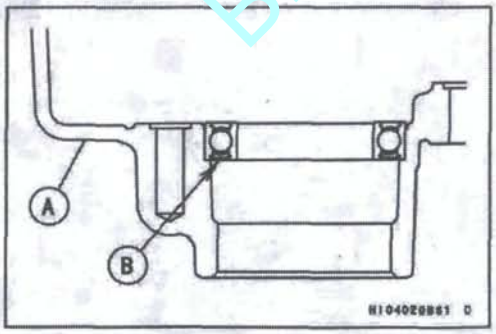
- Press the new crankshaft bearings [A] in the left and right crankcase half [B], so that the stepped side [C] faces inside of the engine.

Special Tool - Bearing Driver Set: 57001-1129



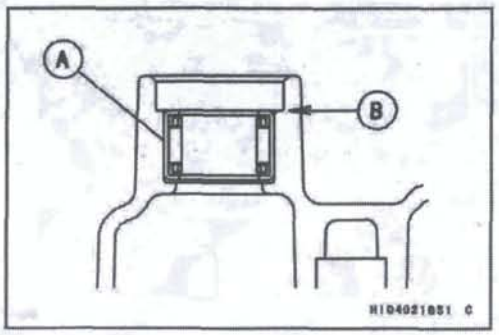
- Press the shift drum bearings [A] in the each crankcase half so that sealed side [B] faces outside of the engine.

Special Tool - Bearing driver Set: 57001-1129



- Press the shift shaft needle bearing [A] in the left crankcase half so that bearing surface flush with the crankcase surface [B].

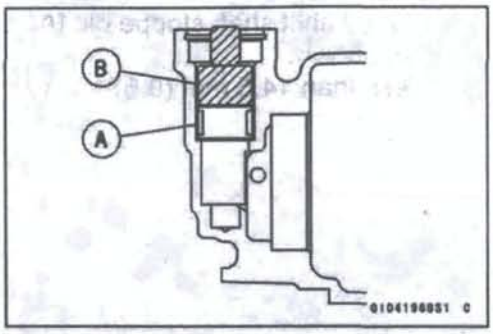
Special Tool - Bearing driver Set: 57001-1129



Crankcase

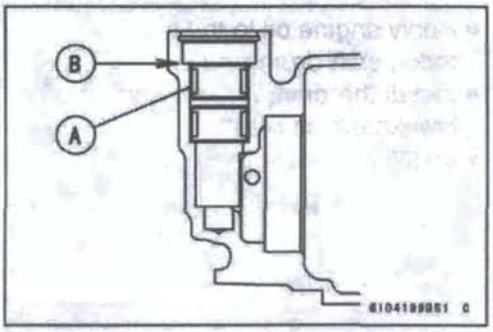
- First, press the inside release shaft needle bearing [A] until it bottom out with the bearing driver set [B].

  Special Tool - Bearing driver Set: 57001-1129



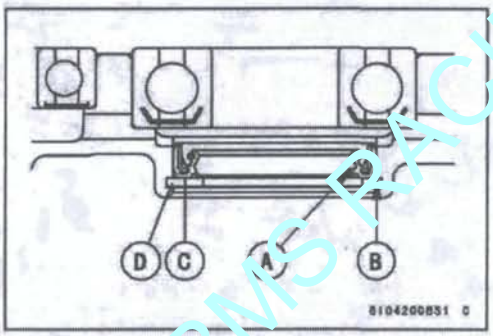
- Next, press the outside release shaft needle bearing [A] until the surface of the bearing is even with the crankcase surface [B].

  Special Tool - Bearing driver Set: 57001-1129



- Replace the oil seals, if removed.
- Press the output shaft and release shaft oil seals [C] so that oil seal lip [A] face to the engine outside and oil seal surface flush with the left crankcase surface [B].
- Press the shift shaft oil seal until it bottom out so that oil seal lip face the engine outside.
- Apply high-temperature grease to the oil seal lip.
- Install the new circlip [D] to the output shaft and release shaft oil seal.

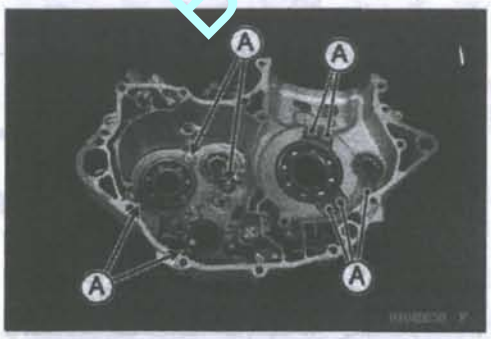
  Special Tool - Bearing driver Set: 57001-1129

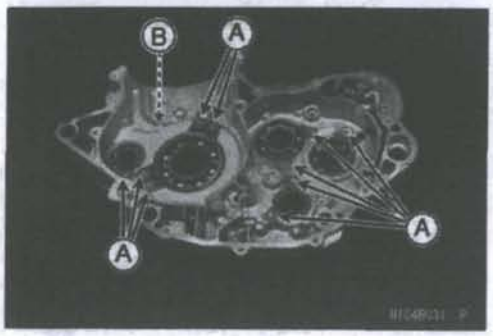


- Apply a non-permanent locking agent to the bearing retaining bolts.
- Tighten the bearing retaining bolts [A].

  Torque - Bearing Retaining Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)

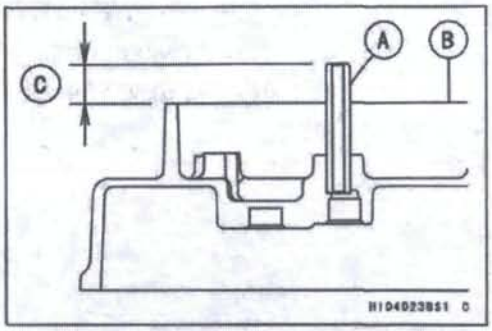
- Install the piston oil nozzle [B], and stake it.



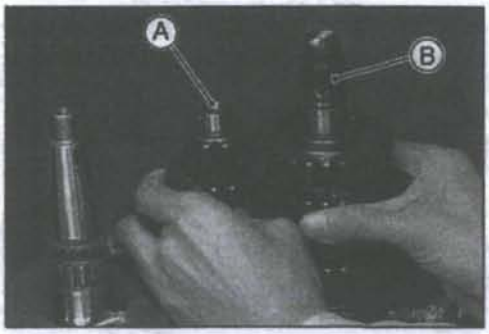


Crankcase

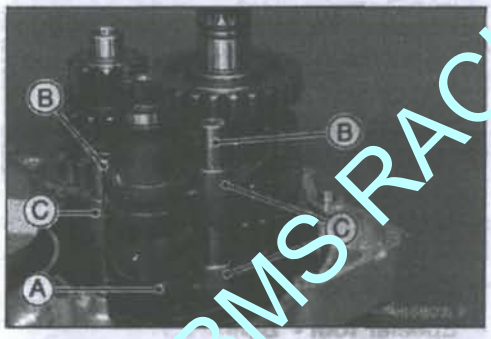
- Press the shift shaft stoppe pin [A] to the right crankcase [B] as shown.
  [C] less than 14.5 mm (0.571 in.)



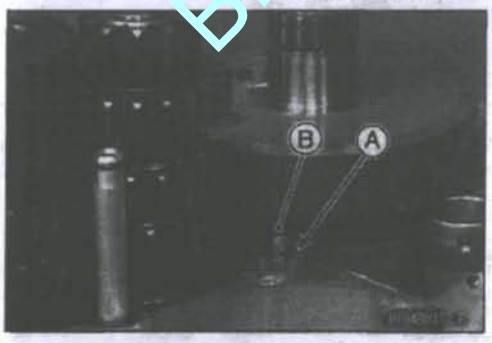
- Apply engine oil to the transmission gears, bearings, shift forks, shift drum and crankshaft bearing.
- Install the drive shaft [A] and output shaft [B] in the right crankcase as a set.
- Install the crankshaft.



- Install:
  Shift Drum [A] (see Transmission Installation)
  Shift Rods [B] (see Transmission Installation)
  Shift Forks [C] (see Transmission Installation)



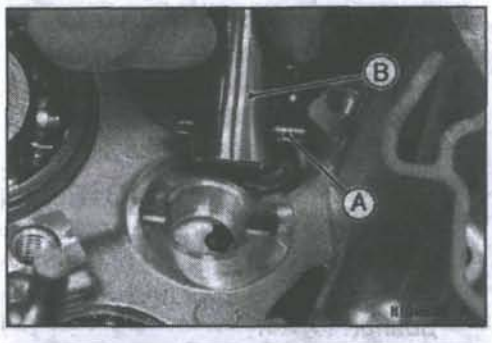
- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring, and install it.
- Install:
  Dowel Pin (Oil Passage) [B]



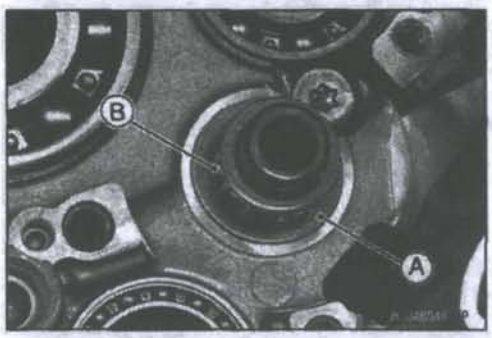
- Be sure to install the dowel pins [A]

Crankcase

- Set the pin [A] to the idle gear shaft [B], and install them to the left crankcase half.

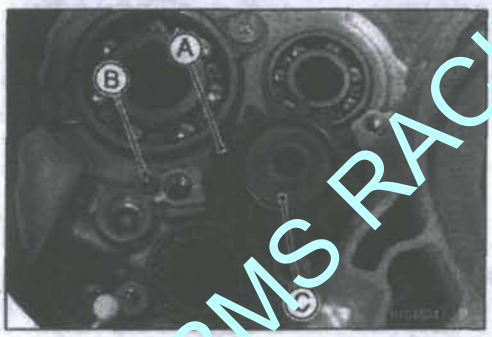


- Install:
  Washer [A]
  Needle Bearing [B]



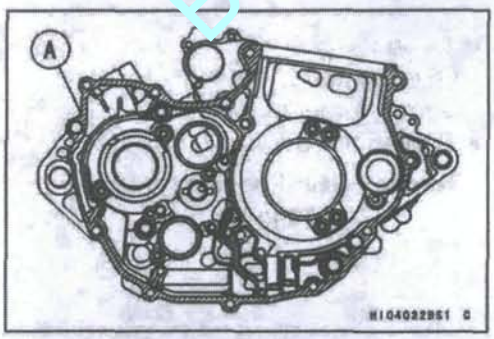
- Install:
  Reverse Idle Gear [A]
  Dowel Pin [B]
  Washer [C]
  Idle Gear Holder
- Apply a non-parmanent locking agent to the idle gear holder bolts.
- Tighten:

Torque - Reverse Idle Gear Holder Bolts: 12 N·m (1.2 kgf·m, 106 in·lb)

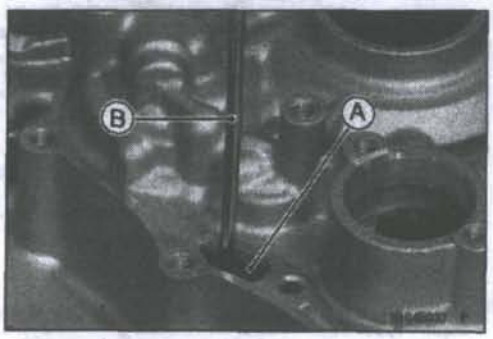


- Apply liquid gasket to the mating surface [A] of the left crankshaft half.

Sealant - Kawasaki Bond (Liquid Gasket - Gray): 92104 -1063



- Set the Left crankcase halve on the right crankcase halve.
- While turning the reverse idle gear [A] with the tip of a screw driver [B], mesh the reverse idle gear and reverse gears.



Crankcase

- Using a plastic hammer, press the rear portion of the crankcase, and tap the area around the crankshaft of the left crankcase. While maintaining the mating surfaces of the right and left crankcase halves constantly parallel, mate the crankcase halves evenly.

NOTE

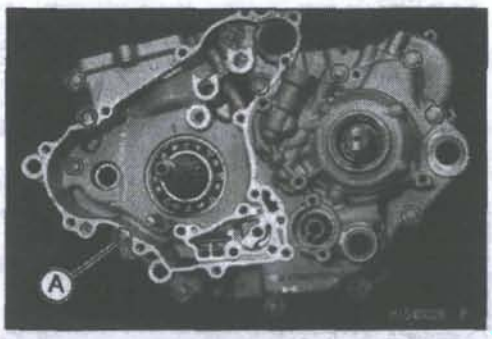
○*Constantly check the alignment of the two crankcase halves, and the position of the transmission shafts, and shift drum. The front and rear of the crankcase must be pushed together evenly.*

- Tighten the crankcase bolts [A], starting with the periphery of the crankshaft, then outward.

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

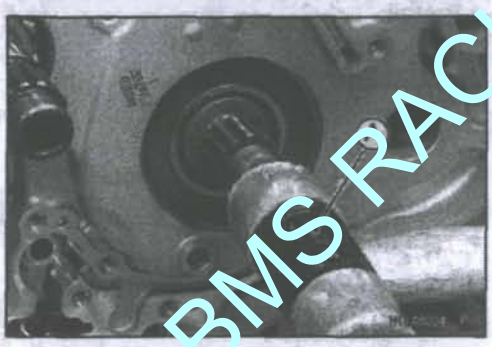
NOTE

○*After tightening the crankcase bolts, wipe up the liquid gasket seeping out around the mating surface, especially around the area.*



- Make sure that the crankshaft, driveshaft, and the output shaft, rotate smoothy (in the neutral position).

★If the crankshaft will not turn, probably the crankshaft is not centered; tap the appropriate end of the crankshaft with a mallet [A] to reposition it.



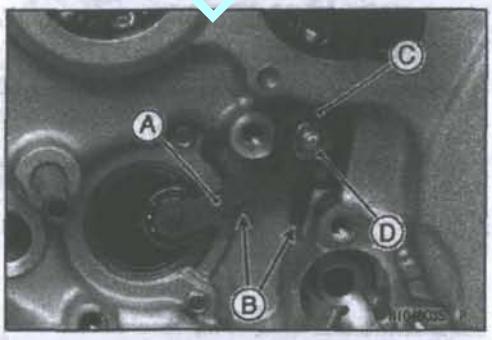
- Install the gear positioning lever [A].

○Fit each end [B] of the spring or original positions.

○Do not forget to install the collar and washer [C].

- Tighten the gear positioning lever nut [D].

Torque - Gear Positioning Lever Nut: 8.8 N·m (0.90 kgf·m, 78 in·lb)

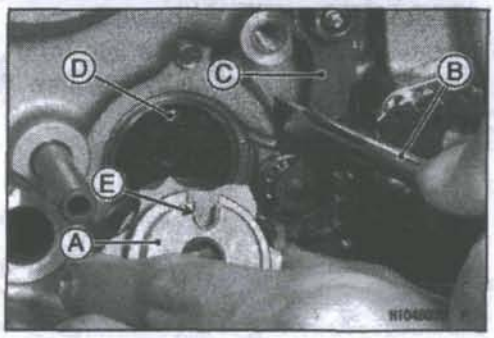


- To install the shift drum cam [A], use the driver [B] to bring the gear positioning lever [C] to the bottom of the crankcase.
- Mate the shift drum pin [D] into the shift drum hole.

○Fit the groove [E] of the shift drum cam on the shift drum pin.

- Apply non-permanent locking agent to the shift drum cam bolts and tighten them.

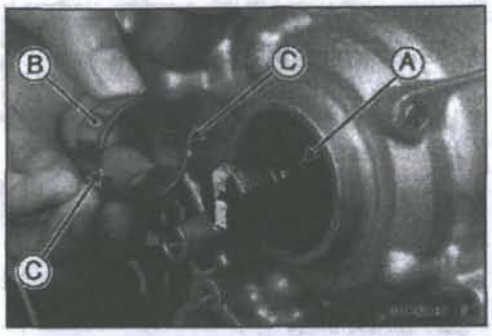
Torque - Shift Drum Cam Bolt: 29 N·m (3.0 kgf·m, 21 ft·lb)



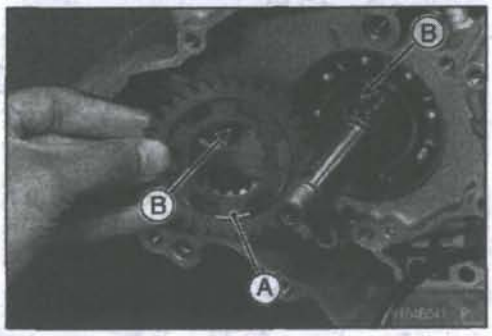
- Check to see that gears shift smoothly from 1st to 5th gear, and 5th to 1st while spinning the output shaft.
- Set the shift drum in the neutral position.

Crankcase

- Replace the O-ring [A] on the output shaft with a new one.
- Install O-ring on the output shaft while expanding the O -ring by the hand.
- Apply engine oil to the O-ring.
- Apply engine oil to the outside surface of the collar [B].
- Insert the collar with the oil groove end [C] facing inside.



- Install the balancer drive gear [A] so that the align the tooth lacked portions [B] of the balancer drive gear and crankshaft .
- Replace the circlip with a new one, and install it.



Crankshaft

Crankshaft Removal

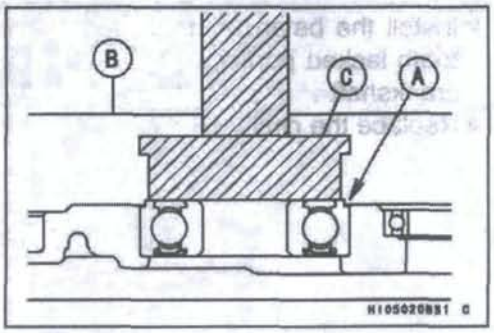
- Disassemble the crankcase (see Crankcase Disassembly).
- Using the hand, pull out the crankshaft [A] from the right crankcase [B].

Crankshaft Installation

- Apply high-temperature grease to the outer side of the crankshaft bearings and use the bearing driver set [C] to face the stepped side [A] to the engine inside and drive the bearing to the bottom of the crankcase [B]. While driving the bearing in, make sure to use a holder to support the boss area.

Special Tool - Bearing Driver Set: 57001-1129

- Install the crankshaft to the right crankcase.
- Apply engine oil to the connecting rod big end bearing.



Crankshaft Disassembly

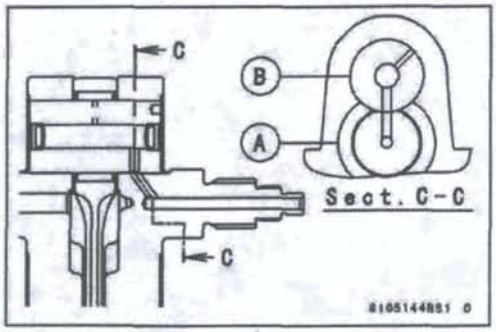
Since assembly of the crankshaft demands exacting tolerances, the disassembly and reassembly of the crankshaft can only be done by a shop having the necessary tools and equipment.

- If it should be necessary to disassemble the crankshaft, use a press to remove the crankpin.

Crankshaft Assembly

Since the assembly of the crankshaft demands exacting tolerances, the disassembly and reassembly of the crankshaft can only be done by a shop having the necessary tools and equipment.

- Carefully align the oil passage hole in the right flywheel [A] with the one in the crankpin [B] at rebuilding of the crankshaft as shown.



- Reassemble the crankshaft according to the standard tolerances in Specifications.

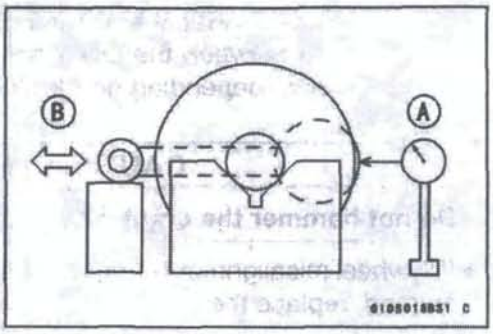
○Connecting rod bend, twist.
○Connecting rod big end radial clearance.
○Cold-fitting tolerance between crankpin and flywheels.
○Side clearance between the connecting rod big end and one of flywheels.
○Crankshaft runout.

Crankshaft

Crankshaft Inspection

Connecting Rod Big End Radial Clearance

- Set the crankshaft on V blocks, and place a dial gauge [A] against the connecting rod big end.
- Push [B] the connecting rod first towards the gauge and then in the opposite direction. The difference between two gauge readings is the radial clearance.



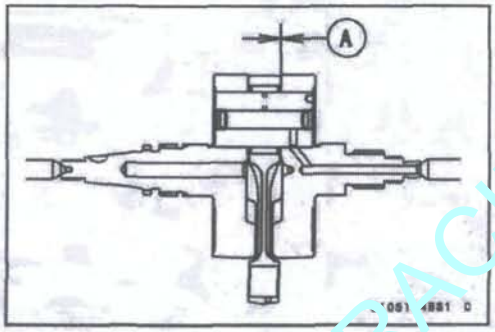
Connecting Rod Big End Radial Clearance

Standard:	**0.002 mm ~ 0.014 mm (0.00008 ~ 0.0006 in.)**
Service Limit:	**0.06 mm (0.002 in.)**

★If the radial clearance exceeds the service limit, crankshaft should be either replaced or disassembled and crankpin, needle bearing, and connecting rod big end should be examined for wear.

Connecting Rod Big End Side Clearance

- Measure the connecting rod big end side clearance [A].



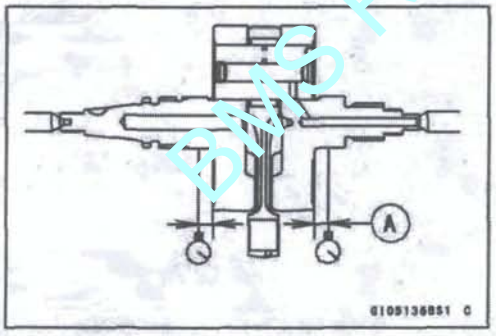
Connecting Rod Big End Side Clearance

Standard:	**0.25 ~ 0.35 mm (0.0098 ~ 0.014 in.)**
Service Limit:	**0.6 mm (0.02 in.)**

★If the clearance exceeds the service limit, replace the crankshaft assembly.

Crankshaft Runout

- Set the crankshaft in a flywheel alignment jig or on V blocks, and place a dial gauge as shown and turn the crankshaft slowly. The maximum difference in gauge reading is the crankshaft runout.

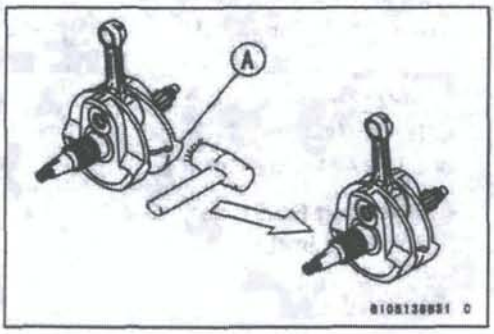


Standard:	**TIR 0.03 mm (0.001 in.) or less**
Service Limit:	**TIR 0.08 mm (0.003 in.)**

★If the runout at either point exceeds the service limit, replace the crankshaft assembly with a new one or align the crankshaft so that the runout falls within the service limit.

8.5 mm (0.33 in.) [A]

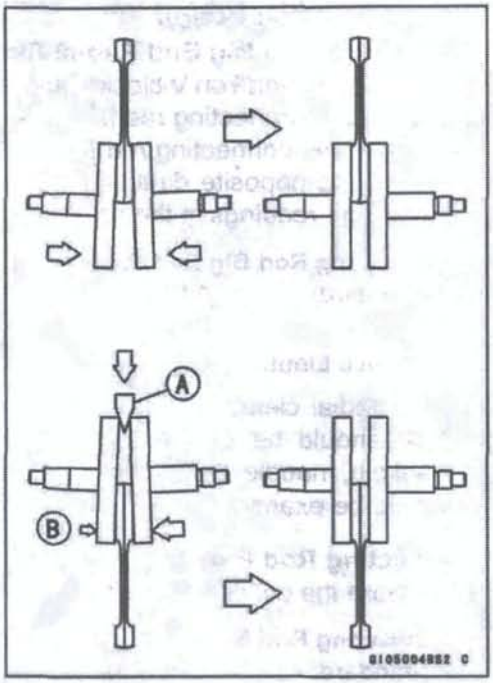
- First correct the horizontal misalignment by striking the projecting crank half [A] with a plastic, soft lead, or brass hammer as shown.
- Recheck the runout with a dial gauge and repeat the process until the runout falls within the service limit.



- Next, correct the vertical misalignment by either driving a wedge [A] in between the crank halves or by squeezing them in a vice, depending on the nature of the misalignment.

CAUTION
Do not hammer the crank half at the point [B].

★If flywheel misalignment cannot be corrected by the above method, replace the crank pin or the crankshaft itself.



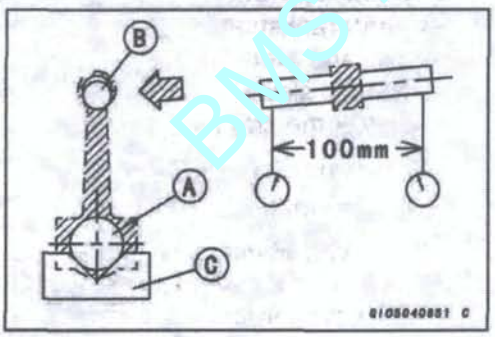
Connecting Rod Big End Seizure

★In case of serious seizure with damaged flywheels, the crankshaft must be replaced.

★In case of less serious damage, disassemble the crankshaft and replace the crankpin, needle bearing, and connecting rod.

Connecting Rod Bend

- Remove the connecting rod.
- Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
- Select an arbor of the same diameter as the piston pin and more than 105 mm long, and insert the arbor [B] through the connecting rod small end.
- On a surface plate, set the big-end arbor on a V block [C].



- With the connecting rod held vertically, use a height gauge to measure the difference in the height of the arbor above the surface plate over a 100 mm length to determine the amount of connecting rod bend.

★If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

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

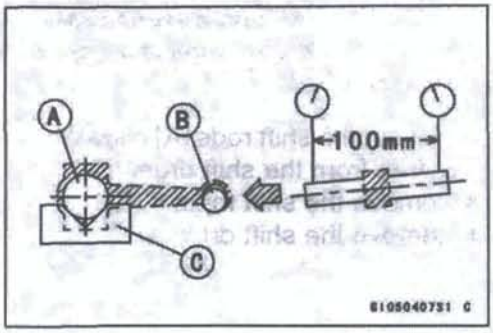
Crankshaft

Connecting Rod Twist

- With the big-end arbor [A] still on the V block [C], hold the connecting rod horizontally and measure the amount that the arbor [B] varies from being parallel with the surface plate over a 100 mm length of the arbor to determine the amount of connecting rod twist.

★If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

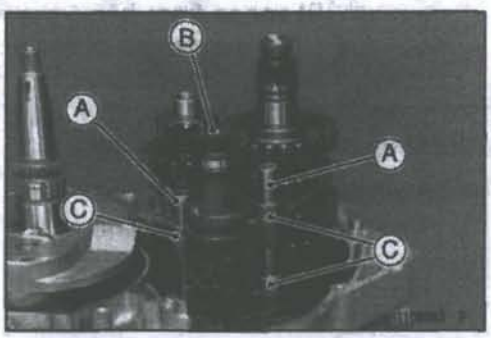
Connecting Rod Twist
Service Limit: TIR 0.2/100 mm (0.008/3.94 in.)



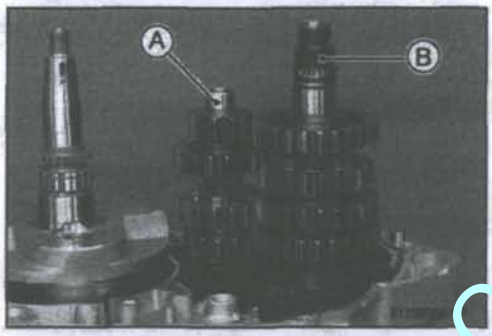
Transmission

Transmission Shaft Removal

- Disassemble the crankcase halves (see Crankcase Disassembly).
- Pull out the shift rods [A] allowing the shift fork guide pins to free from the shift drum [B].
- Remove the shift forks [C].
- Remove the shift drum.

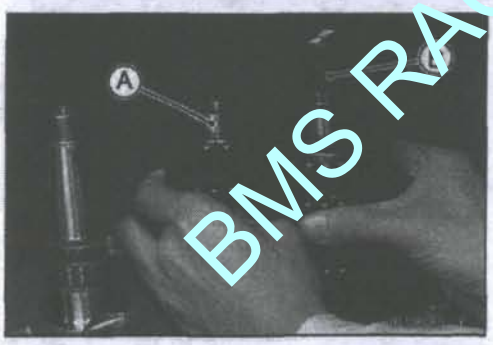


- Pull out the drive shaft [A] and output shaft [B] together with their gears meshed.



Transmission Shaft Installation

- Apply engine oil to the sliding portion of the transmission shaft, gears, and ball bearings.
- Install the drive shaft [A] and output shaft [B] in the right crankcase with their gears meshed.
- Install the shift drum.

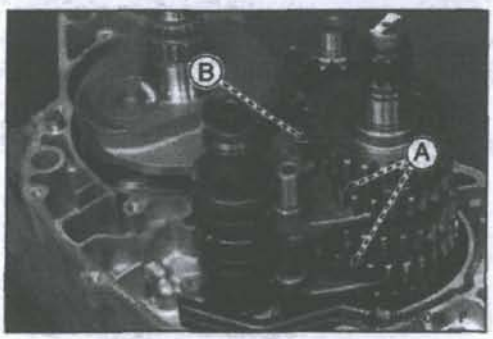


- Apply a small amount of engine oil to the shift fork fingers and fit each shift fork into the groove of the proper gear.
- The shift forks can be identified by their shape or mark.

OInstall output shift forks with its mark [A] facing the engine left side.

OInstall the drive shaft fork with its mark [B] facing the engine right side.

Marks: 034 (*Drive shaft*)
035 (Output shaft)



- Assembly the crankcase (see Crankcase Assembly).

Transmission

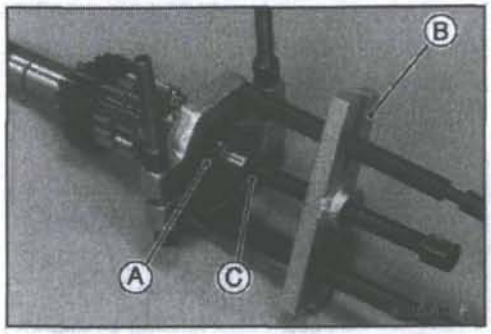
Transmission Shaft Disassembly

- Remove the transmission shafts.

○The reverse gear [A] on the drive shaft is press fitting.

- Remove the reverse gear on the drive shaft with the bearing puller [B] and adapter [C].

Special Tool - Bearing Puller: 57001-135
Bearing Puller Adapter: 57001-1526



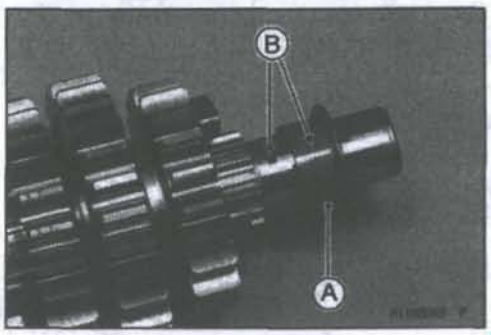
- Remove the circlips, washers, then gears.

Special Tool - Outside Circlip Pliers: 57001-144

- Do not reuse the removed circlips.

Transmission Shaft Assembly

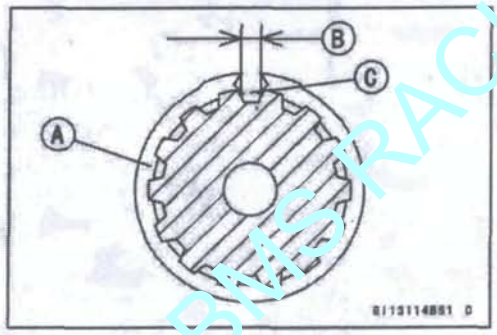
- Apply engine oil liberally to the bushings transmission shafts, gears and bearings.
- Install the gear bushings [A] on the each shafts with their holes [B] aligned.



- Replace any circlips that were removed with new ones.

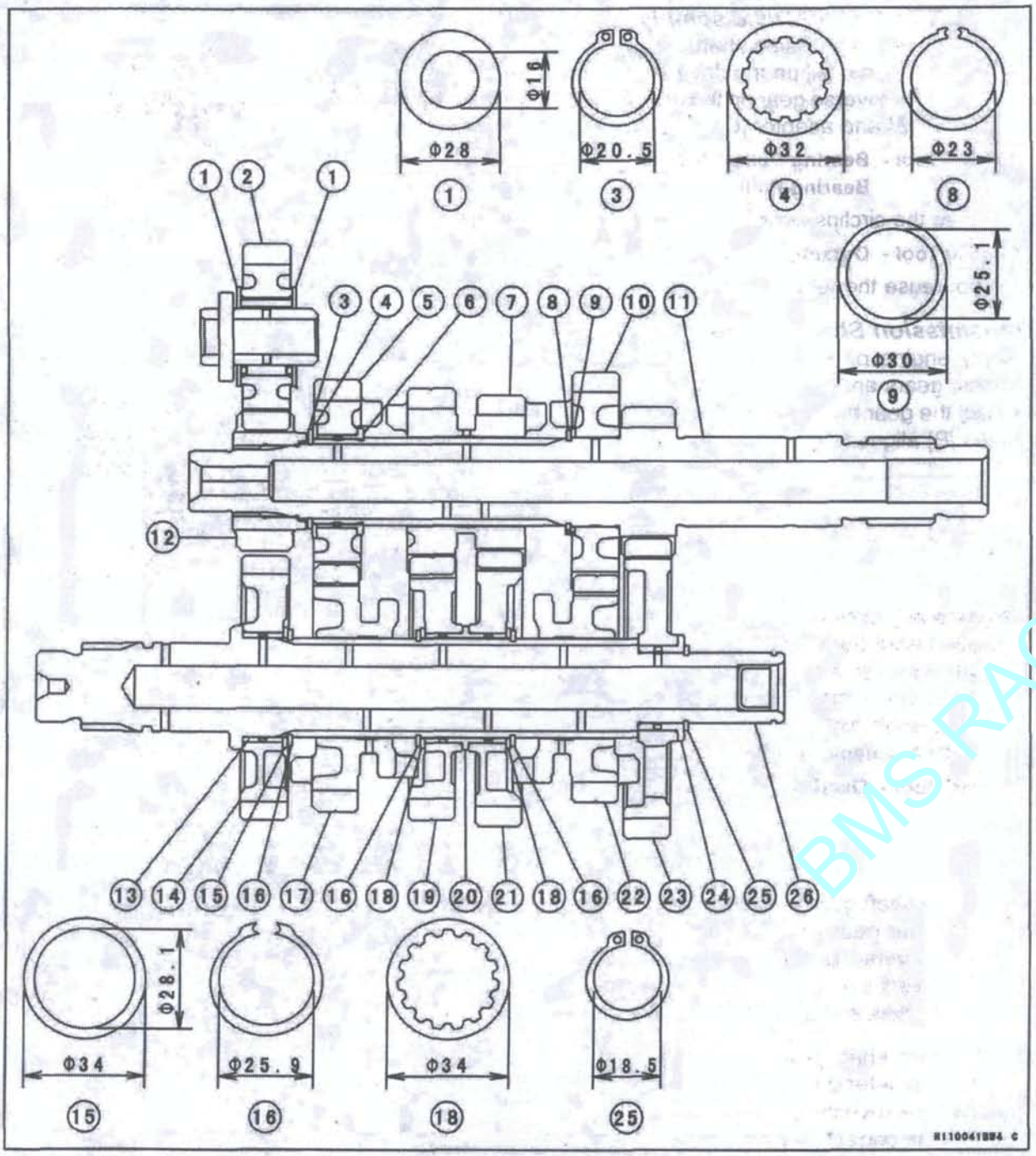
○Always install the circlips [A] so that the opening [B] is aligned with a spline groove [C], and install toothed washers. To install a circlip without damage, first fit the circlip onto the shaft expanding it just enough to install it, and then use a suitable gear to push the circlip into place.

Special Tool - Outside Circlip Pliers: 57001-144



- The drive shaft gears can be identified by size; the smallest diameter gear is 1st gear, and the largest is 5th (except the reverse gear). Be sure that all parts are put back in the correct sequence, facing the proper direction, and that all circlips and the washers are properly in place.
- The output shaft gears can be identified by size; the largest diameter gear is 1st gear, and the smallest is 5th (except the reverse gear). Be sure that all parts are put back in the correct sequence, facing the proper direction, and that all circlips and washers are properly in place.

Transmission



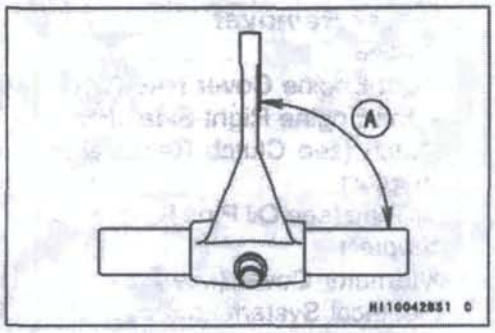
1. Washer (φ 16 × φ 28)
2. Reverse Idle Gear (16T)
3. Snap Ring (φ 20.5)
4. Toothed Washer (φ 32)
5. 4th Gear (18T)
6. Bushing (φ 21.4 × φ 26 × 12.8)
7. 2nd/3rd Gear (15T /17T)
8. Snap Ring (φ 23)
9. Washer (φ 30 × φ 25.1)
10. 5th Gear (21T)
11. Drive Shaft
12. Reverse Gear (11T)
13. Bushing (φ 28 × φ31 × 11)
14. Reverse Gear (26T)
15. Washer (φ 34 × φ 28.1)
16. Snap Ring (φ 25.9)
17. 4th Gear (23T)
18. Toothed Washer (φ 34)
19. 3rd Gear (26T)
20. Bushing (φ 25 × φ31 × 22.7)
21. 2nd Gear (27T)
22. 5th Gear (22T)
23. 1st Gear (29T)
24. Bushing (φ20 × φ 24 × 12.75)
25. Snap Ring (φ 18.5)
26. Output Shaft

- Check each gear spins or slides freely on the transmission shaft without binding after assembly.

Transmission

Shift Fork Bending

- Visually inspect the shift forks, and replace any fork that is bent. A bent fork may cause difficulty in shifting, or allow the transmission to jump out of gear when under power.
  90° [A]



Shift Fork/Gear Groove Wear

- Measure the thickness [A] of the shift fork ears, and measure the width [B] of the gear grooves (with which the fork engages).

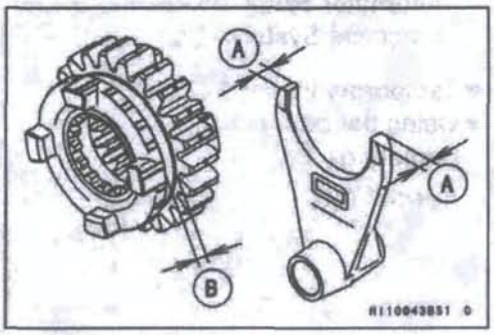
Shift Fork Ear Thickness

Standard:	**4.9 ~ 5.0 mm (0.193 ~ 0.197 in.)**
Service Limit:	**4.8 mm (0.19 in.)**

Gear Shift Fork Groove Width

Standard:	**5.05 ~ 5.15 mm (0.199 ~ 0.203 in.)**
Service Limit:	**5.25 mm (0.207 in.)**

★If the thickness of a shift fork ear is less than the service limit, the shift fork must be replaced.
★If the gear groove is worn exceeding the service limit, the gear must be replaced.



Shift Fork Guide Pin/Shift Drum Groove Wear

- Measure the diameter of each shift fork guide pin [A], and measure the width [B] of each shift drum groove.

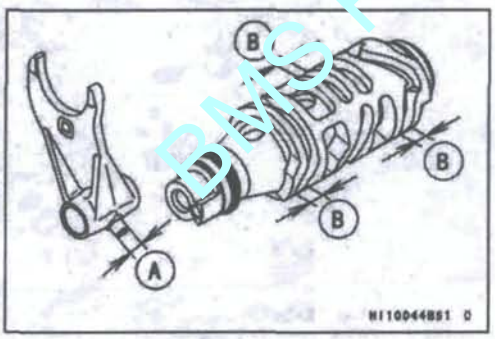
Shift Fork Guide Pin Diameter

Standard:	**5.9 ~ 6.0 mm (0.232 ~ 0.236 in.)**
Service Limit:	**5.8 mm (0.228 in.)**

Shift Drum Groove Width

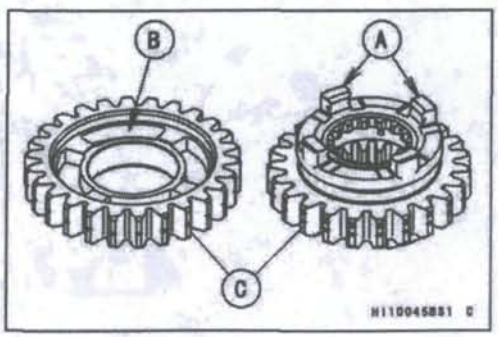
Standard:	**6.05 ~ 6.20 mm (0.238 ~ 0.244 in.)**
Service Limit:	**6.3 mm (0.25 in.)**

★If the guide pin on any shift fork is less than the service limit, the fork must be replaced.
★If any shift drum groove is worn exceeding the service limit, the drum must be replaced.



Gear Damage

- Visually inspect the gear dogs [A] and gear dog holes [B].
★Replace any damaged gears or gears with excessively worn dogs or dog holes.
- Visually inspect the gear teeth [C] on the transmission gears.
★Replace lightly damaged gear teeth with an oilstone. The gear must be replaced if the teeth are badly damaged.
★When gear is repaired or replaced, the driving gear should also be inspected and repaired or replaced if necessary.



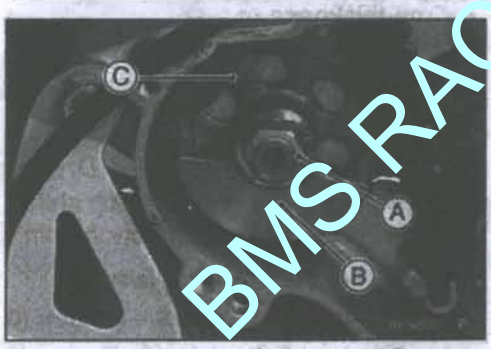
Balancer

Balancer Removal

- Remove:
  Right Engine Cover (see Right Engine Cover Removal in the Engine Right Side chapter)
  Clutch (see Clutch Removal in the Engine Right side chapter)
  Oil Pipe (see Oil Pipe Removal in the Engine Lubrication chapter)
  Alternator Cover (see Alternator Cover Removal in the Electrical System chapter)
  Alternator Rotor (see Alternator Rotor Removal in the Electrical System chapter)
- Temporary install the clutch housing.
- Using the gear holder [A], secure the clutch gear and the primary gear.

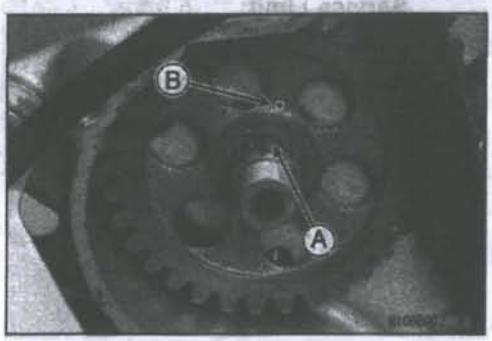
Special Tool - Gear Holder, m2.0: 57001-1557

- Remove:
  Balancer Weight Mounting Nut [A]
  Balancer Weight [B]
  Balancer Gear [C]
- Pull out the balancer shaft from the right crankcase.



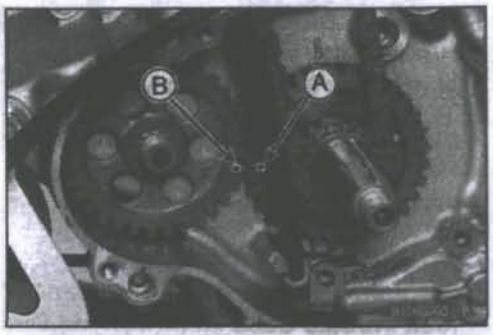
Balancer Installation

- Insert the balancer shaft from the right crankcase.
- Install the balancer gear so that the stepped portion [A] on the balancer shaft and punch mark [B] on the balancer gear align.

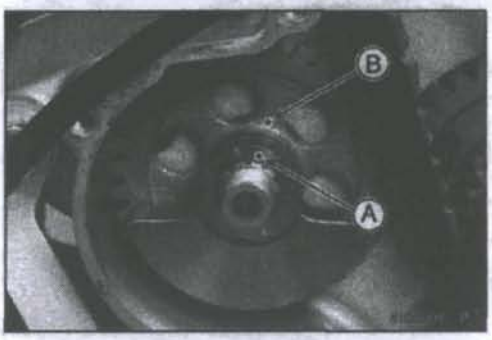


Balancer

- Align the punch mark [A] on the balancer drive gear and punch mark [B] on the balancer gear.



- Install the balancer weight so that the punch mark [A] on the balancer and punch mark [B] on the balancer gear.

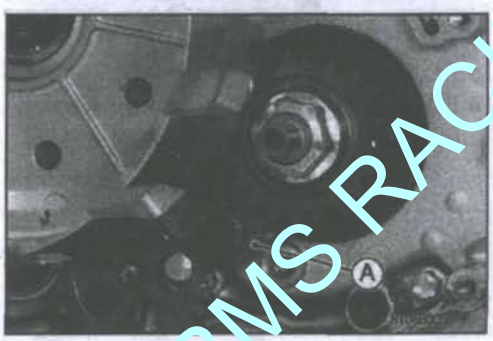


- Using the gear holder [A], secure the clutch gear and the primary gear.

Special Tool - Gear Holder, m2.0: 57001-1557

- Tighten:

Torque - Balancer Weight Mounting Nut: 52 N·m (5.3 kgf·m, 38 ft·lb)



Reverse Shift Mechanism

Reverse Lock Release Lever Free Play Inspection

- Refer to the Reverse Lock Release Lever Free Play Inspection in the Periodic Maintenance chapter.

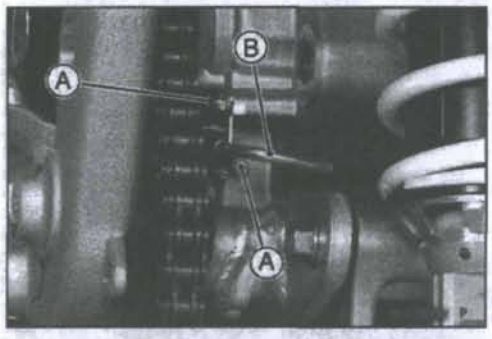
Reverse Lock Release Lever Free Play Adjustment

- Refer to the Reverse Lock Release Lever Free Play Adjustment in the Periodic Maintenance chapter.

Reverse Cable Removal

- Clear the reverse cable upper end from the throttle case (see Throttle Case Removal and Disassembly in the Fuel System (DFI) chapter).

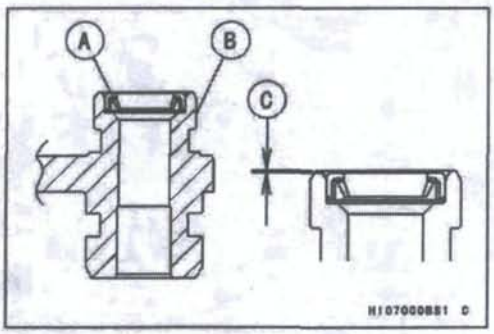
- Remove:
  Swingarm (see Swingarm Removal in the Suspension chapter)
  Bolts [A]
- Pull out the reverse cable [B] to remove it.



- Slide the boot [A]
- Compress the spring [B] as shown, and clear the cable lower end [C] from the push rod.

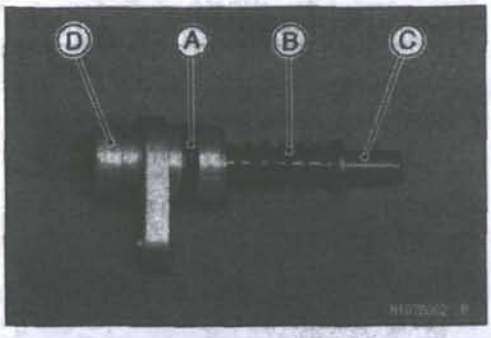
Reverse Cable Installation

- Replace the grease seal [A] if removed.
- Press the grease seal to the cable cap [B] as shown.
  [C] 0.2 ~ 0.6 mm (0.008 ~ 0.02 in.)

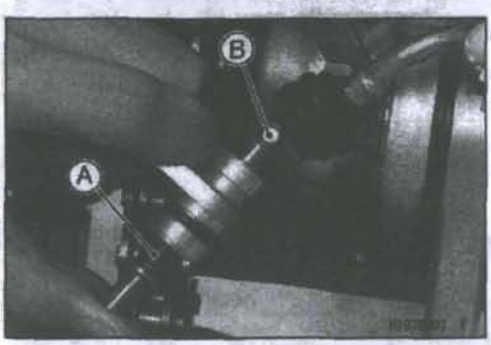


Reverse Shift Mechanism

- Replace the O-ring [A] with a new one.
- Assemble the following parts.
  O-ring
  Spring [B]
  Push Rod [C]
  Cap [D]



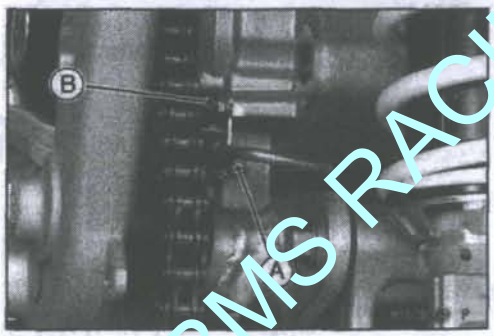
- Lubricate the reverse cable (see General Lubrication in the Periodic Maintenance chapter).
- Route the reverse cable according to the Cable, Wire and Hose Routing section in the Appendix chapter.
- While compressing the spring [A], install the cable lower end [B]



- Install the push rod into the crankcase.
- Tighten the cable mounting bolts [A].
- Tighten:

Torque - Reverse Cable Cap Bolt [B]: 8.8 N·m (0.90 kgf·m 78 in·lb)

- Install the cable upper end (see Throttle Case Assembly and Installation in the Fuel System (DFI) chapter).



Reverse Cable Lubrication and Inspection

- Whenever the Reverse cable is removed or in accordance with the Periodic Maintenance Chart in the Periodic Maintenance chapter, lubricate the cable.
- Refer to the General Lubrication in the Periodic Maintenance chapter for the cable lubrication and inspection.

Bearings/Oil Seals

Bearing Replacement

CAUTION

Do not remove the ball bearings unless it is necessary. Removal may damaged them.

- Remove the ball bearing and/or needle bearing outer race using a press or puller.

NOTE

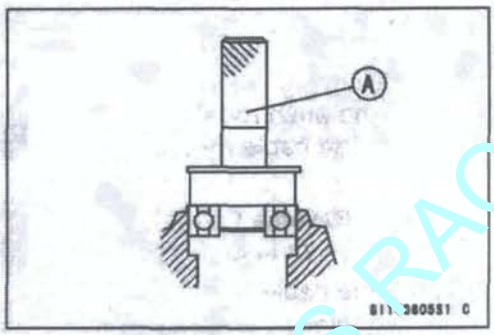
○*In the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max, and tapping the bearing in or out.*

CAUTION

Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.

- Install the new bearing until its outer race stops at the bottom of the case using a press and the bearing driver set [A].

Special Tool - Bearing Driver Set: 57001-1129



Bearing Inspection

CAUTION

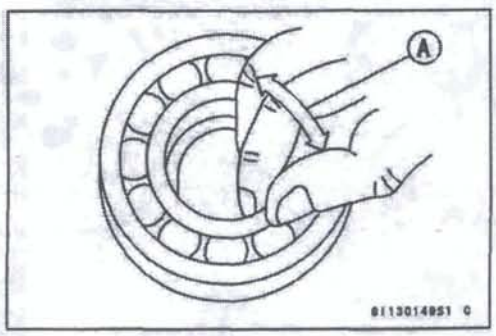
Do not remove the bearings for inspection. Removal may damage them.

- Inspect 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 to it.

○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.



Bearings/Oil Seals

- Check the needle bearing.

○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 seal.

★Replace the oil seal if the lips are deformed, discolored (indicating that the rubber has deteriorated), hardened or otherwise damaged.

Wheels/Tires

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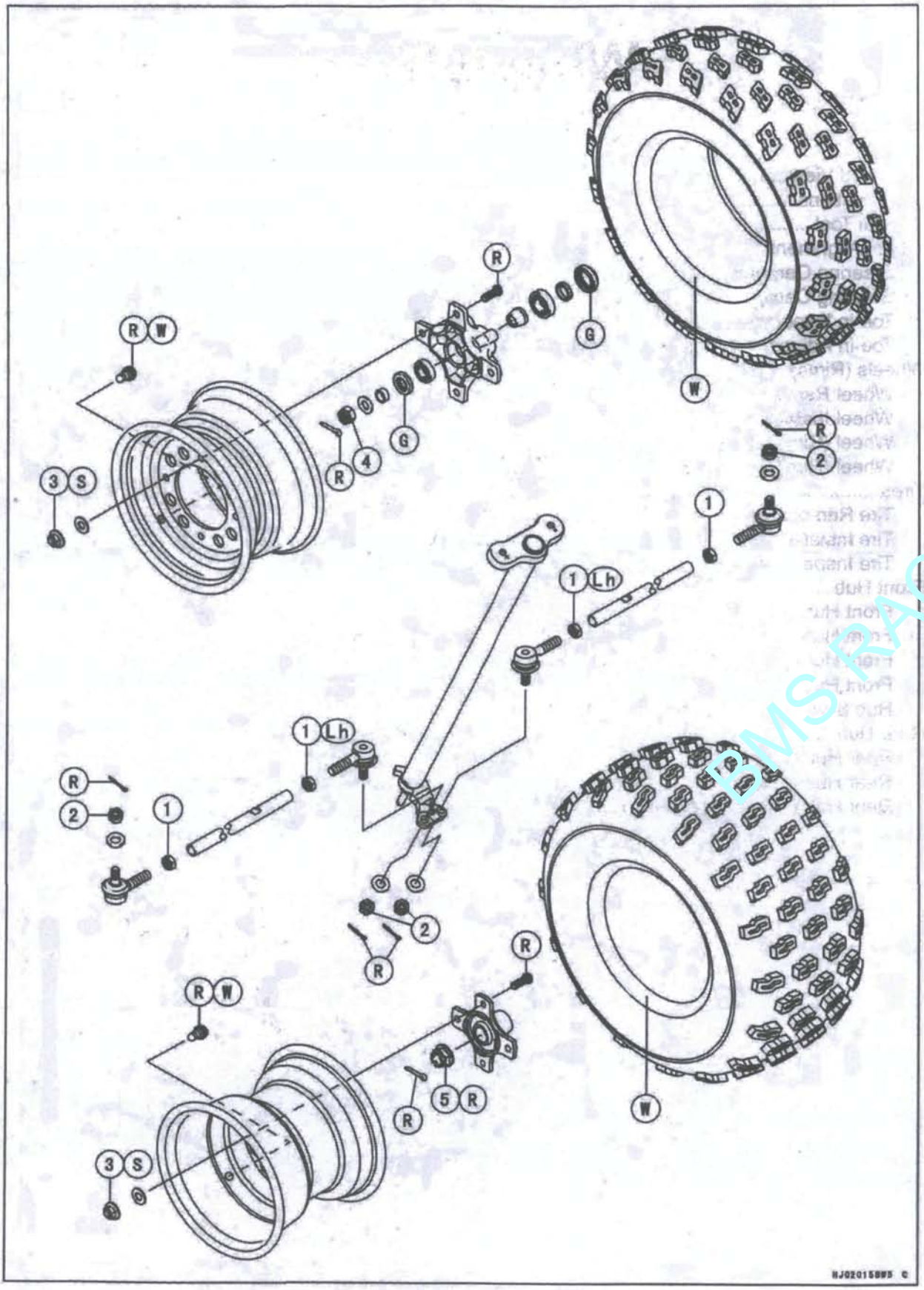
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Tie-rod Locknuts	22	2.2	16	Lh (2)
2	Tie-rod End Nuts	36.5	3.7	27	
3	Wheel Nuts	79	8.0	58	S
4	Front Hub Nuts	71.5	7.3	53	
5	Rear Hub Nuts	265	27	195	R

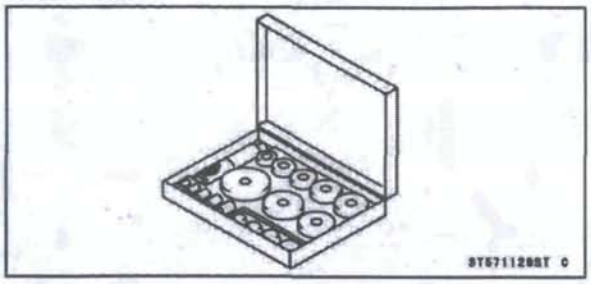
G: Apply grease.
Lh: Left-hand Threads
R: Replacement Parts
S: Follow the specified tightening sequence.
W: Apply water or soap and water solution.

Specifications

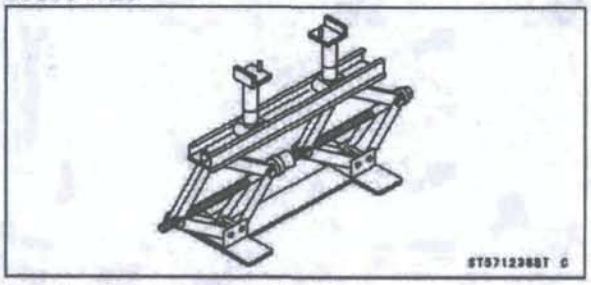
Item	Standard	Service Limit
Wheel Alignment		
Toe-in of Front Wheel:	–20 ~ 0 mm (–0.79 ~ 0 in.) at 1G	– – –
Wheel (Rims)		
Rim Size:		
Front	10 × 5.5	– – –
Rear	9 × 8	– – –
Tires		
Standard Tire:		
Front	AT 21 × 7R10 DUNLOP, KT391, Tubeless	– – –
Rear	AT 20 × 10R9 DUNLOP, KT396, Tubeless	– – –
Tire Air Pressure (when cold):		
Front	30 kPa (0.30 kgf/cm², 4.4 psi)	– – –
Rear	27 kPa (0.27 kgf/cm², 3.9 psi)	– – –
Maximum Tire Air Pressure (to seat beads, when cold)	250 kPa (2.5 kgf/cm², 36 psi)	– – –
Tire Tread Depth:		
Front	12.7 mm (0.500 in.)	3 mm (0.12 in.)
Rear	13.0 mm (0.512 in.)	3 mm (0.12 in.)

Special Tool

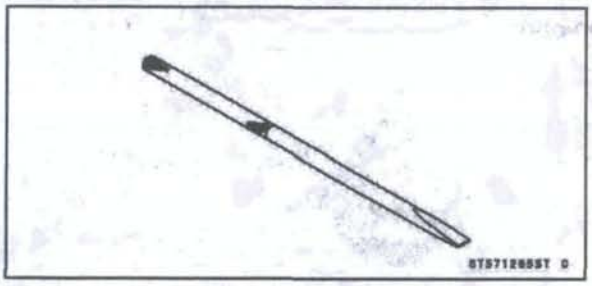
Bearing Driver Set:
57001-1129



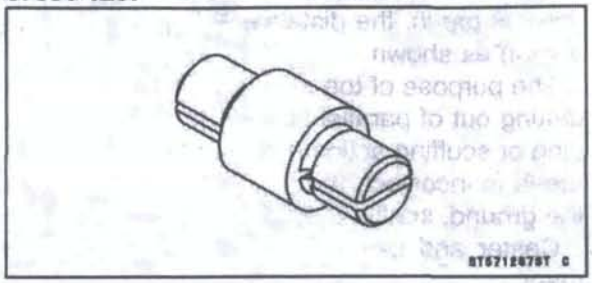
Jack:
57001-1238



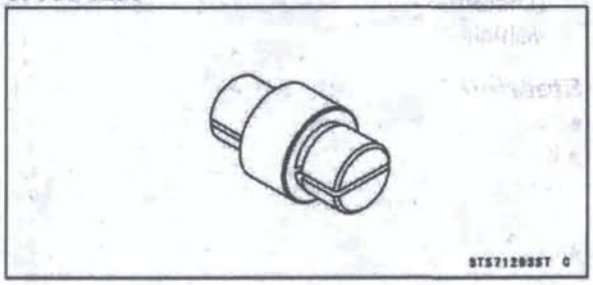
Bearing Remover Shaft, ϕ9:
57001-1265



Bearing Remover Head, ϕ15 × ϕ17:
57001-1267



Bearing Remover Head, ϕ20 × ϕ22:
57001-1293



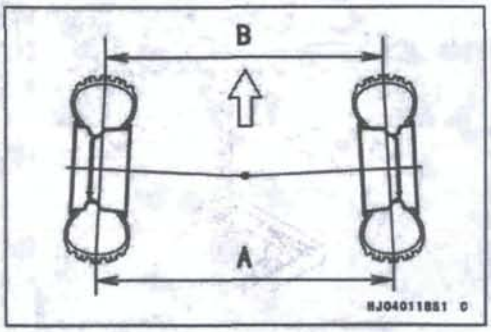
Wheel Alignment

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 (Rear) - B (Front) = Amount of Toe-in
(Distance A and B are measured at axle height with the vehicle sitting on the ground, or at 1G.)



Steering Centering Inspection

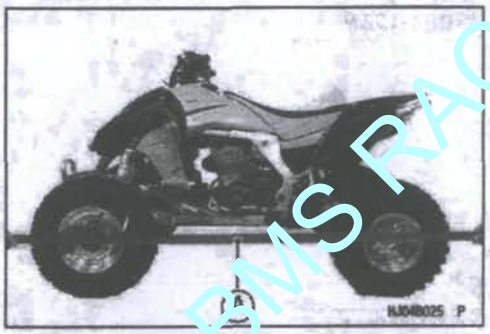
- Test ride the vehicle.

★If the handlebar is straight when the vehicle is traveling in a straight line, go on to the Toe-in Inspection procedure (see Toe-in Inspection).

★Otherwise, go on to the Steering Centering Adjustment procedure (see Steering Centering Adjustment).

Steering Centering Adjustment

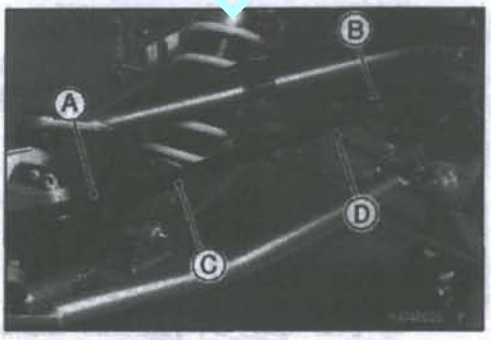
- Hold a straightedge [A] against the rear wheel rim on one side at axle height.



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

NOTE

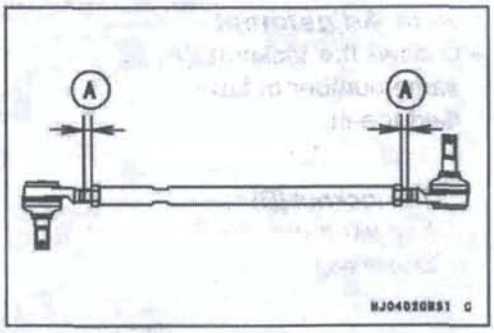
○*The locknut [B] near the flattened area [D] on the tie-rod has left-hand threads. Turn the wrench clockwise for loosening.*



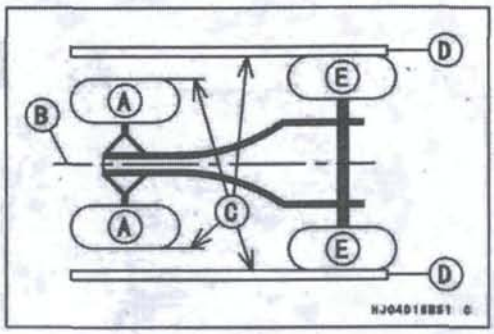
Wheel Alignment

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.

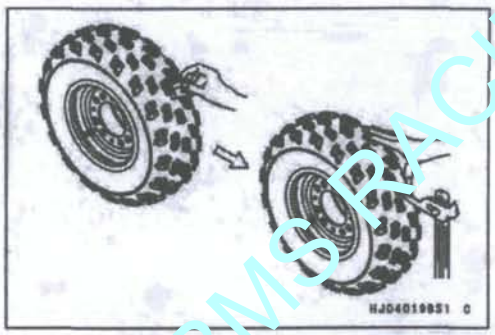


- Repeat the straightedge procedure on the other side of the vehicle. Now the front wheels are parallel to each other and to the center line of the vehicle.
  Front Wheel [A]
  Vehicle Center Line [B]
  Parallel each other [C]
  Straightedges [D]
  Rear Wheels [E]
- Go on to the Toe-in Inspection procedure.



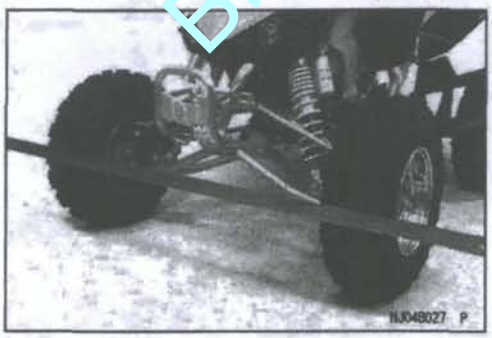
Toe-in Inspection

- Apply a heavy coat of chalk or a paint line near the center of the front tires.
- Using a needle nose scriber, make a thin mark near the center of the chalk coating while turning the wheel.



- With the front wheels on the ground, set the handlebar straight ahead.
- At the level of the axle height, measure the distance between the scribed or painted lines for both front and rear of the front tires.
- Subtract the measurement of the front from the measurement of the rear to get the toe-in.

★If the toe-in is not in the specified range, go on to the Toe-in Adjustment procedure.



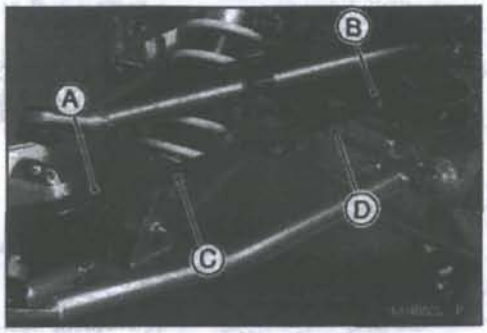
Toe-in of Front Wheels

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

Wheel Alignment

Toe-in Adjustment

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

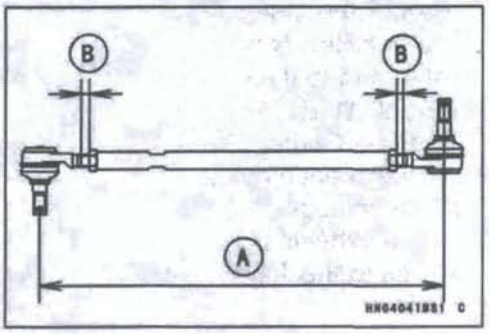


NOTE

○The locknut [B] near the flattened area [D] on the tie-rod has left-hand threads. Turn the locknut clockwise for loosening.

NOTE

○The toe-in will be near the specified value, if the tie-rod length [A] is 402 mm (15.8 in.) on each tie-rod.



CAUTION

Adjust the tie-rod length so that the visible thread length [B] is even on both ends of the tie-rod. Uneven thread length could cause tie-rod damage.

- Check the toe-in.
- Tighten:

Torque - Tie-rod Locknuts: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Test ride the vehicle.

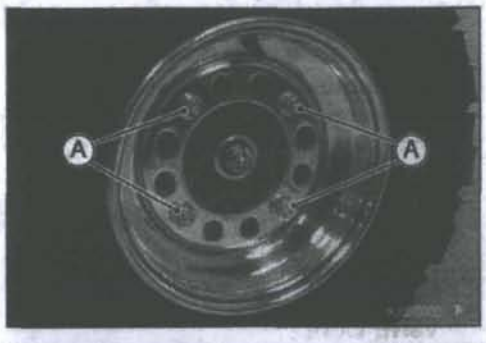
Wheels (Rims)

Wheel Removal

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

Special Tool - Jack: 57001-1238

- Remove:
  Wheel Nuts
  Wheel



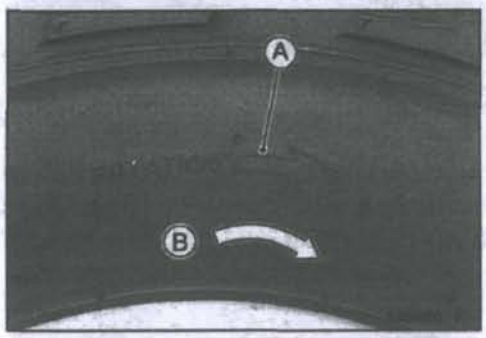
Wheel Installation

Front Wheels

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

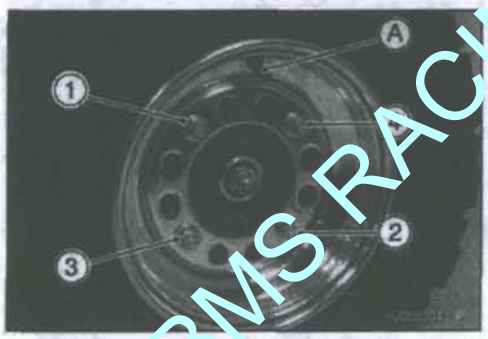
NOTE

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



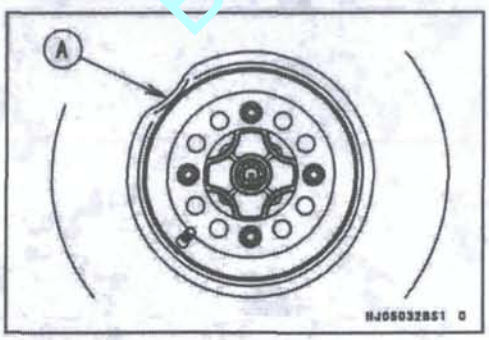
- Position the wheel so that the air valve [A] is toward the outside of the vehicle.
- Wipe dry the taper surface of the rim.
- Wipe dry the threads and the taper surface of the nuts.
- Install the wheel nuts so that the taper side faces to the rim.
- First, temporary tighten the wheel nuts in a criss-cross pattern.
- Finally tighten the wheel nuts in a criss-cross pattern.

Torque - Wheel Nuts: 79 N·m (8.0 kgf·m, 58 ft·lb)

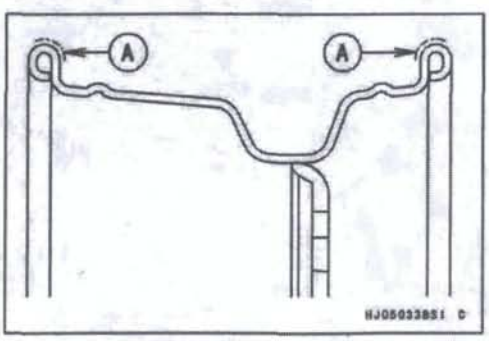


Wheel (Rim) Inspection

- 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.



Wheels (Rims)

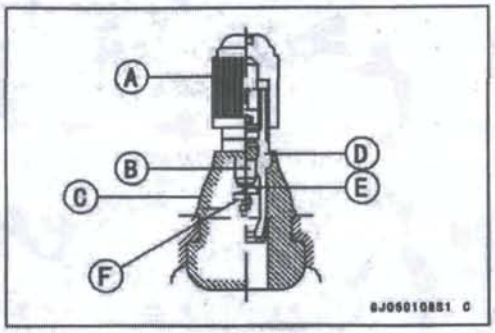
Wheel (Rim) Replacement

- 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.



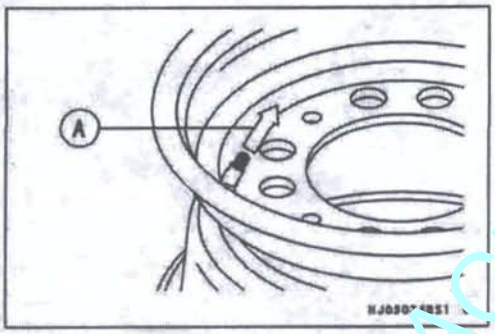
Plastic Cap [A]
Valve Core [B]
Stem Seal [C]
Valve Stem [D]
Valve Seat [E]
Valve Opened [F]

- Install a new air valve in the new rim.

○Remove the valve cap, lubricate the stem with a soap and water solution, and pull [A] the stem 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.



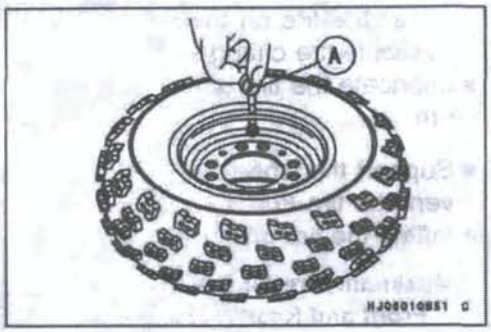
- Mount the tire on the new rim (see Tire Installation).
- Install the wheel (see Wheel Installation).
- Install the air valve cap.

Tires

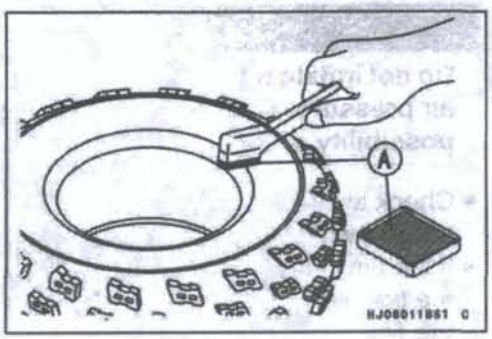
Tire Removal

- Remove the wheel.
- Unscrew the valve core to deflate the tire.

○Use a proper valve core tool [A].



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



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 in the Periodic Maintenance chapter).
- 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.

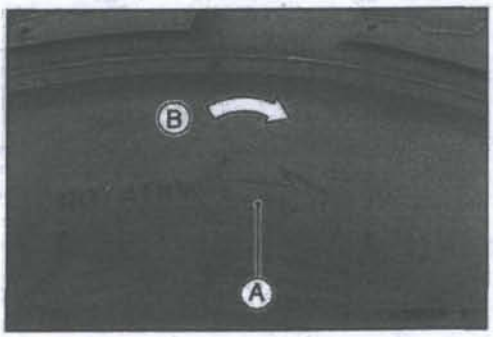
Front Tires

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

○The tires should be installed on the rims so that each air valve is toward the outside of the vehicle.

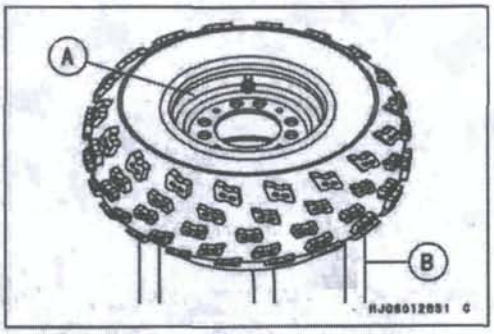
NOTE

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



Tires

- Install the tire on the rim using a suitable commercially available tire changer.
- Lubricate the tire beads again and center the tire on the rim.
- Support the wheel rim [A] on a suitable stand [B] to prevent the tire from slipping off.
- Inflate the tire until the tire beads seat on the rim.

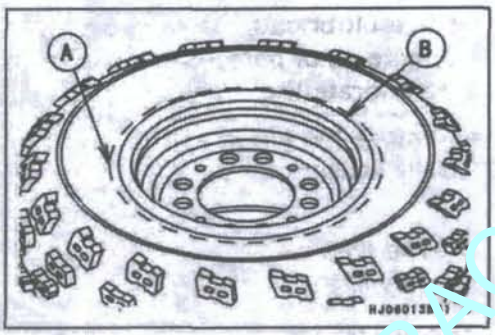


Maximum Tire Air Pressure (to seat beads when cold)
Front and Rear: 250 kPa (2.5 kgf/cm², 36 psi)

⚠ WARNING

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:	**30 kPa (0.30 kgf/cm², 4.4 psi)**
Rear:	**27 kPa (0.27 kgf/cm², 3.9 psi)**

- Install the air valve cap.
- Install the wheel (see Wheel Installation).
- Wipe off the soap and water solution on the tire and dry the tire before operation.

⚠ WARNING

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.

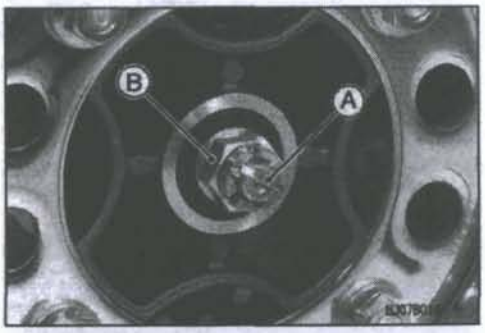
Tire Inspection

- Refer to the Tire Inspection in the Periodic Maintenance chapter.

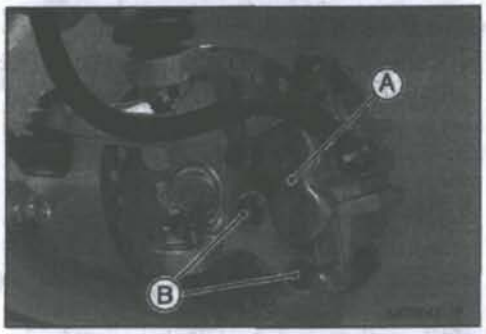
Front Hub

Front Hub Removal

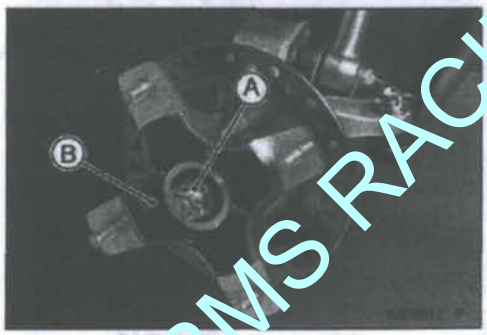
- Remove:
  Cotter Pin [A]
- Loosen the hub nut [B].



- Remove the front wheel (see Wheel Removal).
- Remove the caliper [A] by taking off the mounting bolts [B], and let the caliper hang free.



- Remove the axle hub [A], and pull off the front hub [B] and brake disc.
- Separate the brake disc from the front hub.



Front Hub Installation

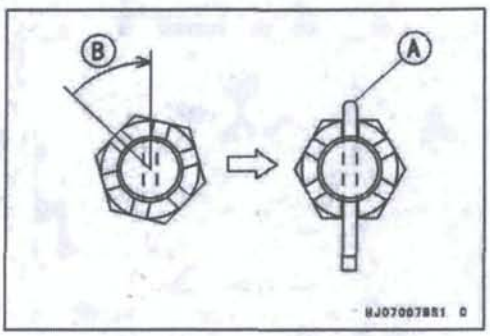
- Install the brake disc (see Disc Installation in the Brakes chapter).
- Wipe dry the spline portion of the hub.
- Wipe dry the threads and seating surface of the nuts.
- Install the front wheel temporary.
- Tighten:

Torque - Front Hub Nuts: 71.5 N·m (7.3 kgf·m, 53 ft·lb)

- Remove the front wheel.
- Insert a new cotter pin [A].

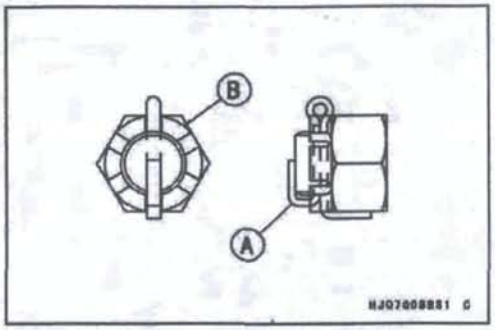
NOTE

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



Front Hub

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

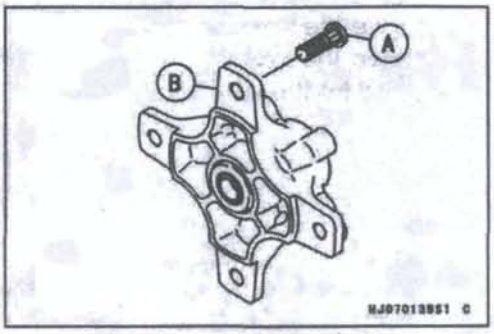


Front Hub Disassembly

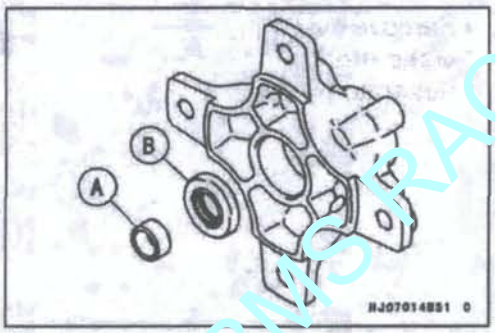
- Remove the front hub (see Front Hub Removal).

★If any hub bolt [A] is damaged, replace it.

- Remove the hub bolt from hub [B] using a press.

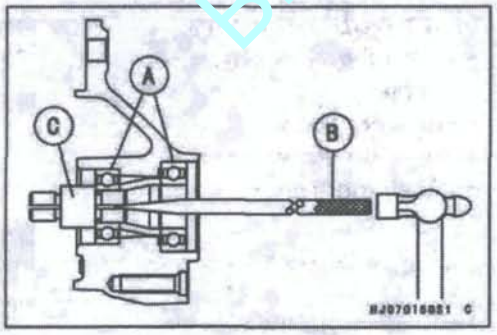


- Remove:
  Collars [A]
  Dust Seals [B]



- Take the bearings [A] out of the hub, using the bearing remover.

Special Tools - Bearing Remover Shaft: 57001-1265 [B]
Bearing Remover Head, ϕ15 × ϕ17: 57001 -1267 (For Outside Bearing)
Bearing Remover Head, ϕ20 × ϕ22: 57001 -1293 [C] (For Inside Bearing)



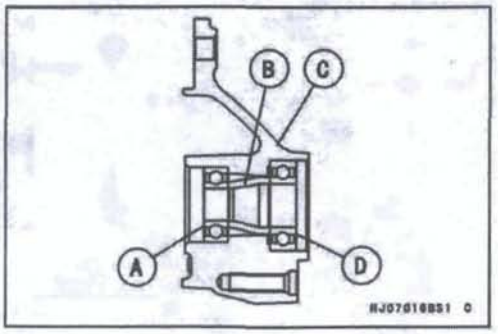
Front Hub Assembly

- Before installing the hub bearings, blow any dirt or foreign particles out of the hub with compressed air to prevent contamination of the bearings.
- Replace the bearings with new ones.
- Press in the one side bearing [A] until it is bottomed.

Special Tool - Bearing Driver Set: 57001-1129

- Insert the collar [B] in the hub [C] as shown.
- Press in the other side bearing [D] until it is bottomed.

Special Tool - Bearing Driver Set: 57001-1129



NOTE

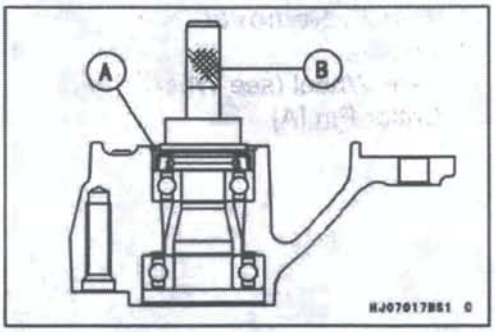
OInstall the bearings so that the marked side faces out.

Front Hub

- Replace the dust seals with new ones.
- Press in the dust seal [A] until it is bottomed.
- Apply grease to the dust seal lips.

Special Tool - Bearing Driver Set: 57001-1129 [B]

- Press the hub bolts using a press, if removed.



Hub Bearing Inspection

○Since the hub bearings are made to extremely close tolerances, the clearance can not normally be measured.

NOTE

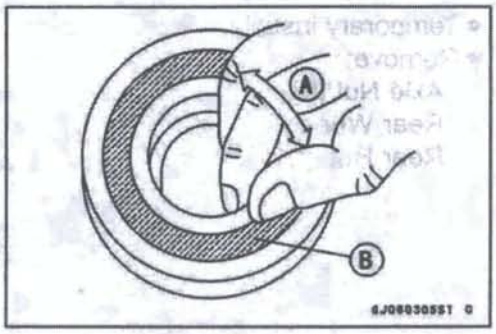
○*Do not remove any bearings for inspection. If any bearings are removed, they will need to be replaced with new ones.*

- Turn each bearing in the hub back and forth [A] while checking for plays, roughness, or binding.

★If bearing play, roughness, or binding is found, replace the bearing.

- Examine the bearing seal [B] for tears or leakage.

★If the seal is torn or is leaking, replace the bearing.

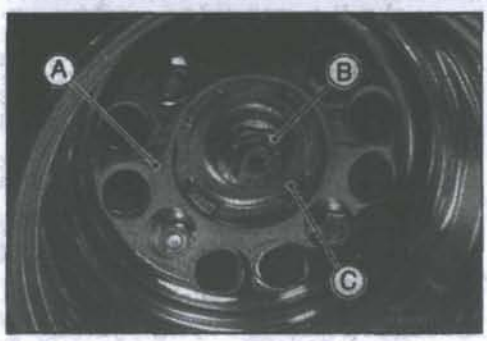


Rear Hub

Rear Hub Removal

- Remove:
  Rear Wheel (see Wheel Removal)
  Cotter Pin [A]

- Temporary install the rear wheel [A].
- Remove:
  Axle Nut [B]
  Rear Wheel
  Rear Hub [C]



Rear Hub Installation

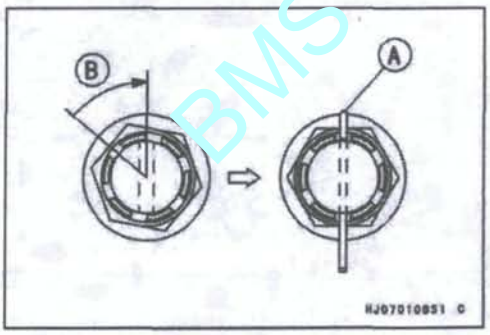
- Replace the rear hub nuts with new ones.
- Wipe dry the spline portion of the hub.
- Wipe dry the threads and seating surface of the nuts.
- Tighten:

Torque - Rear Hub Nuts: 265 N·m (27 kgf·m, 195 ft·lb)

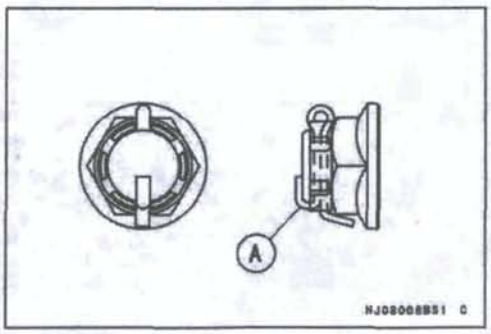
- Insert a new cotter pin [A].

NOTE

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



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

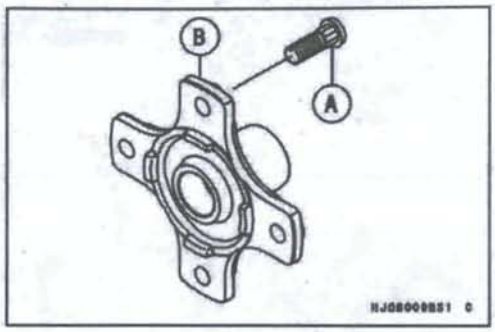


Rear Hub

Rear Hub Disassembly/Assembly

★If any hub bolt [A] is damaged, replace it.

- Remove the hub bolt from hub [B] using a press.
- Press the hub bolt using a press.



Final Drive

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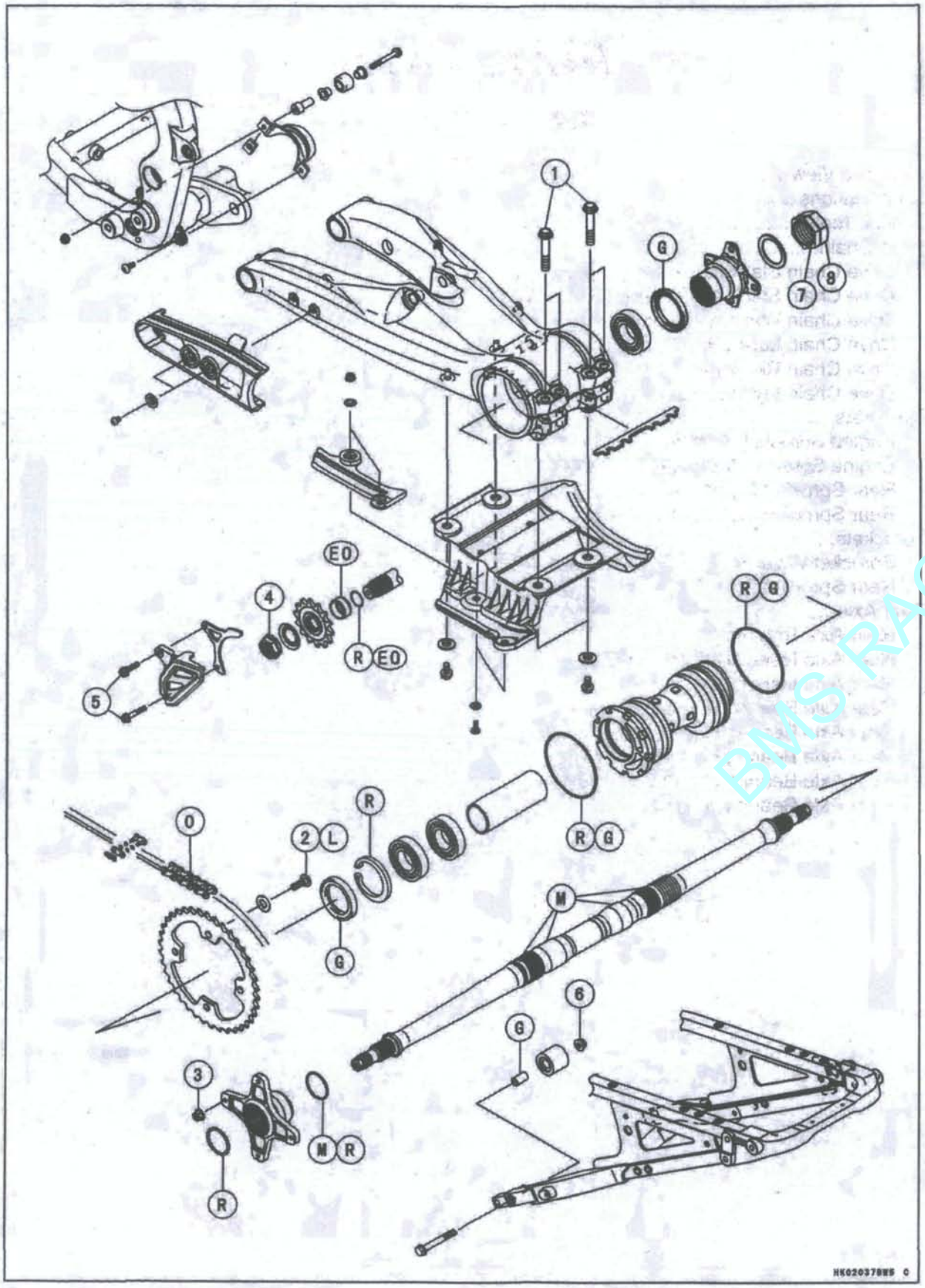
Exploded View



Exploded View

No	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear Axle Clamp Bolts	32	3.3	24	
2	Rear Sprocket Bolts	36.5	3.7	27	L
3	Rear Sprocket Nuts	31.5	3.2	23	
4	Engine Sprocket Nut	127	13	94	
5	Engine Sprocket Cover Bolts	8.8	0.90	78 in·lb	
6	Chain Guide Roller Mounting Nut	31.5	3.2	23	
7	Rear Axle Locknut (Inner)	200	20	148	
8	Rear Axle Locknut (Outer)	250	25	184	

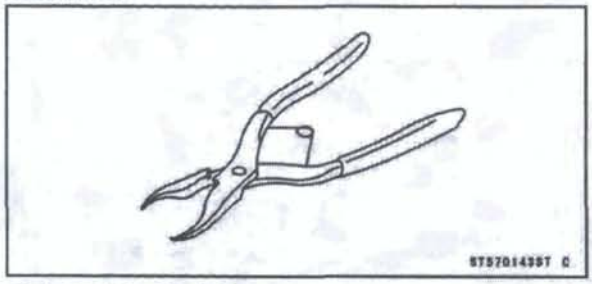
EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
O: Apply oil.
R: Replacement Parts

Specifications

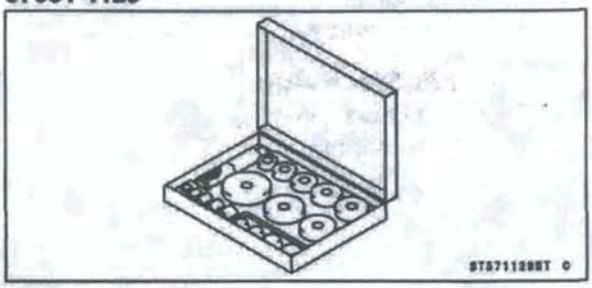
Item	Standard	Service Limit
Drive Chain		
Chain Slack	40 ~ 50 mm (1.57 ~ 1.97 in.)	– – –
Chain 20-link Length	317.5 ~ 318.2 mm (12.50 ~ 12.53 in.)	323 mm (12.7 in.)
Standard Chain:		
Make	ENUMA	– – –
Type	EK520SR-O_2	– – –
Length	94 Links	– – –
Sprocket		
Rear Sprocket Warp	0.4 mm (0.016 in.) or less	0.5 mm (0.02 in.)
Rear Axle Shaft		
Rear Axle Shaft Runout	0.2 mm (0.008 in.) or less	0.7 mm (0.03 in.)

Special Tools

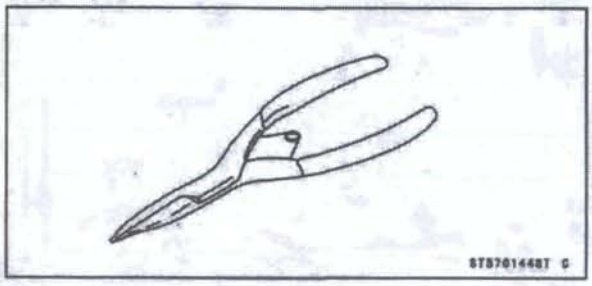
Inside Circlip Pliers:
57001-143



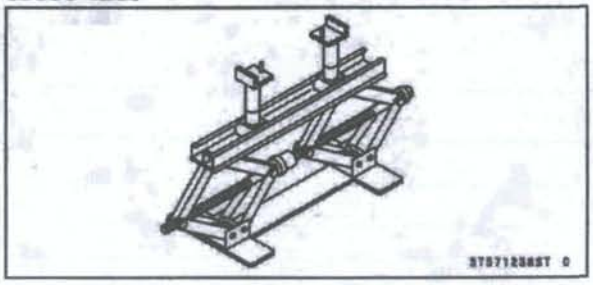
Bearing Driver Set:
57001-1129



Outside Circlip Pliers:
57001-144



Jack:
57001-1238



Drive Chain

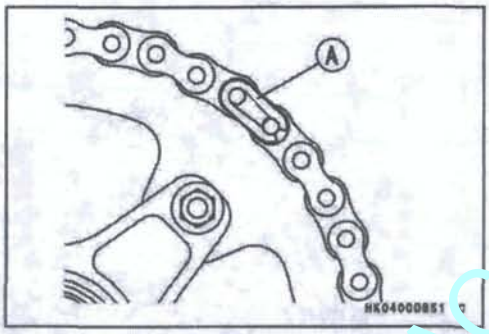
Drive Chain Slack Inspection
- Refer to the Drive Chain Slack Inspection in the Periodic Maintenance chapter.

Drive Chain Slack Adjustment
- Refer to the Drive Chain Slack Adjustment in the Periodic Maintenance chapter.

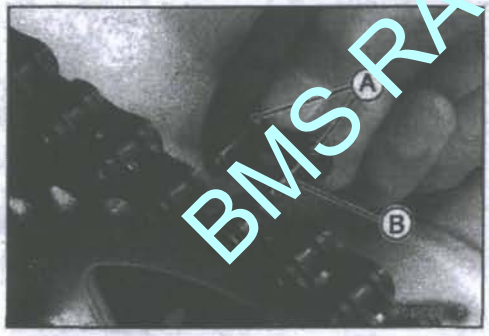
Drive Chain Wear Inspection
- Refer to the Drive Chain Wear Inspection in the Periodic Maintenance chapter.

Drive Chain Lubrication
- Refer to the Drive Chain Lubrication in the Periodic Maintenance chapter.

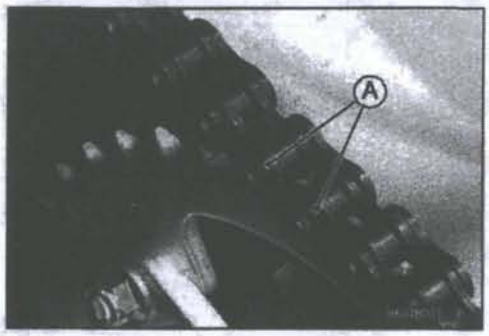
Drive Chain Removal
- Remove the engine sprocket cover (see Engine Sprocket Removal).
- Remove the clip [A] from the master link using pliers, and free the drive chain from the rear sprocket.
- Remove the drive chain from the chassis.



Drive Chain Installation
- Fit the drive chain back onto the sprockets with the ends at the rear sprocket.
- Install the O-rings [A] to the master link [B].
- Install the master link from the right side.

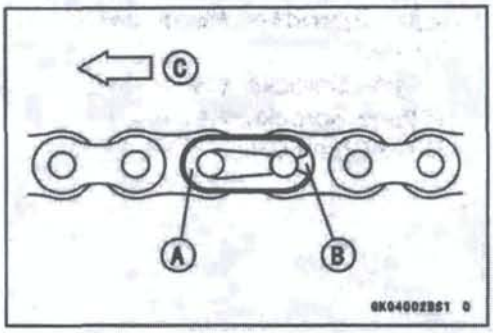


- Install:
  O-rings [A]
  Link Plate



Drive Chain

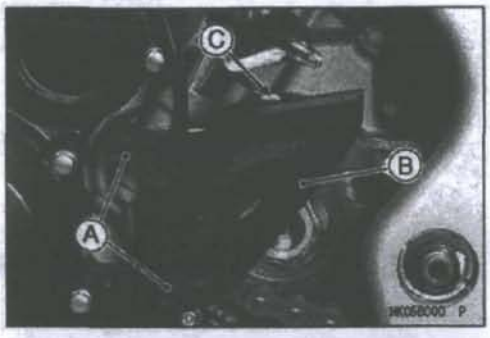
- Install the clip [A] so that the closed end of the "U" [B] pointed in the direction of chain rotation [C].
- Adjust the drive chain slack (see Drive Chain Slack Adjustment in the Periodic Maintenance chapter).
- Check the rear brake.



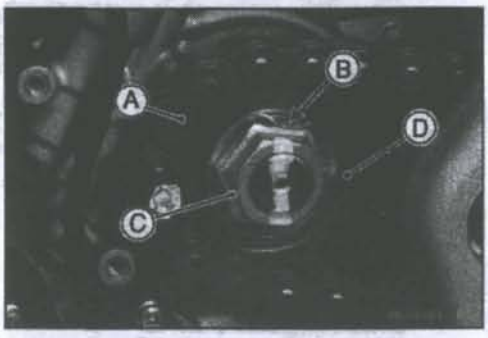
Sprockets

Engine Sprocket Removal

- Remove:
  Engine Sprocket Cover Bolts [A]
  Engine Sprocket Cover [B]
  Drive Chain Guide [C]



- Remove:
  Drive Chain [A] (free of engine sprocket)
- Flatten the bended sprocket washer [B].
- Remove the engine sprocket nut [C] and sprocket washer, and pull off the engine sprocket [D].



Engine Sprocket Installation

- Install the engine sprocket so that the stamp mark [A] facing the outside.
- Replace the sprocket washer with a new one.
- Install the sprocket washer and sprocket nut.

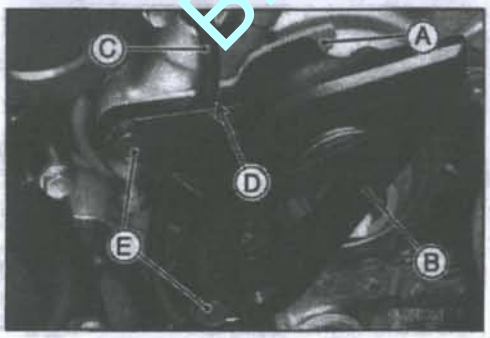
Torque - Engine Sprocket Nut: 127 N·m (13 kgf·m, 94 ft·lb)

- Bend the one side of the sprocket washer on the nut.

- Install the chain guide [A] and engine sprocket cover [B].

○Run the neutral/reverse switch lead [C] between chain guide and groove [D] of the sprocket cover.

Torque - Engine Sprocket Cover Bolts [E]: 8.8 N·m (0.90 kgf·m, 78 ft·lb)

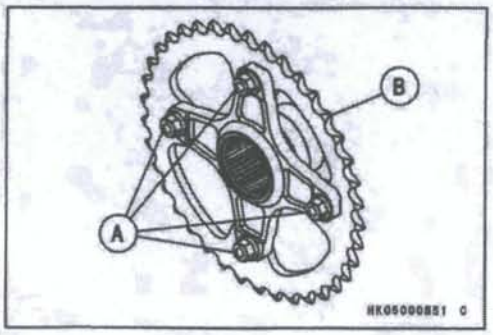


Rear Sprocket Removal

- Remove:
  Rear Hub (Left) (see Rear Hub Removal in the Wheels/Tires chapter)
  Rear Sprocket Nuts [A]
  Rear Sprocket [B]

NOTE

○*When loosening the rear sprocket nuts, hold the rear break on.*

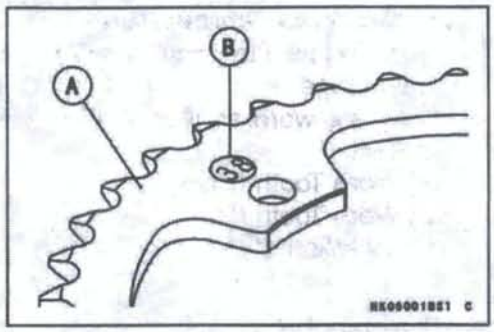


Sprockets

Rear Sprocket Installation

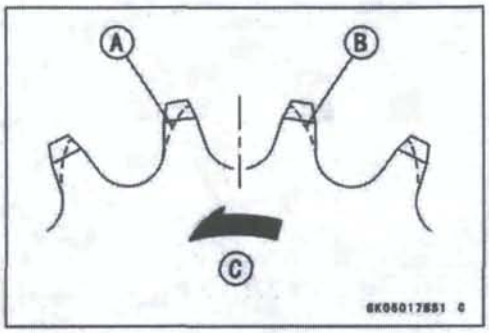
- Apply a non-permanent locking agent to the rear sprocket bolts.
- Install the rear sprocket [A] so that the marked side [B] faces outside.
- Install the rear sprocket bolts, and tighten the bolts and nuts.

Torque - Rear Sprocket Bolts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)
Rear Sprocket Nuts: 31.5 N·m (3.2 kgf·m, 23 ft·lb)



Sprockets

Sprocket Wear Inspection



- Visually inspect the front and rear sprocket teeth for wear and damage.

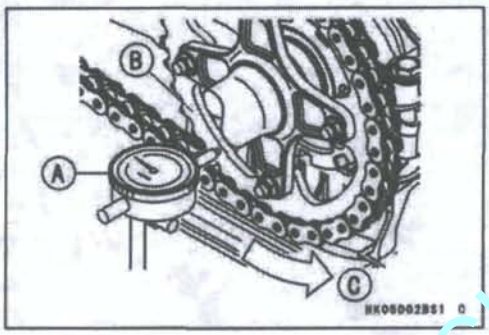
★If they are worn as illustrated or damaged, replace the sprocket.

[A] Worn Tooth (Engine Sprocket)
[B] Worn Tooth (Rear Sprocket)
[C] Direction of Rotation

NOTE

○*If a sprocket requires replacement, the chain is probably worn also. When replacing a sprocket, inspect the chain.*

Rear Sprocket Warp Inspection



- Using the jack, raise the rear wheel off the ground.

Special Tool - Jack: 57001-1238

- Set a dial gauge [A] against the rear sprocket [B] near the teeth as shown and rotate [C] the rear wheel to measure the sprocket runout (warp). The difference between the highest and lowest dial gauge readings is the amount of runout (warp).

★If the runout exceeds the service limit, replace the rear sprocket.

Rear Sprocket Warp

Standard:	**0.4 mm (0.016 in.) or less**
Service Limit:	**0.5 mm (0.02 in.)**

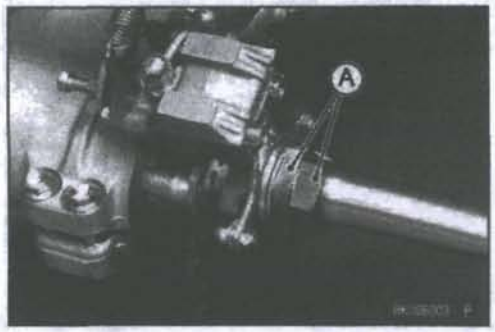
Rear Axle

Rear Axle Removal

- Remove:
  Rear Bottom Guard (see Rear Bottom Guard Removal in the Frame chapter)
  Rear Axle Locknuts [A]
- Support the rear of the vehicle on a jack with both rear wheels off the ground.

Special Tool - Jack : 57001-1238

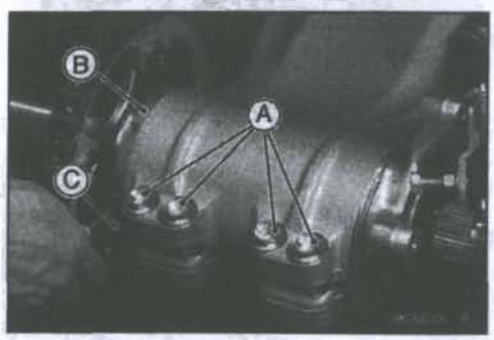
- Remove:
  Rear Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Rear Hub (see Rear Hub Removal in the Wheels/Tires chapter)



- Remove:
  Rear Caliper Mounting Bolts [A]
  Rear Caliper (from the brake disc) [B]

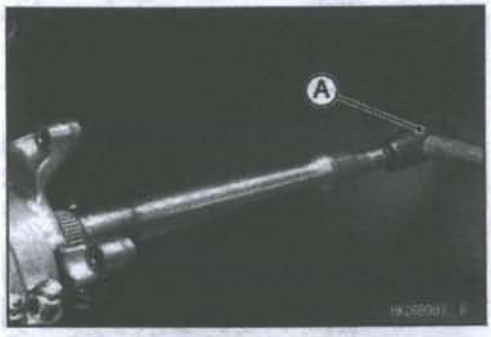
- Remove:
  Rear Brake Disc [A] with the holder [B]

- Loosen the rear axle clamp bolts [A] fully.
- Loosen the chain adjuster [B] with the owner's tool [C].



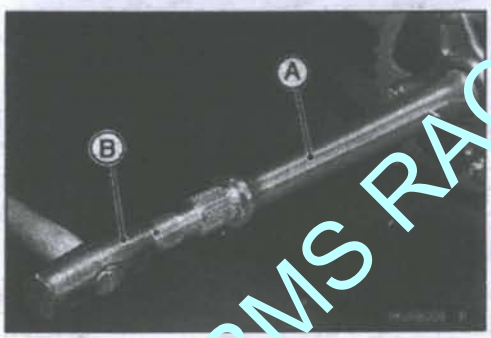
Rear Axle

- Tap the rear axle right side end with the copper mallet [A] until the sprocket holder stopper ring is exposed.



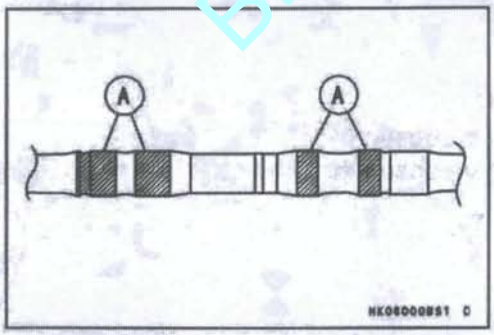
- Remove:
  Sprocket Holder Stopper Ring [A]

- Remove the rear axle [A] to tap the axle left side end with the copper mallet [B].

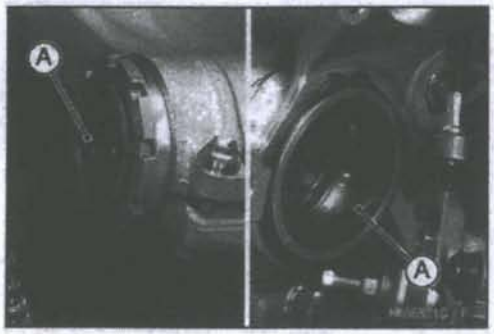


Rear Axle Installation

- Install:
  Rear Axle Bearing Housing (see Rear Axle Bearing Housing Installation)
- Apply molybdenum grease [A] to the rear axle as shown.

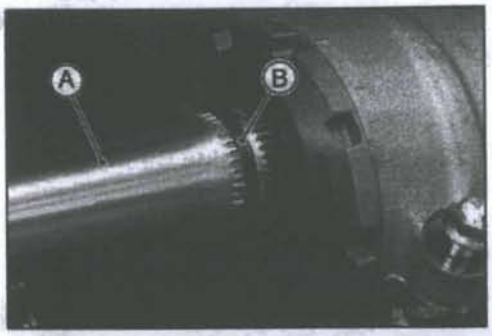


- Apply grease to the grease seal lips [A] on the bearing housing.

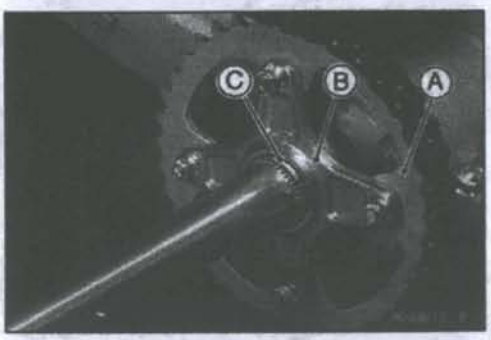


Rear Axle

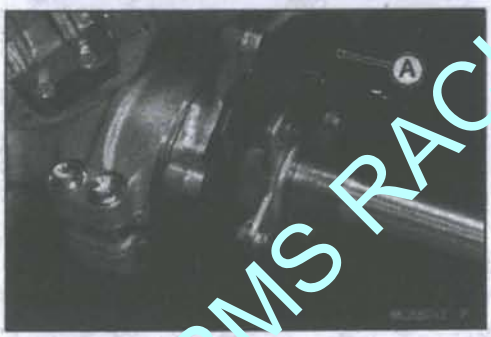
- Insert the rear axle [A].
- Replace the O-ring [B] with a new one.
- Install the O-ring as shown.
- Apply molybdenum disulfide grease to the O-ring.



- Install the sprocket [A] with the sprocket holder [B].
- Replace the sprocket holder stopper ring [C] with a new one, and install it.
- Tap the rear axle left side end with the copper mallet.

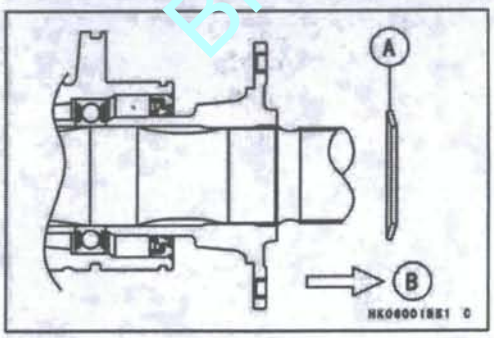


- Install:
  Rear Brake Disc [A] with the holder



- Install the spring [A] as shown.
  [B] Right Side
- Tighten:

Torque - Rear Axle Locknut (Inner) : 200 N·m (20.4 kgf·m, 148 ft·lb)
Rear Axle Locknut (Outer) : 250 N·m (25.5 kgf·m, 184 ft·lb)



Rear Axle Inspection

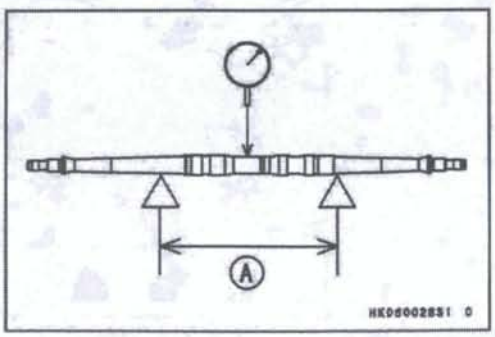
- Visually inspect the rear axle for damages.

★If the axle is damaged or bent, replace it.

- Place the axle in V blocks that are 100 mm (3.94 in.) [A] apart, and set a dial gauge on the axle at a point halfway between the blocks. Turn the axle to measure the runout. The difference between the highest and lowest dial readings is the amount of runout.

★If the runout exceeds the service limit, replace the axle.

Axle Runout/100 mm (3.94 in.)
Standard: 0.2 mm (0.008 in.) or less
Service Limit: 0.7 mm (0.03 in.)



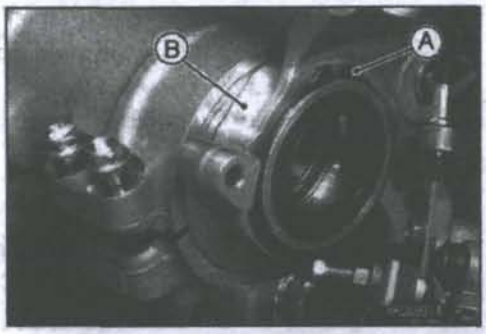
Rear Axle

Rear Axle Bearing Housing Removal

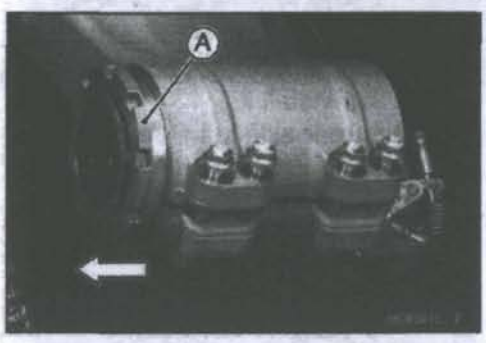
- Remove:
  Rear Axle (see Rear Axle removal)
  Circlip [A]

Special Tool - Outside Circlip Pliers: 57001-144

- Remove:
  Caliper Holder [B]



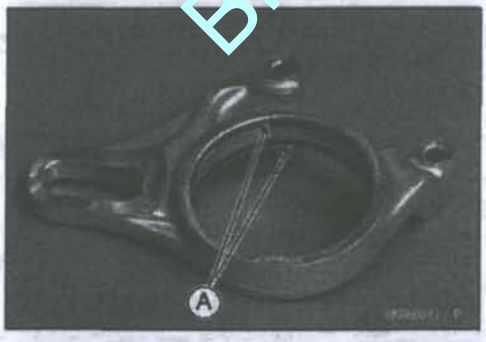
- Pull out the bearing housing [A] from the swingarm left side.



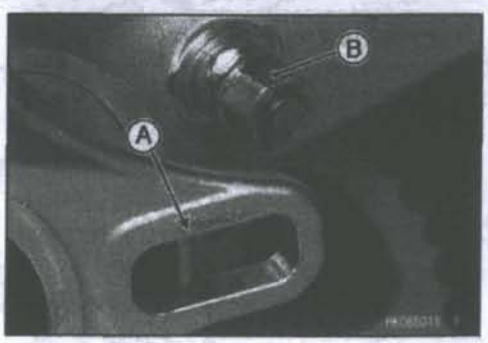
Rear Axle Bearing Housing Installation

- Assemble the rear axle bearing housing.
- Replace the O-rings [A] with new ones, and install them.
- Apply grease to the O-rings.
- Install the bearing housing from the swingarm left side.

- Replace the O-rings [A] with new ones, and install them to the caliper holder.
- Apply grease to the O-rings.



- Install the caliper holder so that hole [A] fit the collar [B].

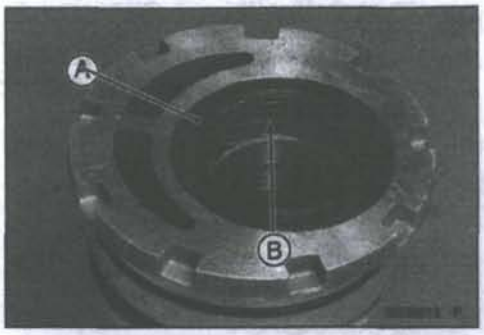


Rear Axle

Rear Axle Bearing Housing Disassembly

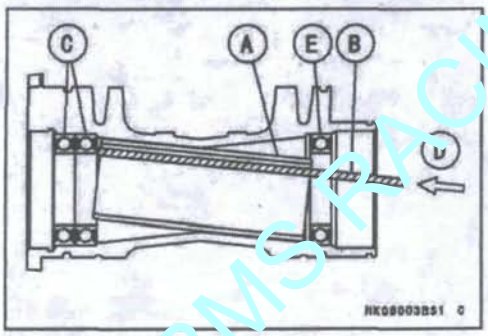
- Remove the rear axle bearing housing (see Rear Axle Bearing Housing)
- Remove:
  Grease Seal [A]
  Circlip [B]

Special Tool - Inside Circlip Pliers: 57001-143



- Remove:
  Grease Seal [A]

- Incline the collar [A] in the bearing housing.
- Using the suitable bar [B], remove the bearings [C] by tapping [D] evenly around the bearing inner race.
- Remove:
  Collar
  Another Bearing [E]



Rear Axle Bearing Housing Assembly

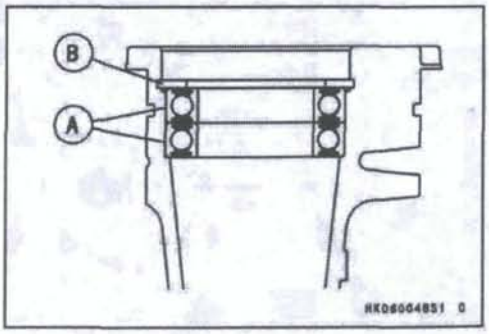
- Replace the following parts with new ones.
  Bearings
  Circlip
  Grease Seal

- Using a press and the bearing driver set, install the left side bearings [A] until them bottom out.

Special Tool - Bearing Driver Set: 57001-1129

- Install the circlip [B].

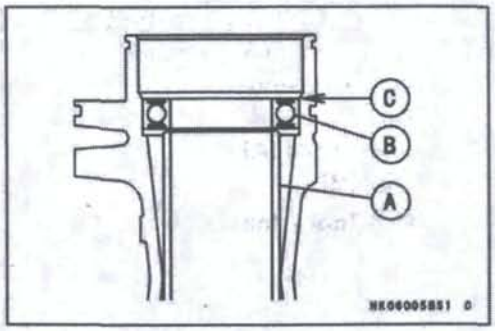
Special Tool - Inside Circlip Pliers: 57001-143



Rear Axle

- Install the collar [A].
- Using a press and the bearing driver set, install the right side bearing [B] so that the bearing outside surface is flush [C] with the end face.

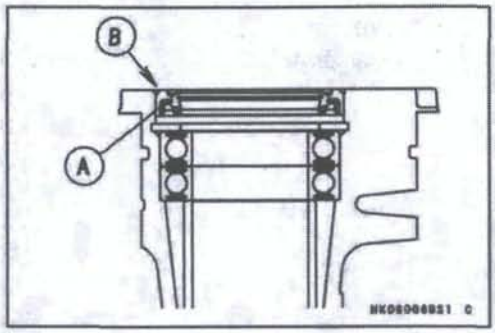
Special Tool - Bearing Driver Set: 57001-1129



- Using a press and the bearing driver set, install the both side grease seals [A] so that the grease seal surface are flush [B] with the surface of the bearing housing.

Special Tool - Bearing Driver Set: 57001-1129

- Apply grease to the grease seal lips.



Rear Axle Bearing Housing Inspection

Since the bearings are made to extremely close tolerances, the clearance cannot normally be measured.

NOTE

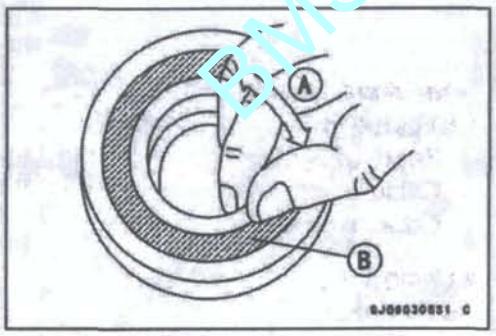
○*Do not remove any bearings for inspection. If any bearings are removed, they will need to be replaced with new ones.*

- Turn each bearing in the housing back and forth [A] while checking for plays, roughness, or binding.

★If bearing play, roughness, or binding is found, replace the bearing.

- Examine the bearing seal [B] for tears or leakage.

★If the seal is torn or is leaking, replace the bearing.



Brakes

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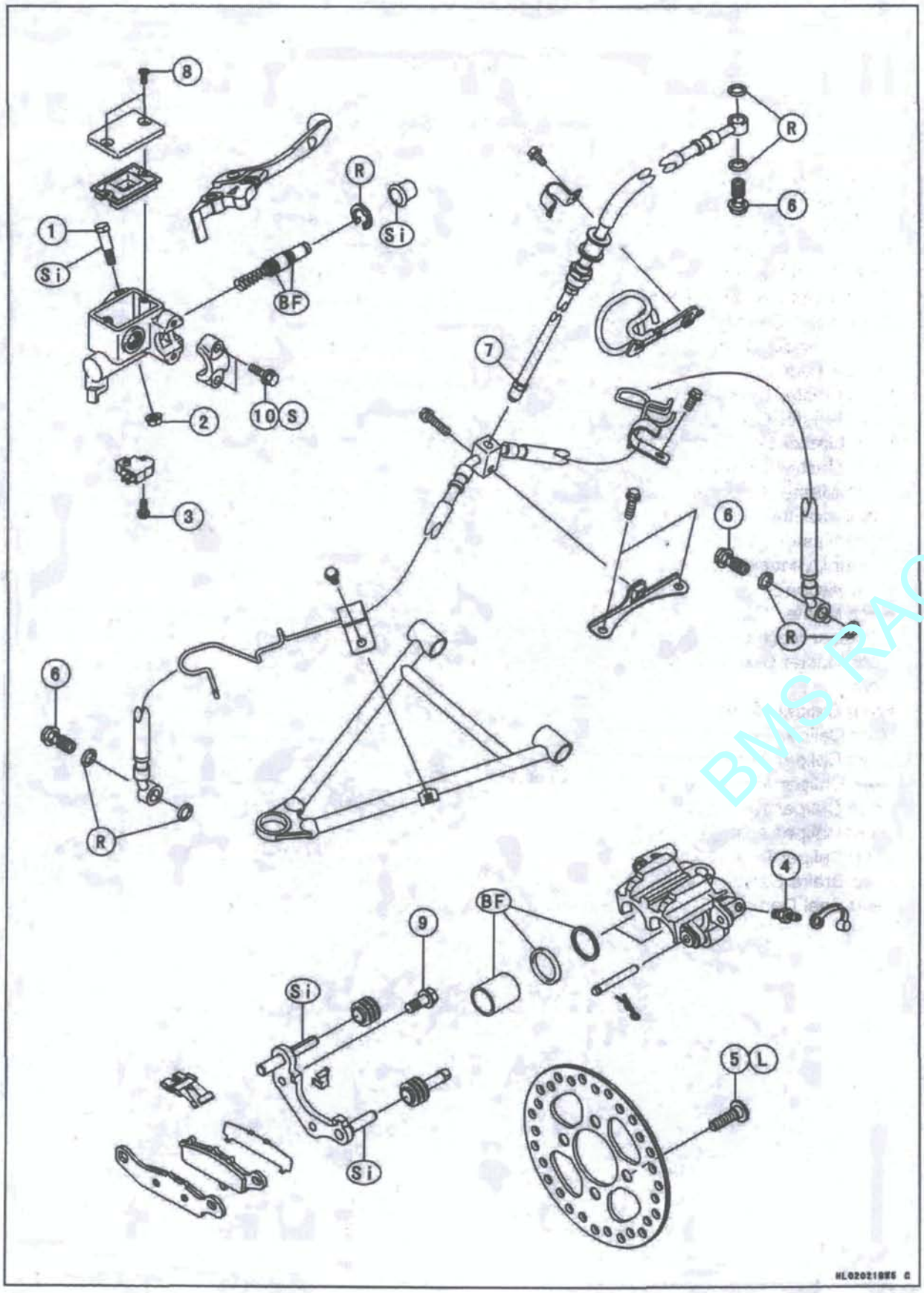
Exploded View

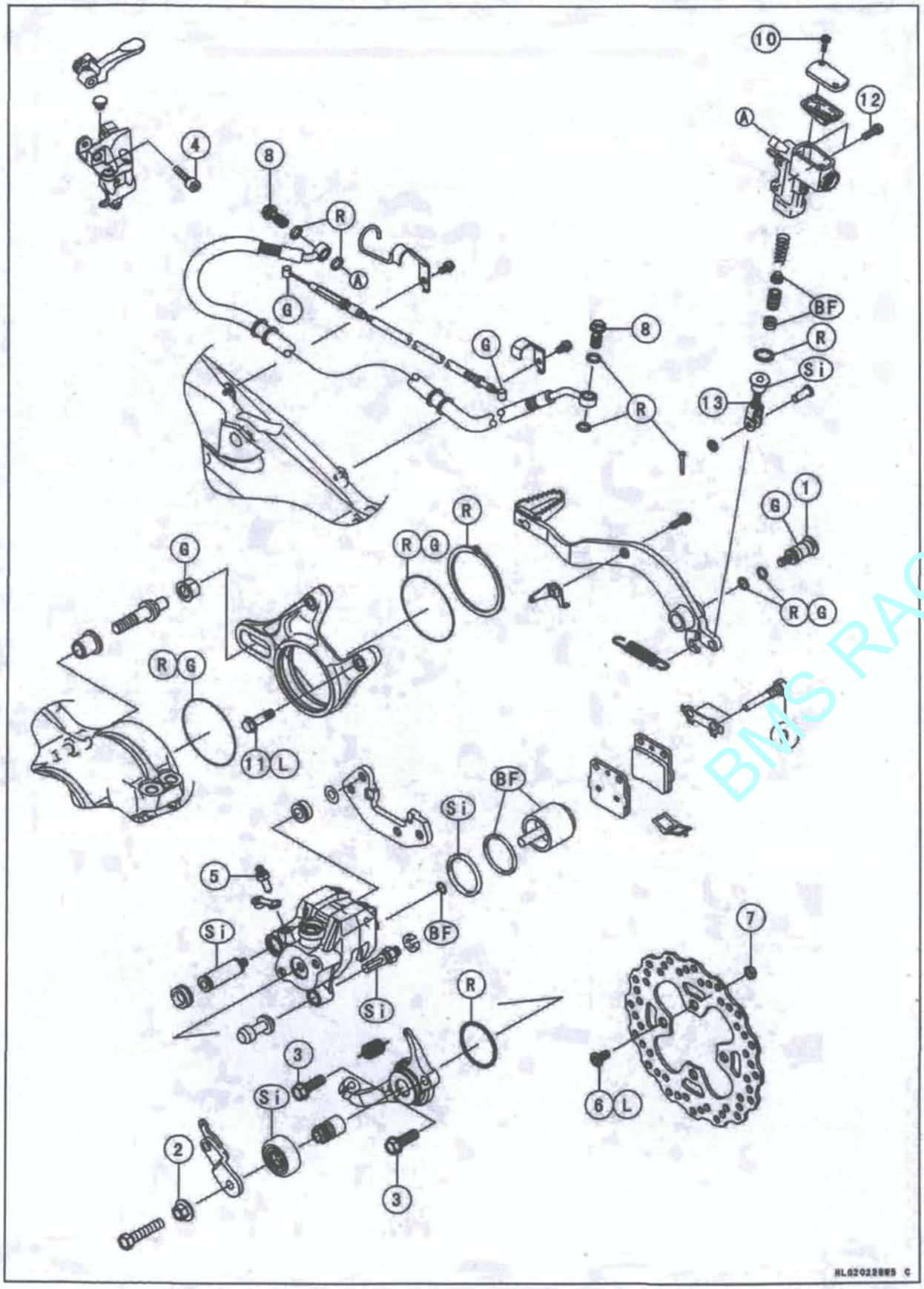


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Brake Lever Pivot Bolt	5.9	0.60	52 in·lb	Si
2	Brake Lever Pivot Bolt Locknut	5.9	0.60	52 in·lb	
3	Front Brake Light Switch Mounting Bolt	1.2	0.12	11 in·lb	
4	Front Caliper Bleed Valves	7.8	0.80	69 in·lb	
5	Front Brake Disc Mounting Bolts	36.5	3.7	27	L
6	Front Brake Hose Banjo Bolts	26.5	2.7	20	
7	Front Brake Hose Fitting Nut	18	1.8	13	
8	Front Brake Reservoir Cap Screws	1.5	0.15	13 in·lb	
9	Front Caliper Mounting Bolts	26.5	2.7	20	
10	Front Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S

BF: Apply brake fluid.
L: Apply a non-permanent locking agent.
R: Replacement Parts
S: Follow the specified tightening sequence.
Si: Apply silicone grease.

Exploded View



Specifications

Item	Standard	Service Limit
Brake Fluid		
Grade	DOT 4	– – –
Disc Brake		
Pad Lining Thickness:		
Front	4.0 mm (0.15 in.)	1 mm (0.04 in.)
Rear	4.3 mm (0.17 in.)	1 mm (0.04 in.)
Disc Thickness	3.3 ~ 3.7 mm (0.13 ~ 0.14 in.)	3 mm (0.12 in.)
Disc Runout	TIR 0.2 mm (0.008 in.) or less	TIR 0.3 mm (0.012 in.)
Brake Lever, Brake Pedal		
Brake Lever Position	Adjustable (to suit rider)	– – –
Brake Lever Free Play	Non-adjustable	– – –
Brake Pedal Free Play	Non-adjustable	– – –

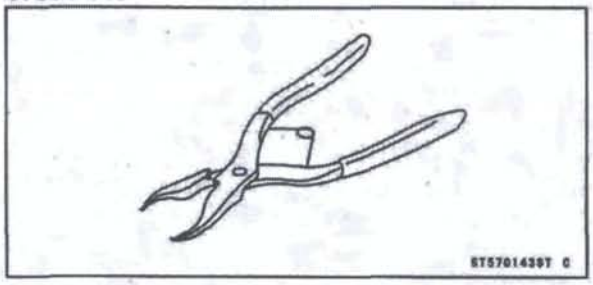
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Brake Pedal Pivot Bolt	19.6	2.0	14	
2	Parking Brake Adjusting Bolt Locknut	17	1.7	12	
3	Parking Brake Bracket Mounting Bolts	22	2.2	16	
4	Parking Lever Pivot Bolt	16	1.6	12	
5	Rear Caliper Bleed Valve	5.4	0.55	48 in·lb	
6	Rear Brake Disc Mounting Bolts	36.5	3.7	27	L
7	Rear Brake Disc Mounting Nuts	17.5	1.8	13	
8	Rear Brake Hose Banjo Bolts	24.5	2.5	18	
9	Rear Brake Pad Bolts	17	1.7	12	
10	Rear Brake Reservoir Cap Bolts	1.5	0.15	13 in·lb	
11	Rear Caliper Mounting Bolts	26.5	2.7	20	L
12	Rear Master Cylinder Mounting Bolts	9.3	0.95	82 in·lb	
13	Rear Master Cylinder Push Rod Locknut	17	1.7	12	

BF: Apply brake fluid.
G: Apply grease.
L: Apply a non-permanent locking agent.
R: Replacement Parts
Si: Apply silicone grease.

Special Tool

Inside Circlip Pliers:
57001-143



Brake Fluid

⚠ WARNING

When working with the disc brake, observe the precautions listed below.

1. Never reuse old brake fluid.
2. Do not use fluid from a container that has been left unsealed or that has been open for a long time.
3. Do not mix two types and brands of fluid for use in the brake. This lowers the brake fluid boiling point and could cause the brake to be ineffective. It may also cause the rubber brake parts to deteriorate.
4. Don't leave the reservoir cap off for any length of time to avoid moisture contamination of the fluid.
5. Don't change the fluid in the rain or when a strong wind is blowing.
6. Except for the disc pads and disc, use only disc brake fluid, isopropyl alcohol, or ethyl alcohol for cleaning brake parts. Do not use any other fluid for cleaning these parts. Gasoline, engine oil, or any other petroleum distillate will cause deterioration of the rubber parts. Oil spilled on any part will be difficult to wash off completely and will eventually deteriorate the rubber used in the disc brake.
7. When handling the disc pads or disc, be careful that no disc brake fluid or any oil gets on them. Clean off any fluid or oil that inadvertently gets on the pads or disc with a high-flash point solvent. Do not use one which will leave an oily residue. Replace the pads with new ones if they cannot be cleaned satisfactorily.
8. Brake fluid quickly ruins painted surfaces; any spilled fluid should be completely washed away immediately.
9. If any of the brake line fittings or the bleed valve is opened at any time, the **AIR MUST BE BLED FROM THE BRAKE LINE.**

Brake Fluid Recommendation

Use extra heavy-duty brake fluid only from a container marked DOT4.

Recommended Disc Brake Fluid
Grade: DOT 4

Brake Fluid Level Inspection

- Refer to the Brake Fluid Level Inspection in the Periodic Maintenance chapter.

Brake Fluid Change

- Refer to the Brake Fluid Change in the Periodic Maintenance chapter.

Brake Fluid

Brake Line Air Bleeding

NOTE

OThe procedure to bleed the front brake line is as follows. Bleeding the rear brake line is the same as for the front brake.

- 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

OTap 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:

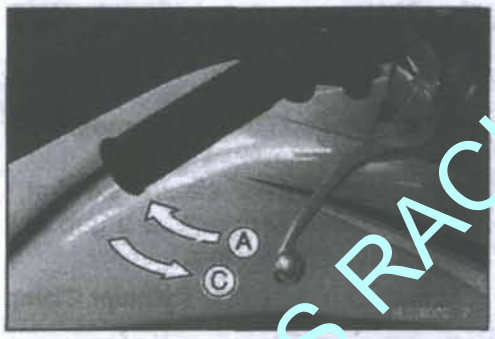
OHold the brake lever applied [A].
OQuickly open and close the valve [B].
ORelease the brake lever [C].

- The fluid level must be checked several times during the bleeding operation and replenished as necessary.

NOTE

OIf 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.

OIf 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:

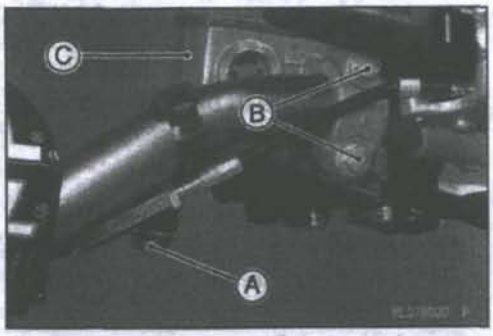
Torque - Front Caliper Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Rear Caliper Bleed Valve: 5.4 N·m (0.55 kgf·m, 48 in·lb)

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

Master Cylinder

Front Master Cylinder Removal

- Remove:
  Brake Hose Banjo Bolt [A]
  Master Cylinder Clamp Bolts [B]
  Master Cylinder [C]

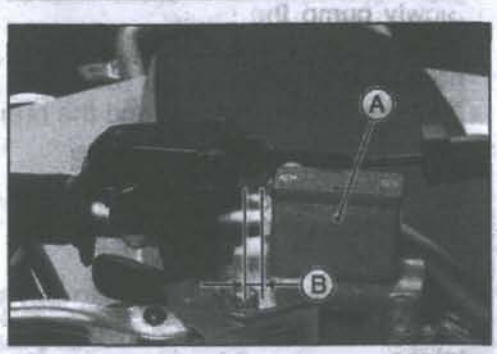


CAUTION

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

Front Master Cylinder Installation

- Install the master cylinder [A] so that the reservoir cap is horizontally and position it as shown.
  [B] 10 ~ 15 mm (0.39 ~ 0.59 in.)



- The master cylinder clamp must be installed with the "UP" mark [A] upwards.
- Tighten the upper clamp bolt first, and then the lower clamp bolt. There will be a gap at the lower part of the clamp after tightening.

Torque - Front Master Cylinder Clamp Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Use a new flat washer on each side of the brake hose fitting, and tighten the banjo bolt.

Torque - Front Brake Hose Banjo Bolt: 26.5 N·m (2.7 kgf·m, 20 ft·lb)

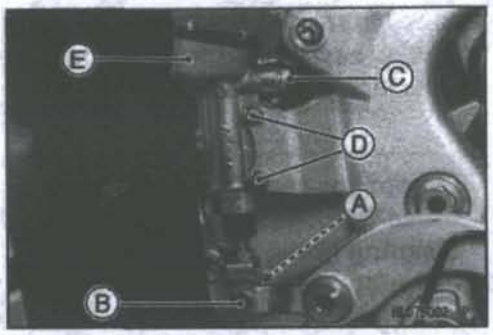
- Bleed the brake line after master cylinder installation (see Brake Line Air Bleeding).
- Check the brake for good braking power, no braking brag, and no fluid leakage.

⚠ 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

Rear Master Cylinder Removal



- Remove the cotter pin [A].
- Pull off the joint pin [B] with washer.

NOTE

OPull off the joint pin while pressing down the brake pedal.

- Unscrew the brake hose banjo bolt [C].
- Unscrew the master cylinder mounting bolts [D], and remove the master cylinder [E].
- When removing the brake hose, temporarily secure the end of the brake hose to some high place to keep fluid loss to a minimum.

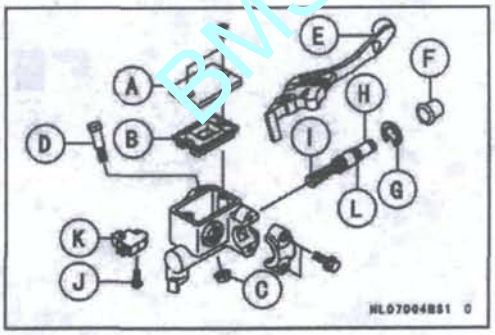
Rear Master Cylinder Installation

- Replace the cotter pin with a new one.
- Replace the washers are on each side of hose fitting with new ones.
- Tighten the following:

Torque - Rear Brake Hose Banjo Bolt: 24.5 N·m (2.5 kgf·m, 18 ft·lb)
Rear Master Cylinder Mounting Bolts: 9.3 N·m (0.95 kgf·m, 82 in·lb)

- Bleed the brake line (see Brake Line Air Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.
- Check the brake pedal position (see Brake Lever and Pedal Position Adjustment in the Periodic Maintenance chapter).

Front Master Cylinder Disassembly



- Remove:
  Front Master Cylinder (see Front Master Cylinder Removal)
- Remove the reservoir cap [A] and diaphragm [B], and pour the brake fluid into a container.
- Remove:
  Brake Lever Pivot Bolt Locknut [C]
  Brake Lever Pivot Bolt [D]
  Brake Lever [E]
  Dust Cover [F]
  Circlip [G]
  Piston [H]
  Spring [I]
  Screw [J]
  Front Brake Light Switch [K]

Special Tool - Inside Circlip Pliers: 57001-143

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

Master Cylinder

Front 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.
- Apply silicone grease to the brake lever pivot bolt and dust cover.
- Tighten:

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

Master Cylinder

Master Cylinder Inspection (Visual Inspection)

- Disassemble the front and rear master cylinders.
- Check that there are no scratches, rust or pitting on the inner wall of each master cylinder [A] and on the outside of each piston [B].

★If a 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 replace to renew the cups.

★If fluid leakage is noted at the brake lever, the piston assembly should be replaced to renew the cup.

- Check the dust covers [E] for damage.

★If they are damaged, replace them.

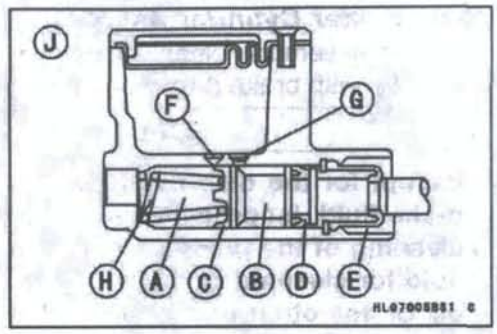
- Check that the relief [F] and supply [G] ports are not plugged.

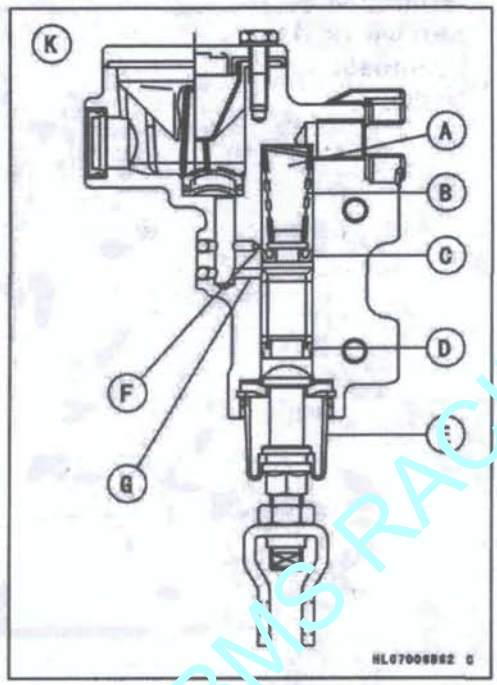
★If the small relief port becomes plugged, the brake pads will drag on the disc. Blow the ports clean with compressed air.

- Check the piston return springs [H] for any damage.

★If a spring is damaged, replace it.

[J] Front Master Cylinder
[K] Rear Master Cylinder





Rear Master Cylinder Disassembly

- Remove the rear master cylinder (see Rear Master Cylinder Removal).

NOTE

ODo not remove the push rod clevis for master cylinder disassembly since removal requires brake pedal position adjustment.

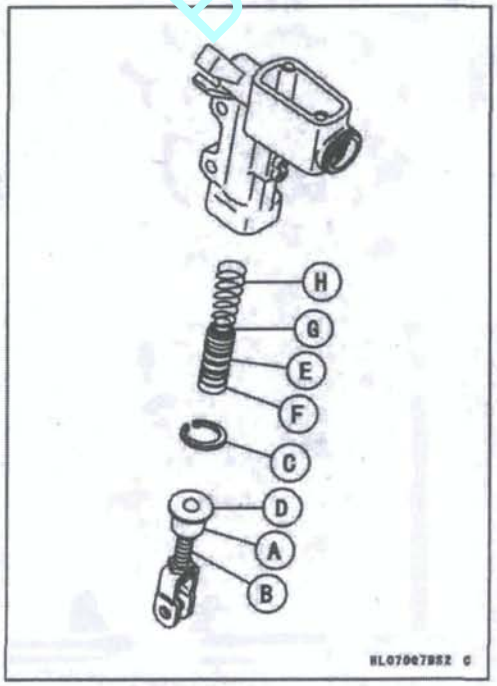
- Remove the reservoir cap and diaphragm, and pour the brake fluid into a container.
- Slide the dust cover [A] on the push rod [B] out of place, and remove the circlip [C].

Special Tool - Inside Circlip Pliers: 57001-143

- Pull out the push rod with the piston stop [D].
- Take off the piston [E], secondary cup [F], primary cup [G], and return spring [H].

CAUTION

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



Master Cylinder

Rear Master Cylinder Assebly

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

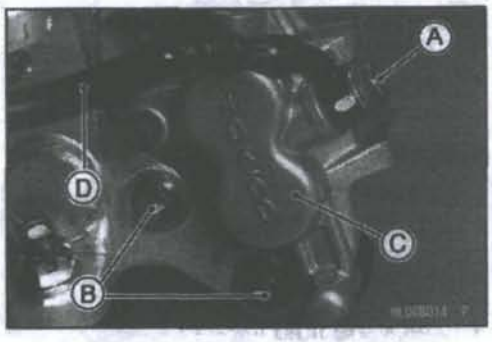
CAUTION

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

- Apply brake fluid to the removed parts and to the inner wall of the cylinder.
- Take care not to scratch the piston or the inner wall of the cylinder.
- Apply silicone grease (ex. PBC grease).
  Push Rod Contact (Rear)
  Dust Cover

Calipers

Front Caliper Removal



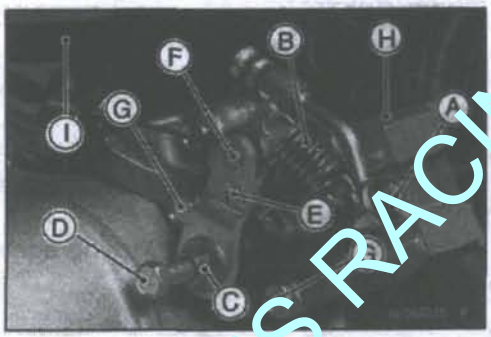
- Remove the front wheel (see Front Wheel Removal in the Wheels/Tires chapter).
- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Unscrew the caliper mounting bolts [B], and detach the caliper [C] from the disc.
- Unscrew the banjo bolt and remove the brake hose [D] from the caliper.

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 Front Caliper Disassembly).*

Rear Caliper Removal



- Release the parking brake.
- Loosen the banjo bolt [A] at the brake hose lower end, and tighten it loosely.
- Remove the parking brake spring [B].
- Remove the parking brake adjusting locknut [C], bolt [D] and cable arm [E].
- Clear the parking cable lower end [F] from the cable arm.
- Unscrew the caliper mounting bolts [G], and detach the caliper [H] from the disc.
- Unscrew the banjo bolt and remove the brake hose [I] 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 Rear Caliper Disassembly).*

Calipers

Front Caliper Installation

- Install the caliper and brake hose lower end.

○Replace the washers that are on each side of hose fitting with new ones.

- Tighten:

Torque - Front Caliper Mounting Bolts: 26.5 N·m (2.7 kgf·m, 20 ft·lb)
Front Brake Hose Banjo Bolt: 26.5 N·m (2.7 kgf·m, 20 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.

Rear Caliper Installation

- Install the caliper and brake hose lower end.

○Replace the washers that are on each side of hose fitting with new ones.

- Apply a non-permanent locking agent to the rear caliper mounting bolts.
- Tighten:

Torque - Rear Caliper Mounting Bolts: 26.5 N·m (2.7 kgf·m, 20 ft·lb)
Rear Brake Hose Banjo Bolt: 24.5 N·m (2.5 kgf·m, 18 ft·lb)

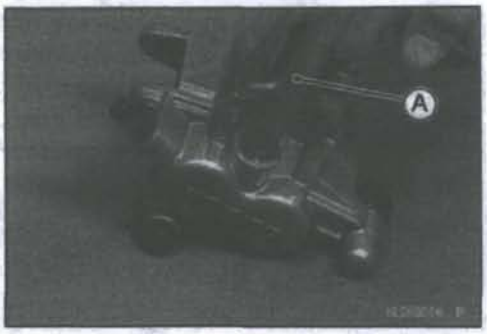
- Check the fluid level in the brake reservoir.
- Bleed the brake line (see Brake Line Air Bleeding).
- Check the brake for good braking power, no brake drag, and no fluid leakage.
- Adjust the parking brake (see Parking Brake Adjustment).

⚠ 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.

Calipers

Front Caliper Disassembly



- Remove:
  Caliper (see Front Caliper Removal)
  Pads (see Front Brake Pad Removal)
  Anti-rattle Spring
- Using compressed air, remove the piston.

○Cover the caliper opening with a clean, heavy cloth.
○Remove the piston by lightly applying compressed air [A] to where the brake line fits into the caliper.

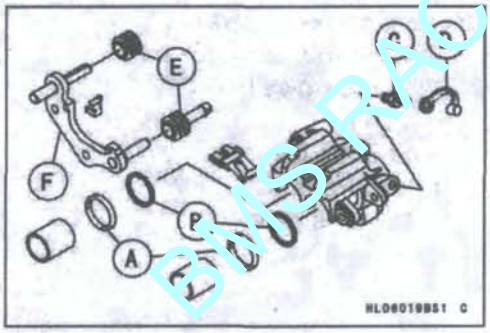
⚠ WARNING

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 (see Front Brake Pad Removal) and anti-rattle spring.
○Pump the brake lever to remove the caliper piston.

- Remove:
  Dust Seals [A]
  Fluid Seals [B]
  Bleed Valve [C] and Rubber Cap [D]
  Boots [E] and Caliper Holder [F]



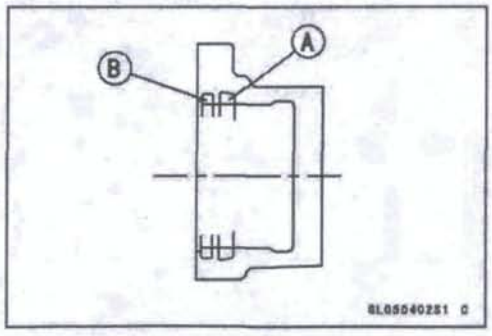
Front Caliper Assembly

- Replace the fluid seal [A] with a new one.

○Apply brake fluid to the fluid seal, and install it into the cylinder by hand.

- Replace the dust seal [B] with a new one if it is damaged.

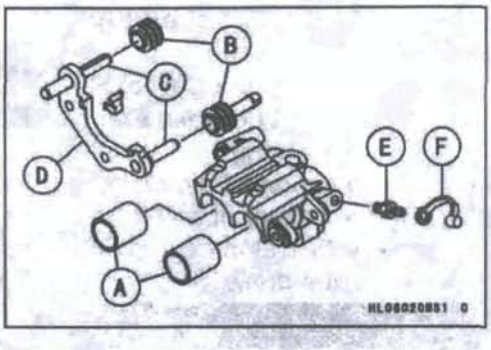
○Apply brake fluid to the dust seal, and install it into the cylinder by hand.



Calipers

- Apply brake fluid to the outside of the pistons [A], and push them into the cylinder by hand. Take care that neither the cylinder nor the piston skirt gets scratched.
- Replace the rubber boots [B] if they are damaged.
- Apply a thin coat of silicone grease to the caliper holder shafts [C] (Silicone grease is a special high temperature, water-resistant grease).
- Install:
  Caliper Holder [D]
  Bleed Valve [E] and Rubber Cap [F]

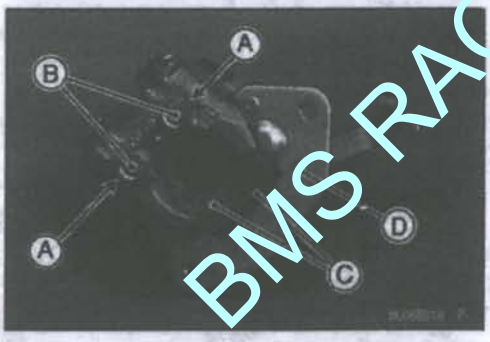
Torque - Front Caliper Bleed Valves: 7.8 N·m (0.80 kgf·m, 69 in·lb)



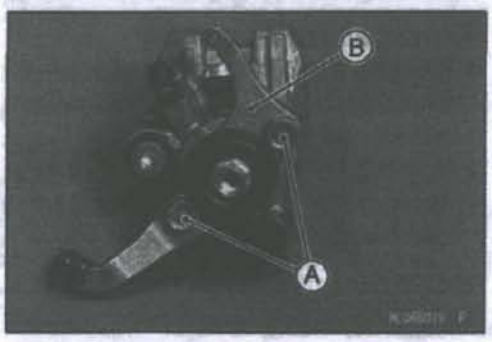
- Install the anti-rattle spring [A] in the caliper as shown.
- Install the pads (see Front Brake Pad Installation).

Rear Caliper Disassembly

- Remove the rear caliper (see Rear Caliper removal).
- Bend the claws [A] of the washer straight.
- Remove:
  Pad Bolts [B]
  Brake Pads [C]
- Pull out the caliper holder [D].



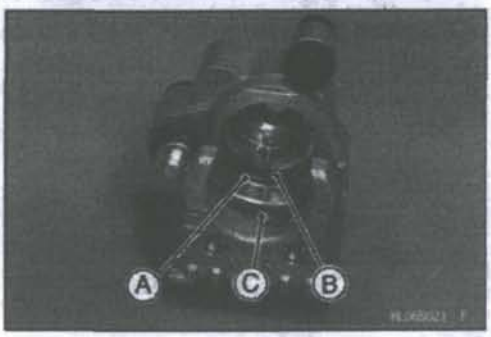
- Remove:
  Bolts [A]
  Parking Brake Bracket [B]



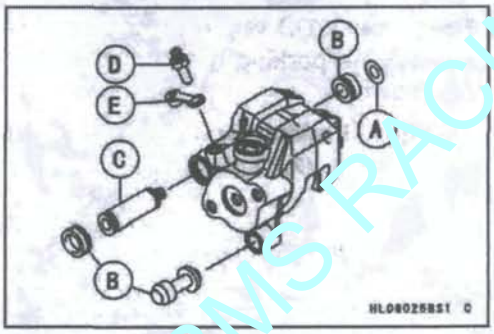
Calipers

- Push out the piston [A].

- Remove:
  Dust Seal [A]
  Fluid Seal [B]
  Anti-rattle Spring [C]



- Remove:
  Washer [A]
  Boots [B]
  Caliper Holder Shaft [C]
  Bleed Valve [D] and Rubber Cap [E]



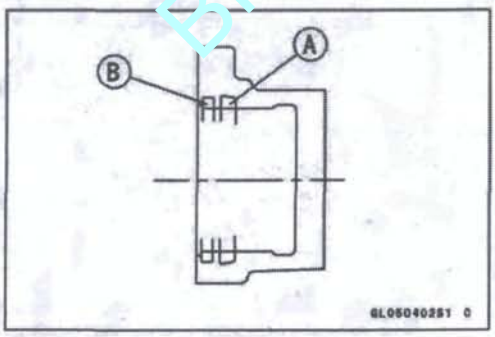
Rear Brake Caliper Assembly

- Replace the fluid seal [A] with a new one.

○Apply silicone grease to the fluid seal, and install it into the cylinder by hand (Silicone grease is a special high temperature, water-resistant grease).

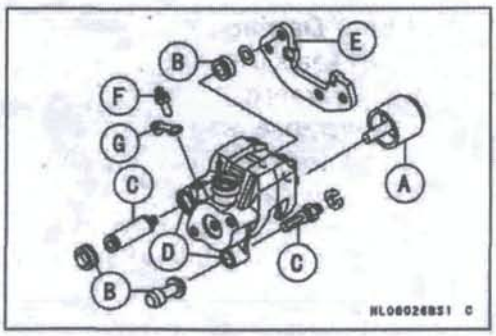
- Replace the dust seal [B] with a new one.

○Apply brake fluid to the dust seal, and install it into the cylinder by hand.



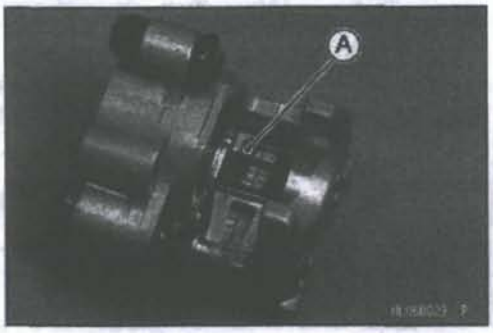
- Apply brake fluid to the outside of the piston [A], and push it into the cylinder by hand. Take care that neither the cylinder nor the piston skirt gets scratched.
- Replace the rubber boots [B] if they are damaged.
- Apply a thin coat of silicone grease to the caliper holder shafts [C] and holder holes [D], and install them.
- Install:
  Caliper Holder [E]
  Bleed Valve [F] and Rubber Cap [G]

Torque - Rear Caliper Bleed Valve: 5.4 N·m (0.55 kgf·m, 48 in·lb)

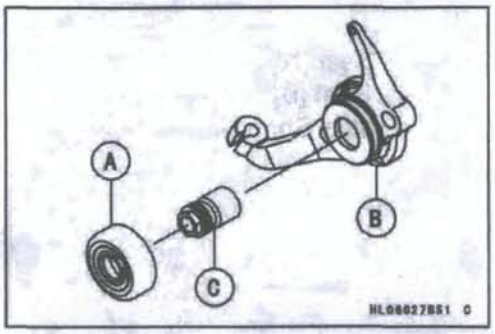


Calipers

- Install the anti-rattle spring [A] in the caliper as shown.
- Install the pads.



- Replace the rubber boot [A] if it is damaged.
- Apply a thin coat of silicone grease to the boot.
- Assemble the parking brake bracket [B], shaft [C] and boot.

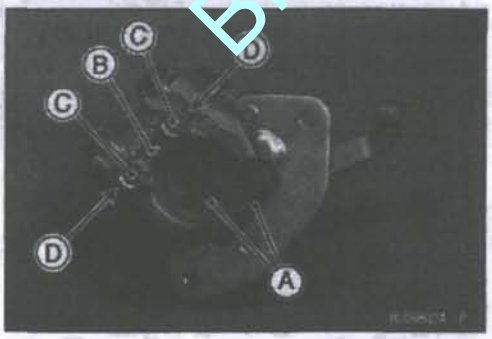


- Replace the O-ring [A] with a new one.
- Install the parking brake bracket.
- Tighten:

Torque - Parking Brake Bracket Mounting Bolts: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Install the pads [A].
- Replace the washer [B] with a new one, and install it.
- Tighten:
- Bend the claws [D] of the washer.

Torque - Rear Brake Pad Bolts [C]: 17 N·m (1.7 kgf·m, 12 ft·lb)

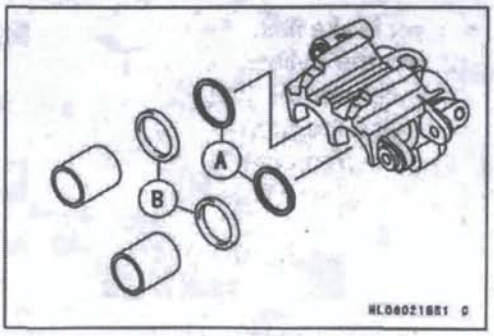


Fluid Seal Damage

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

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

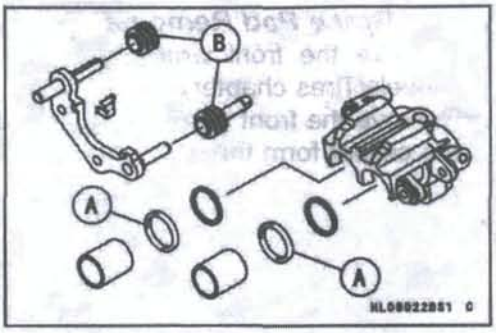


Calipers

Dust Seal and Friction Boot Damage

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

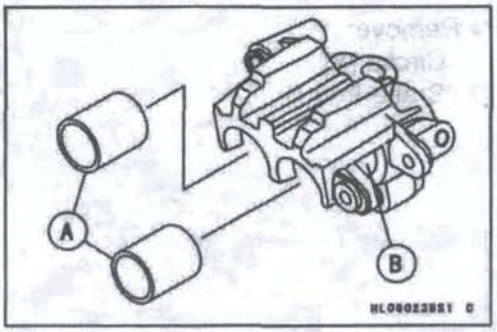
★If they show any damage, replace them.



Piston and Cylinder Damage

- Visually inspect the pistons [A] and cylinder surfaces [B].

★Replace the caliper if the cylinder and piston are badly scored or rusty.



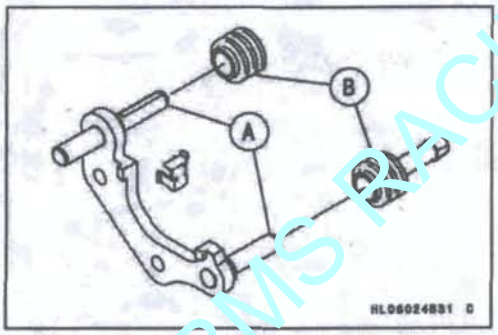
Caliper Holder Shaft Wear Inspection

The caliper body must slide smoothly on the caliper holder shafts [A]. If the body does not slide smoothly, one pad will wear more than the other, pad wear will increase, and constant drag on the disc will raise brake and brake fluid temperature.

- Check to see that the caliper holder shafts are not badly worn or stepped, and that the rubber friction boots [B] 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.

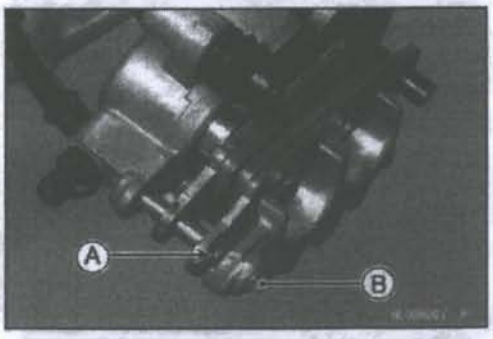


Brake Pads

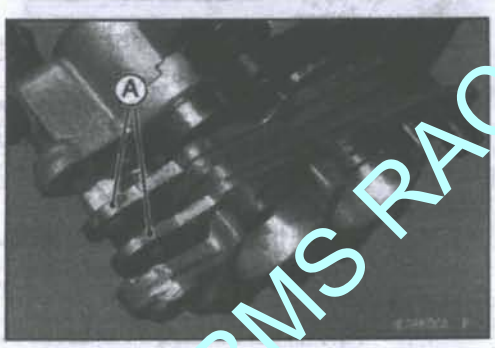
Front Brake Pad Removal

- Remove the front wheel (see Wheel Removal in the Wheels/Tires chapter).
- Remove the front caliper mounting bolts [A], and detach the caliper form the disc.

- Remove:
  Circlip [A]
  Brake Pad Bolt [B]



- Remove:
  Brake Pads [A]



Front Brake Pad Installation

- Push the caliper piston in by hand as far as it will go.
- Be sure that the anti-rattle spring is in place.
- Install:
  Brake Pads
  Brake Pad Bolt
- Tighten the brake pad bolts securely.

⚠ 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.

Rear Brake Pad Removal

- Refer to the Rear Caliper Disassembly.

Rear Brake Pad Installation

- Refer to the Rear Caliper Assembly.

Brake Pad Wear Inspection

- Refer to the Brake Pad Wear Inspection in the Periodic Maintenance chapter.

Brake Discs

Disc Cleaning

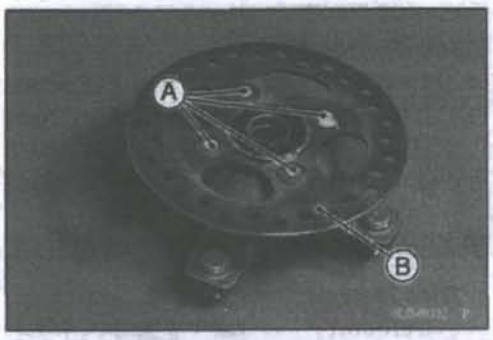
Poor braking can be caused by oil on a disc. Oil on a disc must be cleaned off with an oilless cleaning fluid such as trichloroethylene or acetone.

⚠ WARNING

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

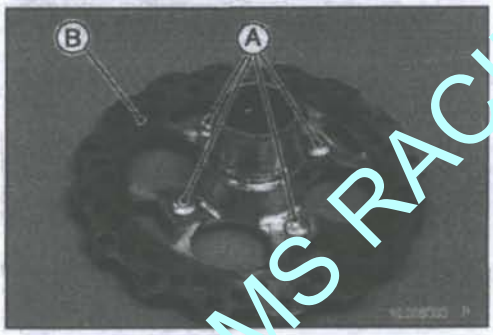
Front Disc Removal

- Remove:
  Front Hub (see Front Hub Removal in the Wheels/Tires chapter)
  Brake Disc Mounting Bolts [A]
  Brake Disc [B]



Rear Disc Removal

- Remove:
  Rear Axle (see Rear Axle Removal in the Final Drive chapter)
  Brake Disc Mounting Bolts [A] and Nuts
  Brake Disc [B]

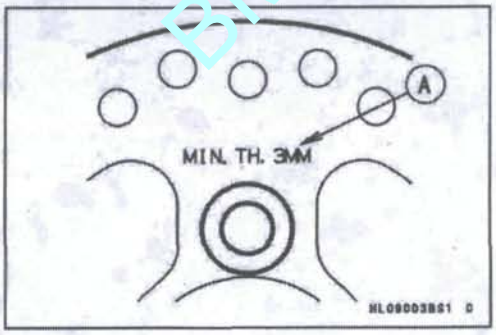


Disc Installation

- The disc must be installed with the marked side [A] facing toward the steering knuckle.
- Apply a non-permanent locking agent to the brake disc mounting bolts.
- Tighten:

Torque - Brake Disc Mounting Bolts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)
Rear Brake Disc Mounting Nuts: 17.5 N·m (1.8 kgf·m, 13 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.



Brake Discs

Disc Wear

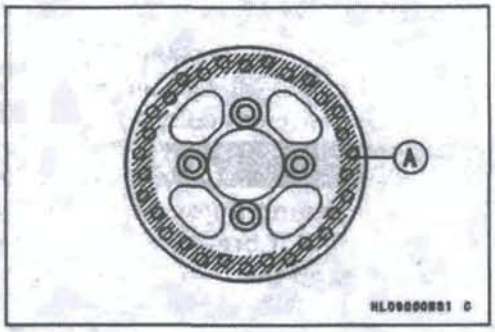
- Measure the thickness of each disc at the point [A] where it has worn the most.

★Replace the disc if it has worn past the service limit.

Disc Thickness

Standard: 3.3 ~ 3.7 mm (0.13 ~ 0.14 in.)

Service Limit: 3 mm (0.12 in.)



Disc Runout

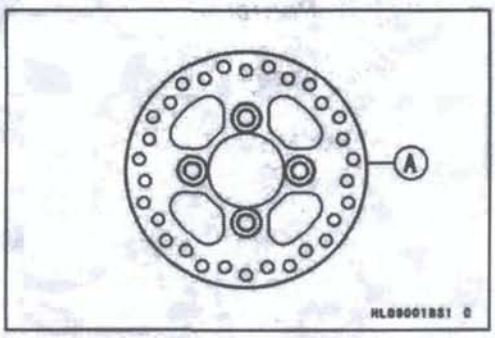
- Jack up the vehicle so that the wheels are off the ground.
- For front brake disc inspection, remove the front wheels and turn the handlebar fully to one side.
- Set up a dial gauge against the disc [A], and measure the disc runout.

★If the runout exceeds the service limit, replace the disc.

Disc Runout

Standard: TIR 0.2 mm (0.008 in.) or less

Service Limit: TIR 0.3 mm (0.012 in.)



Brake Hoses

Brake Hose Inspection

- Refer to the Front Brake Hose and Connections Inspection in the Periodic Maintenance chapter.

Brake Hose Replacement

- Refer to the Front Brake Hose Replacement in the Periodic Maintenance chapter.

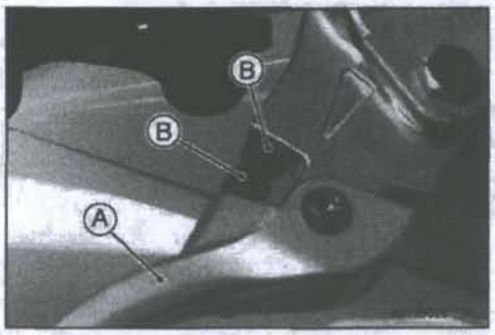
Brake Lever and Pedal

Brake Lever and Pedal Position Adjustment

⚠ WARNING

Always maintain proper brake adjustment. If adjustment is improper, the brake could drag and overheat. This could damage the brake assembly and possibly lock the wheel resulting in loss of control.

- Adjust the front brake lever [A] to suit you.
- Loosen the adjuster locknut [B] and turn the adjuster [C] to either side.
- After adjustment, tighten the locknut.



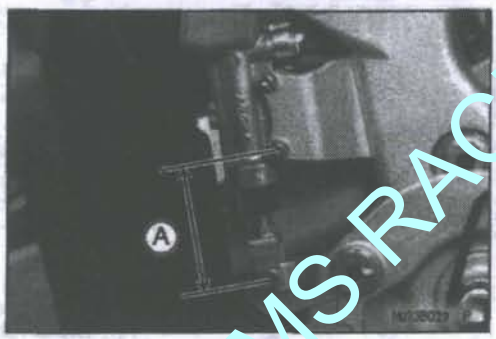
NOTE

○Usually it is not necessary to adjust the pedal position, but always adjust it when the master cylinder is disassembled or pedal position is incorrect.

- Measure the length indicated in the figure.

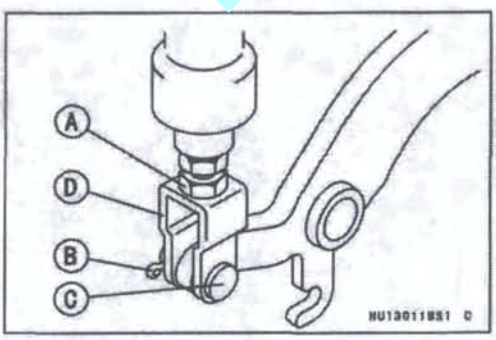
Length [A]
Standard: 67.8 ±1 mm (2.67 ±0.04 in.)

★If it is not specified length, the brake pedal may be deformed or incorrectly installed.
★If it is not within the specified length, adjust the push rod in the master cylinder as follows.



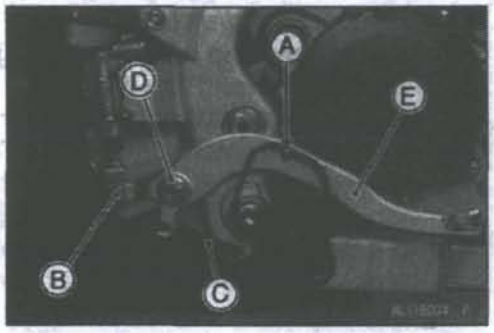
○Loosen the push rod locknut [A].
○Replace the cotter pin with a new one.
○Remove:
Cotter Pin [B]
Washer
Joint Pin [C]
○Turn the bracket [D] to obtain the specified length.
○Tighten the locknut.

Torque - Rear Master Cylinder Push Rod Locknut: 17 N·m (1.7 kgf-m, 12 ft-lb)



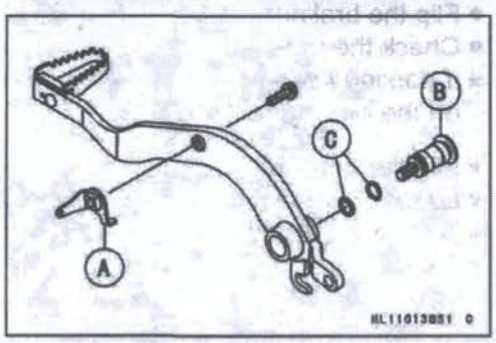
Brake Lever and Pedal

Brake Pedal Removal



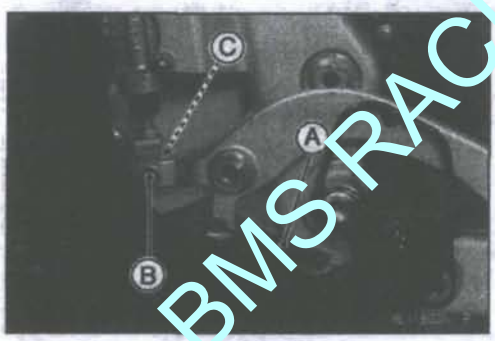
- Remove:
  - Brake Light Switch Spring Bracket Screw [A]
  - Cotter Pin and Joint Pin [B]
  - Brake Pedal Return Spring [C]
  - Brake Pedal Pivot Bolt [D] and O-rings
  - Brake Pedal [E]

Brake Pedal Installation



- Install the brake light switch spring bracket [A].
- Hang the brake light switch spring to the brake light switch and bracket.
- Apply grease:
  - Brake Pedal Pivot Bolt [B]
  - O-rings [C]
- Install the O-rings to the pivot bolt.
- Tighten the brake pivot bolt.

Torque - Brake Pedal Pivot Bolt: 19.6 N·m (2.0 kgf·m, 14 ft·lb)



- Install:
  - Brake Pedal Return Spring [A]
- Replace the cotter pin with new a one.
- Install:
  - Joint Pin [B]
  - Cotter Pin [C]
- Bend the cotter pin ends.
- Adjust the brake pedal position (see Brake Lever and Pedal Position Adjustment)

Parking Brake

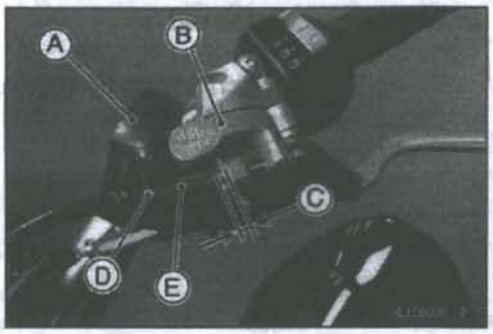
Parking Brake Adjustment

- Pull and remove the rubber cover [A].
- Flip the brake lever [B] to the "PARK OFF" position.
- Holding the outer cable, pull it and check if the cable adjuster end moves more than 2 mm (0.08 in.) [C].

★If it moves more than 2 mm (0.08 in.), adjust the cable tension as follows.

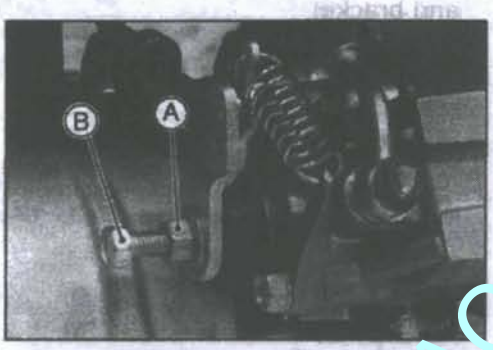
- Loosen the locknut [D] and turn the adjusting nut [E] until movement becomes less than 2 mm (0.08 in.).
- Tighten the locknut securely.
- Flip the brake lever to the "PARK ON" position.
- Check the parking brake for good braking power.

★If parking brake power is weak, adjust the cable tension on the rear caliper as follows.



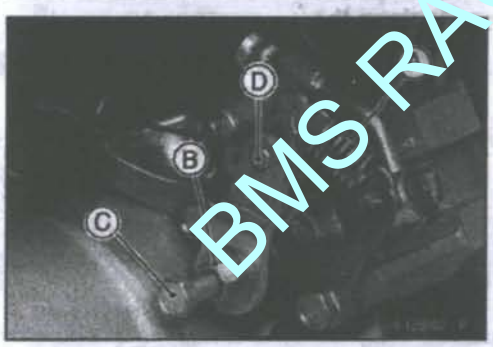
- Flip the brake lever to the "PARK ON" position.
- Loosen the parking brake adjusting nut [A] and bolt [B].
- Turn the adjusting bolt to adjust the parking brake.
- Tighten:

Torque - Parking Brake Adjusting Bolt Locknut : 17 N·m (1.7 kgf·m, 12 ft·lb)

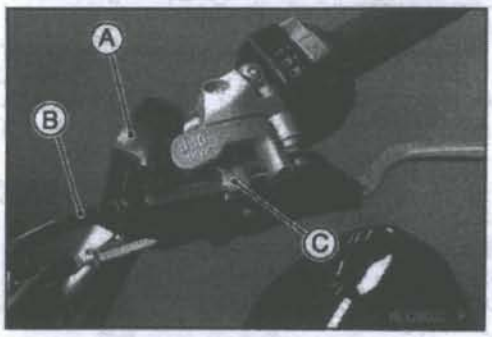


Parking Brake Cable Removal

- Flip the brake lever to the "PARK OFF" position.
- Remove the parking brake spring [A].
- Loosen the parking brake adjusting bolt locknut [B] and bolt [C].
- Clear the parking cable lower end [D].



- Pull and remove the rubber cover [A].
- Pull the parking cable [B] to clear the it from the holder [C].



Parking Brake

- Flip the brake lever to the "PARK ON" position.
- Clear the parking cable upper end [A] from the lever [B].

Parking Brake Cable Installation

- Lubricate the parking brake cable before installation (see General Lubrication in the Periodic Maintenance chapter).
- Install the parking brake cable in accordance with Cable, Wire and Hose Routing section in the Appendix chapter).
- Install the return spring so that the spring ends [A] faces inside.
- Adjust the parking brake (see Parking Brake Adjustment).

Parking Brake Cable Lubrication

- Refer to the General Lubrication in the Periodic Maintenance chapter.

Suspension

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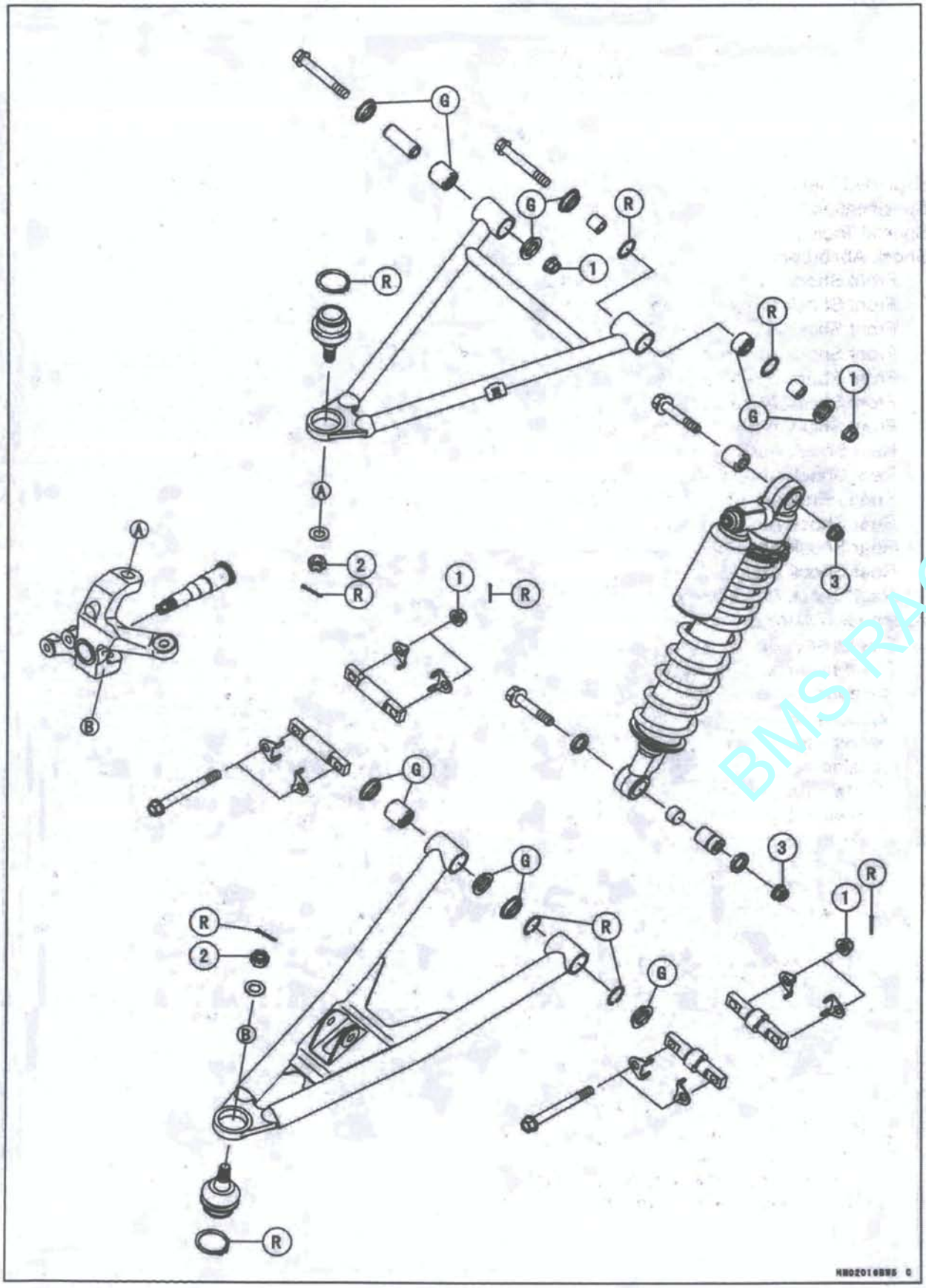
Exploded View

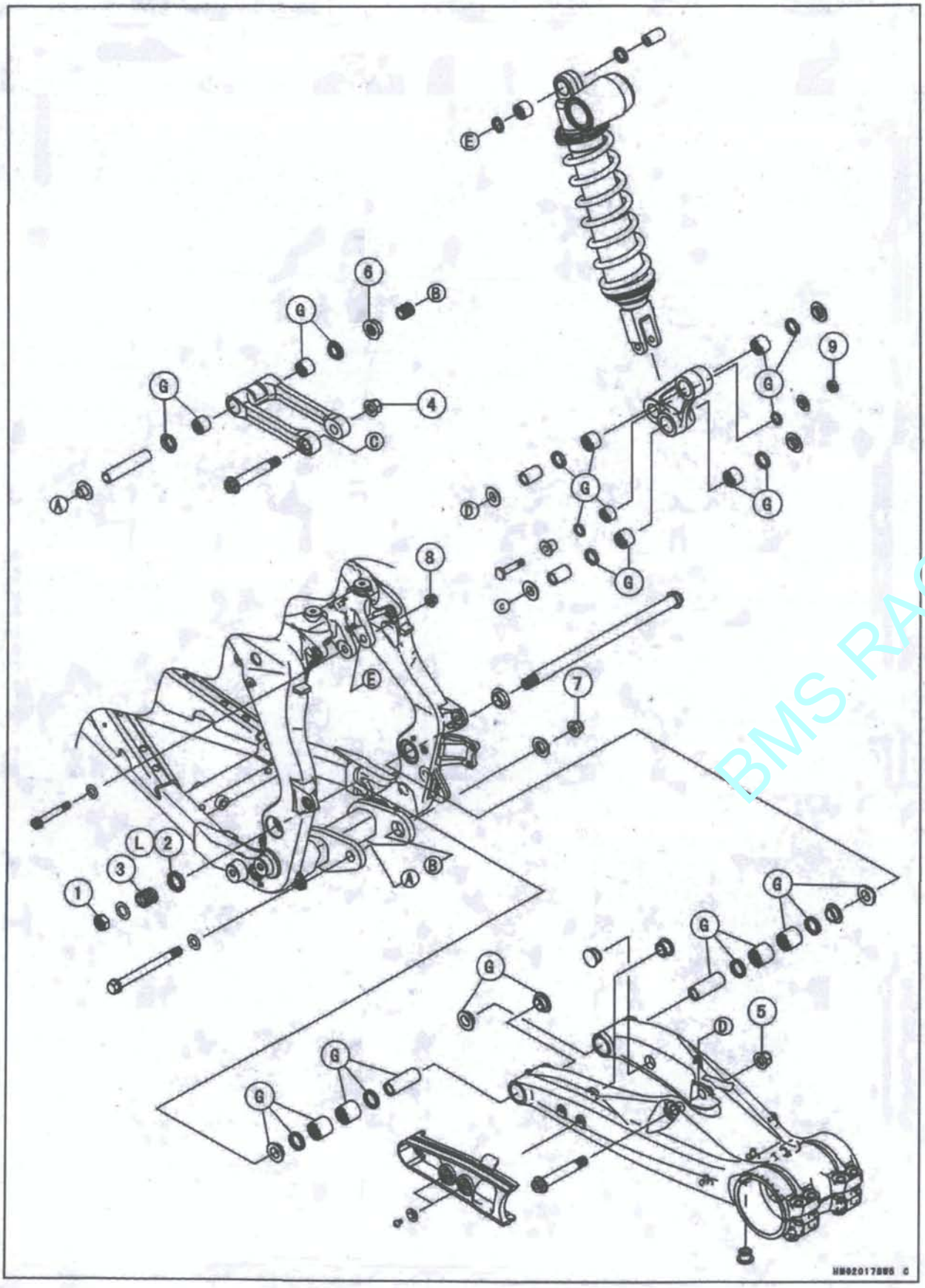


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Suspension Arm Pivot Nuts	36.5	3.7	27	
2	Knuckle Joint Nuts	29	3.0	21	
3	Front Shockabsorber Mounting Nuts	36.5	3.7	27	

G: Apply grease.
R: Replacement Parts

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Swingarm Pivot Shaft Nut	90.5	9.2	67	
2	Swingarm Adjusting Locknut	31.5	3.2	23	L
3	Swingarm Adjusting Bolt	6.0	0.63	53 in·lb	
4	Tie-rod Mounting Nut	71.5	7.3	53	
5	Rocker Arm Pivot Nut	71.5	7.3	53	
6	Tie-rod Adjusting Nut	61.5	6.3	45	
7	Tie-rod Adjusting Locknut	46.5	4.7	34	
8	Rear Shockabsorber Mounting Nut (Upper)	36.5	3.7	27	
9	Rear Shockabsorber Mounting Nut (Lower)	36.5	3.7	27	

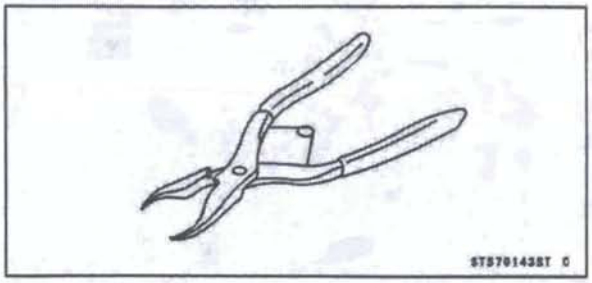
G: Apply grease.
L: Apply a non-parmanent locking agent.

Specifications

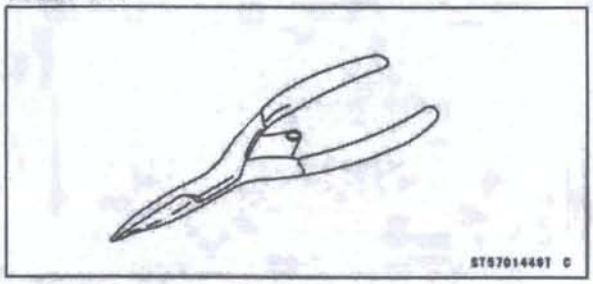
Item	Standard	Service Limit
Shock Absorbers:		
Front Shock Absorber		
Rebound Damping Adjustment		(Adjustable Range)
(from the seated position adjuster turned fully clockwise)	9 clicks counterclockwise	20 clicks
Compression Damping Adjustment		(Adjustable Range)
(from the seated position adjuster turned fully clockwise)	8 clicks counterclockwise	20 clicks
Spring Preload Adjustment		(Adjustable Range)
(Adjusting nut position from the center of the mounting hole upper)	71.5 mm (2.81 in.)	61.5 ~ 81.5 mm (2.42 ~ 3.21 in.)
Gas Pressure	1000 kPa (10.2 kgf/cm², 145 psi)	– – –
Rear Shock Absorber		
Rebound Damping Adjustment		(Adjustable Range)
(from the seated position adjuster turned fully clockwise)	7 clicks counterclockwise	20 clicks
High Speed Compression Damping Adjustment	1-1/4 turn out	(Adjustable Range) 2 turn out
Low Compression Damping Adjustment		(Adjustable Range)
(from the seated position adjuster turned fully clockwise)	11 clicks counterclockwise	20 clicks
Spring Preload Adjustment		(Adjustable Range)
(Adjusting nut position from the center of the mounting hole upper)	79.5 mm (3.13 in.)	71.5 ~ 91.5 mm (2.81 ~ 3.60 in.)
Gas Pressure	1000 kPa (10.2 kgf/cm², 145 psi)	– – –
Tie-Rod, Rocker Arm		
Sleeve Outside Diameter:		
Tie-rod	17.966 ~ 17.984 mm (0.70732 ~ 0.70803 in.)	17.94 mm (0.7063 in.)
Rocker Arm	19.987 ~ 20.000 mm (0.78689 ~ 0.78740 in.)	19.96 mm (0.7858 in.)
Rocker Arm Mounting Bolt Runout	0.1 mm (0.004 in.) or less	0.2 mm (0.008 in.)

Special Tools

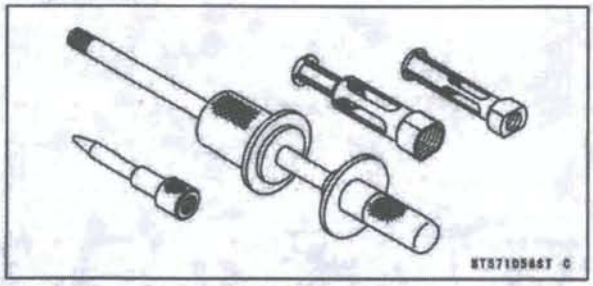
Inside Circlip Pliers:
57001-143



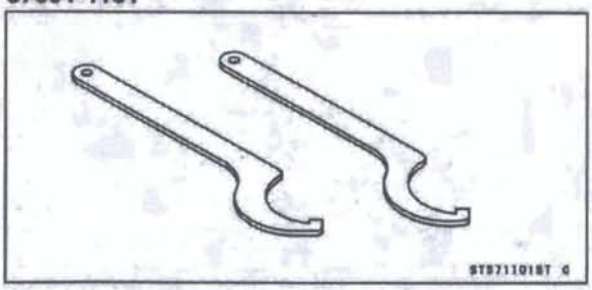
Outside Circlip Pliers:
57001-144



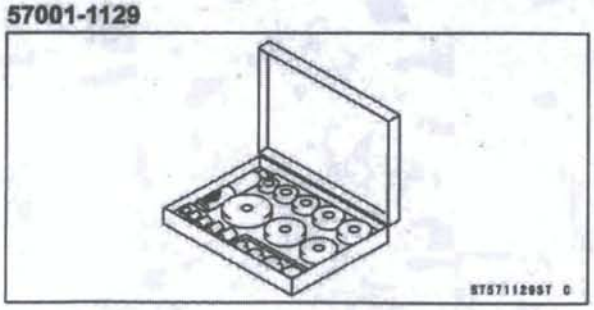
Oil Seal & Bearing Remover:
57001-1058



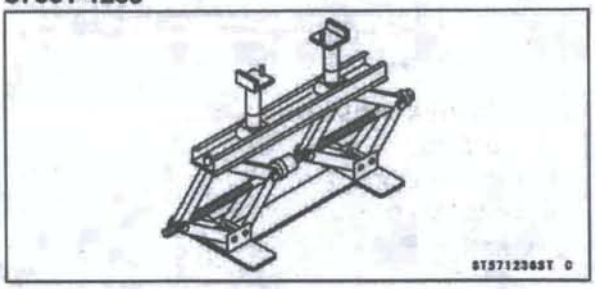
Hook Wrench R37.5, R42:
57001-1101



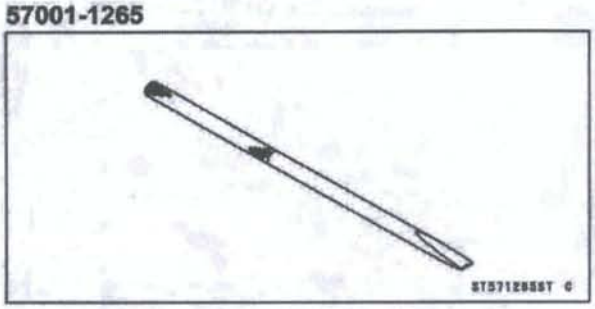
Bearing Driver Set:
57001-1129



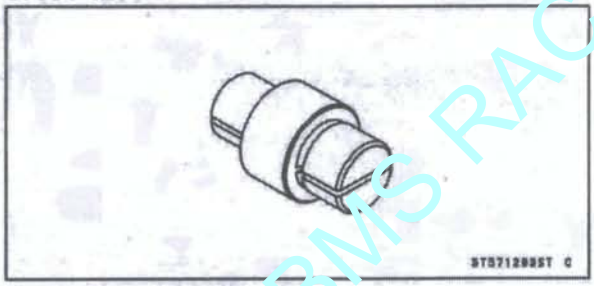
Jack:
57001-1238



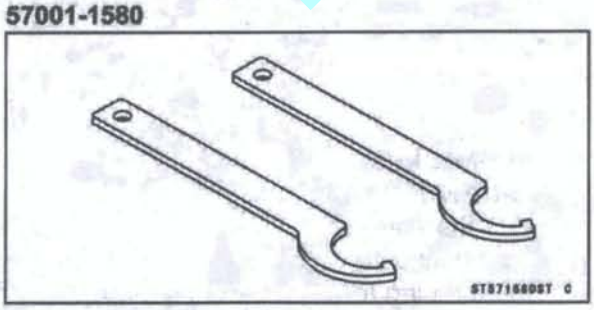
Bearing Remover Shaft, ϕ9:
57001-1265



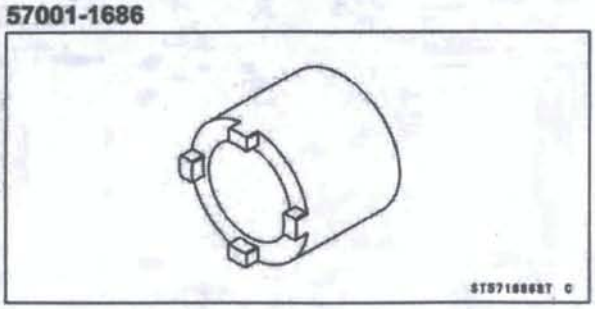
Bearing Remover Head, ϕ20 × ϕ22:
57001-1293



Hook Wrench R=35:
57001-1580



Swingarm Pivot Nut Wrench:
57001-1686



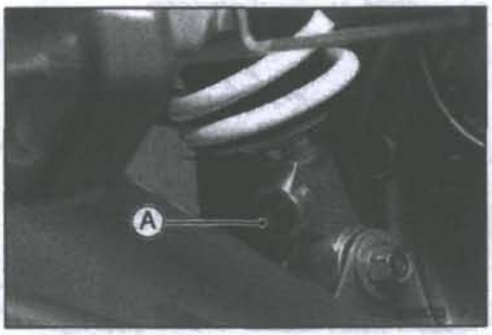
Shock Absorbers

To suit to various riding conditions, the spring preload of the shock absorber can be adjusted or the spring can be replaced with an optional one. Also the damping force can be adjusted easily so changing oil viscosity unnecessary.

Front Shock Absorber Rebound Damping Adjustment

- Turn the rebound damping adjuster [A] on the front shock absorber lower end with the blade of a screwdriver until you feel a click.

★If the damper setting feels too soft or too stiff, adjust it in accordance with the following table:

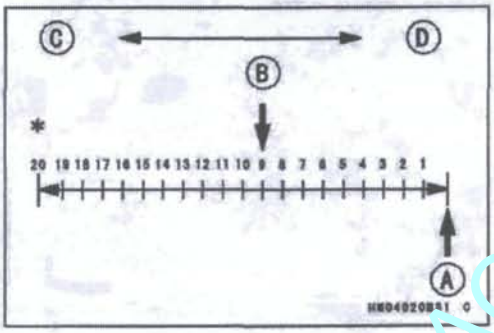


Seated position: adjuster turned fully clockwise [A].

Rebound Damping Adjuster Setting

Standard:	**9 clicks [B]**
	Softer (Counterclockwise) [C]
	Harder (Clockwise) [D]

*: Number of turns counterclockwise usable range - 20 or more.
Counterclockwise from the fully seated position.



⚠ WARNING

If both adjuster are not adjusted equally, handling may be impaired and a hazardous condition may result.

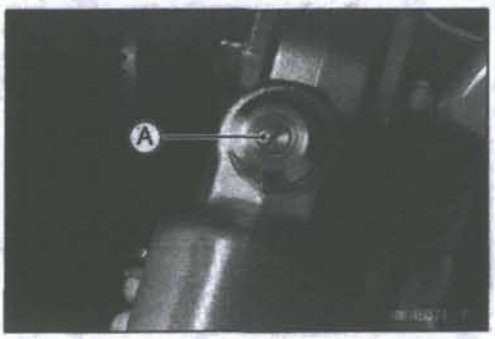
NOTE

○*Adjustment of the rebound damping adjuster for the rear suspension will slightly affect the compression damping force. Always make any damping adjustments in small steps and test their effects before using them in competition.*

Front Shock Absorber Compression Damping Adjustment

- Adjust the compression damping, turn the compression damping adjuster [A] with a flat-head screwdriver.

★If the damping feels too soft or too stiff, adjust it in accordance with the following table.

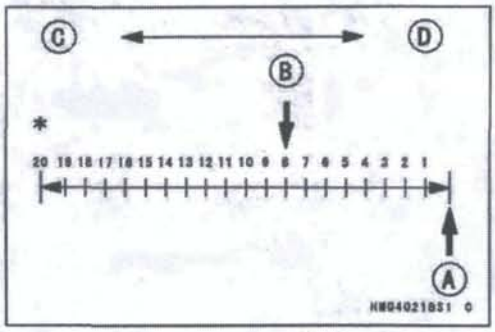


Shock Absorbers

Seated position: adjuster turned fully clockwise [A]

Compression Damping Adjuster Setting
Standard: 8 clicks [B]
Softer (counterclockwise) [C]
Harder (clockwise) [D]

* : Number of turns counterclockwise usable range - 20 clicks or more.
Counterclockwise from the fully seated position.



⚠ WARNING

If both adjuster are not adjusted equally, handling may be impaired and a hazardous condition may result.

NOTE

Adjustment of the rebound damping adjuster for the front suspension will slightly affect the compression damping force. Always make any damping adjustments in small steps and test their effects before using them in competition.

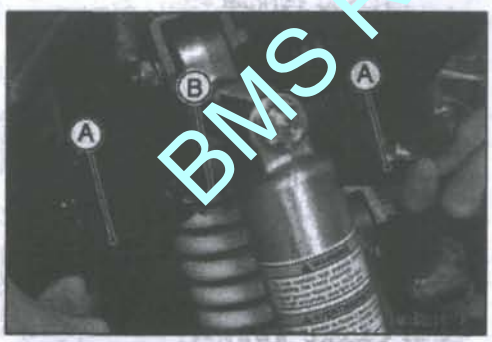
Front Shock Absorber Spring Preload Adjustment

- Using the jack under the frame, raise the front wheels off the ground.

Special Tool - Jack: 57001-1238

- Using the hook wrenches [A], loosen the locknut [B] on the front shock absorber.

Special Tool - Hook Wrench R35: 57001-1580



- Turn the spring [A] with a hand. Turning the adjusting nut downward marks the spring action harder and upward softer.

Shock Absorbers

Spring Preload Adjustment
(Adjusting nut position at the lower surface [A] from the center of the mounting hole)

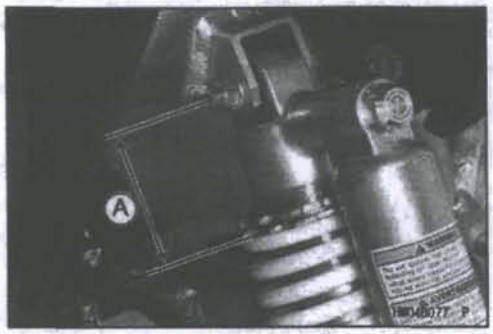
Standard: **71.5 mm (2.81 in.)**

Adjustable Range **61.5 ~ 81.5 mm (2.42 ~ 3.21 in.)**

- Tighten the locknut securely.

Special Tool - Hook Wrench R35: 57001-1580

- After adjusting, move the spring up and down to make sure that the spring is seated.

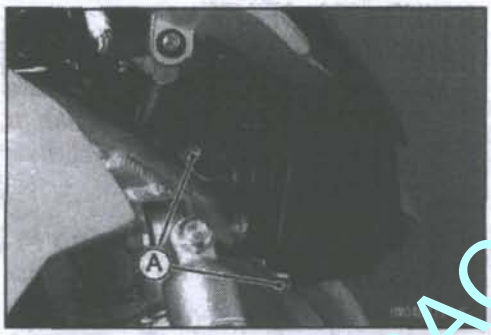


⚠ WARNING

If both setting are not adjusted equally, handling may be impaired and a hazardous condition may result.

Front Shock Absorber Removal

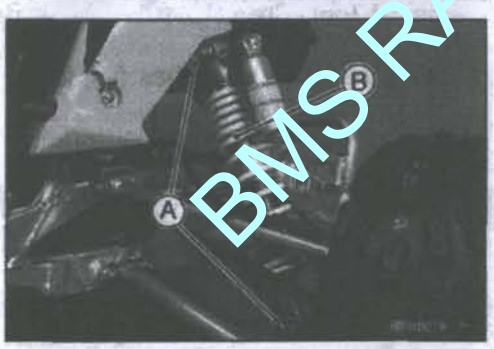
- Remove the headlight mounting bolts [A].



- Support the vehicle on a jack so that the front wheels are off the ground.

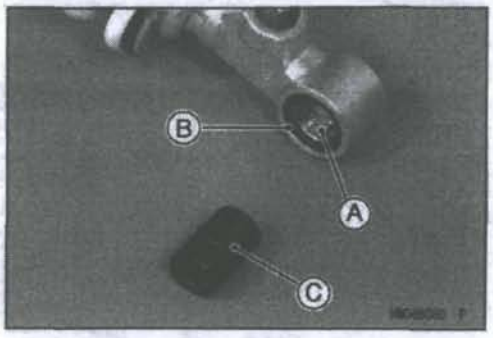
Special Tool - Jack: 57001-1238

- While holding the front wheels, remove the lower and upper shock absorber mounting bolts [A] and nuts.
- Remove the front shock absorber [B].



Front Shock Absorber Installation

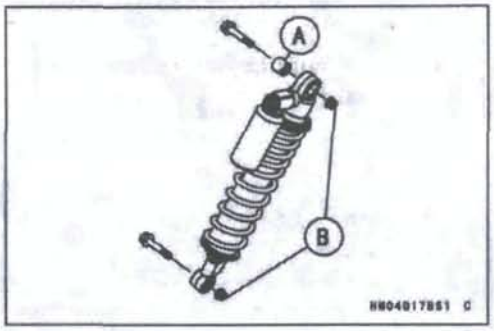
- Apply grease to the inside of lower bushing [A] and grease seal lips [B].
- Install:
  Collar [C]



Shock Absorbers

- Install:
  Rubber Bushing [A] (press)
- Tighten:

Torque - Front Shock Absorber Mounting Nuts [B]: 36.5 N·m (3.7 kgf·m, 27 ft·lb)



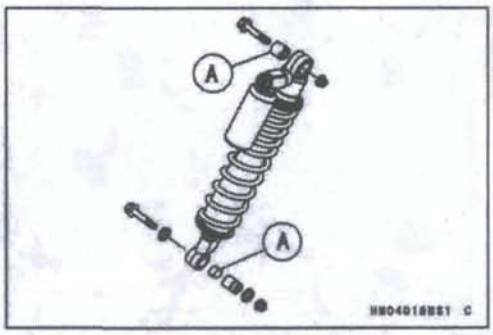
Front Shock Absorber Inspection

- Check the bushings [A] in the upper and lower pivots.

★If bushings are worn, cracked, hardened, or otherwise damaged, replace them.

- External check the front shock absorber.

★If one unit is damaged, replaced both shock absorber as a set. If only one unit is replaced and the two are not balanced, vehicle instability at high speed may result.

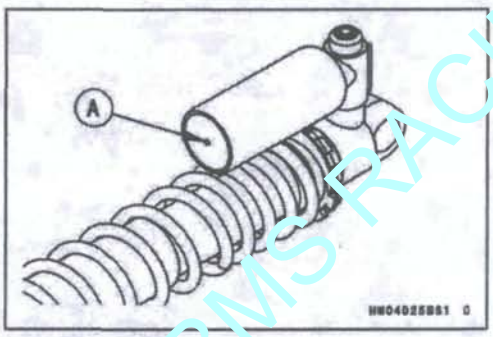


Front Shock Absorber Scrapping

⚠ WARNING

Since the reservoir tank of the front shock absorber contains nitrogen gas, do not incinerate the reservoir tank without first releasing the gas or it may explode.

- Remove the front shock absorber. (see Front Shock Absorber Removal).
- Drill the hole [A] of the reservoir tank using about 2 mm (0.08 in.) drillbit.



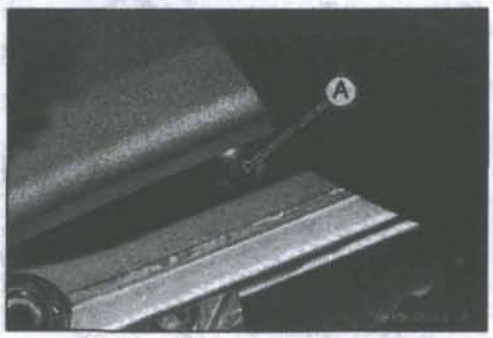
⚠ WARNING

Wear safety glasses when drilling the hole, as the high pressure gas may blow out bits or drilled metal when the hole opens.

Rear Shock Absorber Rebound Damping Adjustment

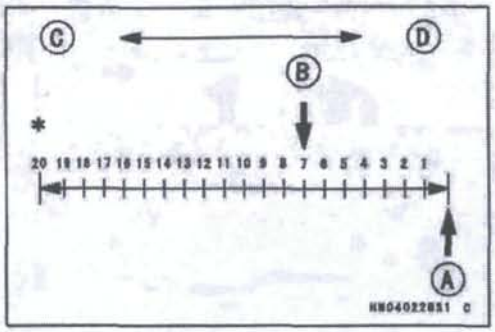
- Turn the rebound damping adjuster [A] on the rear shock absorber lower end with the blade of a screwdriver until you feel a click.

★If the damper setting feels too soft or too stiff, adjust it in accordance with the following table:



Shock Absorbers

Seated position: adjuster turned fully clockwise [A].



Rebound Damping Adjuster Setting

Standard: **7 clicks [B]**

Softer (Counterclockwise) [C]

Harder (Clockwise) [D]

*: Number of turns counterclockwise usable range - 20 or more.
Counterclockwise from the fully seated position.

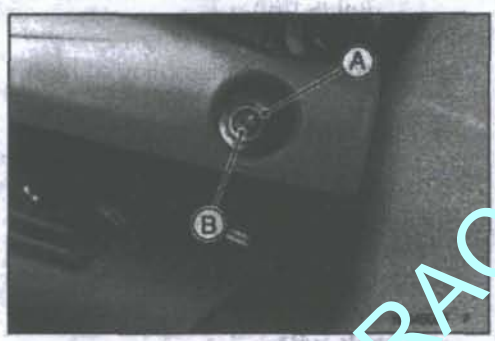
NOTE

○*Adjustment of the rebound damping adjuster for the rear suspension will slightly affect the compression damping force. Always make any damping adjustments in small steps and test their effects before using them in competition.*

Rear Shock Absorber Compression Damping Adjustment

There are two adjustments you can make to the rear shock absorber gas reservoir.

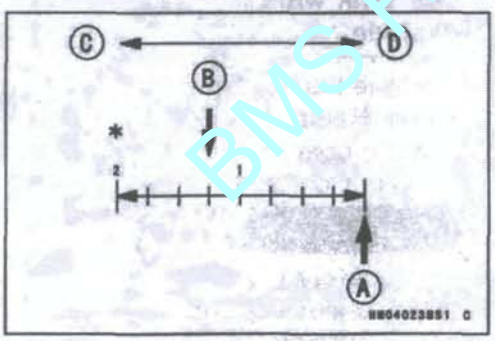
High Speed Compression Damping Adjuster [A]
Low Speed Compression Damping Adjuster [B]



● Adjust the high speed compression damping, turn the high speed compression damping adjuster with a 17 mm wrench.

★ If the damping feels too soft or too stiff, adjust it in accordance with the following table.

Seated position: adjuster turned fully clockwise [A].



High Speed Compression Damping Adjuster Setting

Standard: **1 1/4 turns out [B]**

Softer (counterclockwise) [C]

Harder (clockwise) [D]

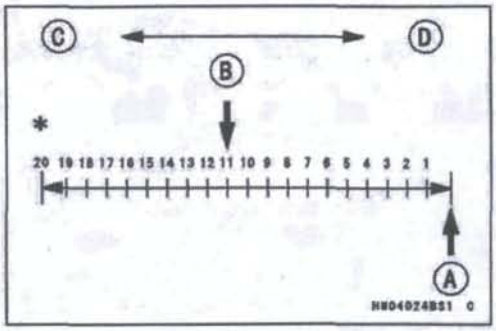
* : Number of turns counterclockwise usable range - 2 or more.
Counterclockwise from the fully seated position.

Shock Absorbers

- Adjust the low speed compression damping, turn the low speed compression damping adjuster with a flat-head screwdriver.

★If the damping feels too soft or too stiff, adjust it in accordance with the following table.

Seated position: adjuster turned fully clockwise [A].



Low Speed Compression Damping Adjuster Setting

Standard: 11 clicks [B]

Softer (counterclockwise) [C]

Harder (clockwise) [D]

* : Number of turns counterclockwise usable range - 20 clicks or more.
Counterclockwise from the fully seated position.

NOTE

○*Adjustment of the rebound damping adjuster for the rear suspension will slightly affect the compression damping force. Always make any damping adjustments in small steps and test their effects before using them in competition.*

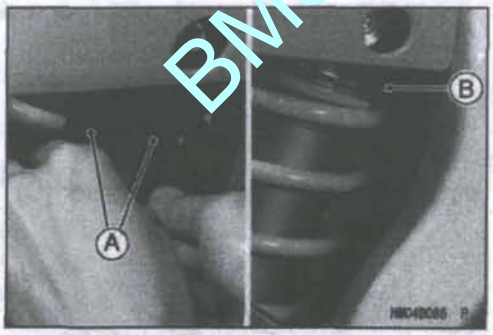
Spring Preload Adjustment

- Remove:
Exhaust Pipe (see Muffler Removal in the Engine Top End chapter)
- Using the jack under the frame, raise the rear wheels off the ground.

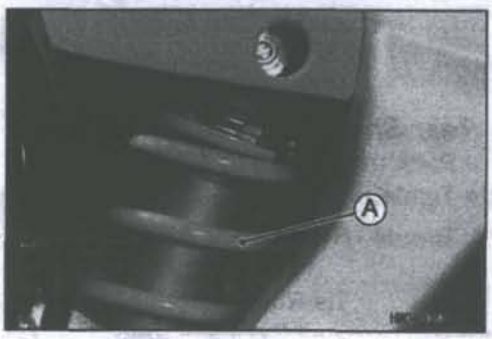
Special Tool - Jack: 57001-1238

- Using the hook wrenches [A], loosen the locknut [B] on the rear shock absorber.

Special Tool - Hook Wrench R37.5, R42: 57001-1101



- Turn the spring [A] as required with a hand. Turning the adjusting nut downward marks the spring action harder and upward softer.

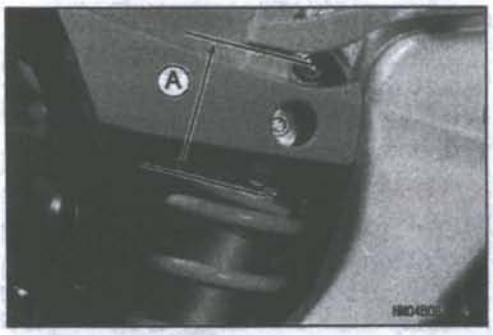


Shock Absorbers

Spring Preload Adjustment
(Adjusting nut position at the lower surface [A] from the center of the mounting hole)

Standard:	**79.5 mm (3.13 in.)**
Adjustable Range	**71.5 ~ 91.5 mm (2.81 ~ 3.60 in.)**

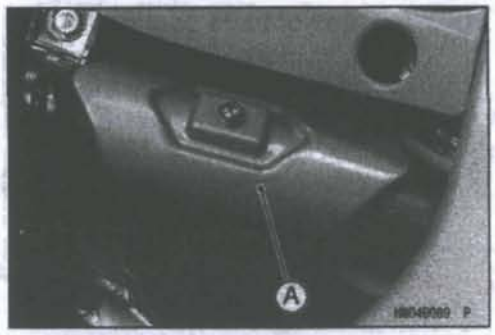
- Tighten the locknut securely.
- After adjusting, move the spring up and down to make sure that the spring is seated.
- Install the exhaust pipe (see Muffler Installation in the Engine Top End chapter).



Rear Shock Absorber Removal

- Remove:
  Seat (see Seat Removal in the Frame chapter)
  Exhaust Pipe Cover [A]
- Using the jack under the frame, raise the rear wheels off the ground.

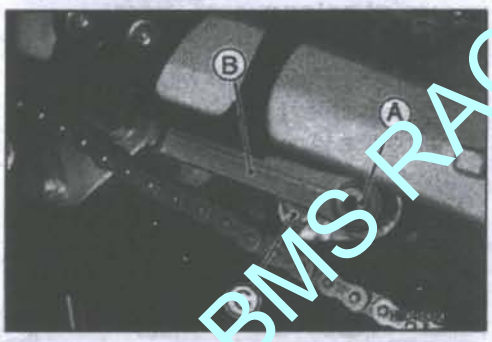
Special Tool - Jack: 57001-1238



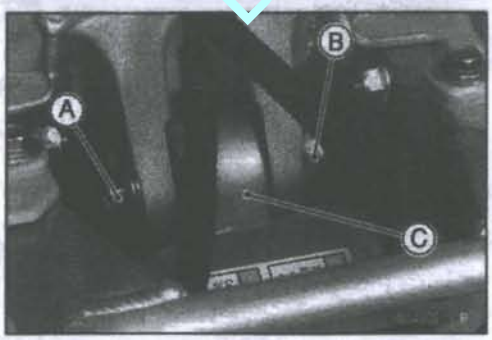
CAUTION

When pulling out the mounting bolts, lift the rear wheel slightly. Forcing or tapping on a bolt could damage the bolt, sleeve, and bearing

- Remove the rear tie-rod mounting bolt and nut [A], and turn the tie-rod [B] downward.
- Remove the rear shock absorber lower mounting bolt [C] and nut.



- Remove the rear shock absorber upper mounting bolt [A] and nut [B].
- pull out the rear shock absorber [C] down and out.



Rear Shock Absorber Installation

- Pack the grease to the oil seal lips.
- Tighten:

Torque - Rear Shock Absorber Mounting Nuts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)
Tie-Rod Mounting Nut: 46.5 N·m (4.7 kgf·m, 34 ft·lb)

Shock Absorbers

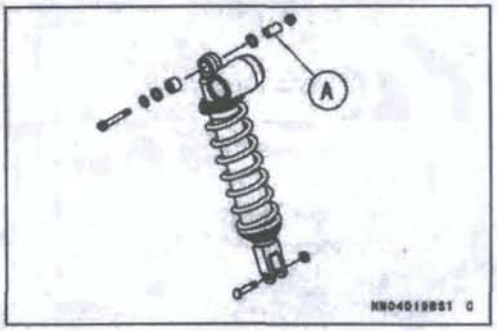
Rear Shock Absorber Inspection

- Check the sleeve [A] in the upper pivot.

★If bushing is worn, cracked, hardened, or otherwise damaged, replace it.

- External check the rear shock absorber.

★If it is damaged, replace it.

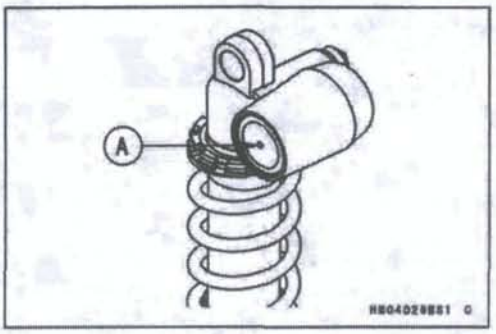


Rear Shock Absorber Scrapping

⚠ 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 rear shock absorber. (see Rear Shock Absorber Removal).
- Drill the hole [A] of the reservoir tank using about 2 mm (0.08 in.) drillbit.



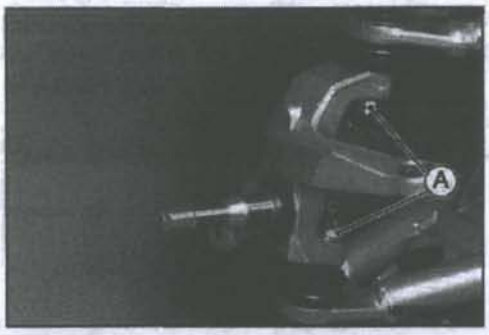
⚠ WARNING

Wear safety glasses when drilling the hole, as the high pressure gas may blow out bits or drilled metal when the hole opens.

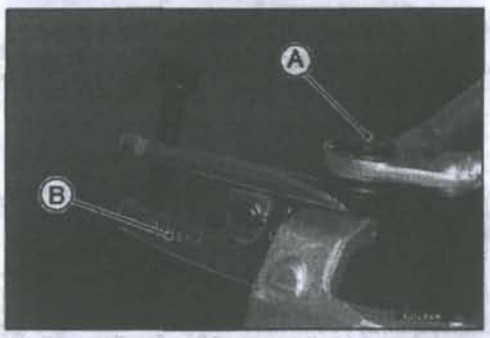
Suspension Arms

Suspension Arm Removal

- Remove:
  Front Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Front Hub (see Front Hub Removal in the Wheels/Tires chapter)
  Tie-rod (see Tie-rod Removal in the Steering chapter)
  Front Shock Absorber (see Front Shock Absorber Removal)
  Cotter Pin, Knuckle Joint Nut [A] and Washer

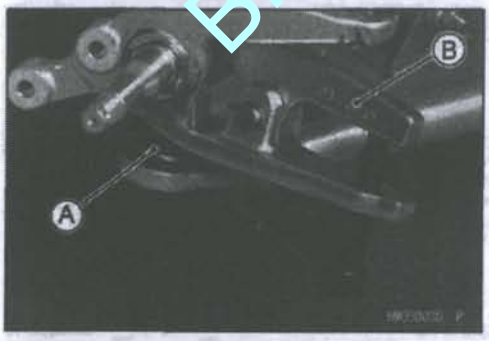


- Remove the knuckle joint [A] from the upper suspension arm using a suitable joint remover [B].

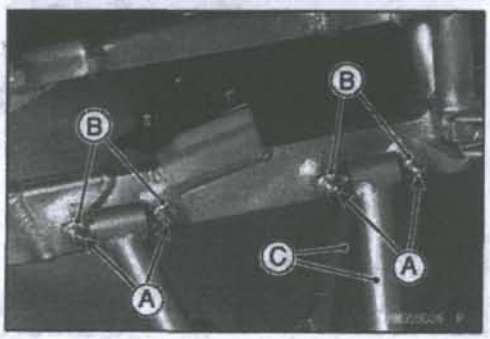


- Remove:
  Bolts [A]
  Brake Hose Clamp [B]
  Upper Suspension Arm Pivot Bolts [C] and Nuts
  Upper Suspension Arm [D]

- Remove the knuckle joint [A] from the lower suspension arm using a suitable joint remover [B].

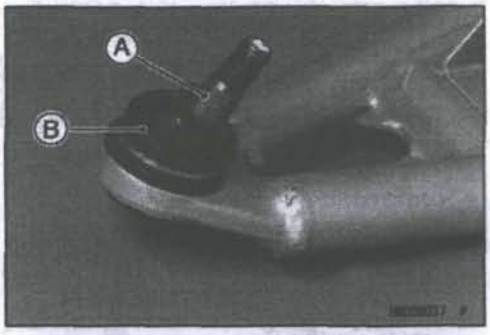


- Remove:
  Cotter Pins [A]
  Suspension Arm Pivot Bolts and Nuts [B]
  Plates
  Lower Suspension Arms [C]



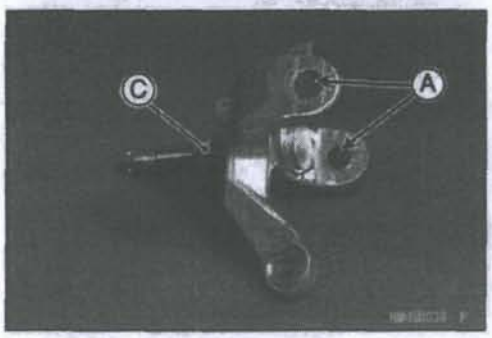
Suspension Arms

Suspension Arm Installation



- Clean the taper surface [A] of the both knuckle joints [B] and steering knuckle [C] with an oil-less cleaning fluid.
- Install:
  Upper Suspension Arm
  Lower Suspension Arm
  Plates
  Suspension Arm Pivot Bolts and Nut (temporary)
  Knuckle Joints, Washers and Nuts
  Front Shock Absorber
- Tighten:

Torque - Suspension Arm Pivot Nuts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)
Knuckle Joint Nuts: 29 N·m (3.0 kgf·m, 21 ft·lb)
Front Shock Absorber Mounting Nuts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)



- Replace the cotter pins with new ones.
- Insert the cotter pins to the knuckle joint.
- Bent the cotter pins

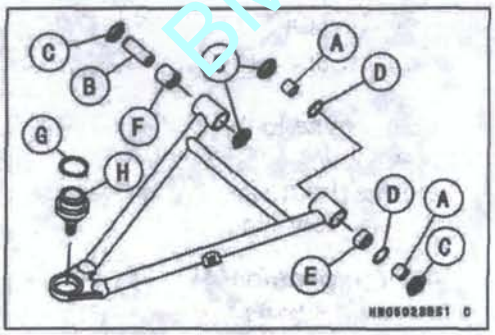
- Install:
  Front Hub (see Front Hub Installation in the wheels/Tires chapter)
  Front Caliper (see Front caliper Installation in the Brakes chapter)
- Install the brake hoses to the upper suspension arms.
- Install:
  Front Wheels (see Wheel Installation in the Wheels/Tires chapter)

Suspension Arm Disassembly

Upper Suspension Arm

- Remove:
  Collars [A] (rear side)
  Sleeve [B] (front side)
  Oil Seals [C]
  Circlips [D]

Special Tool - Inside Circlip Pliers: 57001-143



- Remove:
  Ball Joint Bearing [E] (rear side)
  Needle Bearing [F] (front side)

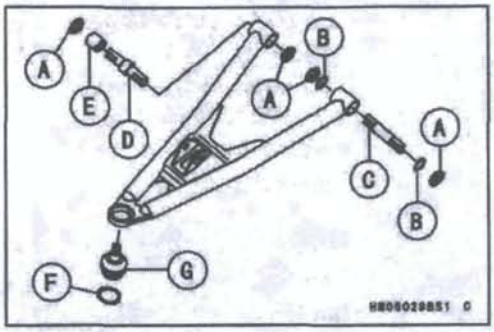
Special tool - Bearing Driver Set: 57001-1129

- Remove:
  Circlip [G]
  Knuckle Joint [H]

Special tool - Outside Circlip Pliers: 57001-144

Suspension Arms

Lower Suspension Arm



- Remove:
  Oil Seals [A]
  Circlips [B] (rear side)

Special Tool - Inside Circlip Pliers: 57001-143

- Remove:
  Ball Joint Bearing [C] (rear side)
  Sleeve [D] (front side)
  Needle Bearing [E] (front side)

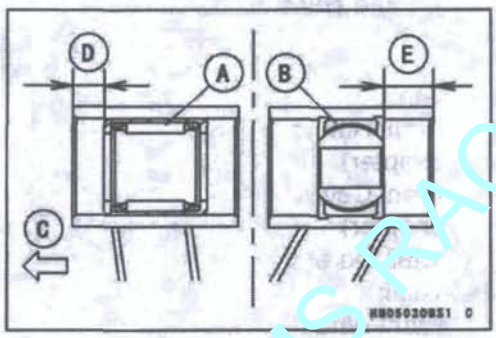
Special Tool - Bearing Driver Set: 57001-1129

- Remove:
  Circlip [F]
  Knuckle Joint [G]

Suspension Arm Assembly

- Apply grease:
  Ball Joint Bearing (upper)
  Needle Bearings

Upper Suspension Arm



- Press the needle bearing [A] and ball joint bearing [B] position as shown.
  [C] Front
  [D] 7.5 ±0.1 mm (0.30 ±0.004 in.)
  [E] 12 mm (0.47 in.)

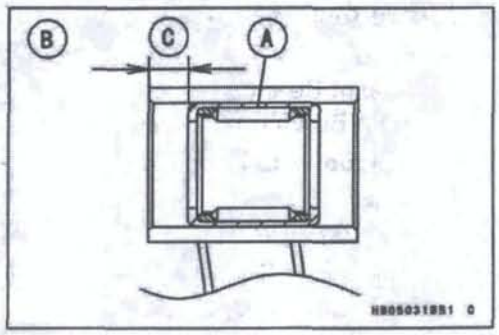
Special Tool - Bearing Driver Set: 57001-1129

- Install:
  New Circlips (rear side)

Special Tool - Inside Circlip Pliers: 57001-143

- Apply grease to the oil seal lips, and install them.
- Install:
  Sleeve (front side)
  Collars (rear side)

Lower Suspension Arm



- Press the needle bearing [A] position as shown.
  [B] Front Side
  [C] 7.5 ±0.1 mm (0.30 ±0.004 in.)

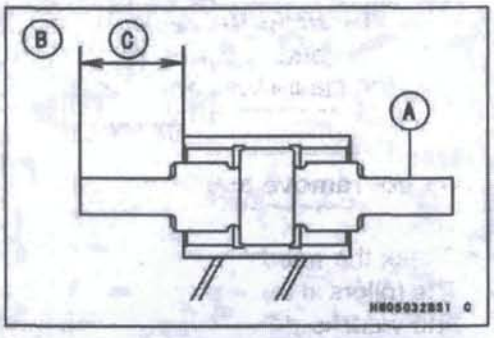
Special Tool - Bearing Driver Set: 57001–1129

Suspension Arms

- Press the ball joint bearing [A] position as shown.
  [B] Rear Side
  [C] 25 ±0.25 mm (0.98 ±0.098 in.)
- Install:
  Circplips (rear side)

Special Tool - Inside Circlip Pliers: 57001-143

- Apply grease oil seal lips, and install them.
- Install:
  Sleeve (front side)



Knuckle Joint Inspection

- Inspect each spherical bearing [A].

★If roughness, excessive play, or seizure is found, replace the knuckle joint.

- Inspect each boot [B].

★If damage, wear or deterioration is found, replace the knuckle joint.

Suspension Arms

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.

- Check the needle bearings.

○The rollers in the needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.

★If the bearing is damaged, replace the bearing.

Oil Seal Inspection

- Inspect the oil seals.

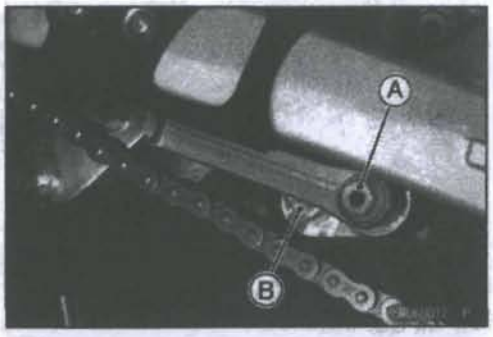
★Replace any if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened, or been otherwise damaged.

Swingarm

Swingarm Removal

- Remove
  Rear Axle (see Rear Axle Removal in the Wheels/Tires chapter)

- Unscrew the rear tie-rod mounting nut and pull out the mounting bolt [A].

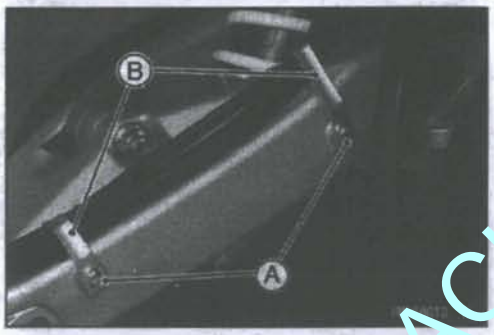


CAUTION

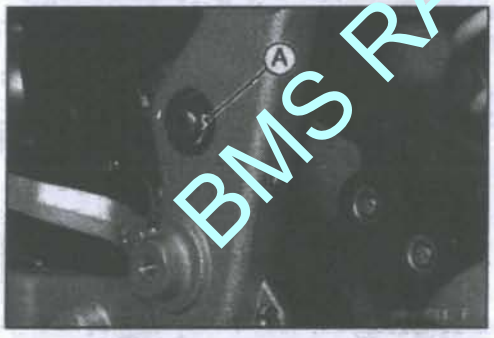
When pulling out the mounting bolts, lift the swingarm wheel slightly. Forcing or tapping on a bolt could damage the bolt, sleeve, and bearing.

- Remove:
  Lower Rear Shock Absorber Mounting Bolts [B] and Nut

- Remove:
  Bolts [A]
  Brake Hose Clamps [B]

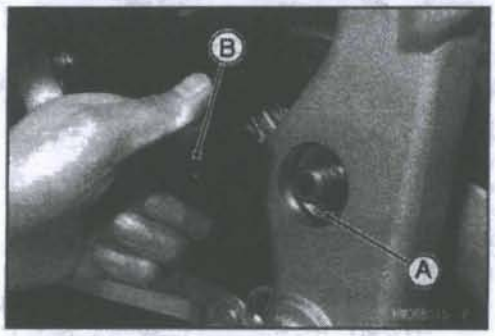


- Remove:
  Swingarm Pivot Shaft Nut [A]
  Washer



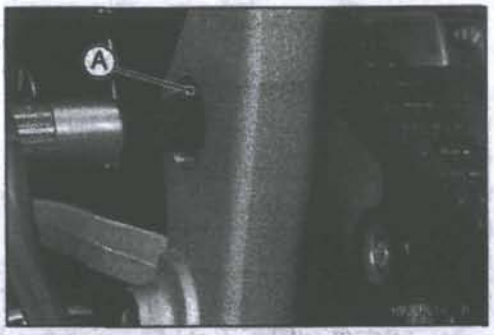
- Remove:
  Swingarm Adjusting Locknut [A]

Special Tool - Swingarm Pivot Nut Wrench [B]: 57001 -1686

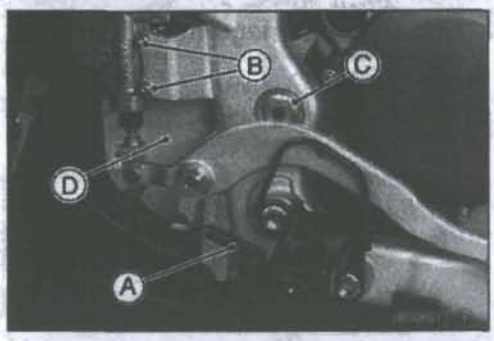


Swingarm

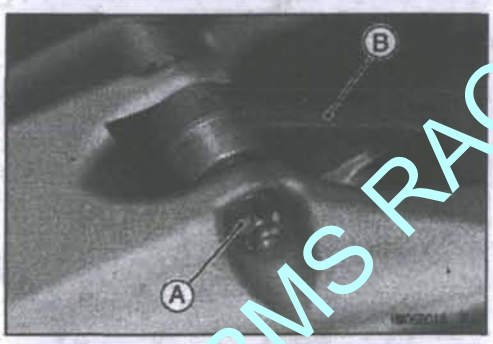
- Remove:
  Swingarm Adjusting Bolt [A]



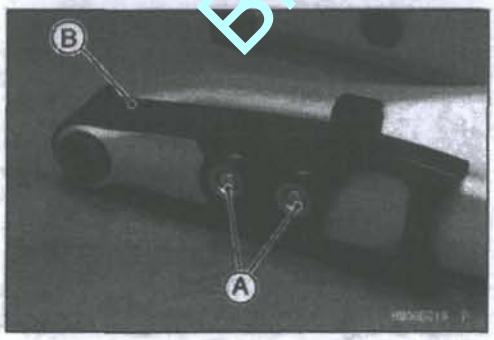
- Remove:
  Brake Pedal Return Spring [A]
  Rear Master Cylinder Mounting Bolts [B]
- Pull out the swingarm pivot shaft [C].
- Remove the swingarm [D] together with the rocker arm.



- Remove:
  Bolts and Nut [A]
  Rocker Arm [B]



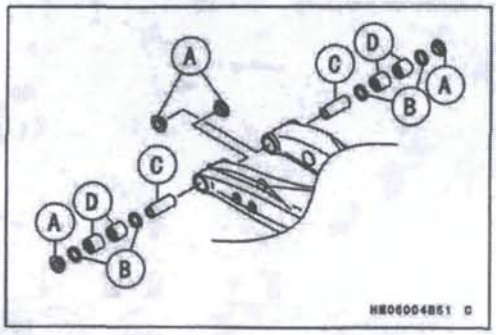
- Unscrew the screws [A]
- Separate the chain slipper [B] from the swingarm.
- Remove:
  Rear Bottom Guard (see Rear Bottom Guard Removal in the Frame chapter)



Swingarm Bearing Removal

- Remove:
  Swingarm (see Swingarm Removal)
  Collars [A]
  Grease Seals [B]
  Sleeves [C]
- Remove the needle bearings [D] using the oil seal & bearing remover.

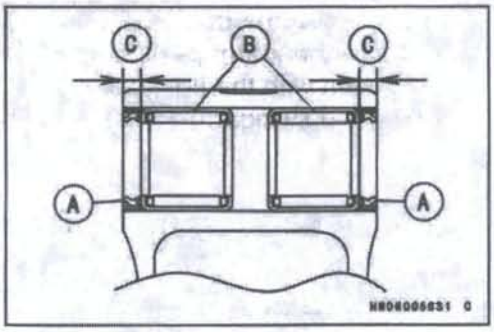
Special Tool - Oil Seal & Bearing Remover: 57001-1058



Swingarm

Swingarm Bearing Installation

- Replace the needle bearings and grease seals with new ones.
- Apply plenty of grease to the sleeves, grease seals [A], and needle bearings [B].



NOTE

○Install the needle bearings so that the manufacturer's marks face out.

○Install the grease seals so that the deep groove side of the rip in-ward.

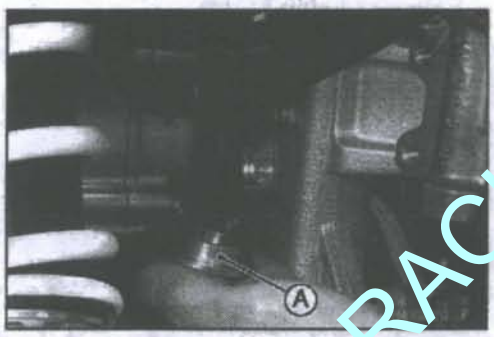
Special Tool - Bearing Driver Set: 57001-1129

- Install the needle bearings position as shown.
  [C]: 5mm (0.2 in.)

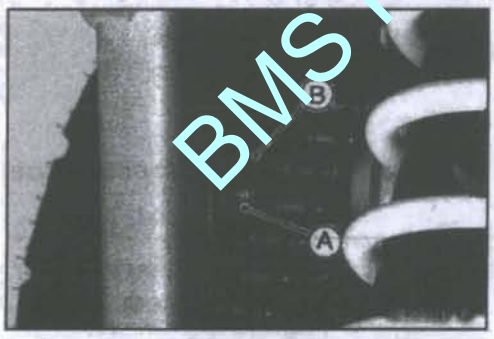
○The installation procedure is the same as the counter side.

Swingarm Installation

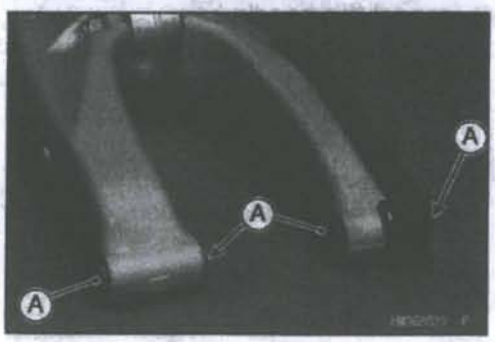
- Apply plenty of grease to the inside of the needle bearings, sleeve, and grease seals.
- Install the collar [A] to the frame.



- Screw the swingarm adjusting bolt [A] until the surface is flush with the frame surface [B].

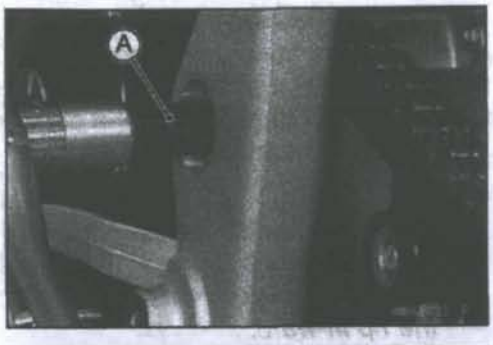


- Install the collars [A] to the swingarm.



Swingarm

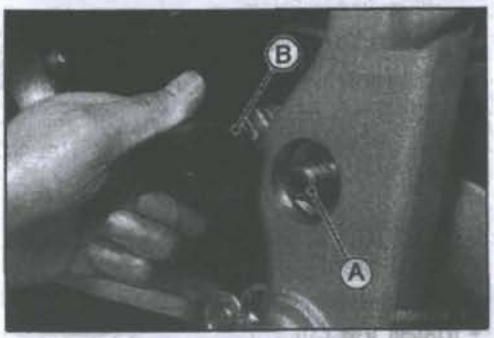
- Install the swingarm.
- Insert the swingarm pivot shaft so that the adjusting bolt can tighten with the hexagon wrench [A].
- Tighten the swingarm adjusting bolt fully.



- Push the swingarm pivot shaft [A] fully.
- Apply a non-parmanent locking agent to the swingarm adjusting locknut.
- Tighten:

Torque - Swingarm Adjusting Locknut : 31.5 N·m (3.2 kgf·m, 23 ft·lb)

Special Tool - Swingarm Pivot Nut Wrench [B]: 57001 -1686



- Install:
  Washer
  Swingarm Pivot Shaft Nut [A]
- Tighten:

Torque - Swingarm Pivot Shaft Nut : 90.5 N·m (9.2 kgf·m, 67 ft·lb)

- Install the removed parts.

Swingarm Bearing, Sleeve Inspection

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

- Inspect the needle bearings installed in the swingarm.

OThe rollers in a bearing normally wear very little, and wear is difficult to measure. Instead of measuring, visually inspect the bearing for abrasion, discoloration, or other damage.

★If the needle bearing, and sleeve show any sings of abnormal wear, discoloration, or damage, replace them as a set.

Tie-Rod, Rocker Arm

Tie-Rod Removal

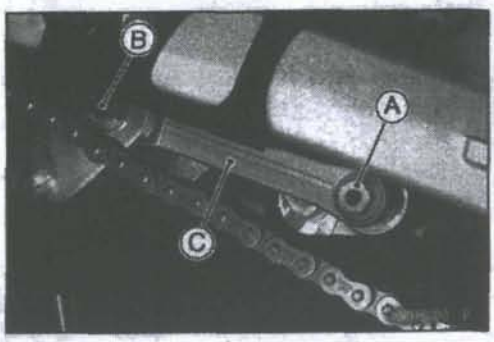
- Using the jack under the frame, raise the rear wheels off the ground.

Special Tool - Jack: 57001-1238

CAUTION

When pulling out the mounting bolts, lift the rear wheels slightly. Forcing or tapping on a bolt could damage the bolt, sleeve, and bearing.

- Remove the rear tie-rod mounting bolt [A] and nut.
- Remove the tie-rod adjusting locknut.
- Loosen the tie-rod adjusting nut and bolt, if necessary.
- Pull out the front tie-rod mounting bolt [B].
- Take out the tie-rod [C].



Tie-Rod Installation

- Apply plenty of grease to the inside of the grease seals.
- Tighten:

Torque - Tie-Rod Adjusting Nut: 61.5 N·m (6.3 kgf·m, 45 ft·lb)
Tie-Rod Adjusting Locknut: 46.5 N·m (4.7 kgf·m, 34 ft·lb)
Tie-Rod Mounting Nut: 71.5 N·m (7.3 kgf·m, 53 ft·lb)

Rocker Arm Removal

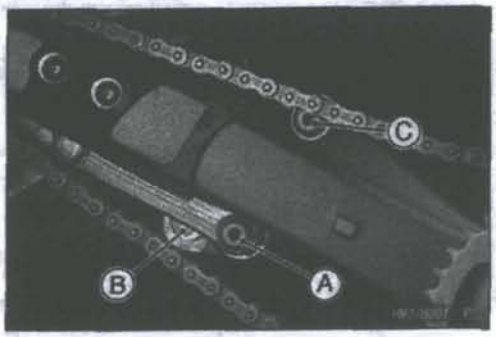
- Using the jack under the frame, raise the rear wheels off the ground.

Special Tool - Jack: 57001-1238

CAUTION

When pulling out the mounting bolts, lift the rear wheels slightly. Forcing or tapping on bolt could damage the bolt, sleeve, and bearing.

- Remove the rear tie-rod mounting bolt [A] and nut.
- Remove the rear shock absorber lower mounting bolt [B] and nut.
- Remove the rocker arm pivot bolt [C] and nut.
- Remove the rocker arm.



Tie-Rod, Rocker Arm

Rocker Arm Installation

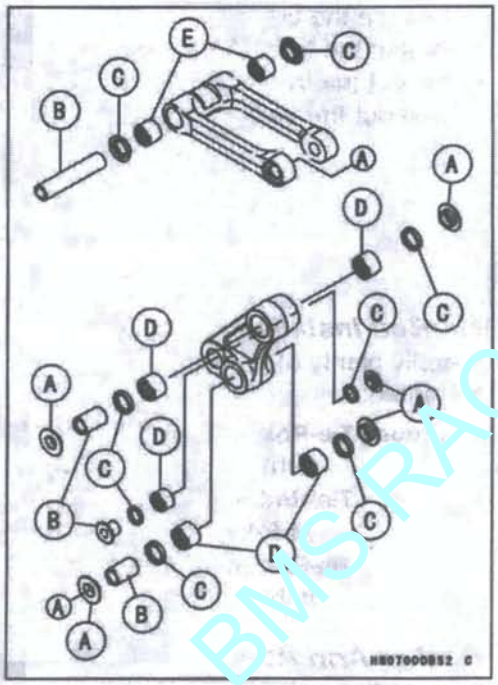
- Apply plenty of grease to the inside of the rocker arm, needle bearings, oil seals and grease seals outside of the sleeve.
- Tighten:

Torque - Rear Shock Absorber Mounting Nut (Lower): 36.5 N·m (3.7 kgf·m, 27 ft·lb)
Rocker Arm Pivot Nut: 71.5 N·m (7.3 kgf·m, 53 ft·lb)
Tie-Rod Mounting Nuts: 71.5 N·m (7.3 kgf·m, 53 ft·lb)

Tie-Rod and Rocker Arm Bearing Removal

- Remove:
  Tie-Rod (see Tie-Rod Removal)
  Rocker Arm (see Rocker Arm Removal)
  Collars [A]
  Sleeves [B]
  Grease Seals [C]
- Remove the needle bearings [D], using the bearing remover head and bearing remover shaft.
- Remove the needle bearing [E], using the oil seal & bearing remover.

Special Tools - Bearing Remover Head, ϕ20 × ϕ22: 57001-1293
Bearing Remover Shaft: 57001-1265
Oil Seal & Bearing Remover: 57001-1058



Tie-Rod, Rocker Arm

Tie-Rod and Rocker Arm Bearing Installation

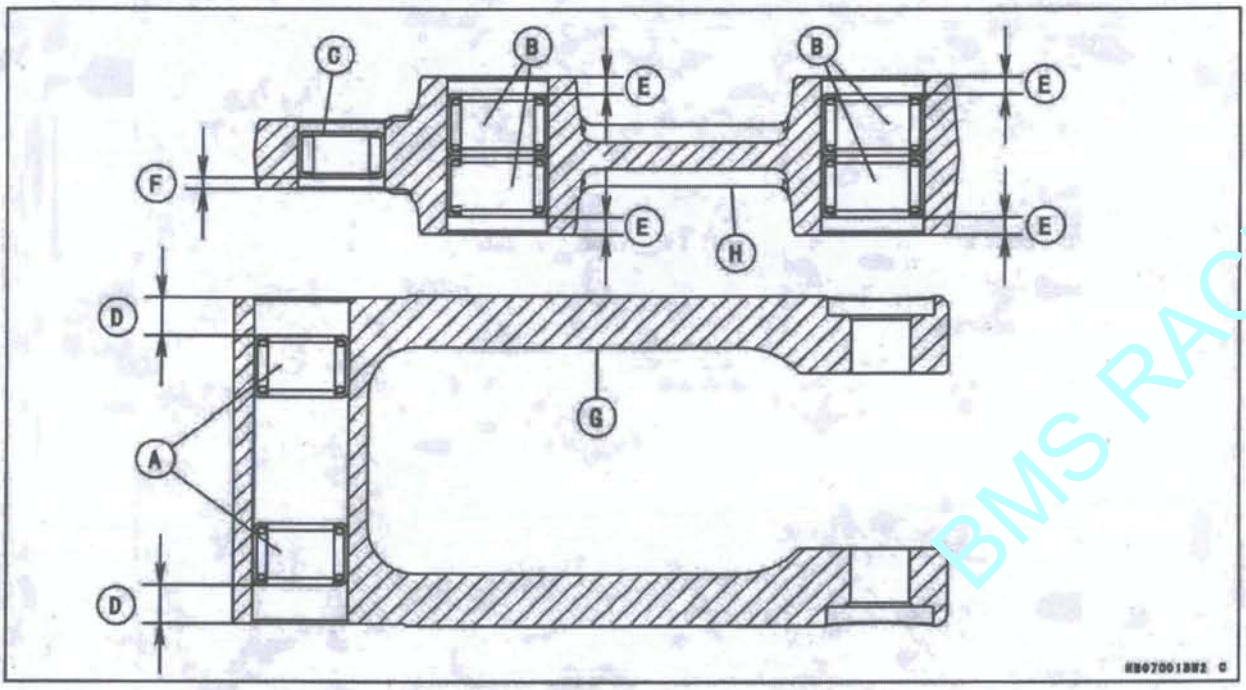
- Replace the needle bearing and grease seals with new ones.
- Apply plenty of grease to the grease seal and needle bearings [A], [B], [C].

NOTE

○*Install the grease seals so that the deep groove side of the rip out-ward.*

- Install the needle bearings position as shown.

9.0 mm (0.35 in.) [D]
4.5 mm (0.18 in.) [E]
3 mm (0.12 in.) [F]
Tie-rod [G]
Rocker Arm [H]

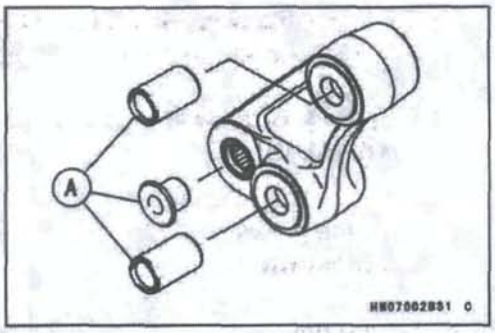


Needle Bearing Inspection

★If there is any doubt as to the condition of either needle bearing, replace the bearing and sleeve as a set.

Tie-Rod, Rocker Arm

Tie-Rod and Rocker Arm Sleeve Wear



- Pull out the sleeves [A] of the tie-rod and rocker arm.
- Measure the outside diameter of the sleeve.

★If the sleeve is worn past the service limit, replace the sleeve.

Sleeve Outside Diameter

Standard:

Tie-rod **17.966 ~ 17.984 mm (0.70732 ~ 0.70803 in.)**

Rocker Arm:

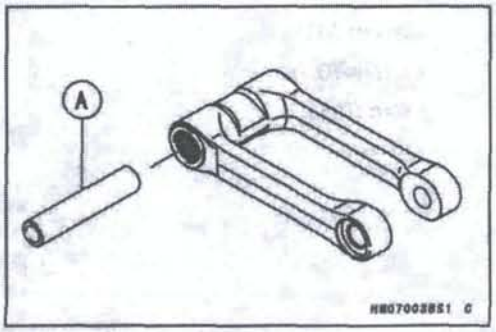
19.987 ~ 20.000 mm (0.78689 ~ 0.78740 in.)

Service Limit:

Tie-rod **17.94 mm (0.7063 in.)**

Rocker Arm:

19.96 mm (0.7858 in.)

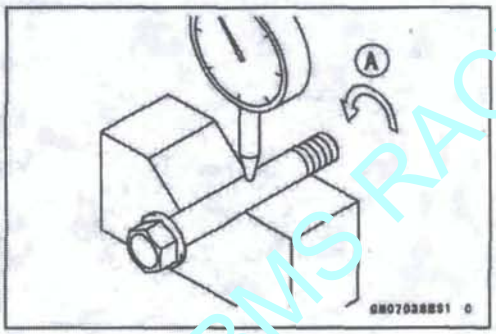


Tie-Rod and Rocker Arm Mounting Bolt Bend

A bent bolt causes vibration, poor handling, and instability.

- To measure the bolt runout, remove the bolt, place it in V blocks, and set a dial gauge to the bolt at a point halfway between the blocks. Turn [A] the bolt to measure the runout. The amount of dial variation is the amount of runout.

★If runout exceeds the service limit, replace the bolt.



Bolt Runout

Standard: **0.1 mm (0.004 in.) or less**

Service Limit: **0.2 mm (0.008 in.)**

Steering

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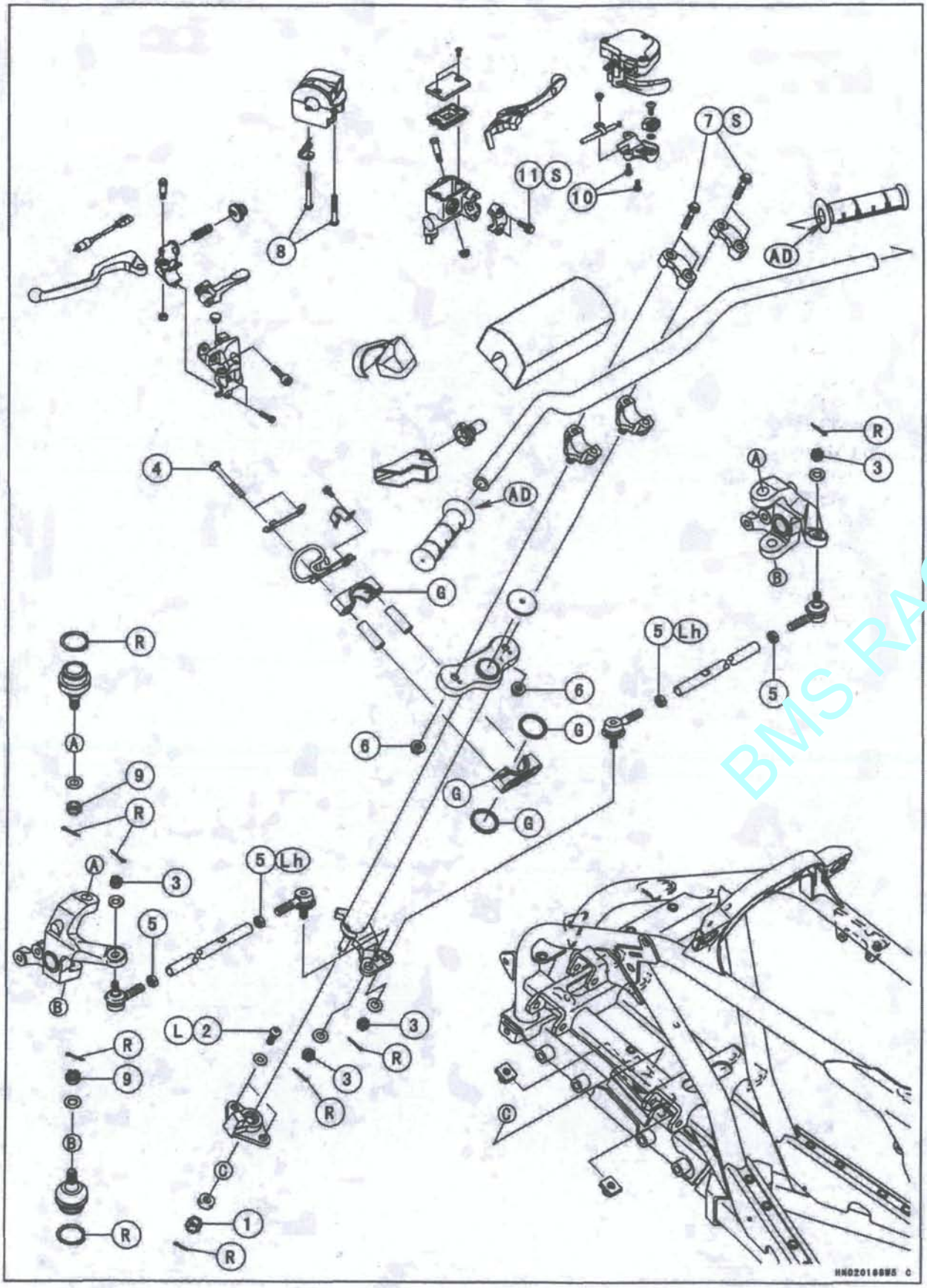
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Steering Stem Bottom End Nut	36.5	3.7	27	
2	Steering Stem Bearing Joint Bolts	22	2.2	16	L
3	Tie-rod End Nuts	36.5	3.7	27	
4	Steering Stem Clamp Bolts	24.5	2.5	18	
5	Tie-rod Locknuts	22	2.2	16	Lh (2)
6	Handlebar Holder Mounting Nuts	36.5	3.7	27	
7	Handlebar Clamp Bolts	29	3.0	21	S
8	Left Handlebar Switch Housing Screws	3.5	0.36	31 in·lb	
9	Knuckle Joint Nuts	29	3.0	21	
10	Throttle Lever Assy Mounting Bolts	3.8	0.39	34 in·lb	
11	Front Master Cylinder Clamp Bolts	8.8	0.90	78 in·lb	S

AD: Apply adhesive agent (Three Bond 1747).
G: Apply grease.
L: Apply a non-permanent locking agent.
Lh: Left-hand Threads
R: Replacement Parts
S: Follow the specific tightening sequence.

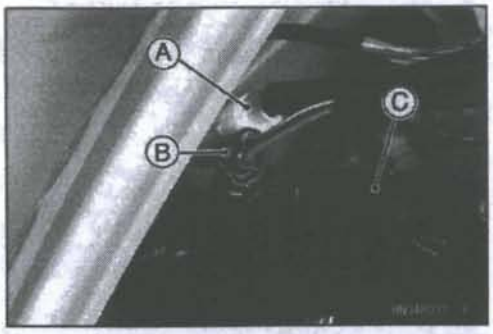
Specifications

Item	Standard	Service Limit
Tie-rods		
Tie-rod Length	402 mm (15.8 in.)	– – –

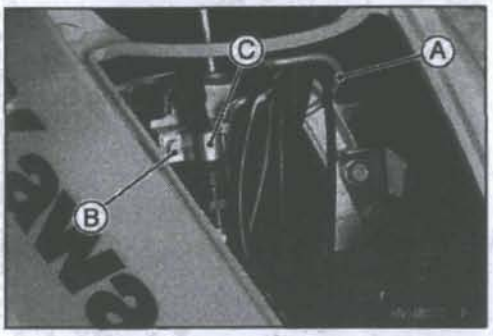
Steering

Steering Stem Removal

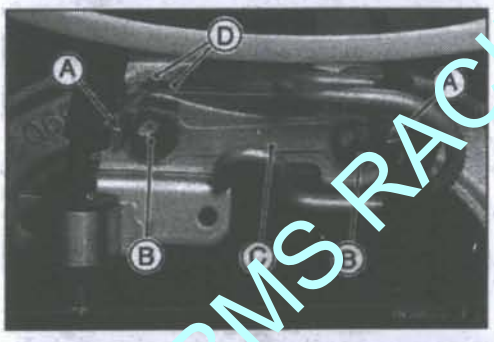
- Remove:
  Handlebar (see Handlebar Removal)
- Disconnect:
  Brake Light Switch Lead Connector [A]
  Starter Lockout Switch Lead Connector [B]
  Left Handlebar Switch Housing Lead Connector [C]



- Clear the following parts from the clamp [A].
  Clutch Cable
  Parking Brake Cable
  Disconnected Connector Leads
- Remove:
  Bolt [B]
  Brake Hose Clamp [C]



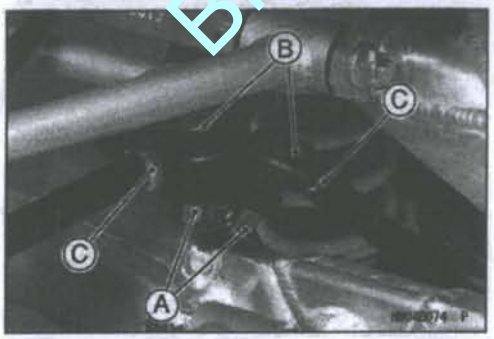
- Bend the claws [A] of the washer straight.
- Remove:
  Steering Stem Clamp Bolts [B]
  Washer [C]
  Steering Stem Clamps [D]
  Grease Seals



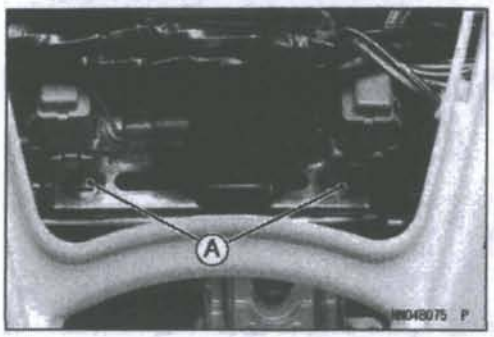
- Remove:
  Cotter Pins
  Tie-rod End Nuts [A]
  Washer
- Remove the tie-rod ends [B] from the steering stem with the suitable joint remover.

CAUTION

Do not loosen the locknuts [C] at the ends of the tie-rod adjusting sleeve, or the toe-in of the front wheels will be changed.



- Remove:
  Electrical Parts Bracket Bolts [A]

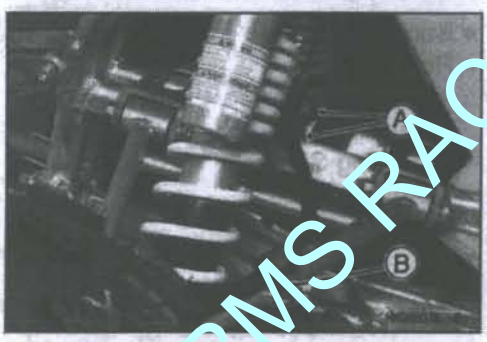


Steering

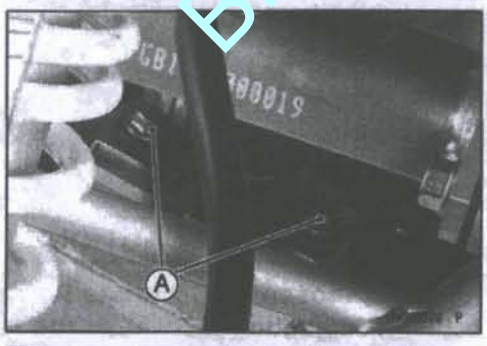
- Remove:
  Bands [A] (Left and Right)

- Remove:
  Rear Fender Mounting Bolts [A]
  Front Outer Fender Mounting Screws [B] (Left and Right)

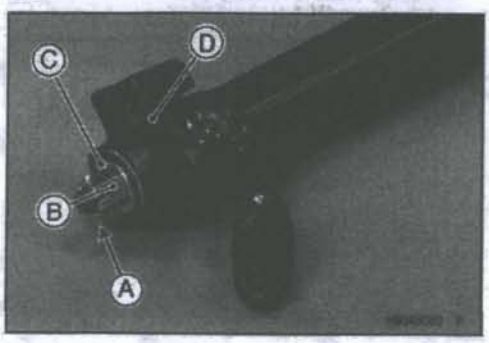
- Remove:
  Brake Hose Bracket Bolts [A]
  Brake Hose Clamp Bolt [B]



- Loosen the steering stem bearing joint bolts [A] fully.
- While lifting up the steering stem, turn it to remove the bolts.
- Pull up the steering stem to clear the electrical parts bracket and front fender.



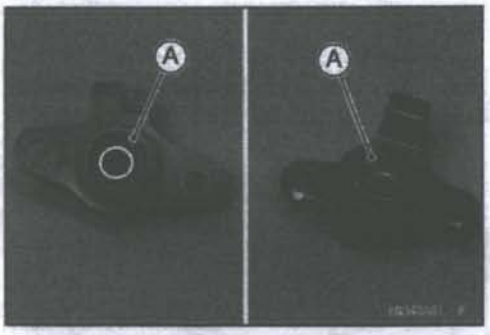
- Remove:
  Cotter Pin [A]
  Steering Stem Bottom End Nut [B]
  Collar [C]
  Steering Stem Bearing [D]



Steering

Steering Stem Installation

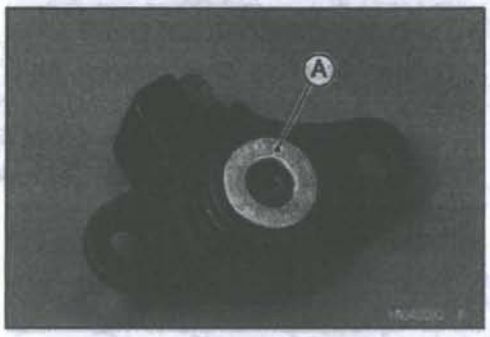
- Full grease up the seal grooves [A] in the steering stem bearing.



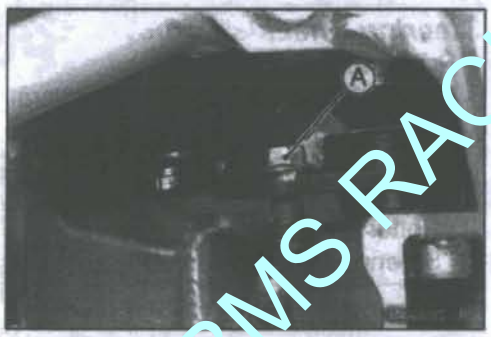
- Install:
  Collar [A]
- Replace the cotter pin with a new one.
- Tighten:

Torque - Steering Stem Bottom End Nut: 36.5 N·m (3.7 kgf·m, 27 ft·lb)

- Bend both ends of the cotter pin.
- Apply a non-permanent locking agent to the steering stem bearing joint bolts.

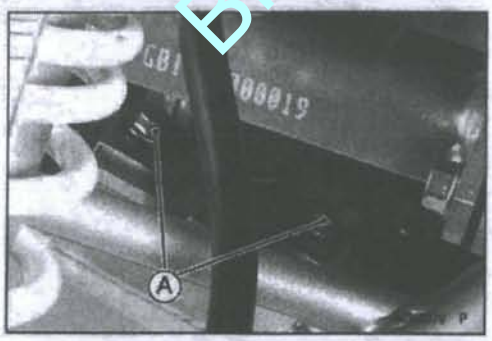


- Insert the rear stem bearing joint bolt [A] to the steering stem before installation as shown.
- Turn the steering stem to clear the frame, and install it.

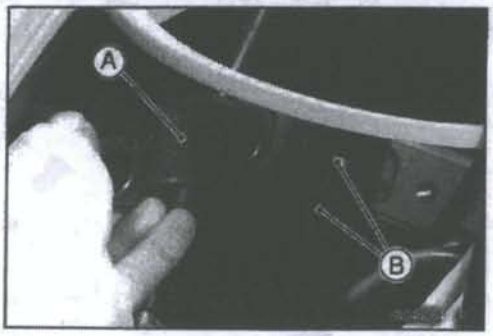


- Tighten:

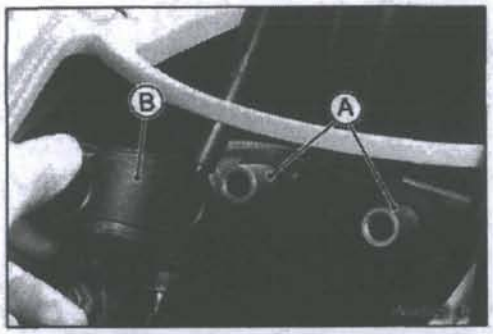
Torque - Steering Stem Bearing Joint Bolts [A]: 22 N·m (2.2 kgf·m, 16 ft·lb)



- Apply grease:
  Inside of Steering Clamp [A]
  Grease Seals [B]



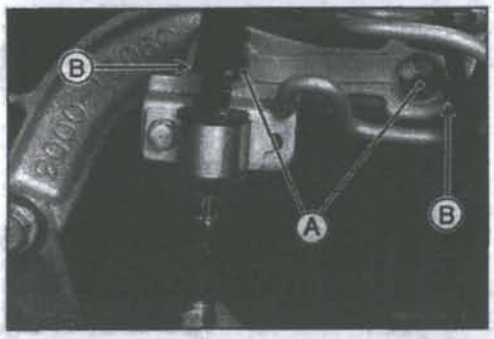
- Install:
  Collars [A]
- Apply grease to the inside of steering clamp [B].



- Tighten:

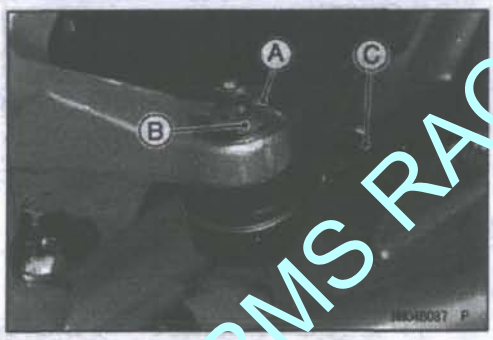
Torque - Steering Stem Clamp Bolts [A]: 24.5 N·m (2.5 kgf·m, 18 ft·lb)
Tie-rod End Nuts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)

- Bend the claws [B] of the washer toward the bolt head.
- Install the removed parts.
- Inspect the toe-in (see Toe-in Inspection in the Wheels/Tires chapter).



Steering Knuckle Removal

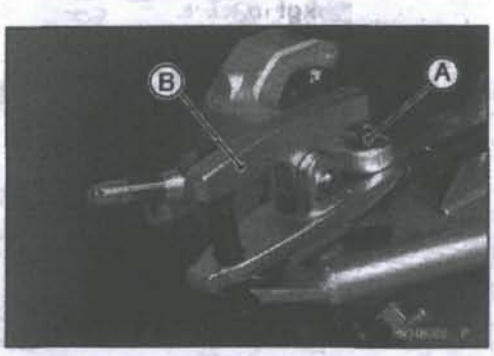
- Remove:
  Front Wheel (see Wheel Removal in the Wheels/Tires chapter)
  Front Hub (see Front Hub Removal in the Wheels/Tires chapter)
  Cotter Pin [A]
  Steering Knuckle Joint Nut [B]



CAUTION

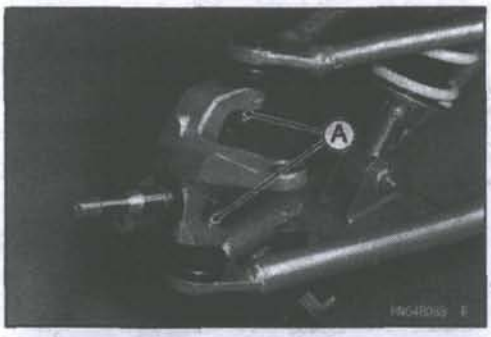
Do not loosen the locknuts [C] at the ends of the tie-rod, or the toe-in of the front wheels will be changed.

- Remove the tie-rod end [A] from the steering knuckle using a suitable joint remover [B].

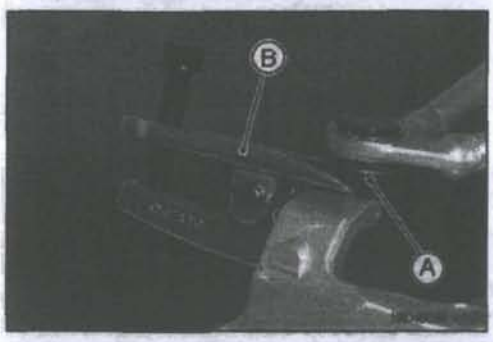


Steering

- Remove:
  Cotter Pins
  Knuckle Joint Nuts [A]
  Washers



- Remove the knuckle joint [A] from the steering knuckle using a suitable joint remover [B].



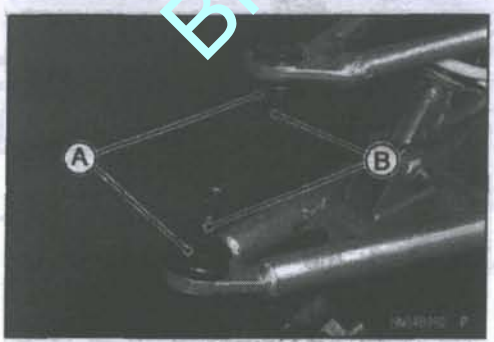
- Remove the knuckle joint [A] from the steering knuckle using a suitable joint remover [B].

Steering Knuckle Installation

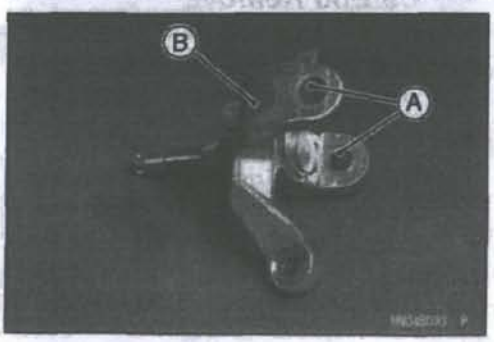
- Check the joint boot [A] is not torn, worn, deteriorated, or is leaking grease.

★If it is found, replace the knuckle joint (see Suspension Arm Disassembly in the Suspension chapter).

- Clean the taper surface [B] of the knuckle joint with an oil-less cleaning fluid.



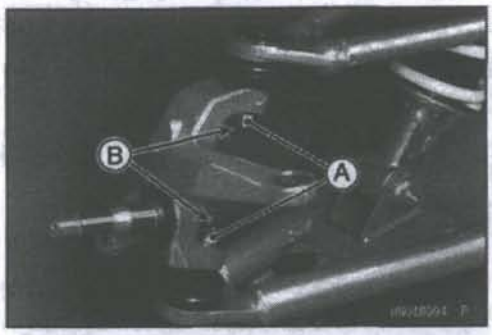
- Clean the taper surfaces [A] in the steering knuckle [B] with an oil-less cleaning fluid.



- Install:
  Washers and Knuckle Joint Nuts [A]
- Tighten:

Torque - Knuckle Joint Nuts: 29 N·m (3.0 kgf·m, 21 ft·lb)

- Install the new cotter pins [B] and bend its both ends.
- Install the removed parts.

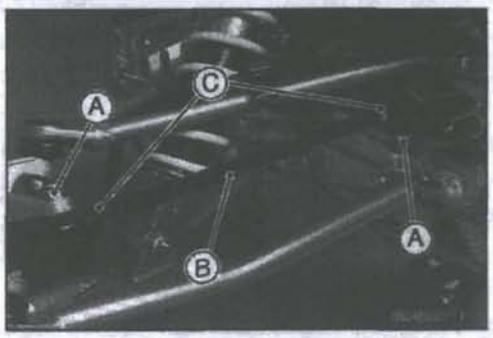


Tie-rod Removal

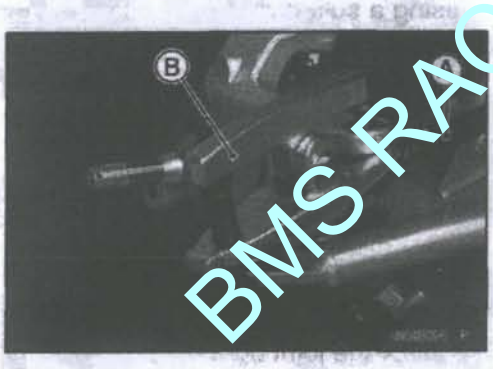
- Remove:
  Front Wheels (see Wheel Removal in the Wheels/Tires chapter)
  Cotter Pin, Tie-rod End Nuts [A] and Washers
  Tie-rod [B]

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.



- Remove the tie-rod end [A] using a suitable joint remover [B] (see Steering Knuckle Removal).



Tie-rod Installation

- The right and left tie-rods are identical.
- Tighten:

Torque - Tie-rod End Nuts: 36.5 N·m (3.7 kgf·m, 27 ft·lb)

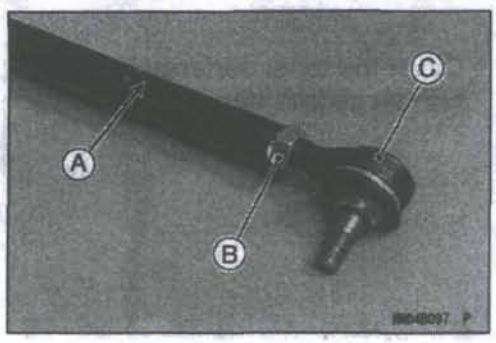
- Inspect the toe-in (see Toe-in Inspection in the Wheels/Tires chapter).

Tie-rod End Removal

- Remove the tie-rod (see Tie-rod Removal).
- Holding the tie-rod flattened area [A], loosen the locknut [B] and unscrew the tie-rod end [C].

NOTE

○*The locknut near the flattened area on the tie-rod has left-hand threads. Turn the wrench clockwise (as viewed from the joint end) for loosening.*



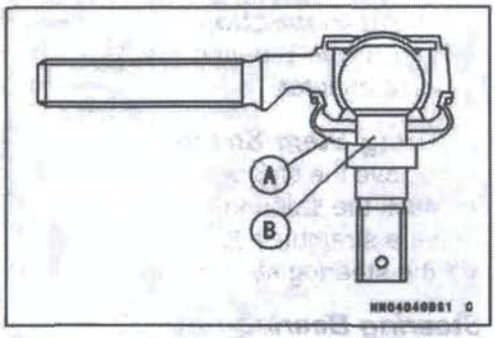
CAUTION

Do not remove the grease seal. It is packed with grease.

Steering

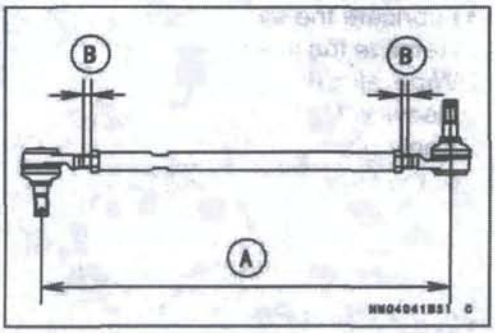
Tie-rod End Installation

- Check that the boot lip [A] is on the shank [B].



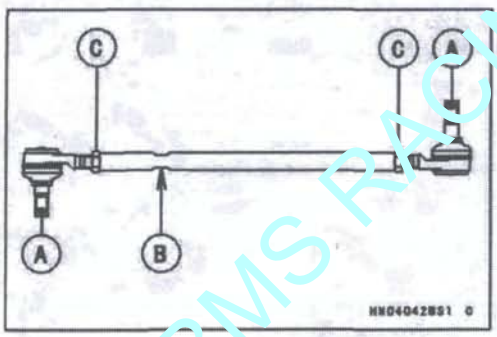
- Install the tie-rod ends so that the tie-rod has the correct length [A], and both visible thread lengths [B] are approximately equal.

Tie-rod Length
Standard: 402 mm (15.8 in.)



- Install the tie-rod ends so that the thread portions [A] of the tie-rod ends are opposite direction 180° as shown.
- Hold the flat surface [B] of the tie-rod end with a wrench, and tighten the locknuts [C].

Torque - Tie-rod Locknuts: 22 N·m (2.2 kgf·m, 16 ft·lb)



Steering Maintenance

Steering Inspection

- Refer to the Steering Inspection in the Periodic Maintenance chapter.

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.

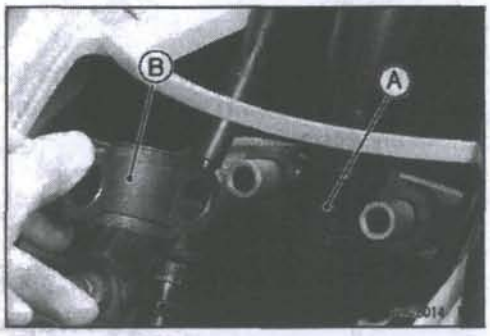
Steering Bearing Sleeve Lubrication

- 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.

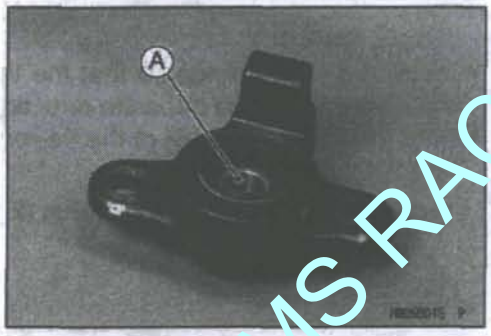
○Apply grease to the steering stem [A] and the inside [B] of the both clamps.



- Lubricate the steering stem bearing [A].

○Remove the steering stem bearing.

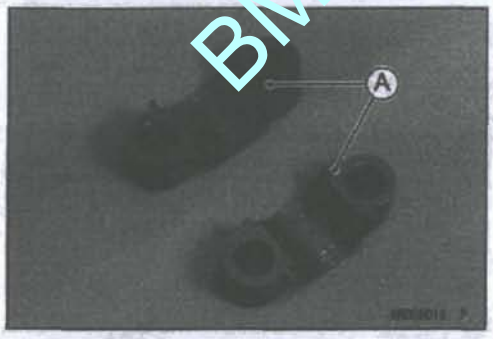
○Pack the grease seal lips with grease.



Steering Stem Clamp Inspection

- Inspect the steering stem clamps [A].

★If roughness, excessive play, or seizure is found, replace both clamps.



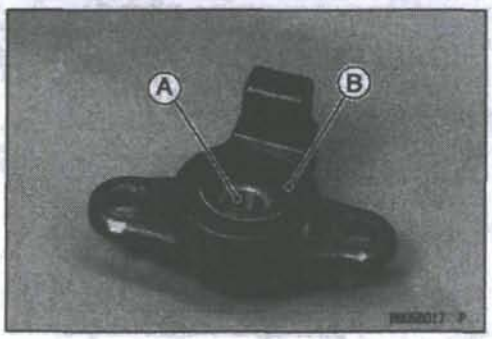
Steering Stem Bearing Inspection

- Inspect the spherical bearing [A].

★If roughness, excessive play, or seizure is found, replace the steering stem bearing.

- Inspect the upper and lower grease seals [B].

★If damage, wear or deterioration is found, replace the steering stem bearing.



Steering Maintenance

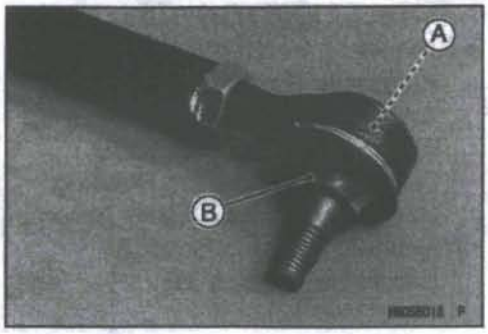
Tie-rod End Inspection

- Inspect each spherical bearing [A].

★If roughness, excessive play, or seizure is found, replace the tie-rod end.

- Inspect each boot [B].

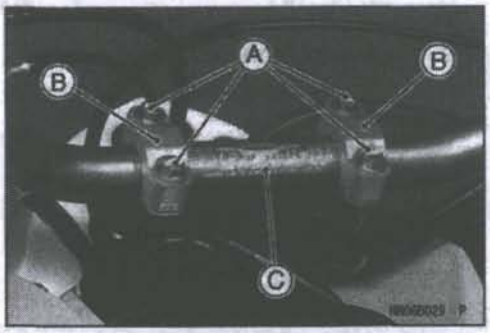
★If damage, wear or deterioration is found, replace the tie -rod end.



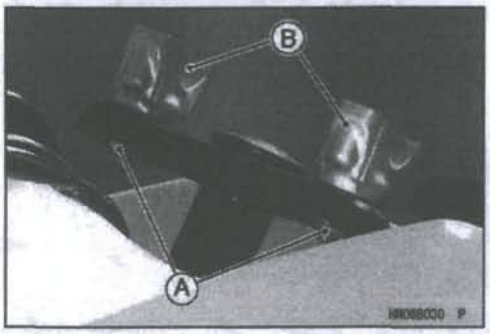
Handlebar

Handlebar and Handlebar Holder Removal

- Remove:
  Handlebar Pad
  Throttle Case
  Front Brake Master Cylinder
  Left Handlebar Switch Housing
  Clutch and Parking Lever Assembly
  Handlebar Clamp Bolts [A]
  Handlebar Clamps [B]
  Handlebar [C]

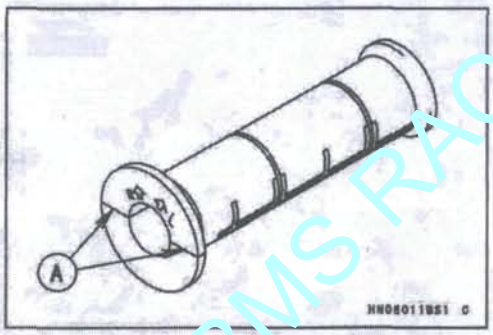


- Remove:
  Handlebar Holder Mounting Nuts [A]
  Handlebar Holders [B]

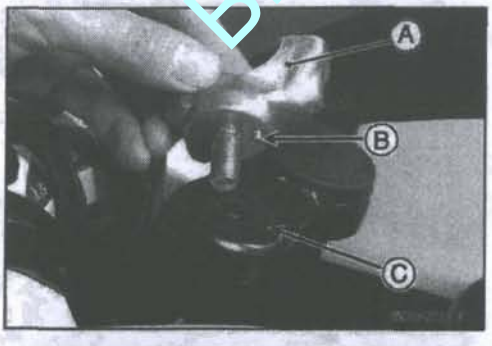


Handlebar and Handlebar Holder Installation

- Apply adhesive cement to the inside of the each handlebar grip.
- Install the each handlebar grip so that the parting line [A] is horizontally.

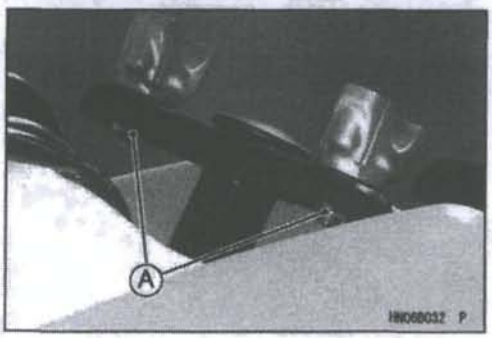


- Install the handlebar holders [A] on the steering stem so that the projection [B] fit to the hole [C] of the steering stem upper surface.



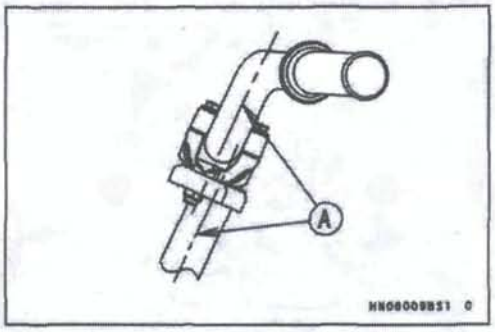
- Tighten:

Torque - Handlebar Holder Mounting Nuts [A]: 36.5 N·m (3.7 kgf·m, 27 ft·lb)

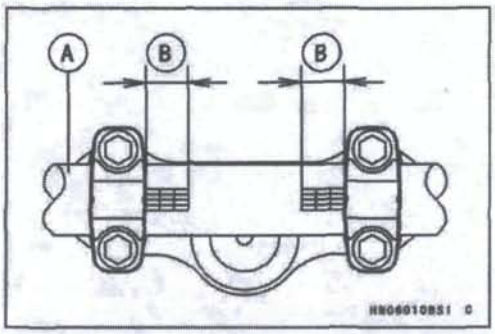


Handlebar

- Install the handlebar so that the angle of the handlebar is parallel [A] to the steering stem.



- Install the handlebar [A] on the handlebar holder so that the protruded scales of the both side adjust to the same width [B].



- Install the handlebar clamps [A].
- Tighten the handlebar clamp bolts [1 ~ 4] following the tightening sequence as shown.

Torque - Handlebar Clamp Bolts: 29 N·m (3.0 kgf·m, 21 ft·lb)

○If the holder is correctly installed, there will be even gaps [B] at the front and rear side.

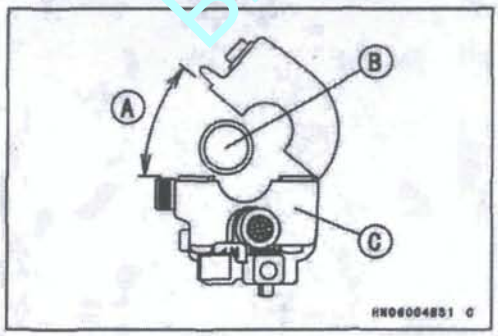
- Install the left switch housing [C] on the handlebar [B] so that the opening angle is 40° [A] or less.

NOTE

○*Do not open the housing more than 40°, the built-in parts in the housing may be damaged.*

- Tighten:

Torque - Left Handlebar Switch Housing Screws: 3.5 N·m (0.36 kgf·m, 31 in·lb)



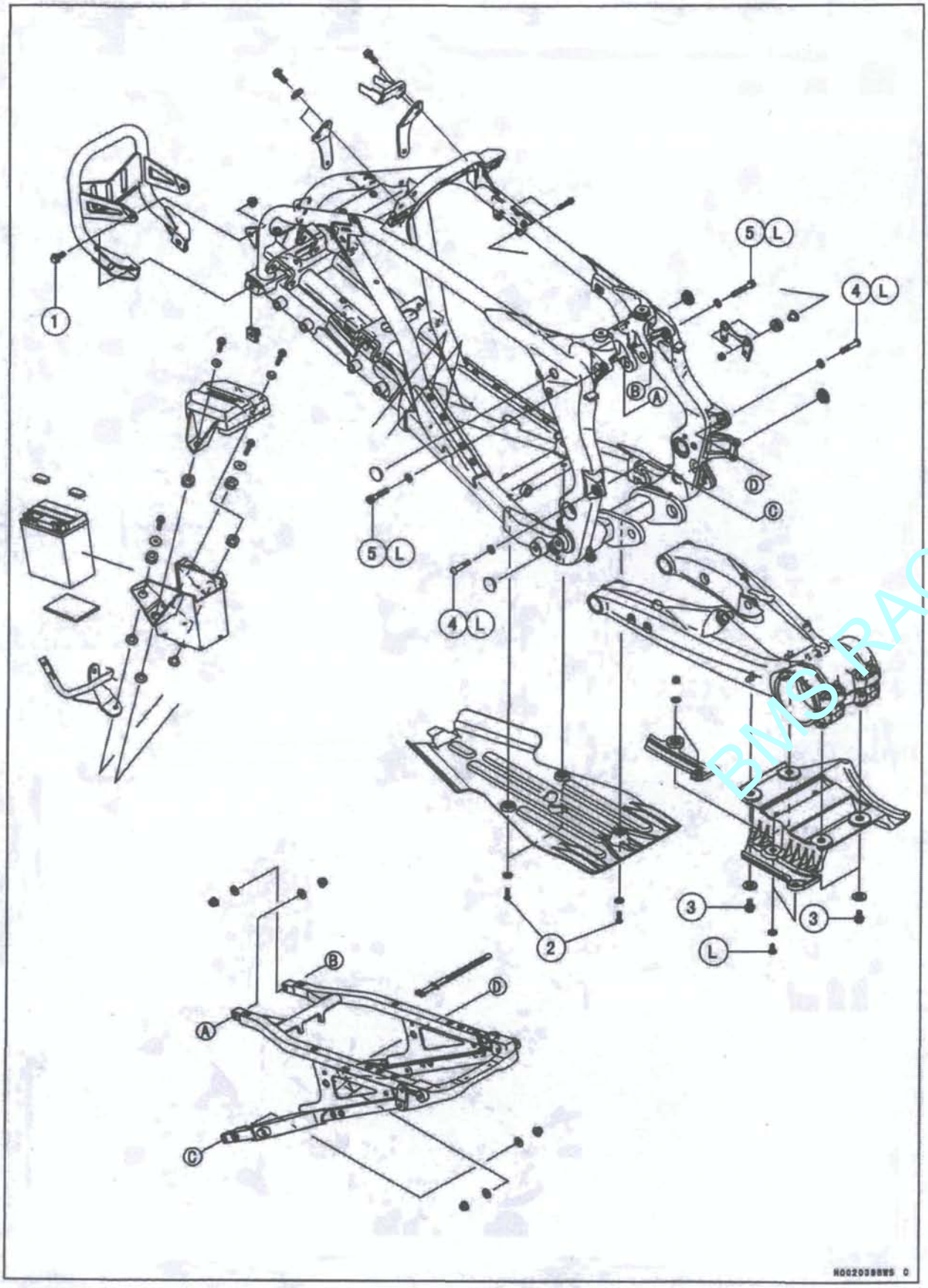
- Install:

Clutch and Parking Brake Lever Assembly (see Clutch Lever Installation in the Engine Right Side chapter)
Front Brake Master Cylinder (see Front Master Cylinder Installation in the Brakes chapter)
Handlebar Pad
Throttle Case (see Throttle Case Assembly/Installation in the Fuel System (DFI) chapter)

Frame

Table of Contents

Exploded View

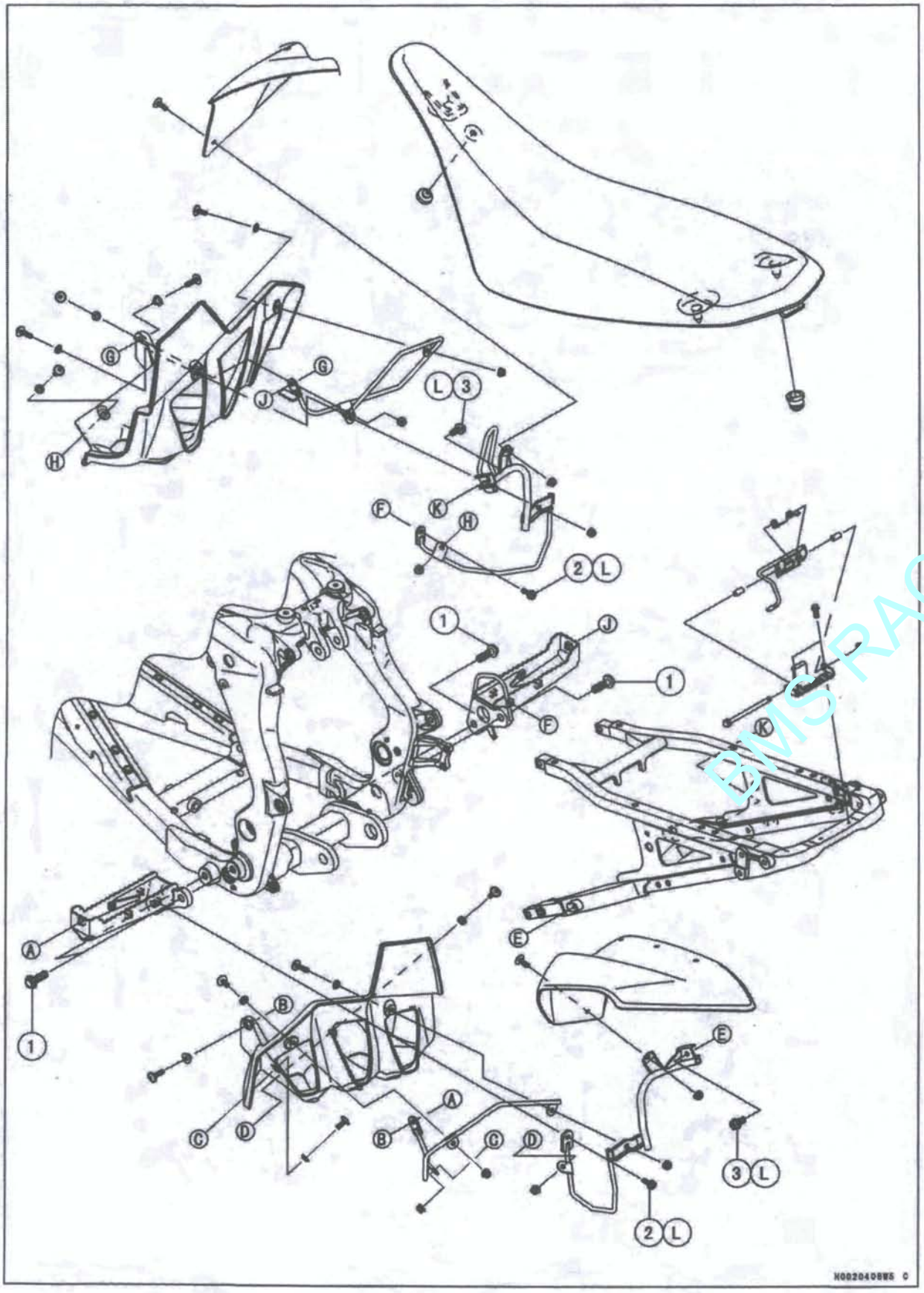


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Front Guard Bolts	26.5	2.7	20	
2	Engine Bottom Guard Bolts	9.3	0.95	82 in·lb	
3	Rear Bottom Guard Bolts	24.5	2.5	18	
4	Lower Rear Frame Mounting Bolts	29.5	3.0	22	L
5	Upper Rear Frame Mounting Bolts	35	3.6	26	L

L: Apply a non-parmanent locking agent.

Exploded View

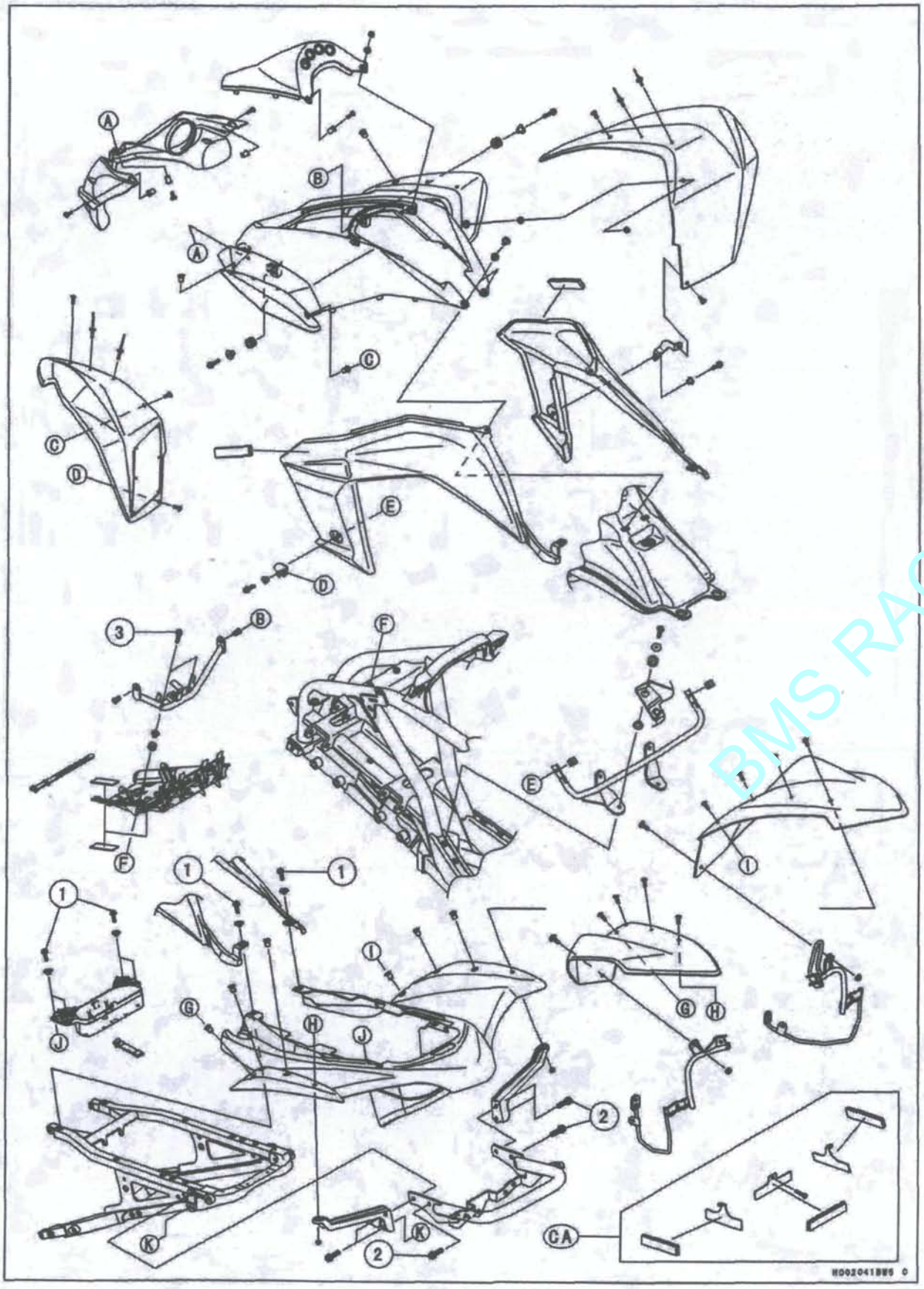


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Footpeg Mounting Bolts	41.5	4.2	31	
2	Lower Foot Guard Bracket Bolts	12.5	1.3	111 in·lb	L
3	Upper Foot Guard Bracket Bolts	27	2.8	20	L

L: Apply a non-parmanent locking agent.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Rear Fender Mounting Bolts	9.3	0.95	82 in·lb	
2	Rear Fender Bracket Mounting Bolts	29.5	3.0	22	
3	Electrical Parts Bracket Bolts	12.5	1.3	111 in·lb	

CA: Canada Model

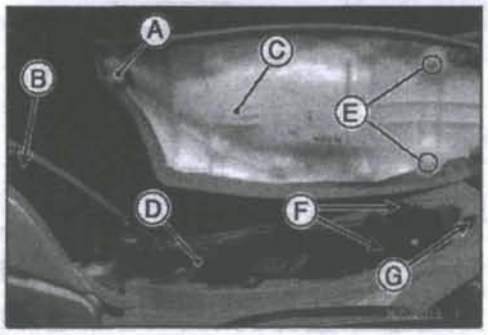
Seat

Seat Removal

- Push down the seat latch [A], and then remove the seat [B] by pulling it up to the rear.

Seat Installation

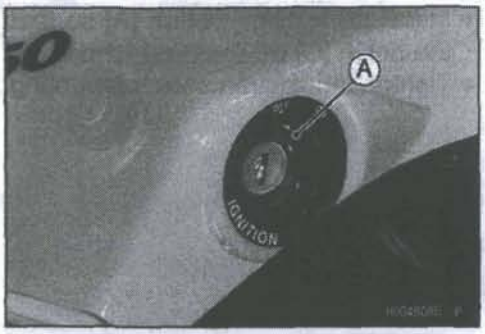
- Slip the front seat hook [A] into the collar [B] on the fuel tank.
- Put the middle seat hook [C] under the frame pipe [D].
- Put the stoppers [E] into the tool case dampers [F].
- Push down the rear part of the seat until the lock [G] clicks.



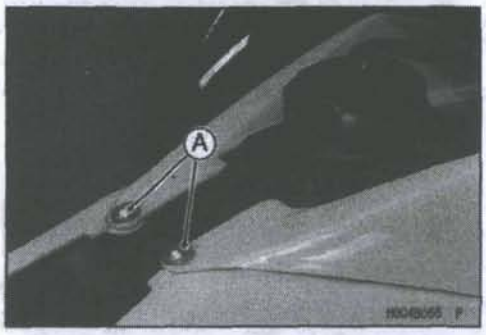
Fenders

Front Fender Removal

- Remove:
  Seat (see Seat Removal)
  Ignition Switch Mounting Nut [A]



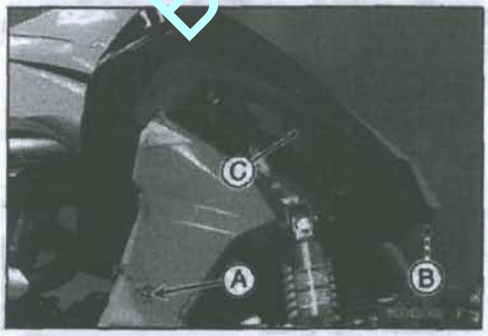
- Remove:
  Screws [A] and Collars



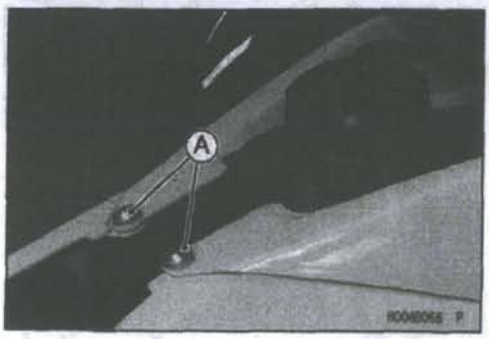
- Remove:
  Screws [A] and Collars (Left and Right)
  Screw [B]
  Bolts [C] and Collars (Left and Right)
  Front Fender [D]

Front Fender Installation

- Install:
  Screws [A] and Collars (Left and Right)
  Screw [B]
  Bolts [C] and Collars (Left and Right)

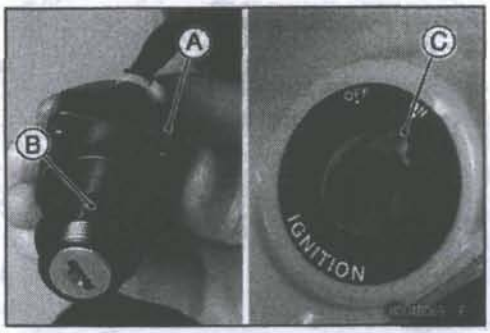


- Install:
  Screw [A] and Collars



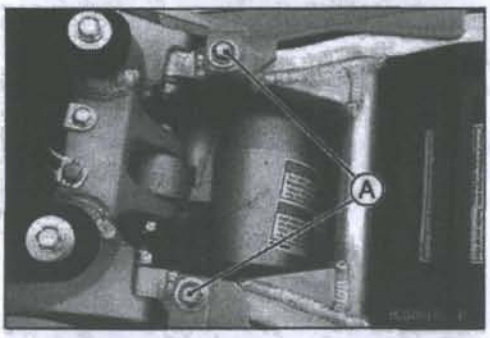
Fenders

- Install the ignition switch [A] so that the projection [B] fit the notch [C] on the front fender.
- Tighten the ignition switch mounting nut securely.



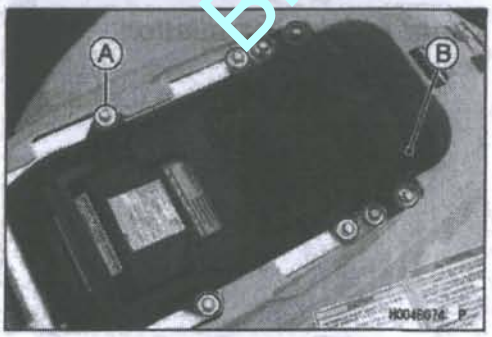
Rear Fender Removal

- Remove:
  Seat (see Seat Removal)
  Bolts [A]

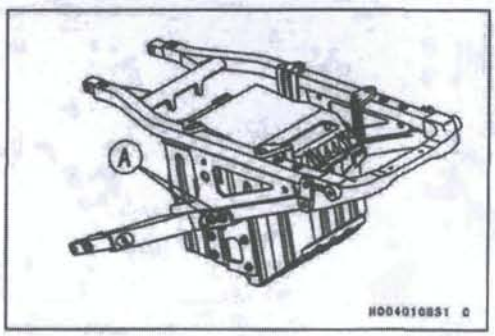


- Remove:
  Screws [A] (Both side)

- Remove:
  Bolts [A]
  Tool Box [B]



- Remove:
  Bolts [A] (Both side)
- While lifting up the air cleaner housing, remove the rear fender.

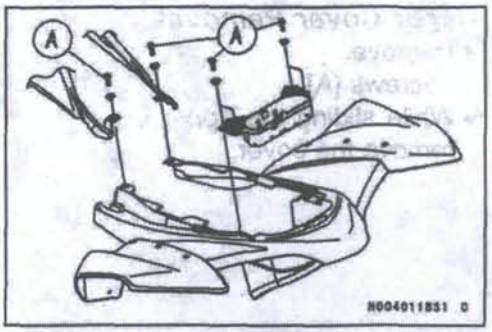


Fenders

Rear Fender Installation

- Rear fender installation is the reverse of removal.

Torque - Air Cleaner Housing Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)
Rear Fender Mounting Bolts [A]: 9.3 N·m (0.95 kgf·m, 82 in·lb)



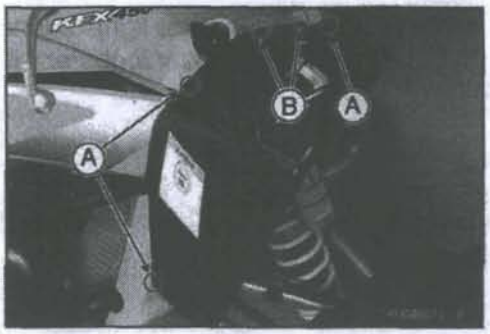
Front Outer Fender Removal

- Remove:
  Screws [A]
- Drill out the rivets [B] with a drill bit of the correct size.

Rivet Removal Drill Bit Size
4.5 mm (0.18 in.)

NOTE

○Stop drilling when the rivet head starts to turn with drill bit.
○Tap the rivet out with a suitable punch and hammer.



Front Outer Fender Installation

- Secure the parts to the outer fender with the rivets using a riveter.

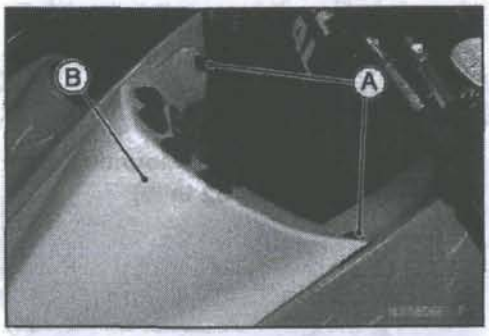
Rear Outer Fender Removal

- Remove:
  Screws [A]
  Rear Outer Fender [B]

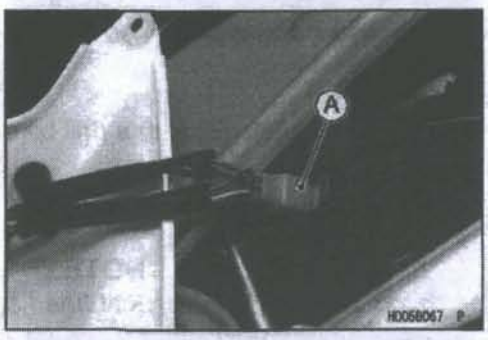
Covers

Upper Cover Removal

- Remove:
  Screws [A]
- While sliding the upper cover [B] backward, lift up it to remove the cover.

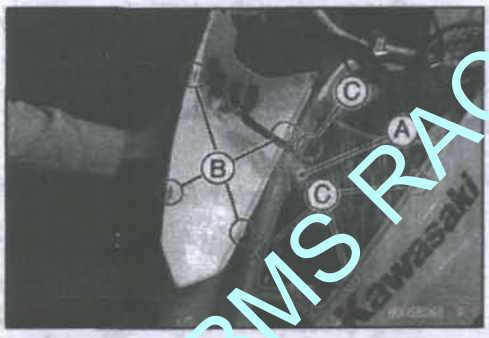


- Disconnect the indicator lights connector [A].
- Remove the upper cover together with the indicator lights.



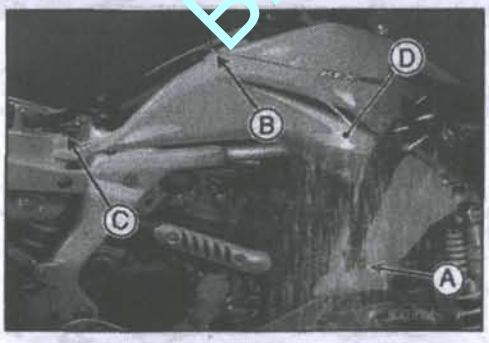
Upper Cover Installation

- Connect the indicator lights connector [A].
- Install the upper cover so that the hook [B] fit to the slits [C] on the front fender.



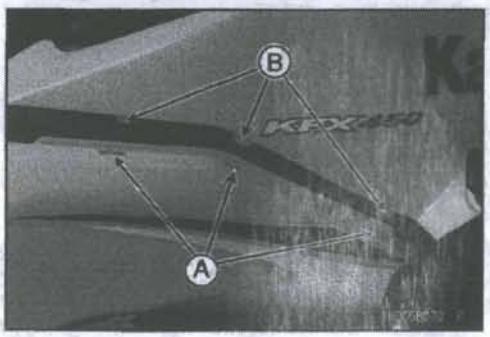
Side Cover Removal

- Remove:
  Seat (see Seat Removal)
  Bolt [A] and Collar
  Screw [B]
  Bolt [C]
  Side Cover [D]



Side Cover Installation

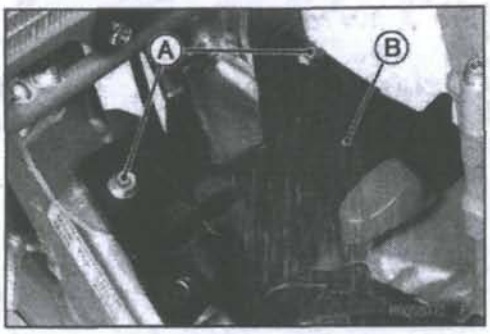
- Install the side cover so that the slots [A] on the side cover fit the hooks [B] on the front fender.



Covers

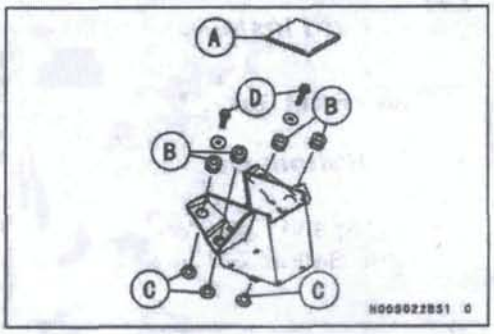
Battery Case Removal

- Remove:
  Battery (see Battery Removal in the Electrical System chapter)
  Bolts [A]
  Battery Case [B]



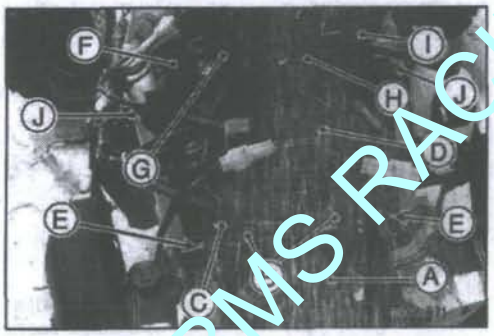
Battery Case Installation

- Stick the rubber damper [A] to the battery case bottom.
- Install the dampers [B] and collars [C] to the battery case.
- Install the battery case, and tighten the mounting bolts [D].



Electrical Parts Bracket Removal

- Remove:
  Front Fender (see Front Fender Removal)
- Remove the following parts from the bracket.
  Regulator/Rectifier [A] (see Regulator/Rectifier Removal in the Electrical System chapter)
  Bolts [B]
  Front Fender Stay [C] (with Fuses and Vehicle-down Sensor)
  ECU [D] (see ECU Removal in the Fuel System (DFI) chapter)
  Bolts [E]
  Radiator Fan Relay [F]
  Fuel Pump Relay [G]
  Starter Control Relay (Neutral) [H]
  Starter Control Relay (Clutch) [I]
  Bands [J]
- Remove the electrical parts bracket forward.

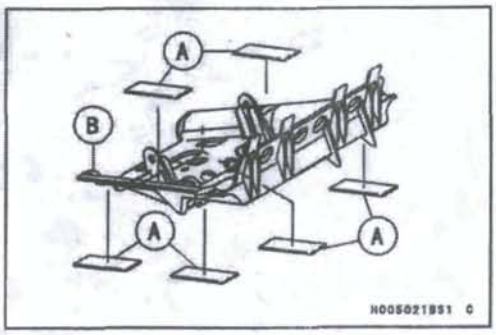


Electrical Parts Bracket Installation

- Stuck the dampers [A] to the electrical parts bracket [B].
- Install the removed parts.
- Tighten:

Torque - Electrical Parts Bracket Bolts: 12.5 N·m (1.3 kgf·m, 111 in·lb)

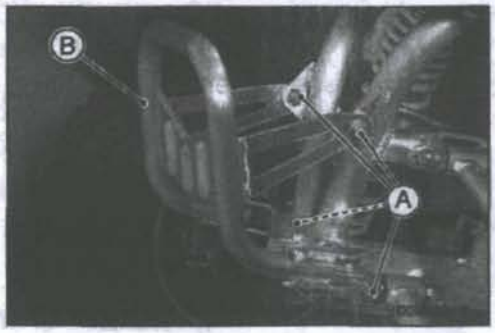
- Route the electrical parts leads according to the Appendix chapter.



Guards

Front Guard Removal

- Remove:
  Bolts [A] and Nuts
  Front Guard [B]



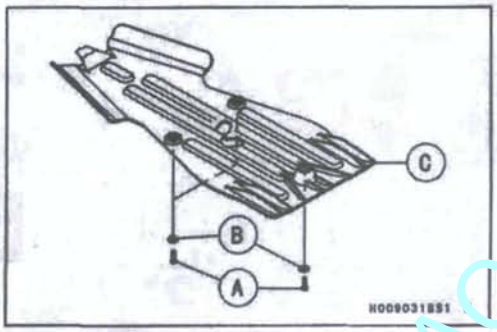
Front Guard Installation

- Tighten:

Torque - Front Guard Bolts: 26.5 N·m (2.7 kgf·m, 20 ft·lb)

Engine Bottom Guard Removal

- Remove:
  Bolts [A] and Collars [B]
  Engine Bottom Guard [C]



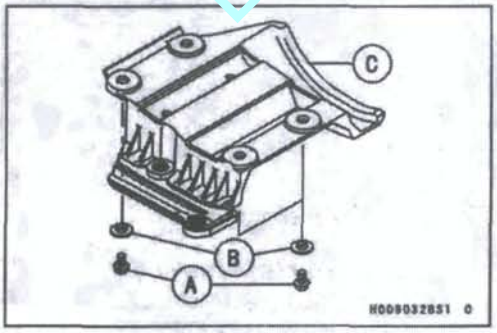
Engine Bottom Guard Installation

- Install:
  Engine Bottom Guard
  Bolts and Collars

Torque - Engine Bottom Guard Bolts: 9.3 N·m (0.95 kgf·m, 82 in·lb)

Rear Bottom Guard Removal

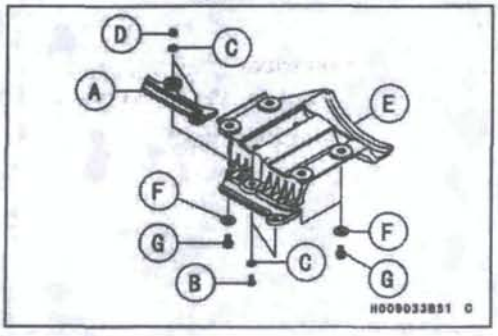
- Remove:
  Bolts [A] and Collars [B]
  Rear Bottom Guard [C] with the chain slipper



Rear Bottom Guard Installation

- Apply a non-parmanent locking agent to the chain slipper screws.
- Install:
  Chain Slipper [A]
  Screws [B]
  Collars [C]
  Nut [D]
  Rear Bottom Guard [E]
  Collars [F]

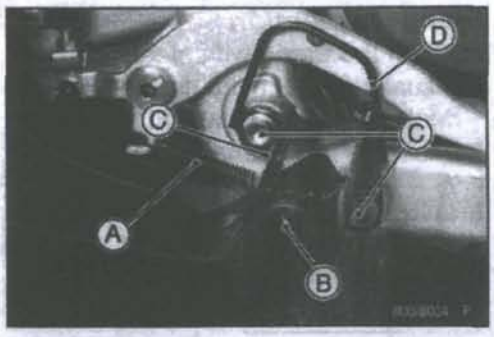
Torque - Rear Bottom Guard Bolts [G]: 24.5 N·m (2.5 kgf·m, 18 in·lb)



Footpegs and Foot Guards

Footpeg Removal

- Remove:
  Brake Pedal Return Spring [A] (Right side only)
  Screw [B]
  Bolts [C]
  Footpeg [D]



Footpeg Installation

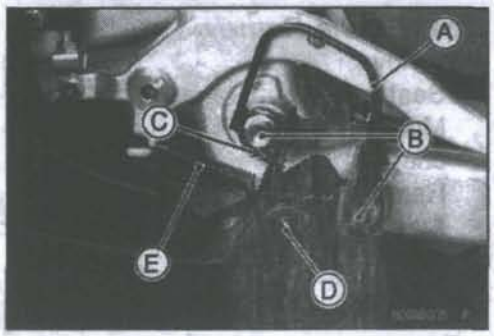
- Install the footpeg [A].
- Tighten:

Torque - Footpeg Mounting Bolts [B]: 41.5 N·m (4.2 kgf·m, 31 ft·lb)

- Apply a non-parmanent locking agent to the lower foot guard bracket bolt [C], and tighten it.

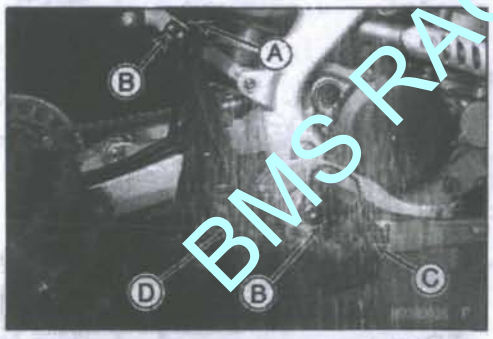
Torque - Lower Foot Guard Bracket Bolts: 12.5 N·m (13 kgf·m, 111 in·lb)

- Install:
  Screw [D]
  Brake Pedal Return Spring [E] (Right side only)



Foot Guard Removal

- Remove:
  Screw and Nut [A]
  Bolts [B]
  Screw [C]
  Foot Guard [D] together with the bracket

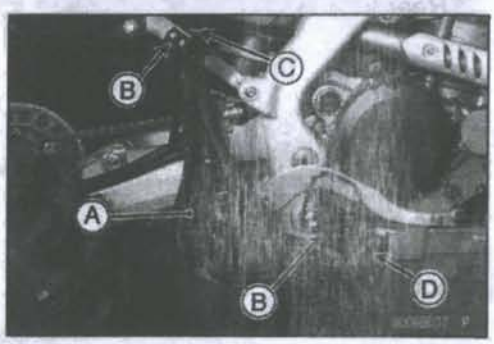


Foot Guard Installation

- Install the foot guard [A].
- Apply a non-parmanent locking agent to the foot guard bracket bolts [B], tighten them.

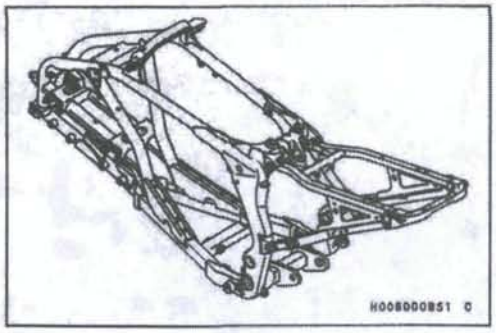
Torque - Lower Foot Guard Bracket Bolts: 12.5 N·m (13 kgf·m, 111 in·lb)
Upper Foot Guard Bracket Bolts: 27 N·m (2.8 kgf·m, 20 ft·lb)

- Install:
  Screw and Nut [C]
  Screw [D]



Frame

Frame Inspection



- Clean the frame with steam cleaner.
- Visually inspect the frame and rear frame for cracks, dents, bending, or warp.

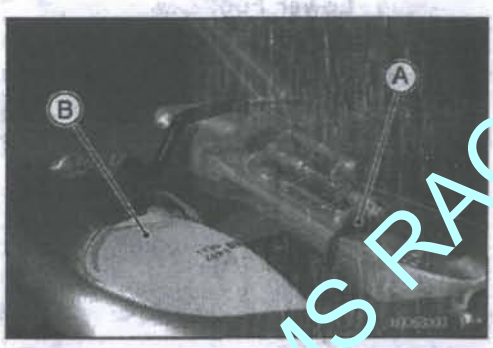
★If there is any damage to the frame, replace it.

⚠ WARNING

A repaired frame may fail in use, possibly causing an accident. If the frame is bent, dented, cracked, or warped, replace it.

Rear Frame Removal

- Remove:
  Seat (see Seat Removal)
  Muffler (see Muffler Removal in the Engine Top End chapter)
  Rear Fender (see Rear Fender Removal)
  Air Cleaner Housing (see Air Cleaner Housing Removal in the Fuel System (DFI) chapter)
- Cut the band [A].
- Remove:
  Tail/Brake Light Unit [B] (see Tail/Brake Light Removal/Installation in the Electrical System chapter)



- Cut the band [A].
- Open the clamp [B].
- Remove:
  Bolt [C] (Both side)
  Rear Frame [D]

Rear Frame Installation

- Apply a non-parmanent locking agent to the rear frame mounting bolts.
- Tighten:

Torque - Lower Rear Frame Mounting Bolts: 29.5 N·m (3.0 kgf·m, 22 ft·lb)
Upper Rear Frame Mounting Bolts: 35 N·m (3.6 kgf·m, 26 ft·lb)

- Install the removal parts.

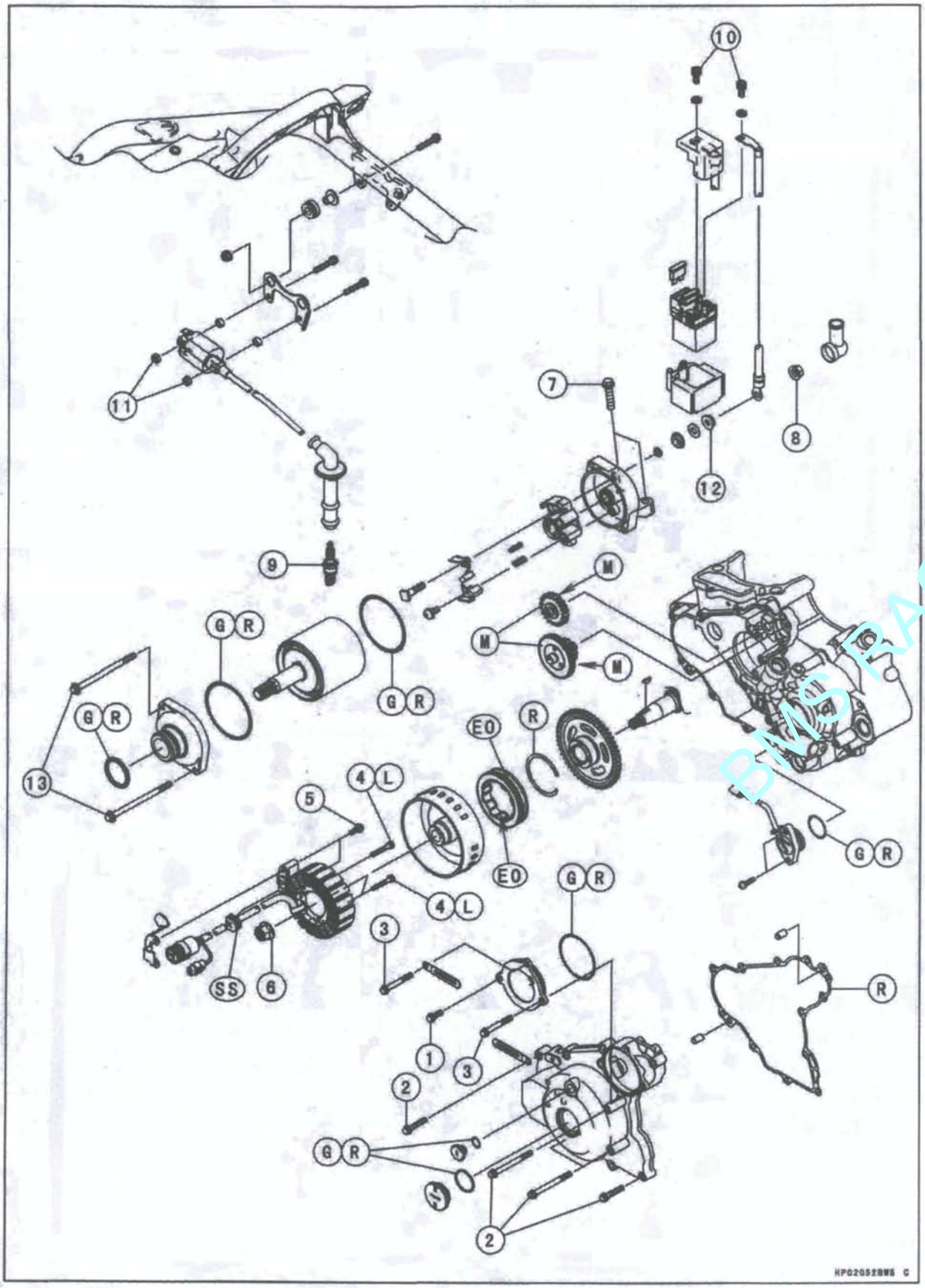
Electrical System

Table of Contents

Exploded View

Dummy Page

Exploded View

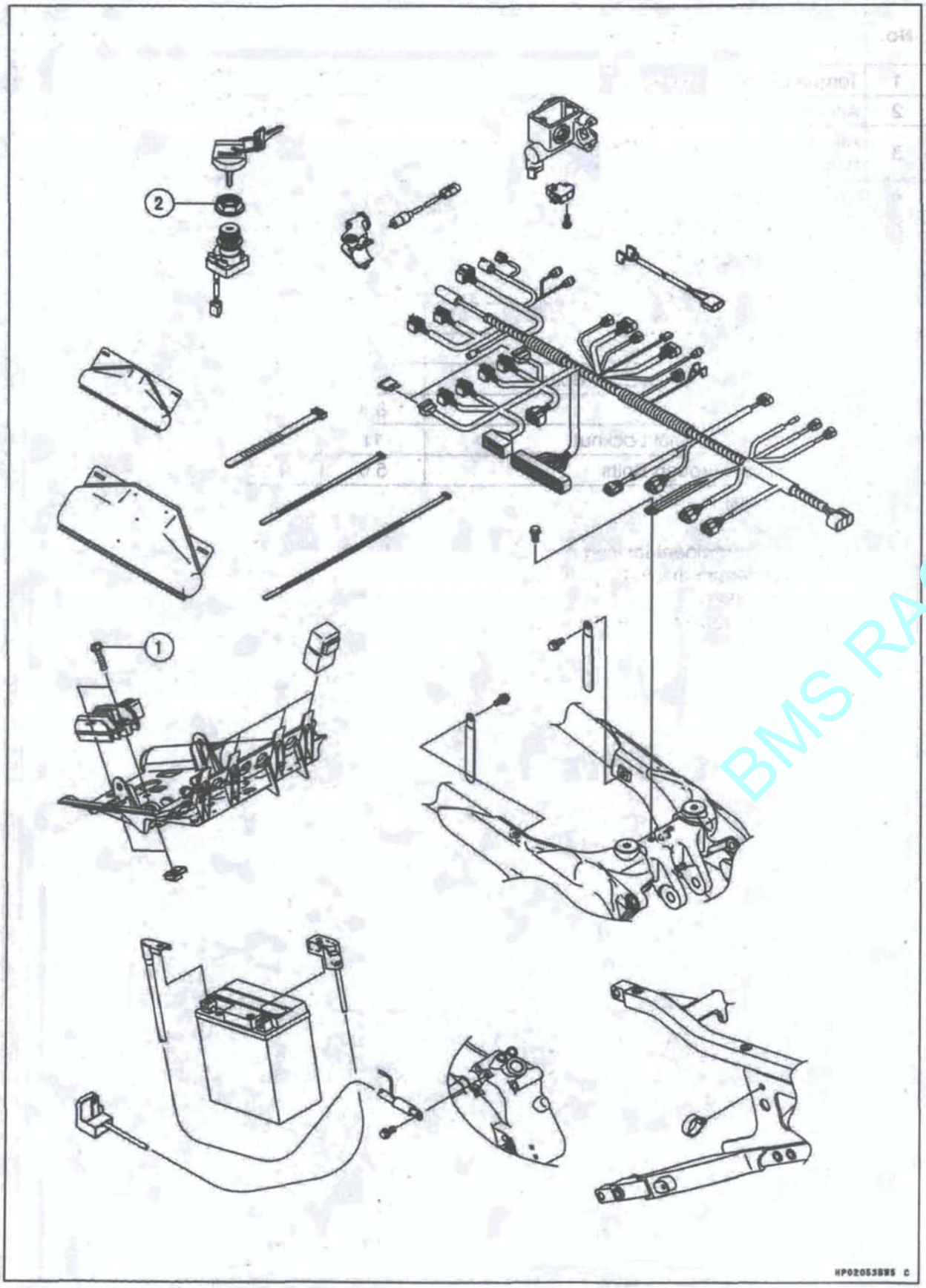


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Torque Limiter Cover Bolt	9.8	1.0	87 in·lb	
2	Alternator Cover Bolts	9.8	1.0	87 in·lb	
3	Alternator Cover and Torque Limiter Cover Bolts	9.8	1.0	87 in·lb	
4	Alternator Stator Bolts	9.8	1.0	87 in·lb	L
5	Crankshaft Sensor Bolts	7.0	0.71	62 in·lb	
6	Alternator Rotor Nut	98	10	72	
7	Starter Motor Mounting Bolts	9.8	1.0	87 in·lb	
8	Starter Motor Terminal Nut	9.8	1.0	87 in·lb	
9	Spark Plug	13	1.3	115 in·lb	
10	Starter Relay Cable Terminal Bolts	4.0	0.41	35 in·lb	
11	Ignition Coil Nuts	8.8	0.90	78 in·lb	
12	Starter Motor Terminal Locknut	11	1.1	97 in·lb	
13	Starter Motor Through Bolts	5.0	0.51	44 in·lb	

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
R: Replacement Parts
SS: Apply silicone sealant (Kawasaki Bond: 92104-0004)

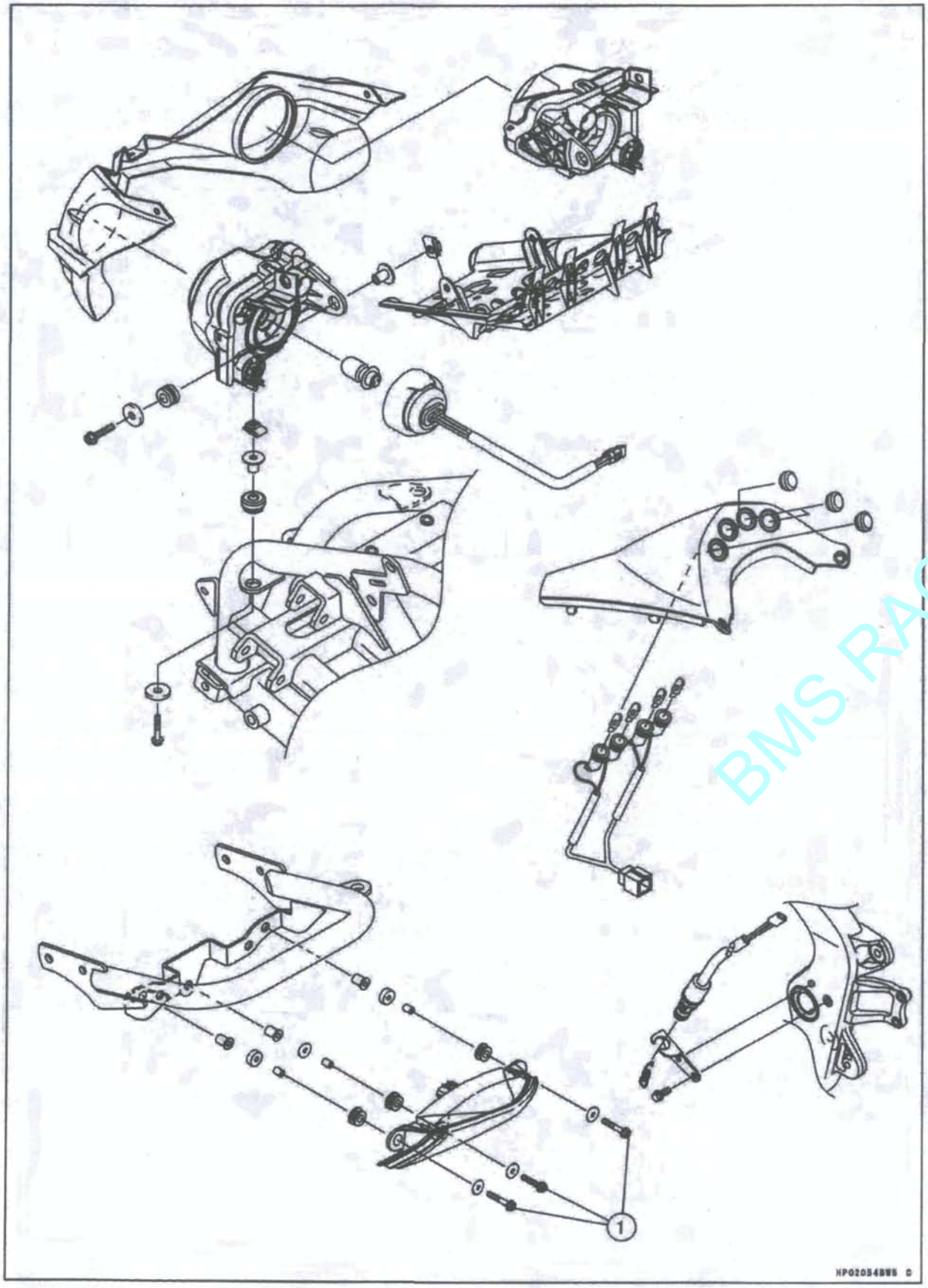
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Regulator/Rectifier Bolts	8.8	0.90	78 in·lb	
2	Ignition Switch Mounting Nut	2.8	0.28	25 in·lb	

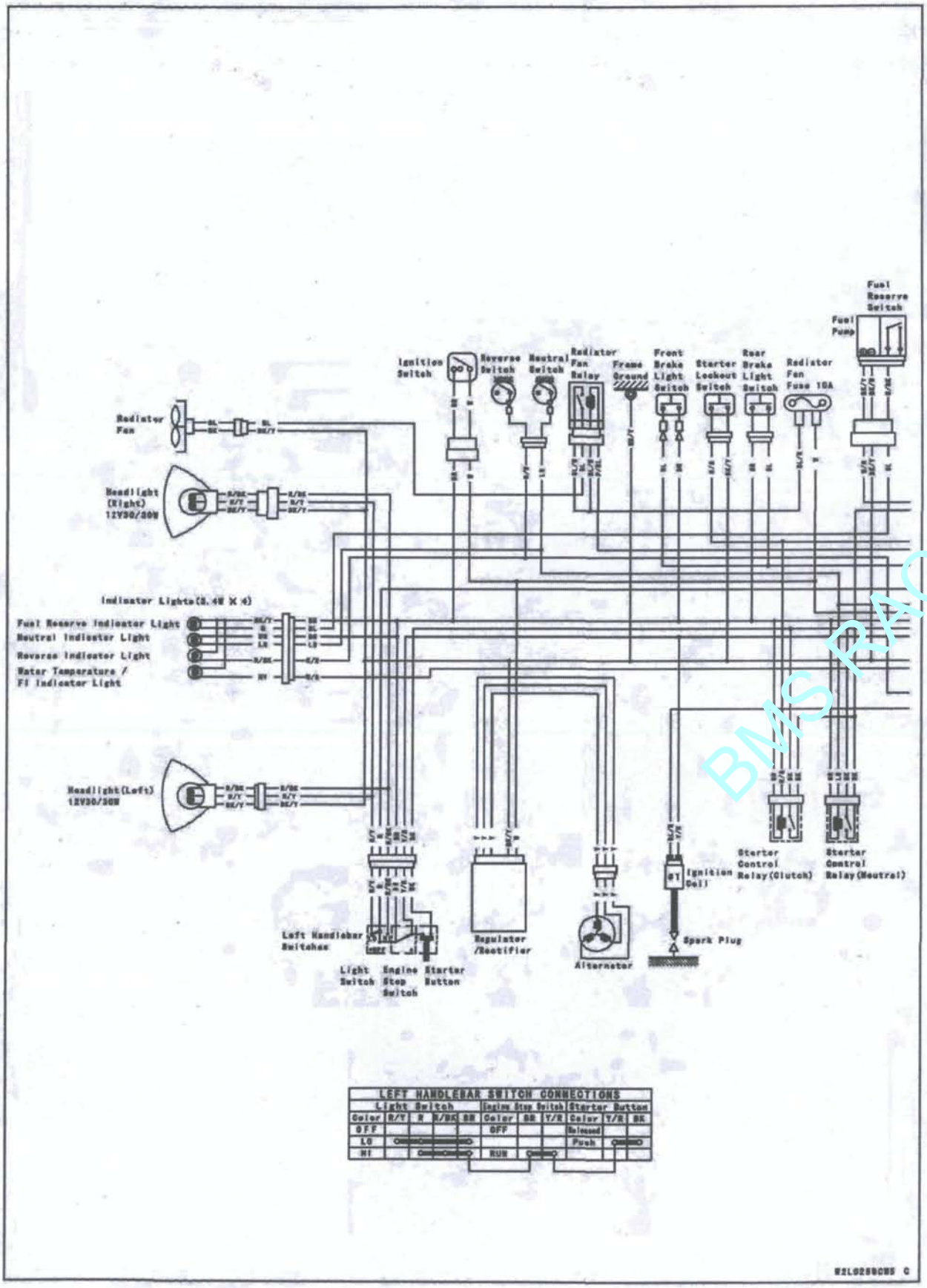
Exploded View



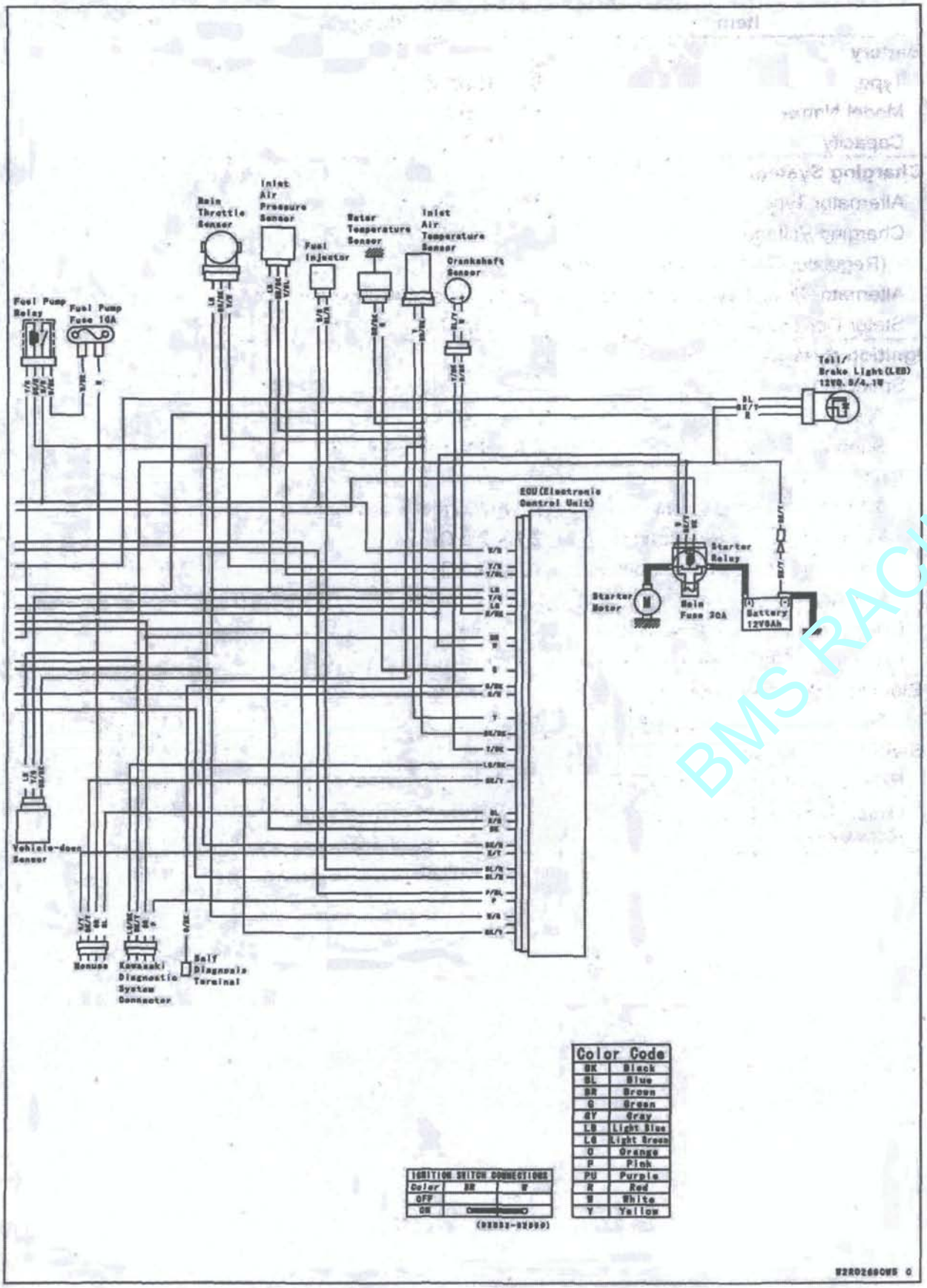
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Tail/Brake Light Unit Mounting Bolts	1.2	0.12	11 in·lb	

Wiring Diagram



Wiring Diagram

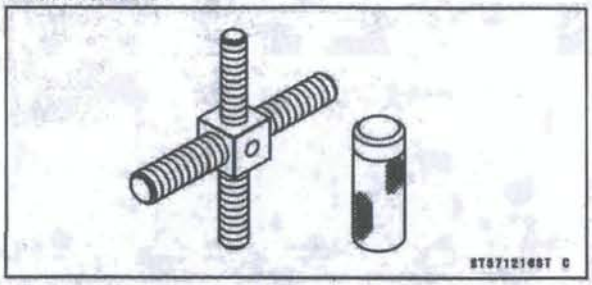


Specifications

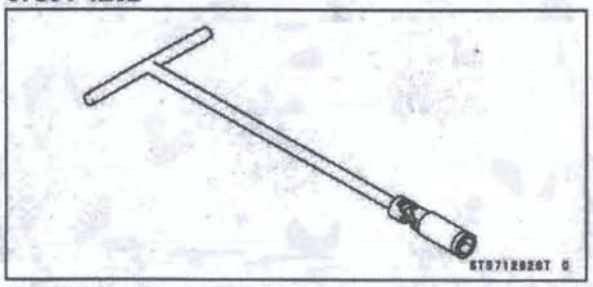
Item	Standard	Service Limit
Battery		
Type	Sealed Battery	– – –
Model Name	YTX7L-BS	– – –
Capacity	12 V 6 Ah	– – –
Charging System		
Alternator Type	Three-phase AC	– – –
Charging Voltage (Regulator/Rectifier Output Voltage)	14.0 ~ 14.5 V	– – –
Alternator Output Voltage (no load)	46 V or more @4 000 r/min (rpm)	– – –
Stator Coil Resistance	0.41 ~ 0.51 Ω	– – –
Ignition System		
Spark Plug:		
Type	NGK CPR8EB	
Spark Plug Gap	0.8 ~ 0.9 mm (0.03 ~ 0.04 in.)	– – –
Ignition Coil:		
3 Needle Arcing Distance	7 mm (0.28 in.) or more	– – –
Primary Winding Resistance	2.1 ~ 2.5 Ω	– – –
Secondary Winding Resistance	10 ~ 16 kΩ	– – –
Primary Peak Voltage	210 V or more	
Crankshaft Sensor Resistance	22 ~ 34 Ω	– – –
Crankshaft Sensor Peak Voltage	2 V or more	– – –
Electric Starter System		
Starter Motor Brush Length	12 mm (0.47in.)	6.5 mm (0.26 in.)
Switch and Sensor		
Rear Brake Light Switch Timing	ON after 10 mm (0.4 in.) of pedal travel	– – –
Water Temperature Sensor Resistance	in the text	

Special Tools and Sealant

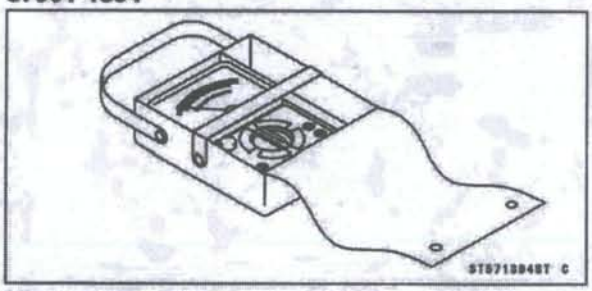
Rotor Puller, M16/M18/M20/M22 × 1.5:
57001-1216



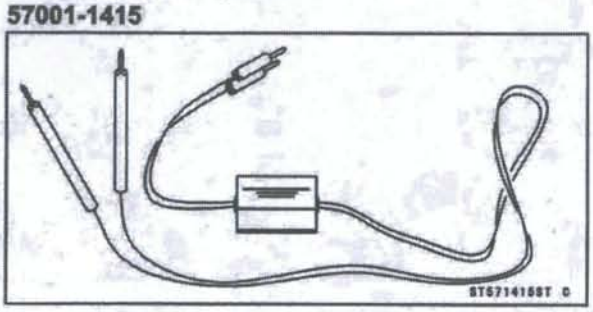
Spark Plug Wrench, Hex 16:
57001-1262



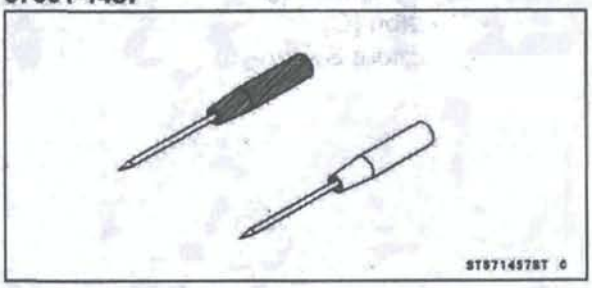
Hand Tester:
57001-1394



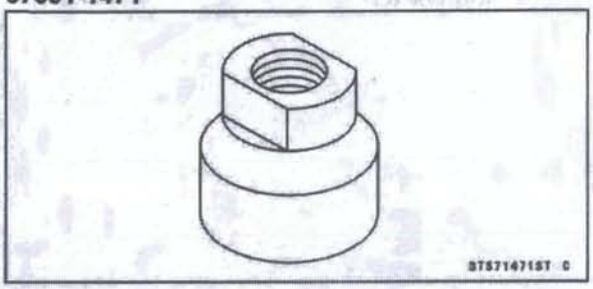
Peak Voltage Adapter:
57001-1415



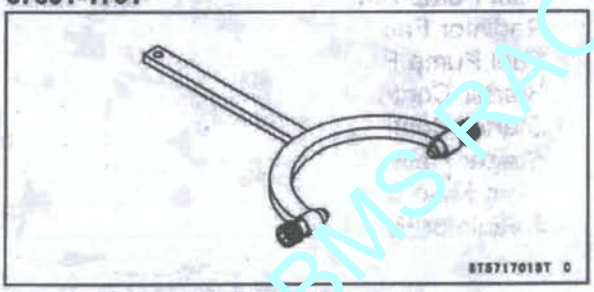
Needle Adapter Set:
57001-1457



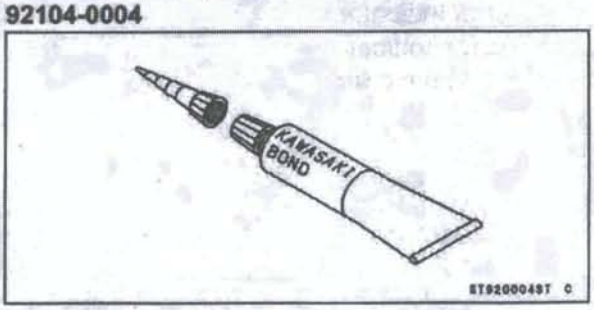
Flywheel Puller, M28 × 1.0:
57001-1471



Flywheel Holder:
57001-1701

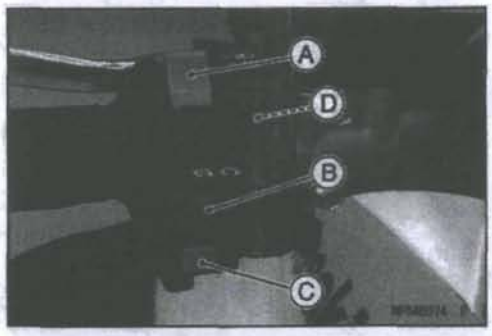


Kawasaki Bond (Silicone Sealant):
92104-0004

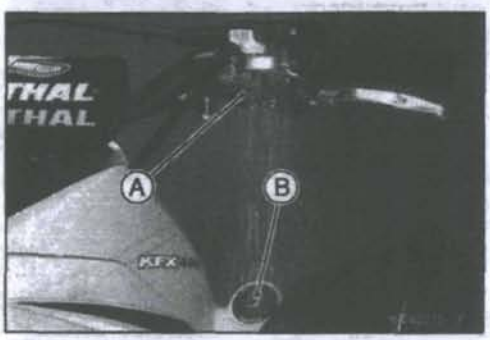


Parts Location

Headlight Switch [A]
Engine Stop Switch [B]
Starter Button [C]
Sterter Lockout Switch [D]

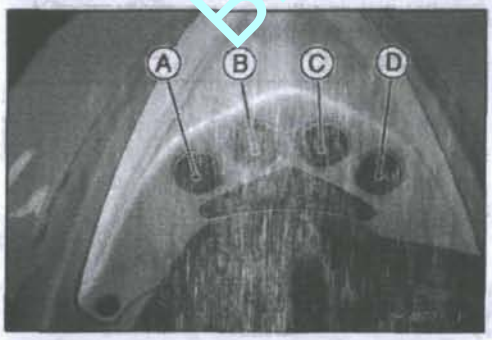


Front Brake Light Switch [A]
Ignition Switch [B]

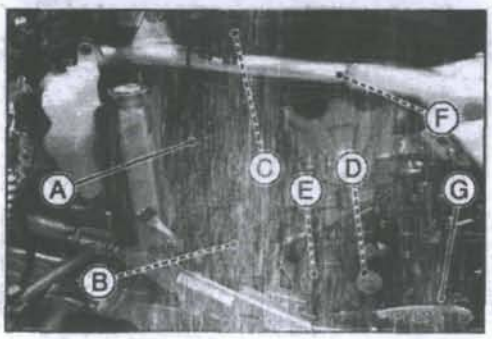


Radiator Fan Fuse 10 A [A]
Fuel Pump Fuse 10 A [B]
Radiator Fan Relay [C]
Fuel Pump Relay [D]
Starter Control Relay (Neutral) [E]
Starter Control Relay (Clutch) [F]
Starter Relay [G]
Main Fuse 30 A [H]
Regulator/Rectifier [I]

Water Temperature Warning/FI Indicator Light [A]
Neutral Indicator Light [B]
Reverse Indicator Light [C]
Fuel Reserve Indicator Light [D]

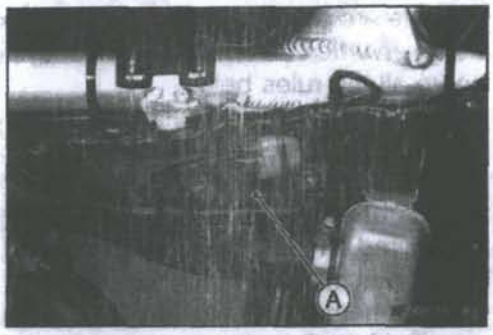


Radiator Fan [A]
Battery 12 V 6 Ah [B]
Fuel Pump/Fuel Reserve Switch [C]
Alternator [D]
Crankshaft Sensor [E]
Spark Plug [F]
Neutral / Reverse Switch [G]



Parts Location

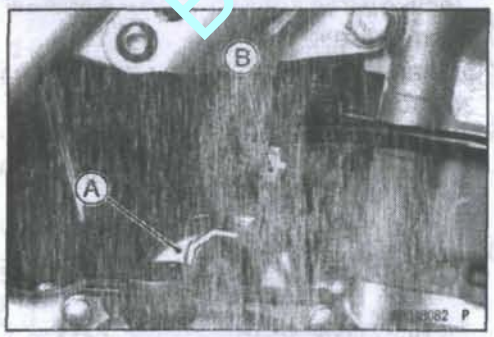
Ignition Coil [A]



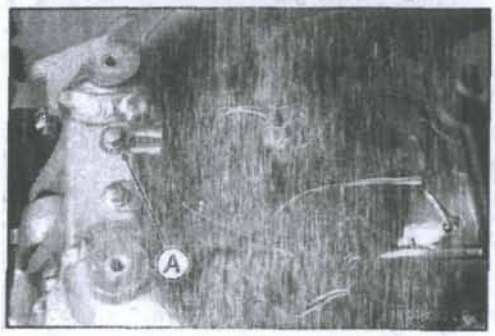
Tail/Brake Light (LED) 12 V 0.5/4.1 W [A]

Rear Brake Light Switch [A]

Starter Motor [A]
Water Temperature Sensor [B]



Frame Ground [A]



Precautions

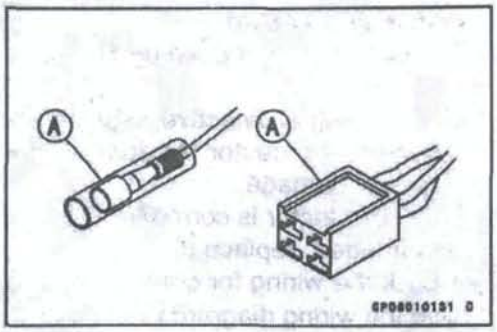
There are a number of important precautions that should be taken when servicing electrical systems. Learn and observe all the rules below.

- Do not reverse the battery lead connections. This will burn out the diodes in the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is required for conducting accurate electrical system tests.
- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- To prevent damaging electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the high current, never keep the starter button depressed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Only use an illumination bulb rated for the voltage or wattage specified in the wiring diagram, or the handle cover could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to chassis ground.
- Troubles may involve one or in some cases all items. Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they too must be repaired or replaced, or the new replacement will soon fail again.
- Make sure all connectors in the circuit are clean and tight, and examine wires for signs of burning, fraying, etc. Defective wires and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).
- Color Codes:

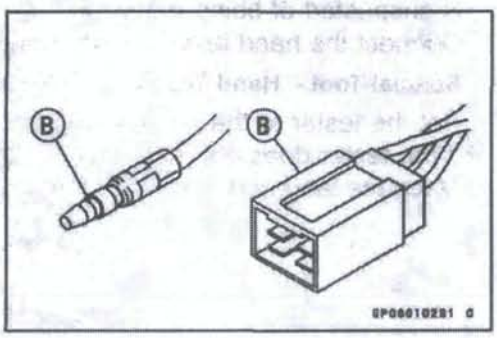
BK	Black	G	Green	P	Pink
BL	Blue	GY	Gray	PU	Purple
BR	Brown	LB	Light blue	R	Red
CH	Chocolate	LG	Light green	W	White
DG	Dark green	O	Orange	Y	Yellow

Precautions

○Electrical Connectors:
Connectors [A]

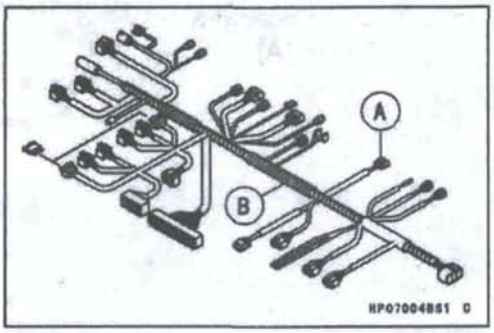


Connectors [B]



Electrical Wiring

Wiring Inspection



- Visually inspect the wiring for signs of burning, fraying, etc.

★If any wiring is defective, replace the damaged wiring.

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

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

- Check the wiring for continuity.

○Use the wiring diagram to find the ends of the lead which is suspected of being a problem.

○Connect the hand tester between the ends of the leads.

Special Tool - Hand Tester: 57001-1394

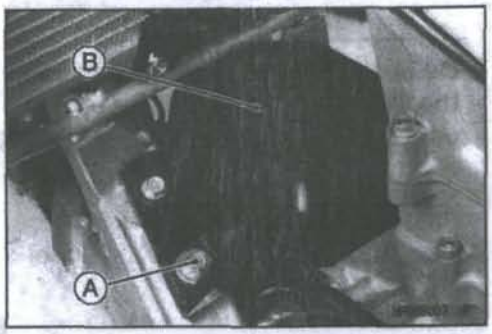
○Set the tester to the ×1 Ω range.

★If the tester does not read 0 Ω, the lead is defective. Replace the lead or the wiring harness [B] if necessary.

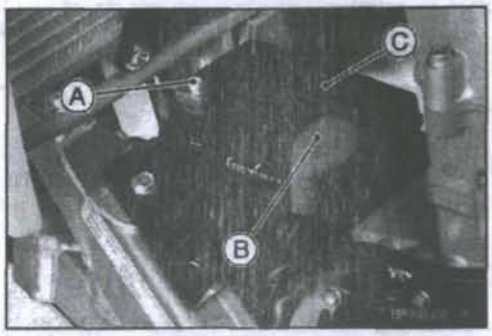
Battery

Battery Removal

- Turn off the ignition switch.
- Remove:
  Battery Cover Bolts [A]
  Battery Cover [B]

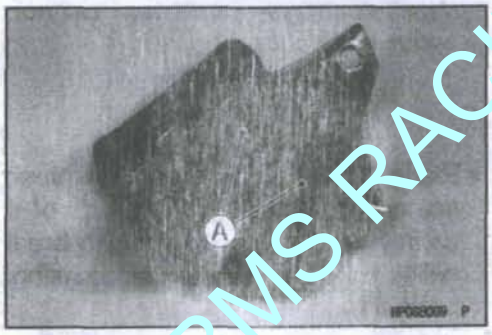


- Disconnect the battery negative (–) cable [A] first, and then the positive (+) cable [B].
- Take out the battery [C].



Battery Installation

- Turn off the ignition switch.
- Stick the rubber dampers [A] to the battery cover inside.
- Connect the positive cable first and then the negative.
- Install:
  Battery Cover
  Battery Cover Bolts

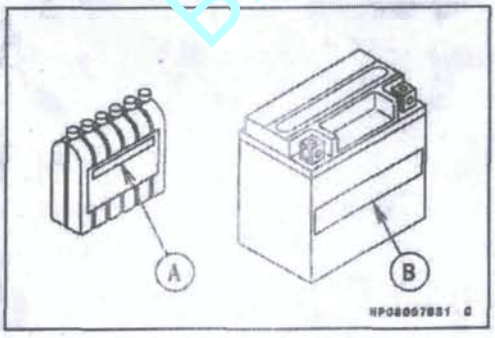


Battery Activation

Electrolyte Filling

- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for KSF450B: YTX7L-BS



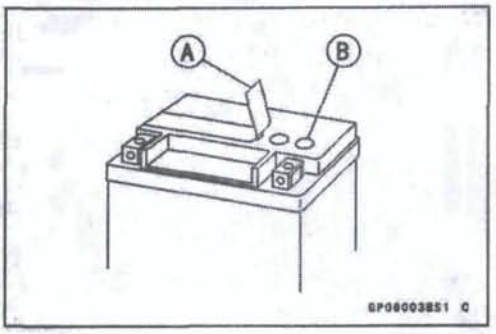
CAUTION

Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type. This is to prevent overfilling of the electrolyte, shorting the battery life, and deterioration of the battery performance.

Battery

CAUTION

Do not remove the aluminum sealing sheet [A] from the filler ports [B] until just prior to use. Be sure to use the dedicated electrolyte container for correct electrolyte volume.

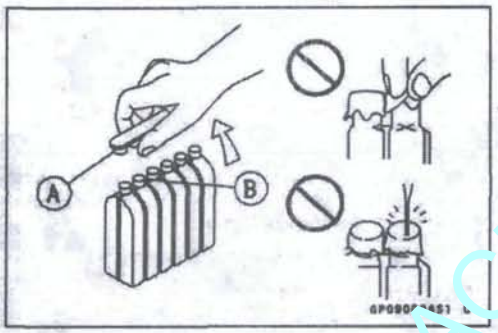


- Place the battery on a level surface.
- Check to see that the sealing sheet has no peeling, tears, or holes in it.
- Remove the sealing sheet.

NOTE

○*The battery is vacuum sealed. If the sealing sheet has leaked air into the battery, it may require a longer initial charge.*

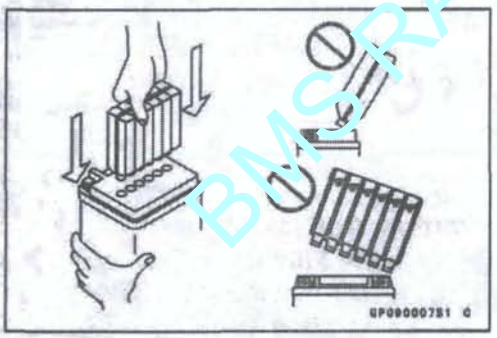
- Remove the electrolyte container from the vinyl bag.
- Detach the strip of caps [A] from the container and set aside, these will be used later to seal the battery.



NOTE

○*Do not pierce or otherwise open the sealed cells [B] of the electrolyte container. Do not attempt to separate individual cells.*

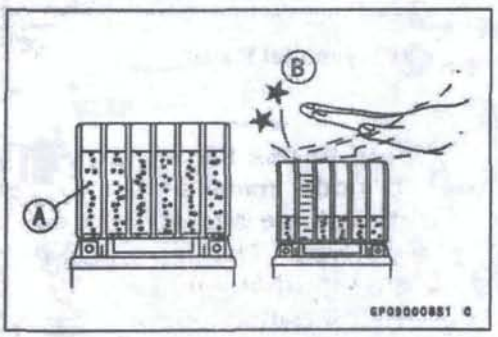
- Place the electrolyte container upside down with the six sealed cells into the filler ports of the battery. Hold the container level, push down to break the seals of all six cells. You will see air bubbles rising into each cell as the ports fill.



NOTE

○*Do not tilt the electrolyte container*

- Check the electrolyte flow.
- ★If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.
- Keep the container in place for **20** minutes or more. Don't remove the container from the battery until it's empty, the battery requires all the electrolyte from the container for proper operation.



CAUTION

Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the electrolyte container until it is completely empty and 20 minutes have elapsed.

Battery

- Gently remove the container from the battery.
- Let the battery sit for **30** minutes prior to charging to allow the electrolyte to permeate into the plates for optimum performance.

NOTE

○*Charging the battery immediately after filling can shorten service life. Let the battery sit for at least **30** minutes after filling.*

Initial Charge

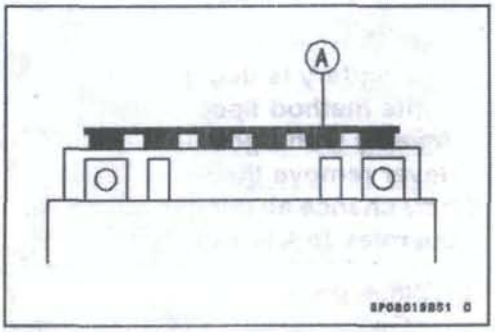
- Place the strip [A] of caps loosely over the filler ports.
- Newly activated sealed batteries require an initial charge.

Standard Charge **1.2 A × 5 ~ 10 hours**

★If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

Kawasaki-recommended chargers:
Optimate III
Yuasa 1.5 Amp Automatic Charger
Battery Mate 150–9

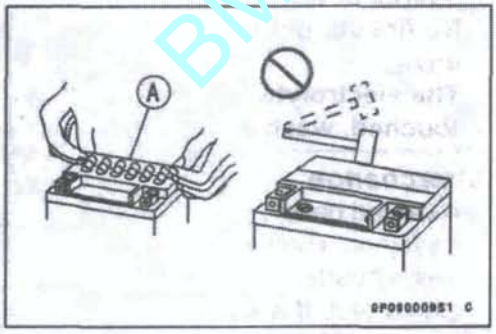
★If the above chargers are not available, use equivalent one.



NOTE

○*Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. If it is not at least 12.8 volts, repeat charging cycle.*

- After charging is completed, press down firmly with both hands to seat the strip of caps [A] into the battery (don't pound or hammer). When properly installed, the strip of the caps will be level with the top of the battery.



CAUTION

Once the strip of the caps [A] is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.

NOTE

○*To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds.*
Re-check voltage and if less than 12.8 volts repeat the charging cycle and load test. If still below 12.8 volts the battery is defective.

Battery

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 .
   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.

3) When you do not use the vehicle for months
   Give a refresh charge before you store the vehicle 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.

Battery

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

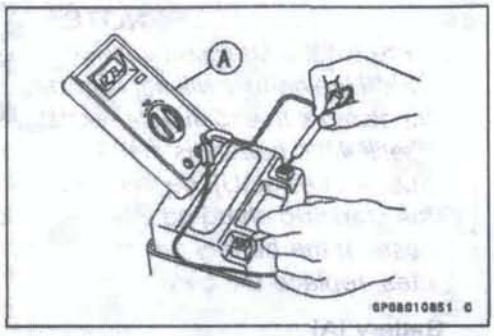
○*Measure with a digital voltmeter [A] which can be read to one decimal place voltage.*

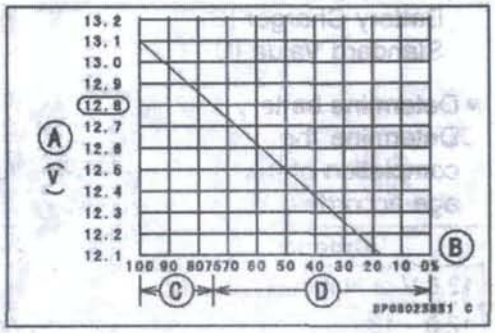
★If the reading is below the specified, refreshing charge is required.

Battery Terminal Voltage

Standard: 12.8 V or more

Terminal Voltage (V) [A]
Battery Charge Rate (%) [B]
Good [C]
Refresh charge is required [D]



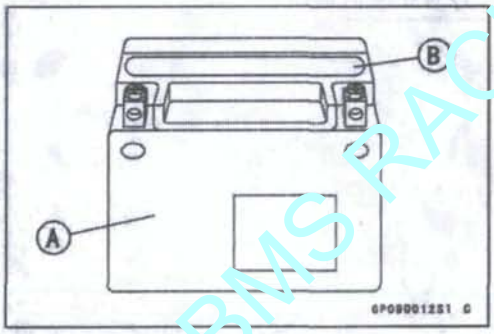


Refreshing Charge

- Remove the battery [A] (see Battery Removal).
- Refresh-charge by following method according to the battery terminal voltage.

⚠ WARNING

This battery is sealed type. Never remove seal sheet [B] even at charging. Never add water. Charge with current and time as stated below.



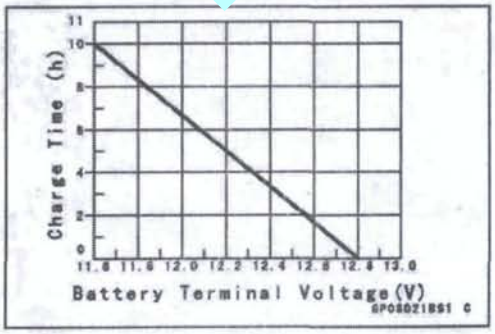
Terminal Voltage: 11.5 ~ less than 12.5 V

Standard Charge

1.2 A × 5 ~ 10 h (refer to following chart)

Quick Charge

6.0 A × 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.

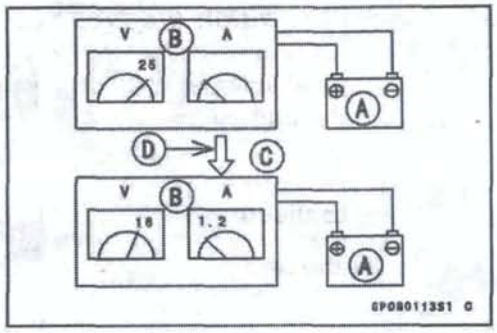
Terminal Voltage: less than 11.5 V

Charging Method: 1.2 A × 20 h

Battery

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.

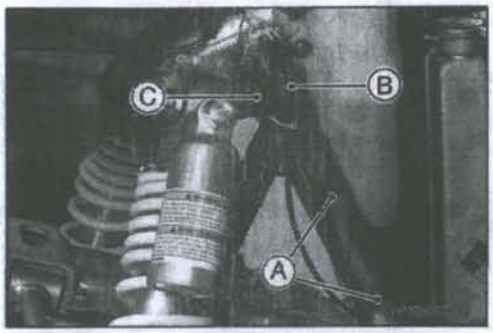
○Determine the condition of the battery 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

Criteria	Judgement
12.8 V or higher	Good
12.0 ~ 12.7 V or lower	Charge insufficient → Recharge
12.0 V or lower	Unserviceable → Replace

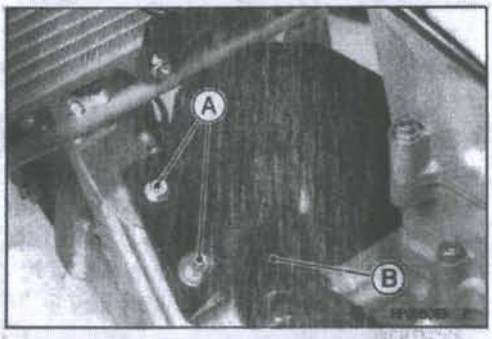
Charging System

Alternator Cover Removal

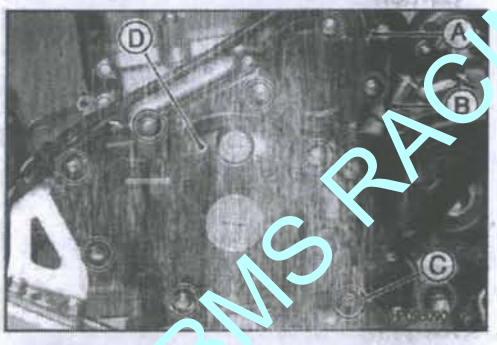
- Remove the engine bottom guard (see Engine Bottom Guard Removal in the Frame chapter).
- Drain the engine oil (see Engine Oil Change in the Periodic Maintenance chapter).
- Cut the bands [A].
- Disconnect the alternator lead connector [B] and crankshaft sensor lead connector [C] from the main harness.



- Loosen the battery cover and case bolts [A] fully.
- While lifting up the battery case [B] to clear the connectors.

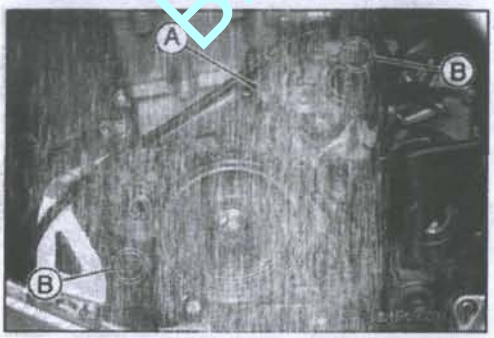


- Remove the shift pedal (see External Shift Mechanism Removal in the Engine Right Side chapter).
- Open the clamp [A] then free the neutral/reverse switch lead [B].
- Remove:
  Alternator Cover Bolts [C].
  Alternator Cover [D]



Alternator Cover Installation

- Replace the gasket [A] with a new one.
- Be sure to install the dowel pins [B].



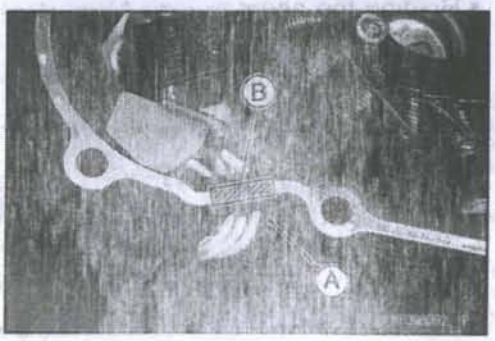
- Fit the grommet [A] into the notch in the alternator cover.
- Apply silicone sealant to the area [B] to the wiring grommet.

Sealant - Kawasaki Bond (Silicone Sealant): 92104-0004

- Tighten:

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

- Run the alternator and crankshaft sensor lead according the Cable, Wire and Hose Routing section in the Appendix chapter.
- Connect the lead connectors.



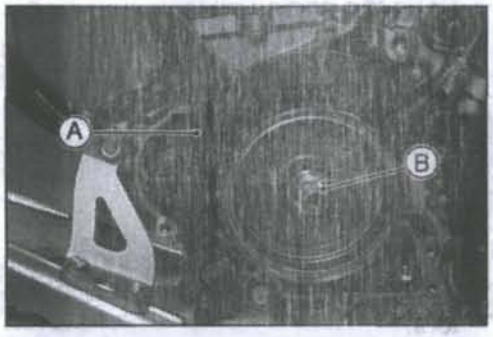
Charging System

Alternator Rotor Removal

- Remove the alternator cover (see Alternator Cover Removal).
- Hold the alternator rotor steady, with the rotor holder [A], and remove the nut [B].

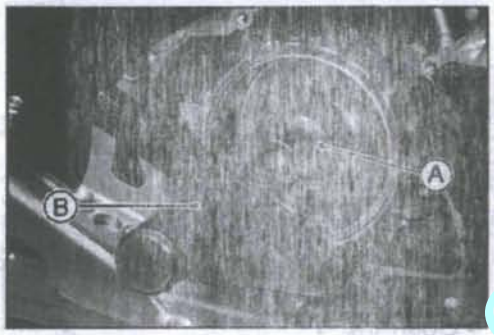
Special Tool - Flywheel Holder: 57001-1701

- Remove the flywaheel holder.



- Screw the flywheel puller [A] into the alternator rotor.
- Screw the rotor puller [B] to the flywheel puller.
- Remove the alternator rotor from the crankshaft by turning in the puller center bolt and tapping the head of the bolt lightly with a hammer, while holding the puller body steady. There is a woodruff key in the crankshaft tapered portion.

Special Tool - Rotor Puller,M16/M18/M20/M22 × 1.5: 57001 -1216
Fywheel Puller M28 × 1.0: 57001-1471



CAUTION

Never strike the grab bar or the flywheel itself. Striking the bar can bond it. If the flywheel is struck, the magnets may lose their magnetism.

Alternator Rotor Installation

- Using a high-flash point solvent, clean off any oil or dirt that may be on the crankshaft taper [A] and the hole [B] in the alternator rotor. Dry them with a clean cloth.
- Fit the woodruff key securely in the slot in the crankshaft.
- Install the starter clutch gear.
- Install the alternator rotor following procedures.

NOTE

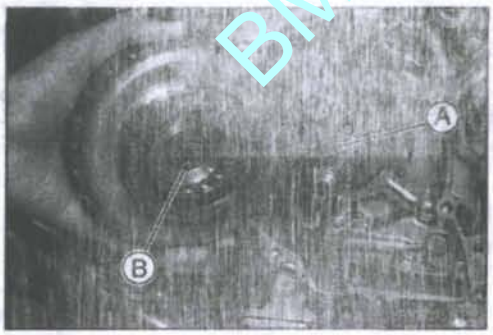
○*Confirm the alternator rotor fit or not to the crankshaft before tightening it with specified torque.*

- Holding the alternator rotor steady with the rotor holder, and tighten the alternator rotor nut.

Special Tool - Flywheel Holder: 57001-1701

Torque - Alternator Rotor Nut: 98 N·m (10 kgf·m, 72 ft·lb)

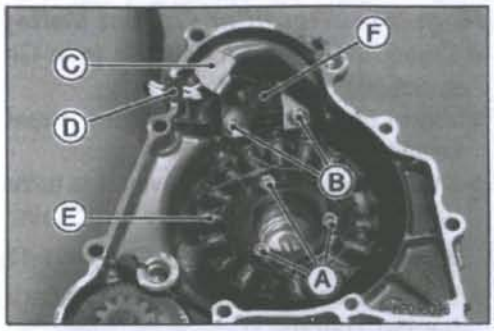
- Install the alternator cover (see Alternator Cover Installation)



Charging System

Alternator Stator Removal

- Remove:
  Alternator Cover (see Alternator Cover Removal)
  Alternator Stator Bolts [A]
  Crankshaft Sensor Bolts [B]
  Wiring Holder Plate [C]
  Wiring Grommet [D]
- Remove the alternator stator [E] and crankshaft sensor [F] as a set.



Alternator Stator Installation

- Apply a non-parmanent locking agent to the alternator stator bolts.
- Install the alternator stator and tighten it.

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

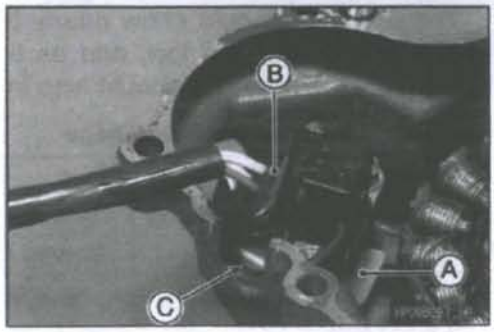
- Install the crankshaft sensor and wiring holder plate [A].
- Run the alternator stator leads under the holder and sensor.

Torque - Crankshaft Sensor Bolts: 7.0 N·m (0.71 kgf·m, 62 in·lb)

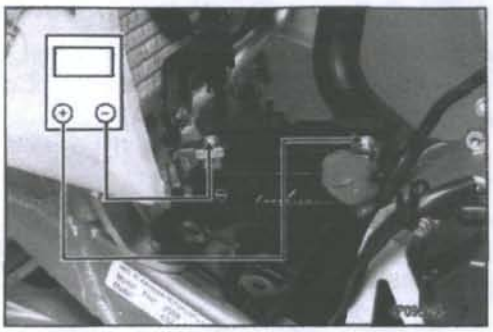
- Apply silicone sealant around the circumference of the wiring grommet.

Sealant - Kawasaki Bond (Silicone Sealant): 92104-0004

- Set the wiring grommet [B] securely in the notch [C].
- Install the alternator cover (see Alternator Cover Installation).



Regulator/Rectifier Output Voltage Inspection



- Check the battery condition (see Charging Condition Inspection).
- 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 (–)	14.0 ~ 14.5 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.

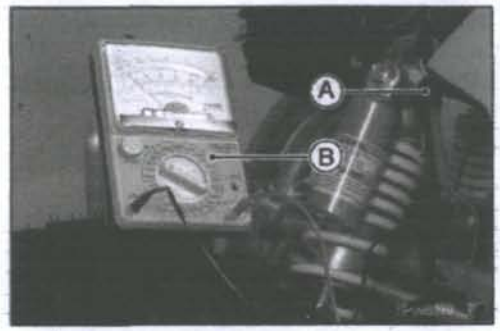
★If the output voltage is much higher than the values specified in the table, the regulator/rectifier is defective or the regulator/rectifier leads are loose or open.

★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.

Charging System

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 [B] as shown in the table.
○Start the engine.
○Run it at the rpm given in the table.
○Note the voltage readings (total 3 measurements).

Special Tool - Hand Tester: 57001-1394

Alternator Output Voltage

Tester Range	Connections		Reading
	Tester (+) to	Tester (–) to	@4 000 rpm
250 V AC	One yellow lead	Another yellow lead	46 V or more

★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.

- 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).

Special Tool - Hand Tester: 57001-1394

Stator Coil Resistance

Tester Range	Connections		Reading
	Tester (+) to	Tester (–) to	
× 1 Ω	White lead	Blue/Yellow lead	0.41 ~ 0.51 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.

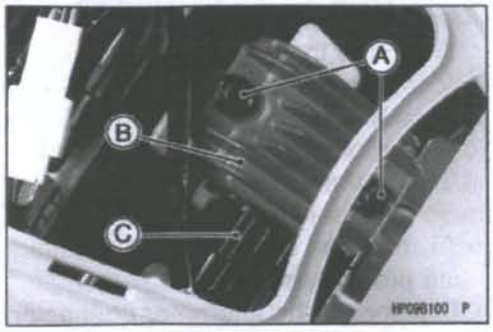
- Using the highest resistance range of the hand tester, measure the resistance between each of the black leads and chassis ground.

★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.

Regulator/Rectifier Removal

- Remove:
  Upper Cover (see Upper Cover Removal in the Frame chapter)
  Bolts [A]
  Regulator/Rectifier [B]
  Connector [C] (disconnect)



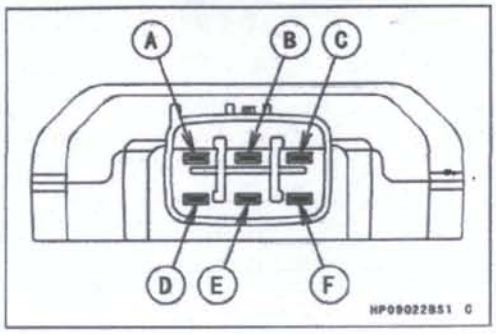
Regulator/Rectifier Inspection

- Remove:
  Regulator/Rectifier (see Regulator/Rectifier Removal)
- Set the hand tester to the × 1 kΩ range and make the measurements shown in the table.

Special Tool - Hand Tester: 57001-1394

- Connect the hand tester to the regulator rectifier.

★If the tester readings are not as specified, replace the regulator/rectifier.



CAUTION

Use only Kawasaki Hand Tester 57001-1394 for this test. A tester other than the Kawasaki Hand Tester may show different readings.
If a megger or a meter with a large capacity battery is used, the regulator/rectifier will be damaged.

Regulator/Rectifier Resistance **(Unit: kΩ)**

		Tester (+) Lead Connection					
	Terminal	A	B	C	D	E	F
(−)*	A	–	0	0	0	0	0
	B	0	–	0	0	0	0
	C	5 ~ 15	0	–	5 ~ 15	5 ~ 15	5 ~ 15
	D	5 ~ 15	0	0	–	0	0
	E	5 ~ 15	0	0	0	–	0
	F	5 ~ 15	0	0	0	0	–

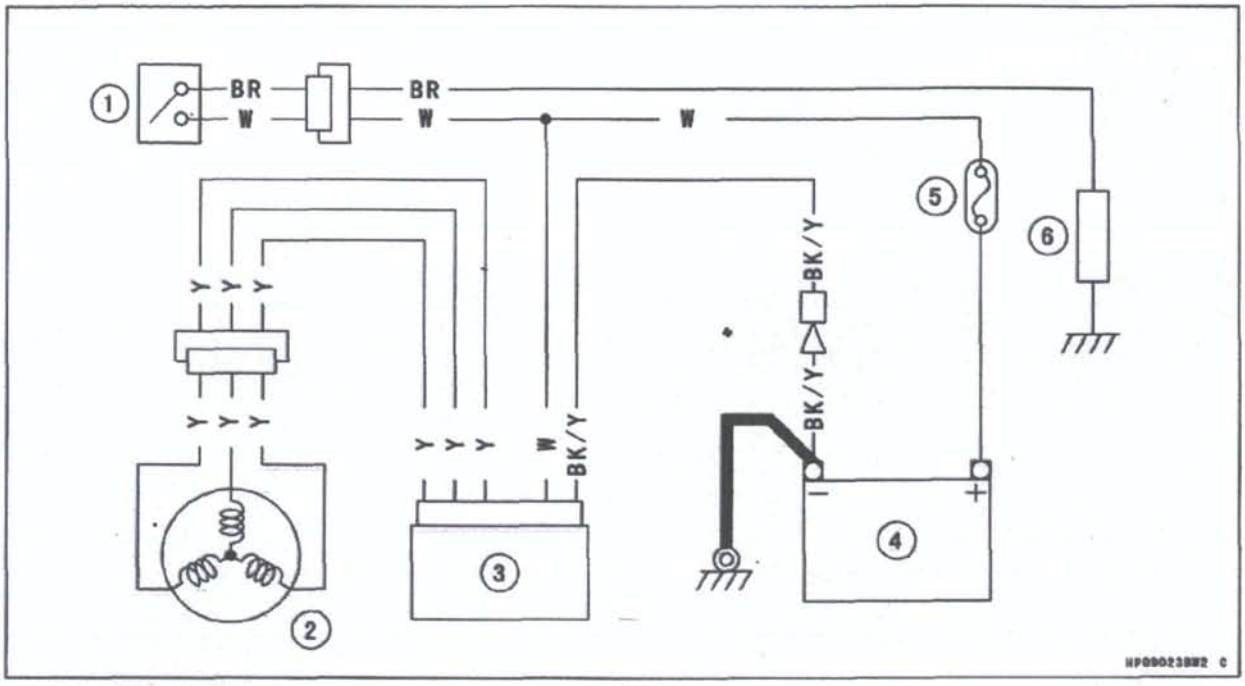
(−)*: Tester (−) Lead Connection

- Install the regulator/rectifier.

Torque - Regulator/Rectifier Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

Charging System

Charging System Circuit



1. Ignition Switch
2. Alternator
3. Regulator/Rectifire
4. Battery 12 V 6 Ah
5. Main Fuse 30 A
6. Load

⚠ WARNING

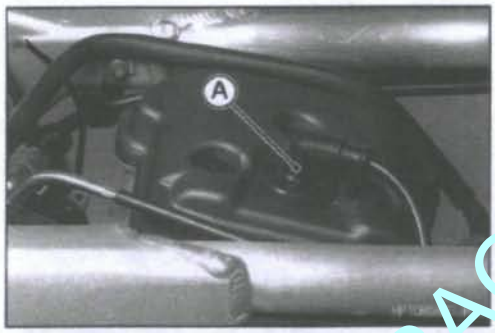
The ignition system produces extremely high voltage.
Do not touch the spark plug, ignition coil, or spark plug lead while the engine is running, or you could receive a severe electrical shock.

CAUTION

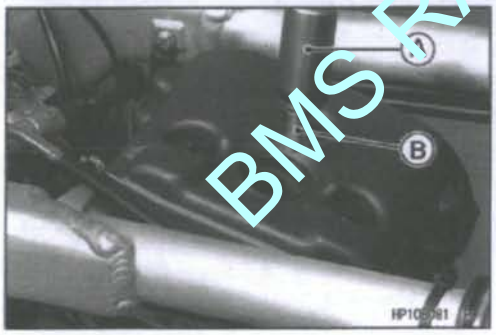
Do not disconnect the battery cable or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent ECU (Electric Control Unit) damage.
Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the ECU (Electric Control Unit).

Spark Plug Removal

- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  Spark Plug Cap [A]



- Using a spark plug wrench [A], remove the spark plug [B].
  Special Tool - Spark Plug Wrench, Hex 16: 57001-1262
  Owner's Tool - Spark Plug Wrench, 16 mm: 92110-0002



Spark Plug Installation

- Tighten:
  Torque - Spark Plug: 13 N·m (1.3 kgf·m, 115 in·lb)
  Special Tool - Spark Plug Wrench, Hex 16: 57001-1262
  Owner's Tool - Spark Plug Wrench, 16 mm: 92110-0002
- Fit the spark plug caps securely.
- Pull up the spark pug caps lightly to make sure of the installation of the spark plug caps.

Spark Plug Cleaning/Inspection

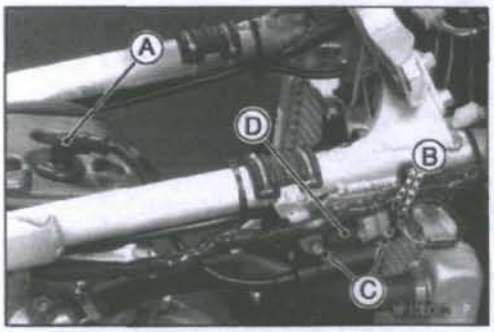
- Refer to the Spark Plug Cleaning/Inspection in the Periodic Maintenance chapter.

Spark Plug Gap Inspection

- Refer to the Spark Plug Gap Inspection in the Periodic Maintenance chapter.

Ignition Coil Removal

- Remove:
  Fuel Tank (see Fuel Tank Removal in the Fuel System (DFI) chapter)
  Spark Plug Cap [A]
  Primary Lead Connectors [B]
  Bolt [C]
  Ignition Coil [D]

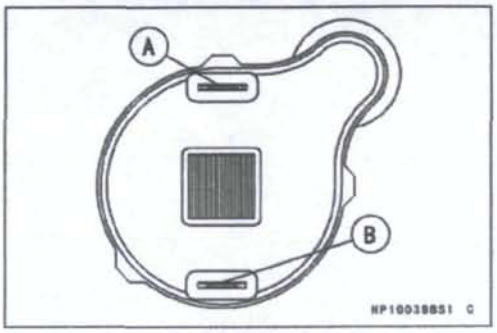


Ignition Coil Installation

- Tighten:

Torque - Ignition Coil Nuts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Connect the primary leads to the ignition coil terminals as shown.
  BL/W Lead → (–) [A]
  Y/R/ Lead → (+) [B]



Ignition Coil Inspection

- Remove the ignition coil (see Ignition Coil Removal).
- 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 3 Needle Arcing Distance
7 mm (0.28 in.) 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.

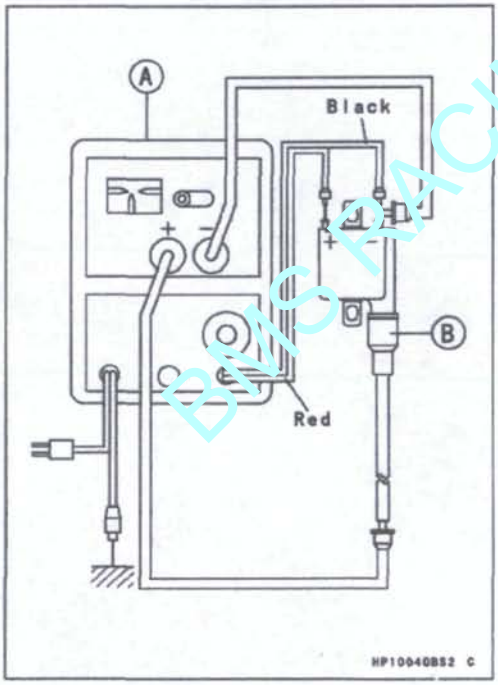
★If the arcing distance is as before, the trouble is with the ignition coil. If the arcing distance is normal, the trouble is with the spark plug cap.

★If a coil tester is not available, the coil can be checked for a broken or badly shorted winding with a hand tester.

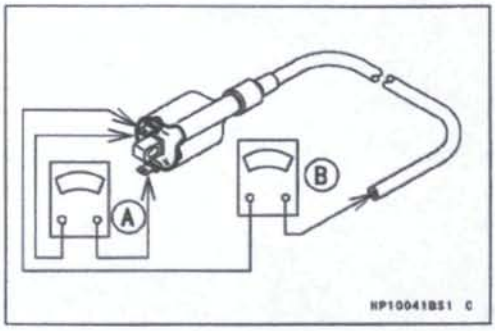
Special Tool - Hand Tester: 57001-1394

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 × 1 Ω range.
• Measure the secondary winding resistance [B] as follows:
○Remove the plug cap by turning it counterclockwise.
○Connect the tester between the spark plug lead and terminal.
○Set the tester to the × 1 kΩ range.



Ignition Coil Winding Resistance
Primary Windings: 2.1 ~ 2.5 Ω
Secondary Windings: 10 ~ 16 kΩ

★If the hand tester does not read as specified, replace the ignition coil.

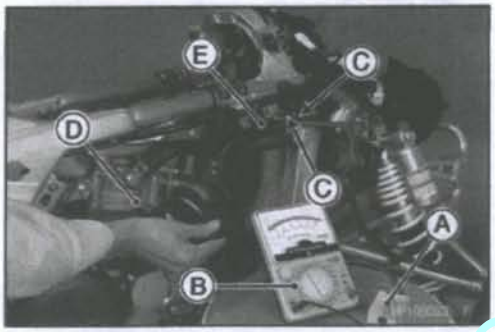
Ignition Coil Primary Peak Voltage Inspection

NOTE

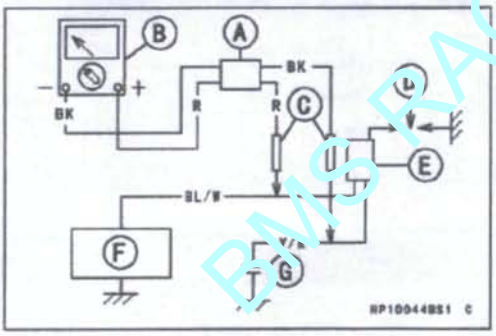
○*Be sure the battery is fully charged.*

• Remove the spark plug cap (see Spark Plug Removal), but do not remove the spark plug.
• Measure the primary peak voltage as follows.
○Connect the peak voltage adapter [A] to the hand tester [B] (1 000 V DC range). Install the needle adapter [C] on the peak voltage adapter leads.

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B



○Insert the needle adapter into the ignition terminals as shown.
○Install a new spark plug [D] into the spark plug cap, and ground it to the engine.
[E] Ignition Coil
[F] ECU
[G] Battery



⚠ 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.

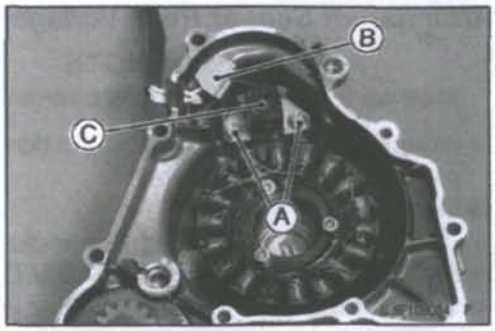
Ignition Coil Primary Peak Voltage
Standard: 210 V or more

★If the reading is less than the specified value, check the following.
Ignition Coil (see Ignition Coil Inspection)
Crankshaft Sensor (see Crankshaft Sensor Inspection)
★If the ignition coil and crankshaft sensor are normal, see the Ignition System Troubleshooting chart.

Ignition System

Crankshaft Sensor Removal

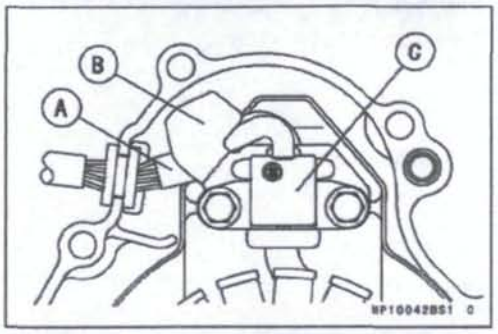
- Remove:
  Alternator Cover (see Alternator Cover Removal)
  Crankshaft Sensor Bolts [A]
  Wiring Holder Plate [B]
  Crankshaft Sensor [C]



Crankshaft Sensor Installation

- Install:
  Stator Coil Leads [A]
  Wiring Holder Plate [B]
  Crankshaft Sensor [C]
- Tighten:

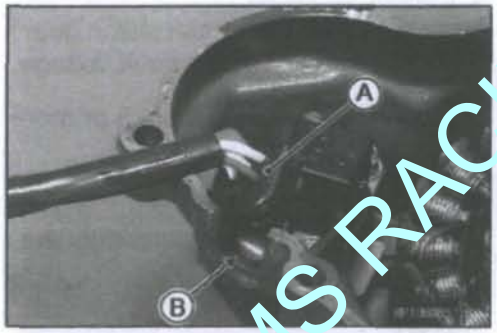
Torque - Crankshaft Sensor Bolts: 7.0 N·m (0.71 kgf·m, 62 in·lb)



- Apply silicone sealant around the circumference of the wiring grommet.

Sealant - Kawasaki Bond (Silicone Sealant): 92104-0004

- Set the wiring grommet [A] securely in the notch [B].
- Install the alternator cover (see Alternator Cover Installation).



Crankshaft Sensor Inspection

- Disconnect the crankshaft sensor lead connector [A].
- Measure the crankshaft sensor resistance.

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

○Connect a hand tester between the W lead and the BL lead.
○Set the tester to the × 10 Ω range.

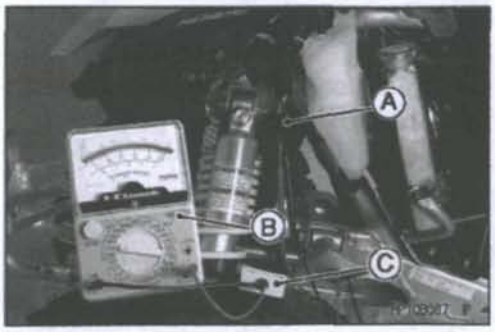
Crankshaft Sensor Resistance
22 ~ 34 Ω

★If the tester does not read as specified, replace the crankshaft sensor.

Crankshaft Sensor Peak Voltage Inspection

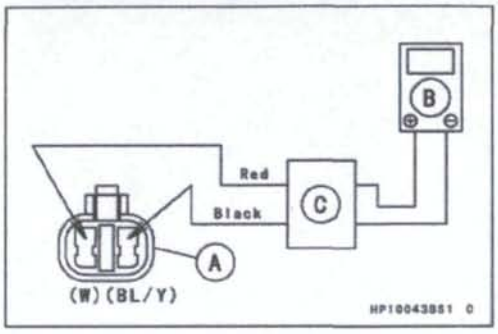
NOTE

○*Be sure the battery is fully charged.*



- Remove the spark plug caps, but do not remove the spark plugs.
- Disconnect:
  Crankshaft Sensor Lead Connector [A]
- Set the hand tester [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the hand tester and crankshaft sensor leads in the connector.

Special Tools - Hand Tester: 57001-1394
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B



Connections:

Crankshaft Sensor Lead		Adapter		Hand Tester
White	←	Red	→	(+)
Blue/Yellow	←	Black	→	(–)

- Turn the ignition switch on, and rotate the engine for 4 ~ 5 seconds with the transmission gear in neutral to measure the crankshaft sensor peak voltage.
- Repeat the measurement 5 or more times.

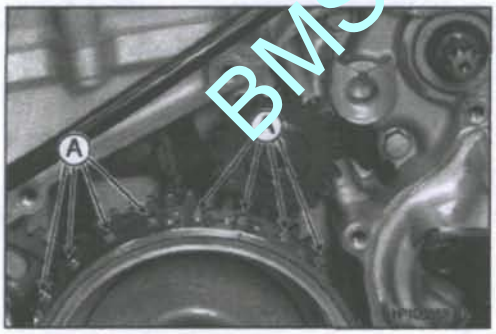
Crankshaft Sensor Peak Voltage
Standard: 2 V or more

★If the peak voltage is lower than the standard, inspect the crankshaft sensor.

Alternator Rotor Inspection

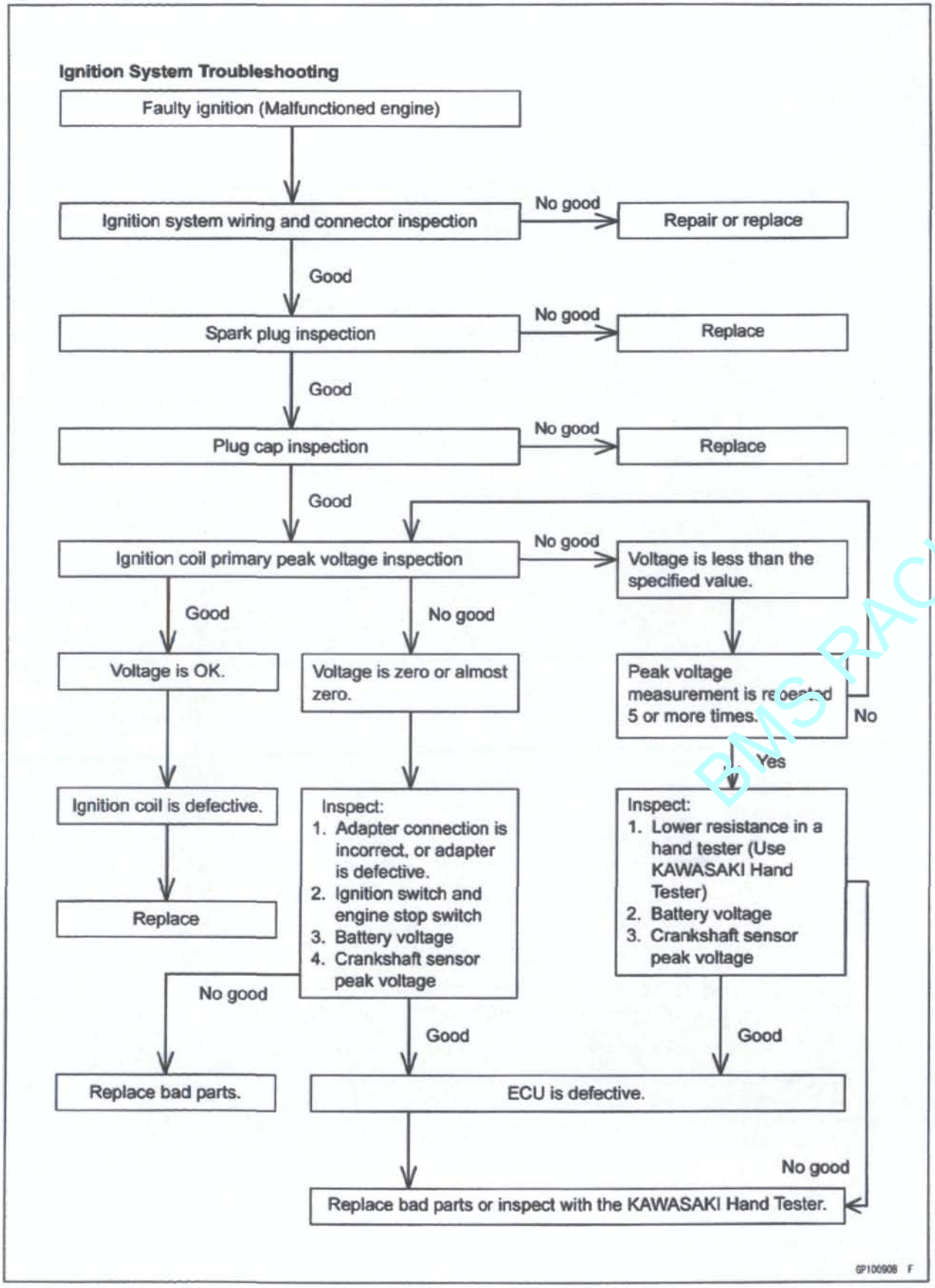
- Check the timing projections [A] for damage such as chipping or grooving.

★If the timing projection on the rotor is visibly damaged, replace the alternator rotor.



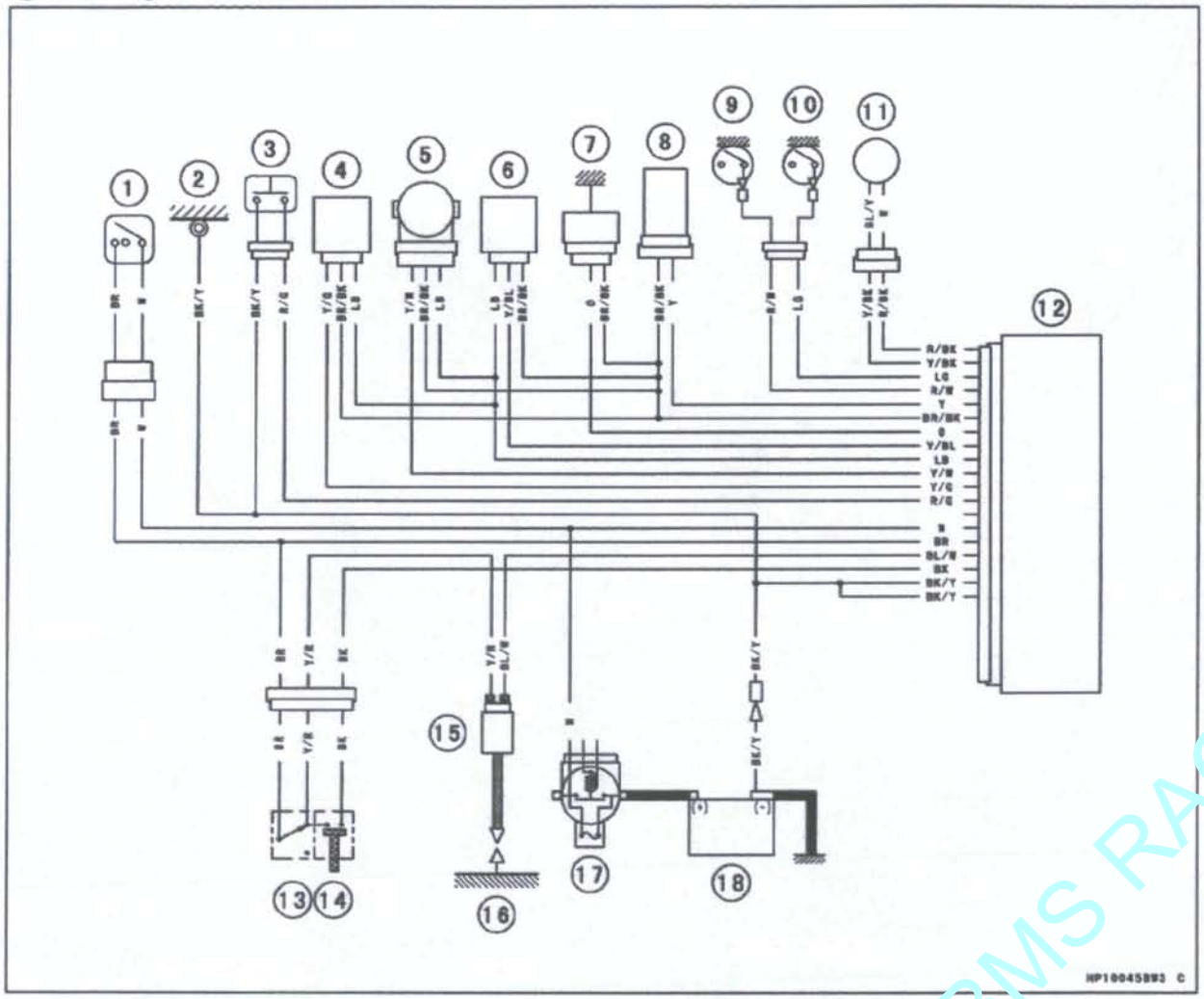
Ignition System

Ignition System Troubleshooting



Ignition System

Ignition System Circuit



1. Ignition Switch
2. Frame Ground
3. Starter Lockout Switch
4. Vehicle-down Sensor
5. Main Throttle Sensor
6. Inlet Air Pressure Sensor
7. Water Temperature Sensor
8. Inlet Air Temperature Sensor
9. Reverse Switch
10. Neutral Switch
11. Crankshaft Sensor
12. ECU (Electronic Control Unit)
13. Engine Stop Switch
14. Starter Button
15. Ignition Coil
16. Spark Plug
17. Main Fuse 30 A
18. Battery 12 V 6 Ah

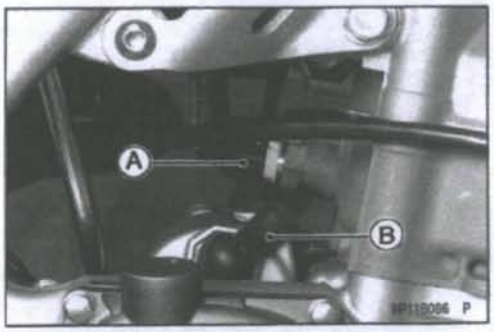
Electric Starter System

Starter Motor Removal

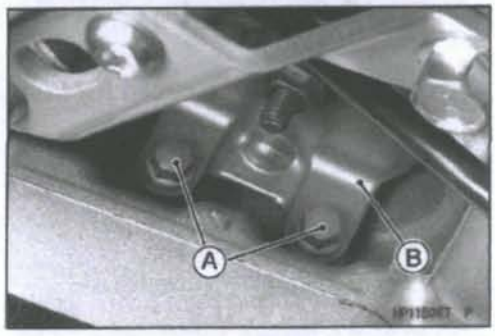
CAUTION

Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.

- Remove:
  Exhaust Pipe (see Muffler Removal in the Engine Top End chapter)
  Water Temperature Sensor Connector [A]
- Slide back the rubber cap [B].



- Remove the starter motor terminal nut.
- Remove the mounting bolts [A].
- Pull out the starter motor [B].

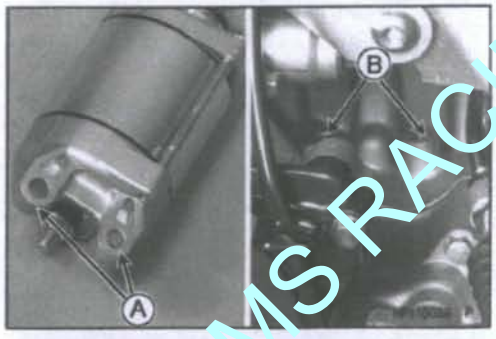


Starter Motor Installation

CAUTION

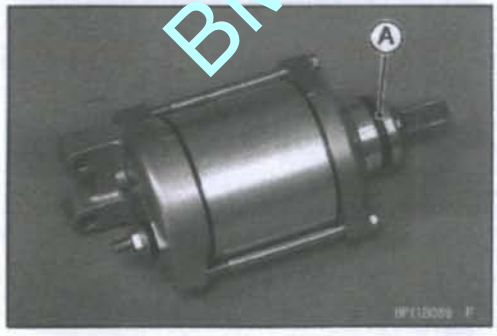
Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.

- When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.



- Replace the O-ring [A] with a new one.
- Apply grease to the O-ring.
- Apply a non-permanent locking agent to the threads of the bolts and tighten the bolts.
- Tighten:

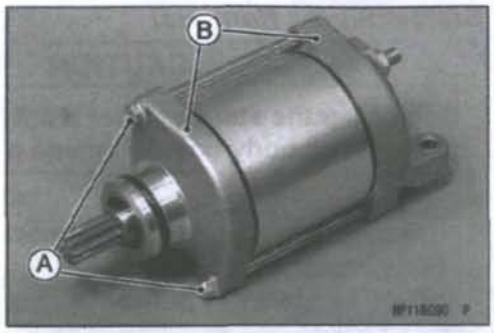
Torque - Starter Motor Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)
Starter Motor Terminal Nut: 9.8 N·m (1.0 kgf·m, 87 in·lb)



- Slide back the rubber cap to the original position.
- Install the removed parts.

Starter Motor Disassembly

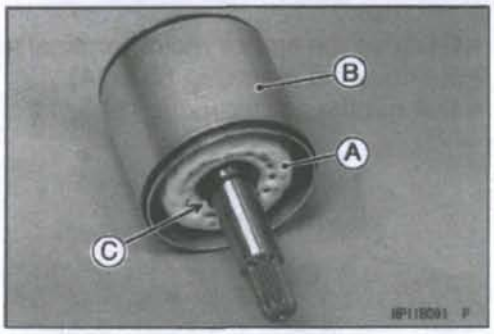
- Remove the starter motor (see Starter Motor Removal).
- Take off the starter motor through bolts [A] and remove the both end covers [B].



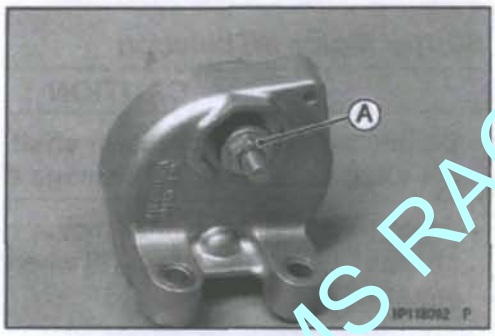
- Pull out the armature [A] out of the yoke [B].

NOTE

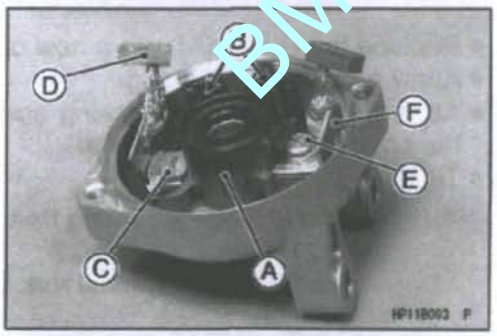
○*Do not remove the circlip [C] from the shaft.*



- Remove the starter motor terminal locknut [A], washer and collar.

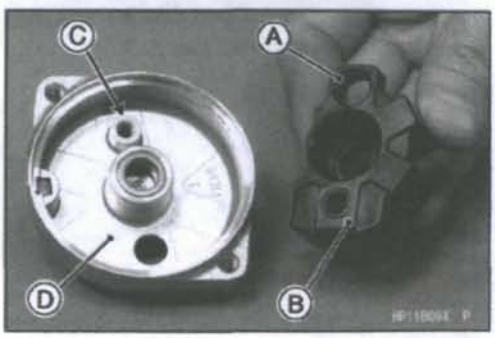


- Pull out the brushes from the brush holder [A].
- Remove:
  Brush Springs [B]
  Starter Motor Terminal [C]
  Positive Brush Assy [D] and O-ring
  Screw [E]
  Negative Brush Assy [F]
  Brush Holder



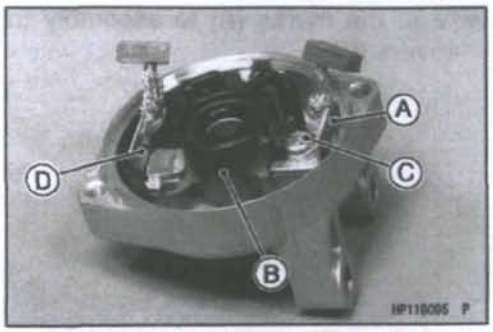
Starter Motor Assembly

- Align the hole [A] of the brush holder [B] to the boss [C] of the end cover [D].



Electric Starter System

- Install the negative brush assy [A] to the brush holder [B].
- Tighten the screw [C] securely.
- Install the positive brush assy [D] to the brush holder.
- Install the starter motor terminal.

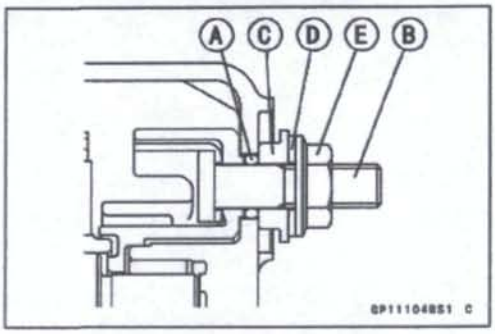


- Replace the O-ring [A] with a new one.
- Install the following parts to the starter motor terminal [B].
  - O-ring
  - Collar [C]
  - Washer [D]
  - Starter Motor Terminal Locknut [E]

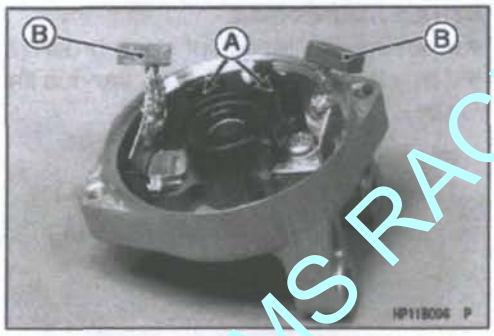
OInstall the collar so that stepped side faces outward.

- Tighten:

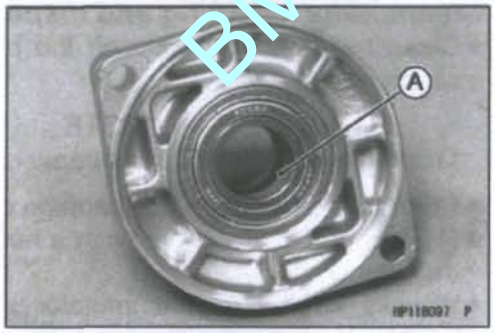
Torque - Starter Motor Terminal Locknut: 11 N·m (1.1 kgf·m, 97 in·lb)



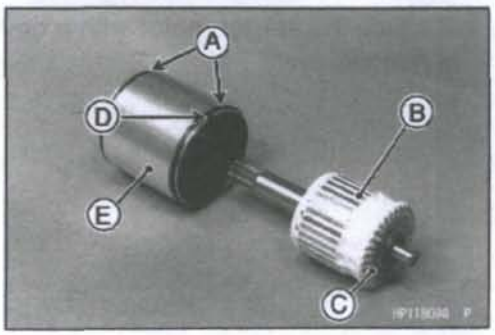
- Install the brush springs [A] and insert the brushes [B].



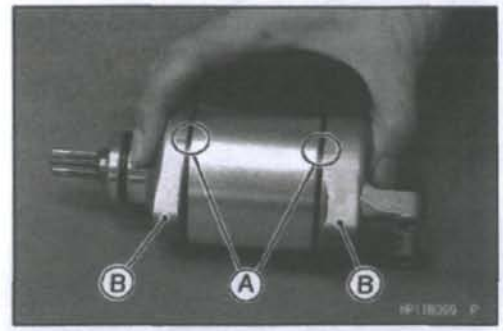
- Apply thin coat of grease to the oil seal [A].



- Replace the O-rings [A] with new ones.
- Insert the armature [B] so that commutator side [C] faces hollow side [D] of the yoke [E].



- Align the marks [A] to assembly the yoke and the end covers [B].



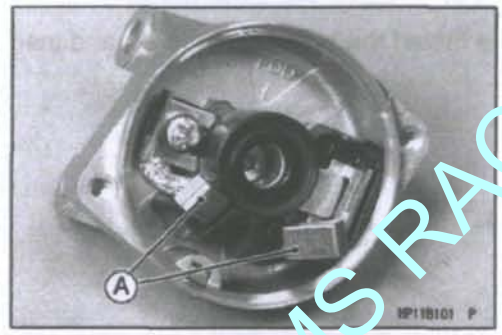
- Tighten:

Torque - Starter Motor Through Bolts [A]: 5.0 N·m (0.51 kgf·m, 44 in·lb)

Brush Inspection

- Measure the length of each brush [A].
- ★If any is worn down to the service limit, replace the brush assy.

Starter Motor Brush Length
Standard: 12 mm (0.47 in.)
Service Limit: 6.5 mm (0.26 in.)



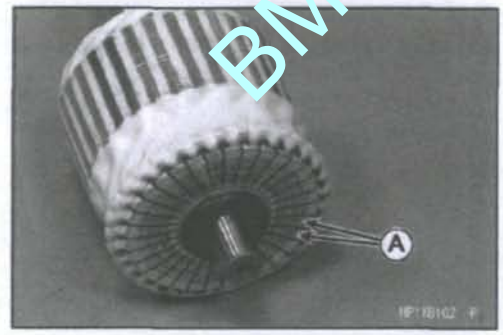
Commutator Cleaning and Inspection

- Clean the metallic debris off the between commutator segments [A].

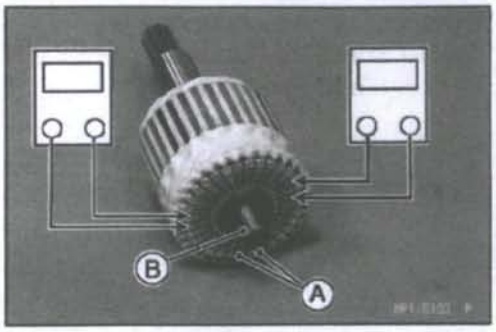
NOTE

○*Do not use emery or sand paper on the commutator.*

- Check the commutator for damage or abnormal wear.
- ★Replace the starter motor with a new one if there is any damage or wear.
- Visually inspect the commutator segments for discoloration.
- ★Replace the starter motor with a new one if discoloration is noticed.



Armature Inspection



- Using the × 1 Ω hand tester range, measure the resistance between any two commutator segments [A].

Special Tool - Hand Tester: 57001-1394

★If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.

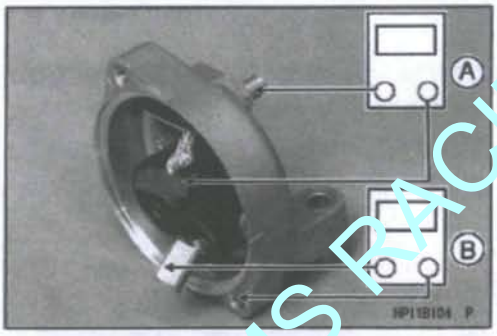
- Using the highest hand tester range, measure the resistance between the segments and the shaft [B].

★If there is any reading at all, the armature has a short and the starter motor must be replaced.

NOTE

○*Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.*

Brush Lead Inspection



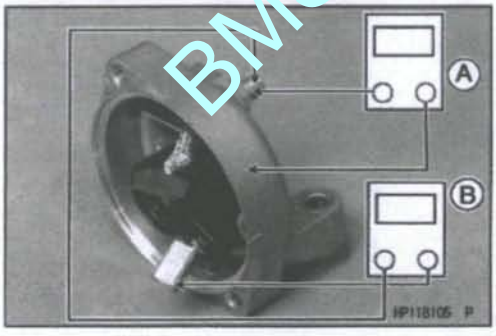
- Using the × 1 Ω hand tester range, measure the resistance as shown.

Terminal Bolt and Positive Brushes [A]
Right-hand End Cover and Negative Brushes [B]

Special Tool - Hand Tester: 57001-1394

★If there is not close to zero ohms, the brush lead has an open. Replace the brush plate assy.

Right-hand End Cover Inspection



- Using the highest hand tester range, measure the resistance as shown.

Terminal Bolt and Right-hand End Cover [A]
Terminal Bolt and Negative Brushes [B]

Special Tool - Hand Tester: 57001-1394

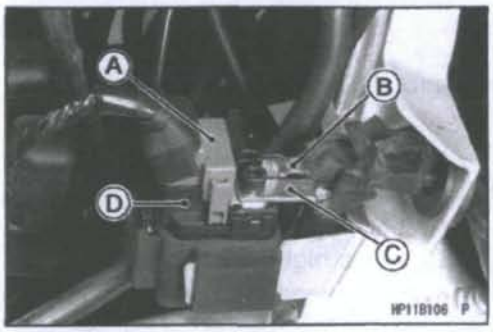
★If there is any reading, the brush assy and/or terminal bolt assy have a short. Replace the starter motor.

Starter Relay Inspection

- Remove the battery negative (–) cable from the battery negative (–) terminal (see Battery Removal).
- Remove:

Front Fender (see Front Fender Removal in the Frame chapter)

- Disconnect the connector [A].
- Disconnect the starter motor cable [B] and battery positive (+) cable [C] from the starter relay [D].



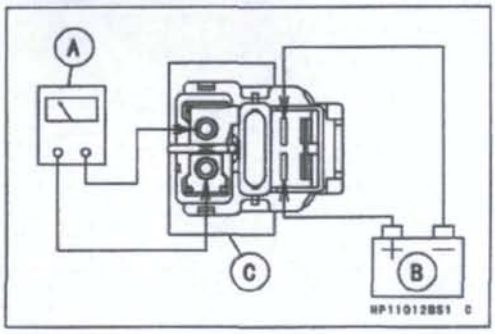
- Connect the hand tester [A] and 12 V battery [B] to the starter relay [C] as shown.

Special Tool - Hand Tester: 57001-1394

★If the relay does not work as specified, the relay is defective. Replace the relay.

Testing Relay

Tester Range:	**× 1 Ω range**
Criteria:	**When battery is connected → 0 Ω**
	When battery is disconnected → ∞ Ω

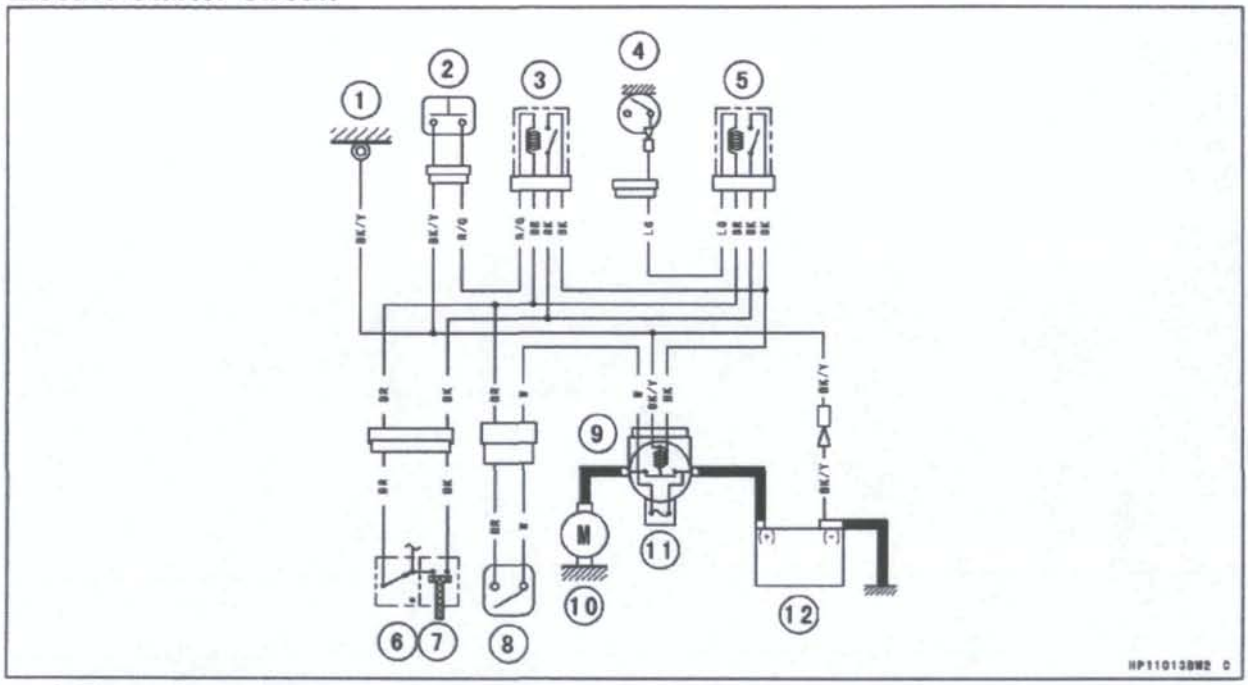


Starter Control Relay Inspection

- Refer to the Relay Inspection.

Electric Starter System

Electric Starter Circuit

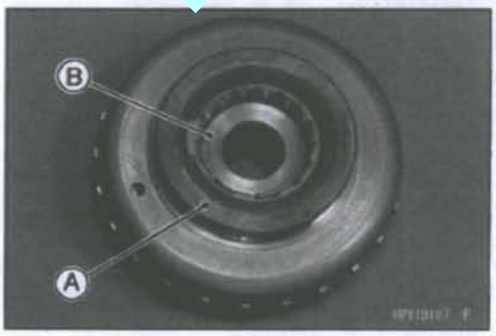


1. Frame Ground
2. Starter Lockout Switch
3. Starter Control Relay (Clutch)
4. Neutral Switch
5. Starter Control Relay (Neutral)
6. Engine Stop Switch
7. Starter Button
8. Ignition Switch
9. Starter Relay
10. Starter Motor
11. Main Fuse 30 A
12. Battery 12 V 6 Ah

Starter Motor Clutch Removal

- Remove:

Alternator Rotor (see Alternator Rotor Removal)
Snap Ring [A]
One-way Clutch [B]



Starter Motor Clutch Installation

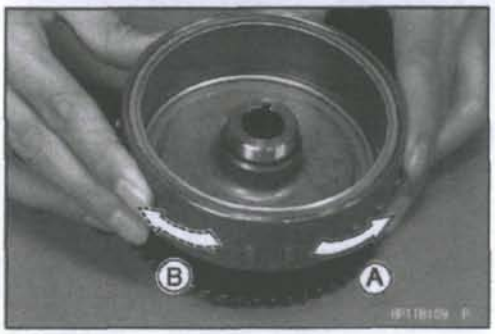
- Apply engine oil to the one-way clutch.
- Install the one-way clutch so that the circlip side [A] faces engine inside.

Starter Motor Clutch Inspection

- Remove:
  Alternator Rotor (see Alternator Rotor Removal)
- Fit the starter clutch gear into the starter motor clutch.

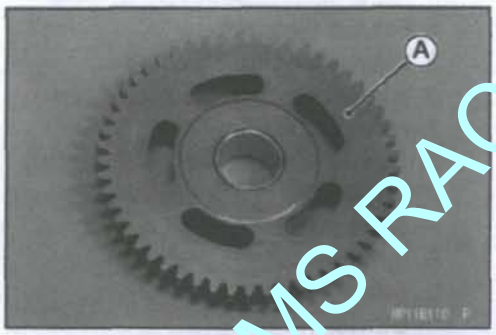
★If the alternator rotor turns counterclockwise [A] freely from the starter clutch gear, but not clockwise [B], the clutch is operating correctly.

★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.



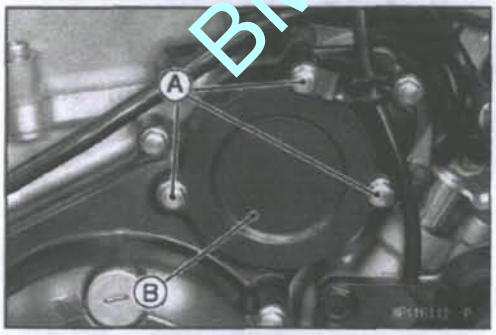
NOTE

○*Examine the starter clutch gear [A]. Replace it if it is worn or damaged.*

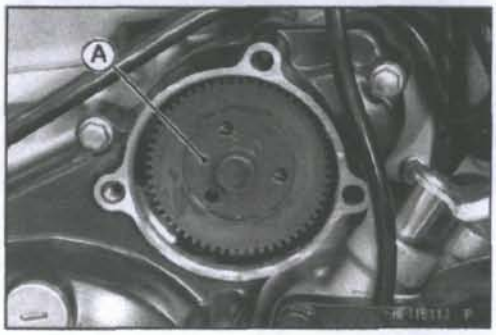


Torque Limiter Removal

- Remove:
  Bolts [A]
  Cover [B]



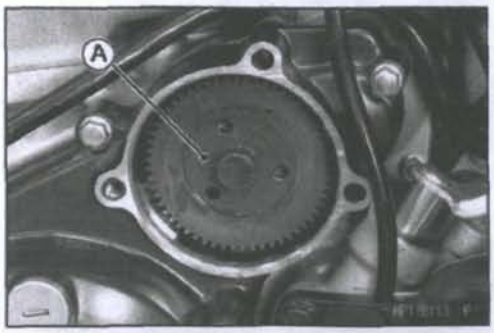
- Remove:
  Torque Limiter [A]



Electric Starter System

Torque Limiter Installation

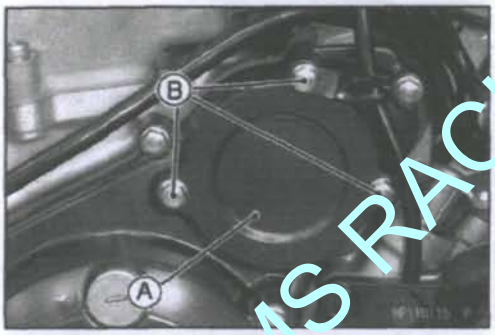
- Apply molybdenum disulfide grease to the torque limiter both side shaft.
- Install the torque limiter [A]



- Replace the torque limiter cover O-ring [A] with a new one.

- Apply grease to the O-ring.
- Install the torque limiter cover [A].
- Tighten:

Torque - Alternator Cover and Torque Limiter Cover Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

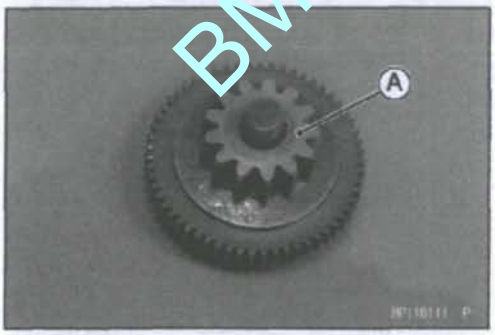


Torque Limiter Inspection

- Remove:
  Torque Limiter (see Torque Limiter Removal)

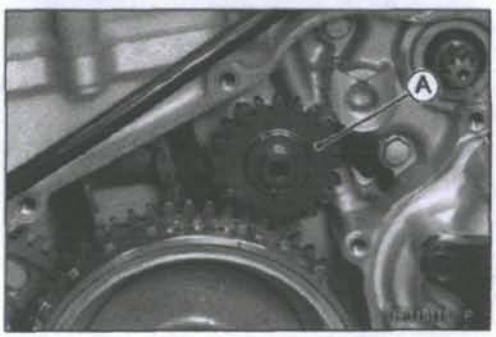
★If the limiter has wear, discoloration, or other damage, replace it as a unit.

- Visually inspect the torque limiter [A].



Starter Idle Gear Removal

- Remove:
  Torque Limiter (see Torque Limiter Removal)
  Alternator Cover (see Alternator Cover Removal)
  Starter Idle Gear [A]



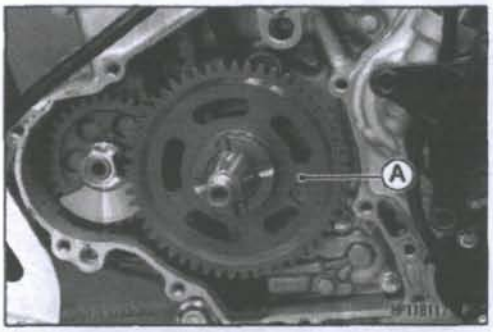
Starter Idle Gear Installation

- Apply molybdenum disulfide grease to the idle gear both side shaft.
- Install the starter idle gear

Electric Starter System

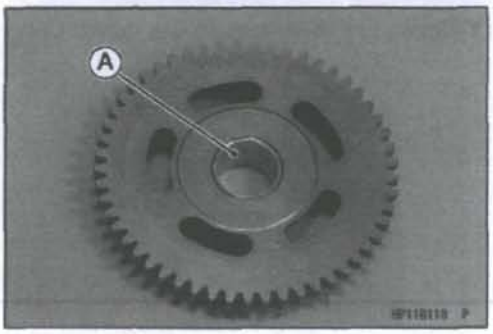
Starter Clutch Gear Removal

- Remove:
  Alternator Rotor (see Alternator Rotor Removal)
  Starter Idle Gear (see Starter Idle Gear Removal)
  Starter Clutch Gear [A]



Starter Clutch Gear Inspection

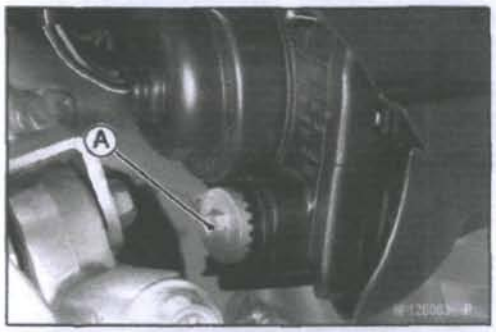
- Apply molybdenum disulfide grease to the sliding surface [A] on the starter clutch gear.
- Install the starter clutch gear to the crankshaft.



Lighting System

Headlight Beam Vertical Adjustment

- Turn the adjuster [A] on each headlight rim in or out to adjust the headlight vertically.

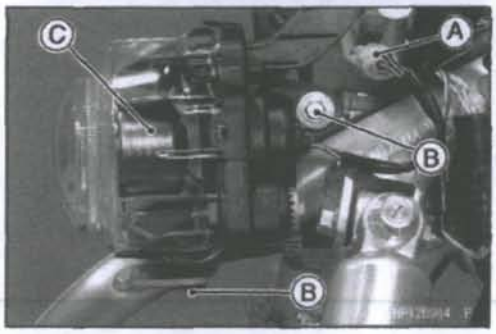


NOTE

○*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.*

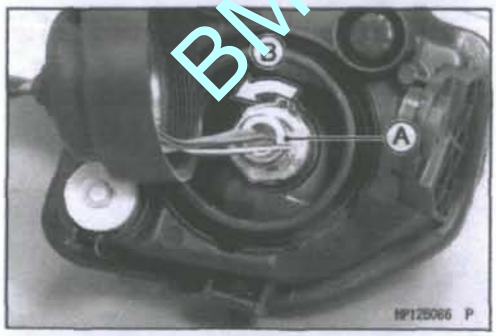
Headlight Bulb Replacement

- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
  Connector [A]
  Bolts [B]
  Headlight Body [C]

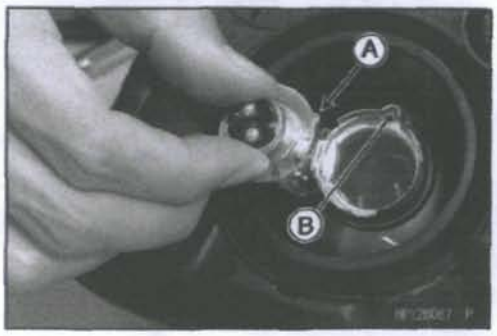


- Remove:
  Dust Cover [A]

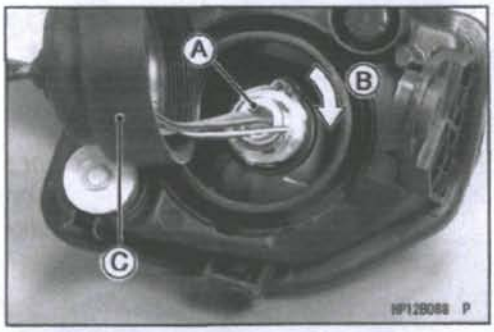
- While pushing the socket [A], turn it counterclockwise [B], and pull it out.
- Remove:
  Headlight Blub



- Install the bulb so that the bulb projection [A] fit dent [B] of the headlight body.

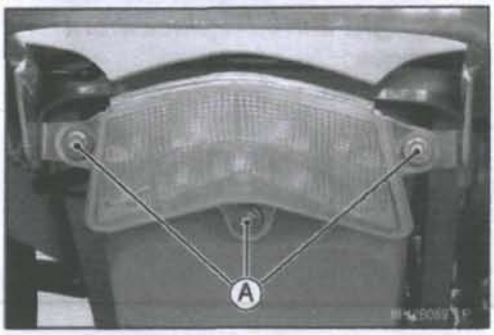


- Install the socket [A] so that while pushing it, turn it clockwise [B] until it is stopped.
- Install the dust cover [C].
- Install the headlight body.

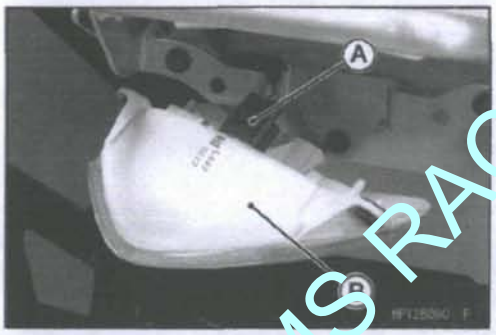


Tail/Brake Light (LED) Removal/Installation

- Remove:
  Bolts [A]

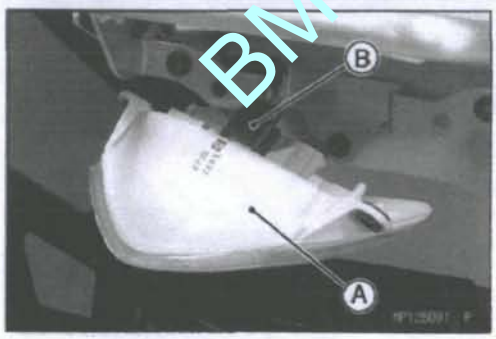


- Remove:
  Connector [A]
  Tail/Brake Light Unit [B]



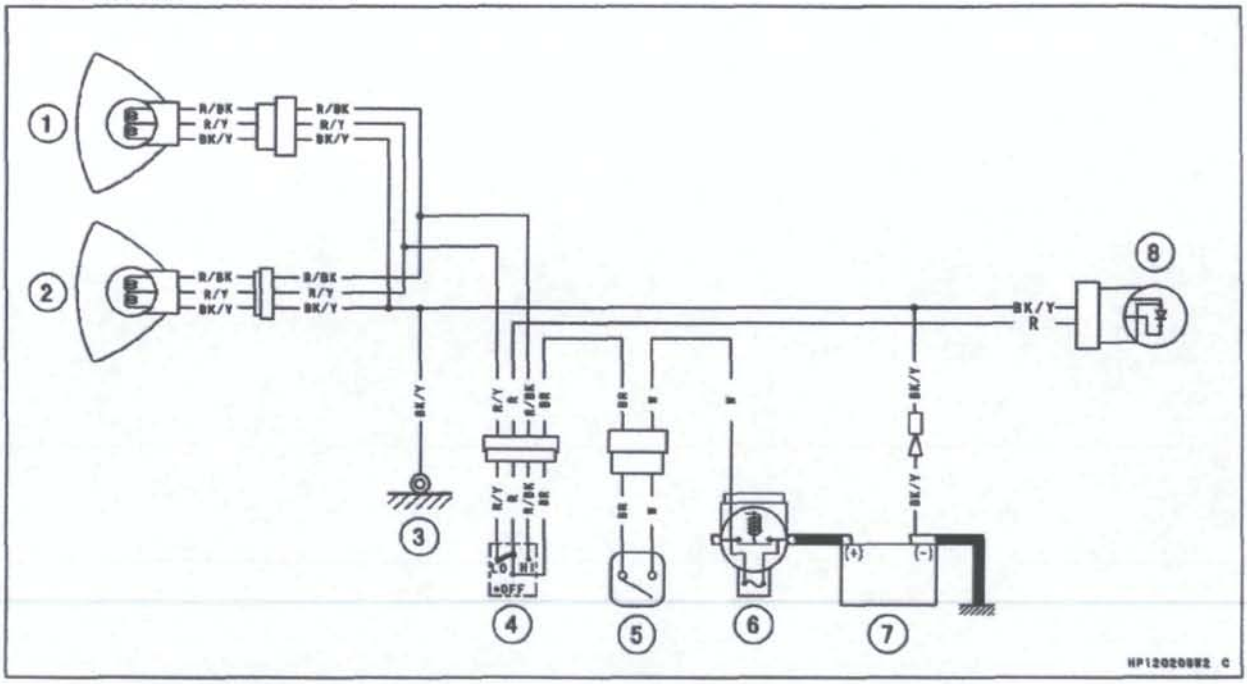
- Connect the tail/brake light unit [A] and main harness connector [B].
- Tighten:

Torque - Tail/Brake Light Unit Mounting Bolts: 1.2 N·m (0.12 kgf·m, 11 in·lb)



Lighting System

Lighting System Circuit



1. Headlight (Right) 12 V 30/30 W
2. Headlight (Left) 12 V 30/30 W
3. Frame Ground
4. Light Switch
5. Ignition Switch
6. Main Fuse 30 A
7. Battery 12 V 6 Ah
8. Tail/Brake Light (LED) 12 V 0.5/4.1 W

Radiator Fan System

Radiator Fan Motor Inspection

- Remove the upper (see Upper Cover Removal in the Frame chapter).
- Disconnect the radiator fan connector [A].

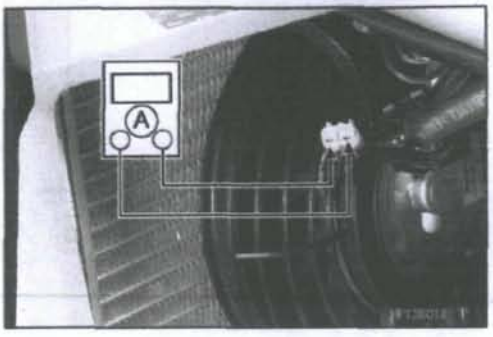
- Using two auxiliary wires, supply battery [A] voltage to the fan motor.

★If the fan does not rotate, the fan motor is defective and must be replaced.

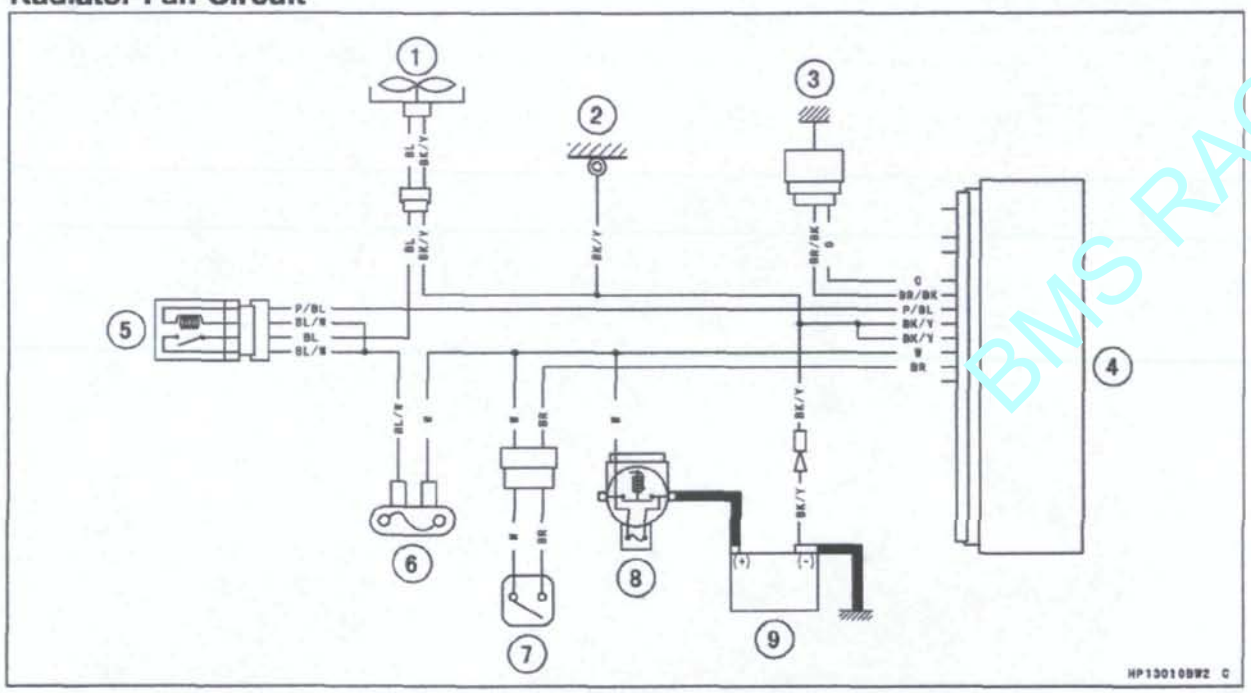
Radiator Fan Motor Leads Connection

BL: Battery (+)

BK: Battery (–)



Radiator Fan Circuit

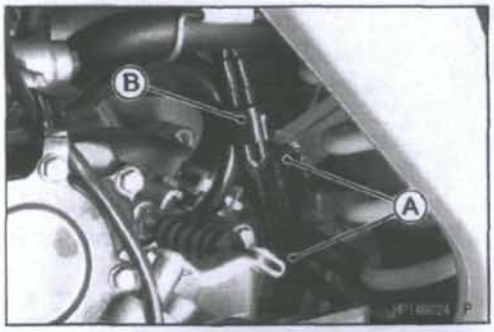


1. Radiator Fan
2. Frame Ground
3. Water Temperature Sensor
4. ECU (Electronic Control Unit)
5. Radiator Fan Relay
6. Radiator Fan Fuse 10 A
7. Ignition Switch
8. Main Fuse 30 A
9. Battery 12 V 6 Ah

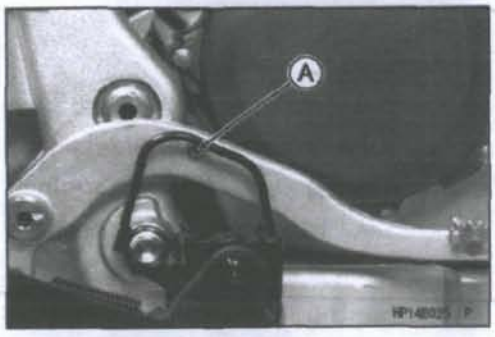
Radiator Fan System

Brake Light Switch Removal

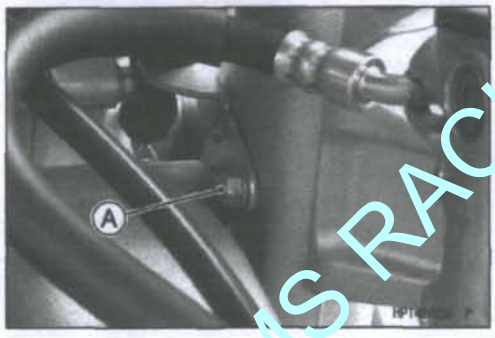
- Cut the bands [A].
- Disconnect the brake light switch connector [B].



- Remove the spring bracket screw [A].

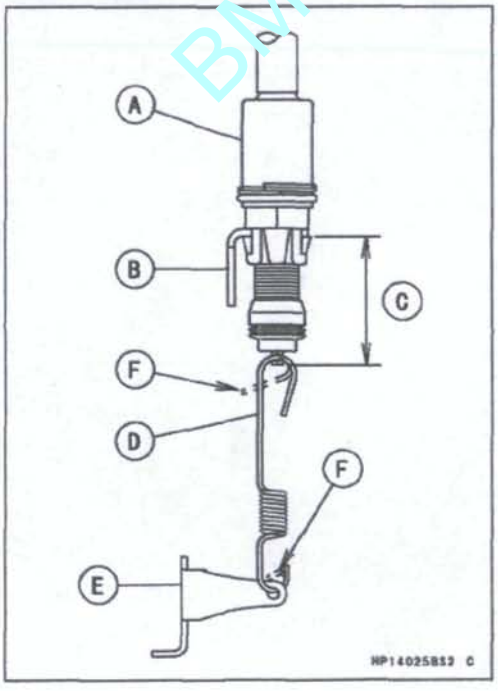


- Remove the brake light switch bracket bolt [A].
- Remove the brake light switch together with the spring and brackets.



Brake Light Switch Installation

- Assemble the brake light switch [A] and bracket [B] as shown.
  [C] 28 mm (1.1 in.)
- Hook the spring [D] so that the longer hook end facing the brake light switch side.
- Hook the shorter hook end of the spring to the spring bracket [E].
- Bend [F] the both spring end so that the spring does not comes out.
- Install the brake light switch, and tighten the switch bracket bolt and spring bracket screw.
- Inspect the brake light timing (see Brake Light Timing Inspection in the Periodic Maintenance chapter).

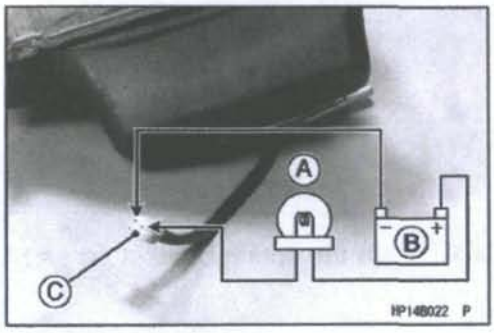


Brake Light Switch Adjustment

- Refer to the Brake Light Timing Adjustment in the Periodic Maintenance chapter.

Fuel Reserve Switch Inspection

- Fill the fuel tank with fuel.
- Close the fuel tank cap surely.
- Remove the fuel tank (see Fuel Tank Removal in the Fuel System (DFI) chapter).
- Connect the test light [A] (12 V 3.4 W bulb a socket with leads) and the 12 V battery [B] to the fuel pump connector [C].



Connections:

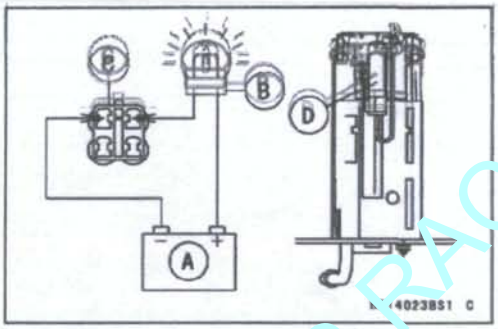
Battery (+) → 12 V 3.4 W Bulb (One Side)

12 V 3.4 W Bulb (Other Side) → R/BK Lead Terminal

Battery (–) → BK/W Lead Terminal

★If the test light turn on, the reserve switch is defective. Replace the fuel pump.

- Remove the fuel pump (see Fuel Pump Removal in the Fuel System (DFI) chapter).
- Connect the test light (12 V 3.4 W bulb in a socket with leads) and the 12 V battery to the fuel pump connector as shown.



12 V Battery [A]
Test Light [B]
Fuel Pump Connector [C]
Fuel Reserve Switch [D]

★If the test light doesn't light, replace the fuel pump.

NOTE

○*It may take a long time to turn on the test light in case that the fuel reserve switch is inspected just after the fuel pump is removed. Leave the fuel reserve switch with leads for inspection connected for few minutes.*

Switches and Sensor

Switch Inspection

- Using the hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).

○For the handlebar switches, ignition switch, refer to tables in the Wiring Diagram.

★If the switch has an open or short, repair or replace it with a new one.

Special Tool - Hand Tester: 57001-1394

Rear Brake Light Switch Connections		
Color	BR	BL
When brake pedal is pushed down	○——	——○
When brake pedal is released		

Neutral Switch Connections		
Color	SW. Terminal	Ground
When transmission is in neutral	○——	——○
When transmission is not in neutral		

Reverse Switch Connections		
Color	SW. Terminal	Ground
When transmission is in reverse	○——	——○
When transmission is not in reverse		

Water Temperature Sensor Inspection

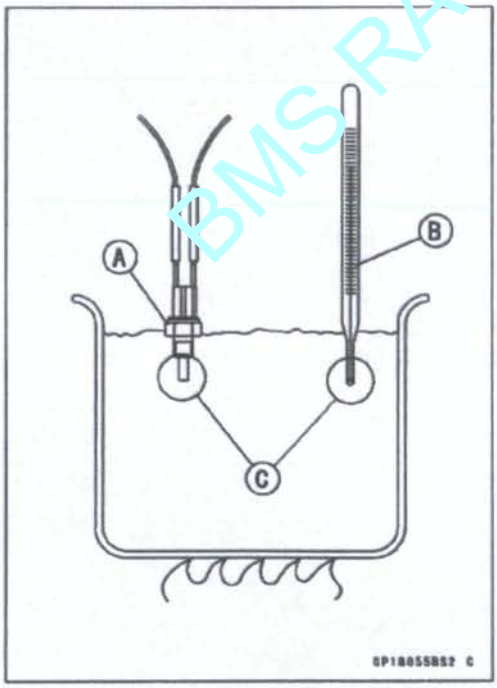
- Remove the water temperature sensor (see Water Temperature Sensor Removal/Installation in the Fuel System (DFI) chapter).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend an accurate thermometer [B] with heat-sensitive portions [C] located in almost the same depth.

NOTE

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

- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using the hand tester, measure the internal resistance of the sensor across the terminal and the body at the temperatures shown in the table.

★If the measurement is out of the range, replace the sensor.



Water Temperature Sensor Resistance

Temperature	Resistance (kΩ)
−20°C (−4°F)	*18.80 ±2.37
0°C (32°F)	*(about 6.544)
40°C (104°F)	1.136 ±0.095
100°C (212°F)	0.1553 ±0.0070

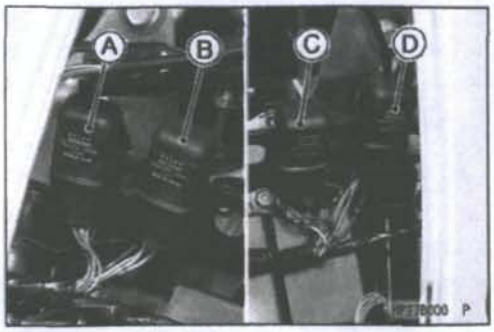
*: Reference Information

Relay

Relay Inspection

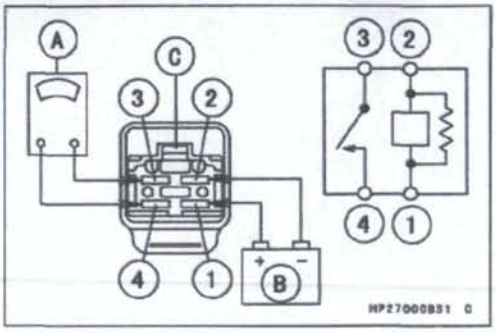
- Remove:
  Upper Cover (see Upper Cover Removal in the Frame chapter)
  Radiator Fan Relay [A]
  Fuel Pump Relay [B]
  Starter Control Relay (Neutral) [C]
  Starter Control Relay (Clutch) [D]

○The starter circuit relays for the brake and are identical.



- Connect the hand tester [A] and a 12 V battery [B] to the starter circuit relay [C] as shown.

★If the relay does not work as specified, the relay is defective. Replace the relay.



Testing Relay

Hand Tester Range: × 1 Ω

Criteria: **When battery is connected ⇒ 0 Ω**

When battery is disconnected ⇒ ∞Ω

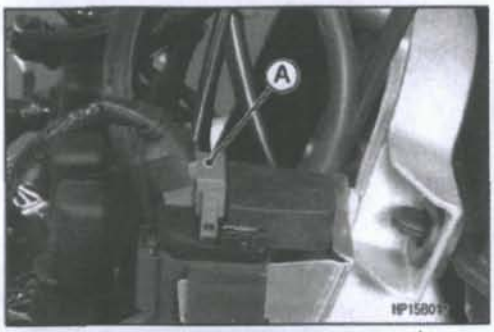
Relay Coil Terminals [1] and [2]

Relay Switch Terminals [3] and [4]

Fuses

30 A Main Fuse Removal

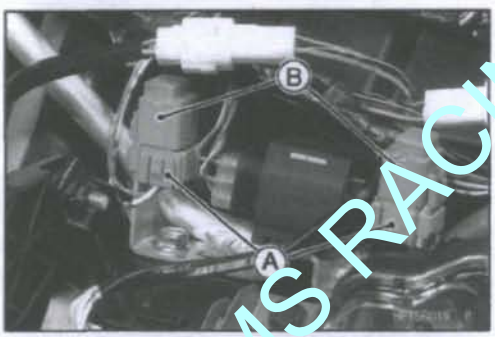
- Remove:
  Front Fender (see Front Fender Removal in the Frame chapter)
  Connector [A]



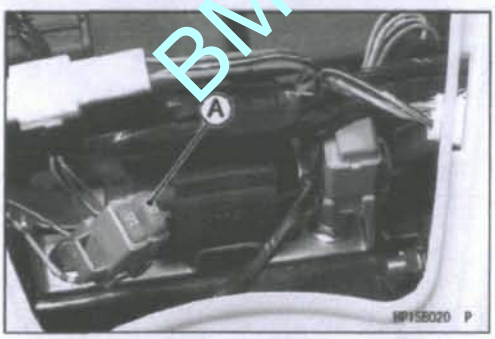
- Pull out the main fuse [A] from the stater relay with the needle nose pliers.

Fuse Removal

- Remove:
  Upper Cover (see Upper Cover Removal in the Frame chapter)
- Pull up the fuse box [A], and remove the lid [B].



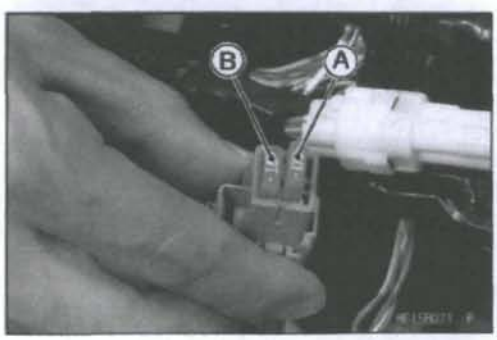
- Pull up the fuse [A] straight out of the fuse box with needle nose pliers.



Fuse Installation

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

- Install the fuse [A] on the original position.
  [B] Spare Fuse



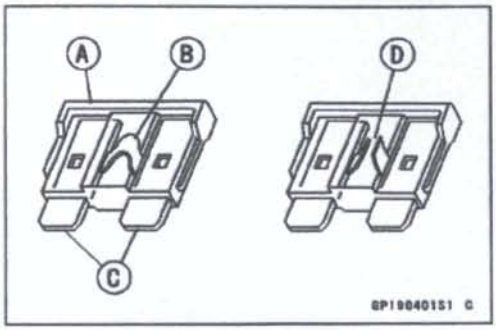
Fuses

Fuse Inspection

- Remove the fuse.
- 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]



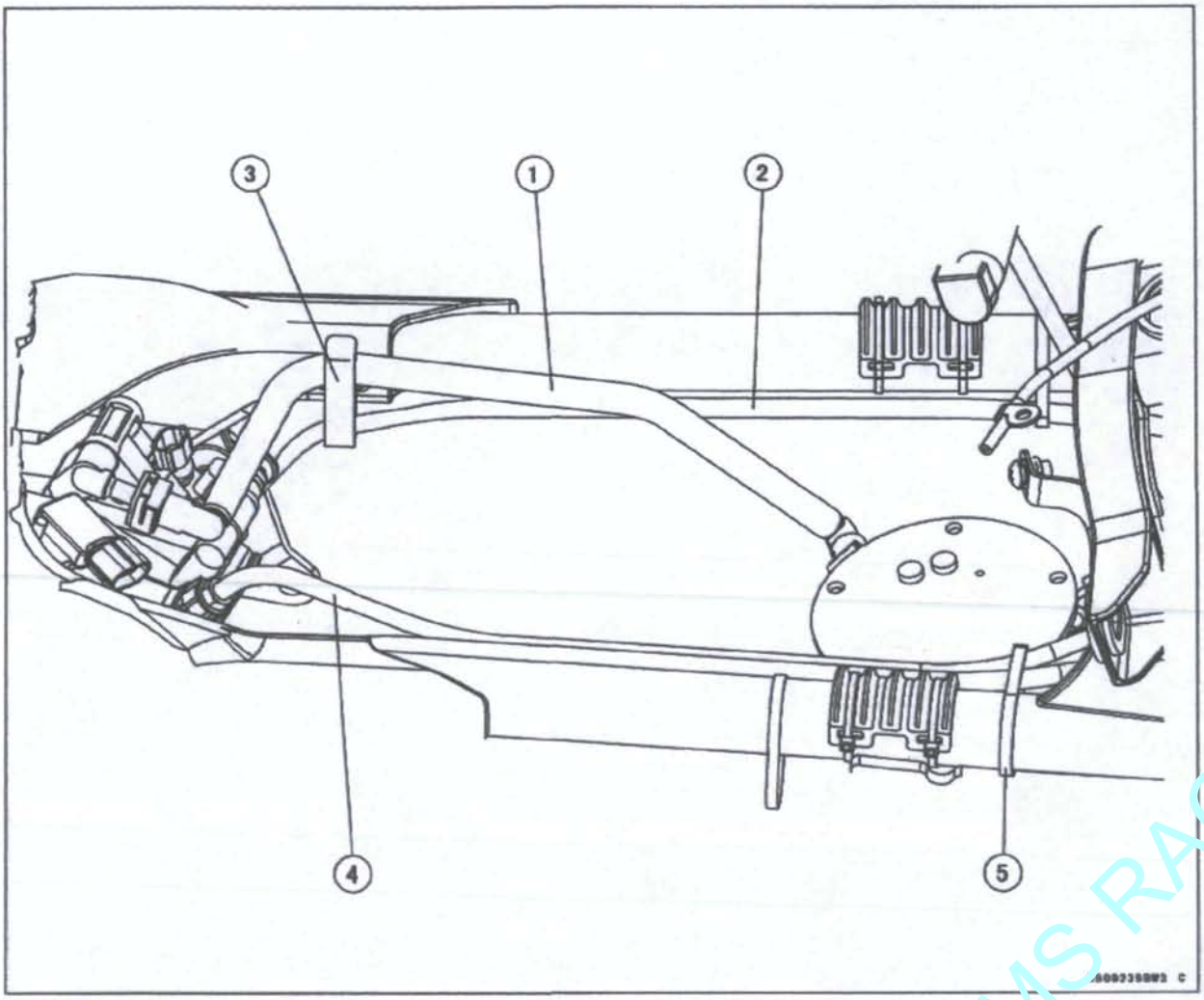
CAUTION

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.

Appendix

Table of Contents

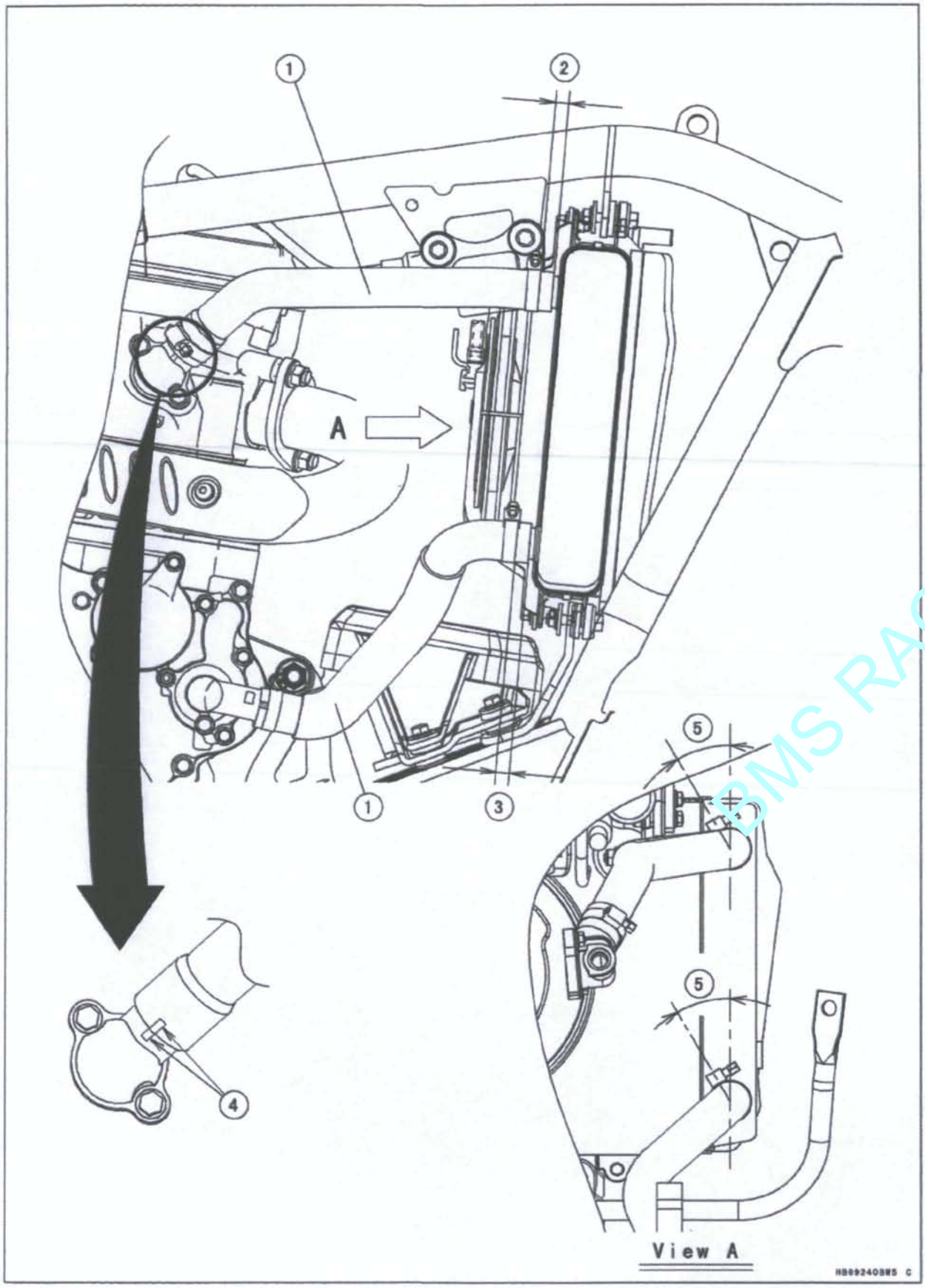
Cable, Wire and Hose Routing



1. Fuel Hose
2. Parking Brake Cable
3. Clamp (Clamp the fuel hose and parking brake cable.)
4. Throttle Cable
5. Band

Dummy Page

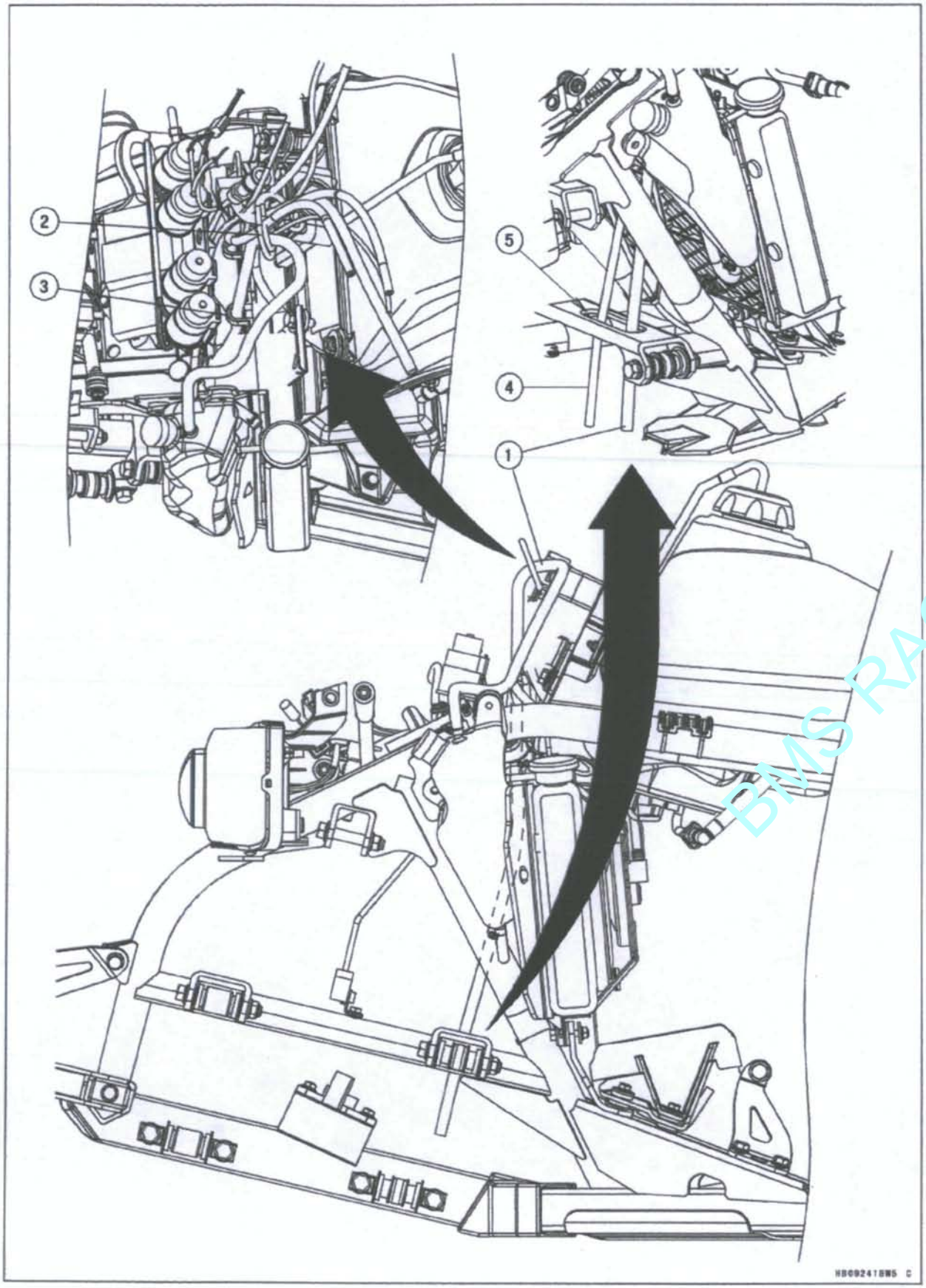
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Radiator Hoses
2. Length from radiator hose end to clamp: 3 ~ 10 mm (0.12 ~ 0.39 in.)
3. Length from radiator hose end to clamp: 5 ~ 14 mm (0.20 ~ 0.55 in.)
4. Align the white mark on the radiator hose and projection on the fitting.
5. Within 30°

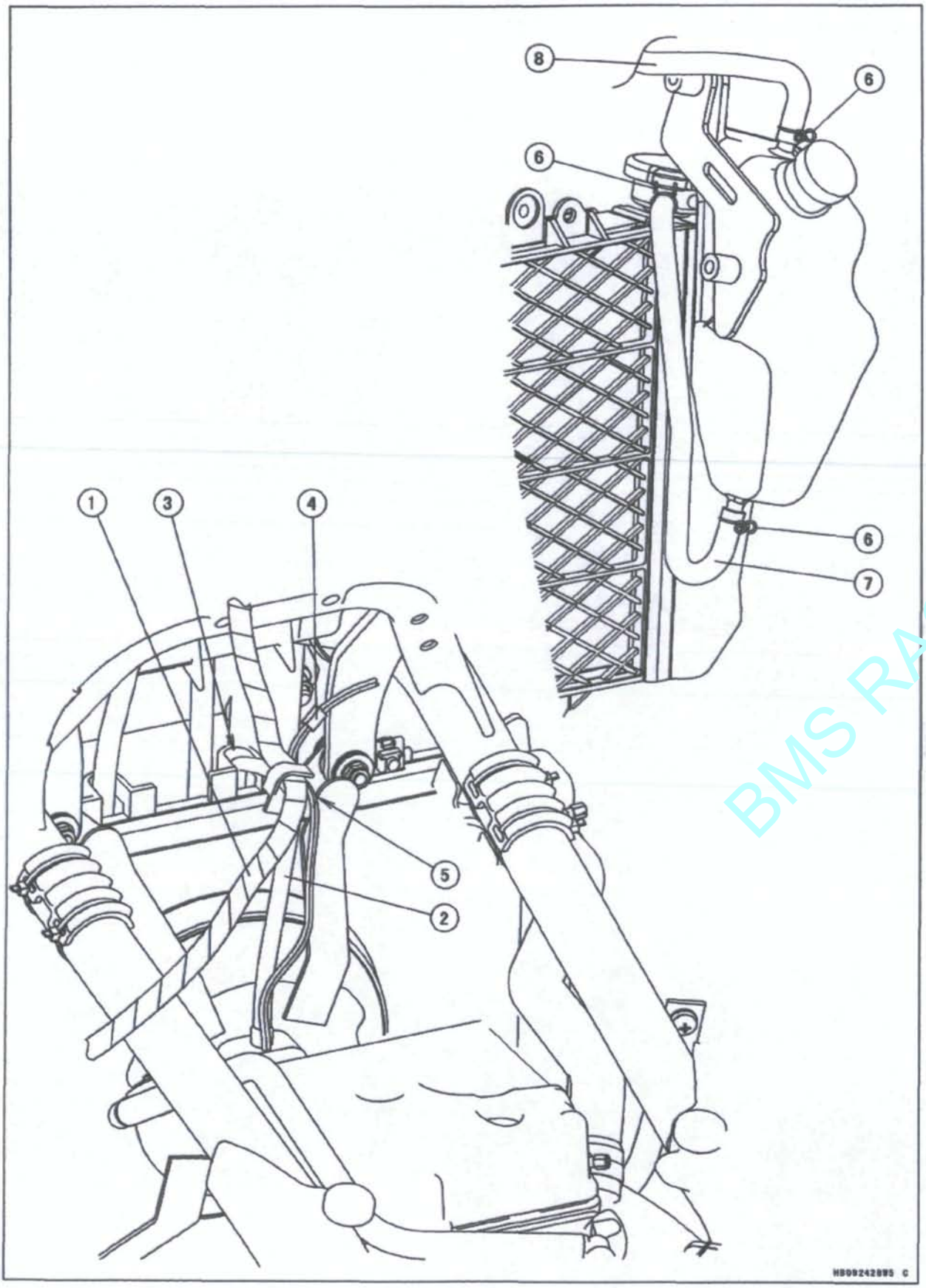
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Coolant Overflow Hose
2. Run the coolant overflow hose into the bracket.
3. Run the coolant overflow hose into the guide of the radiator screen.
4. Radiator Fan Motor Breather Hose
5. Run the coolant overflow hose and fan motor breather hose into the frame bracket hole.

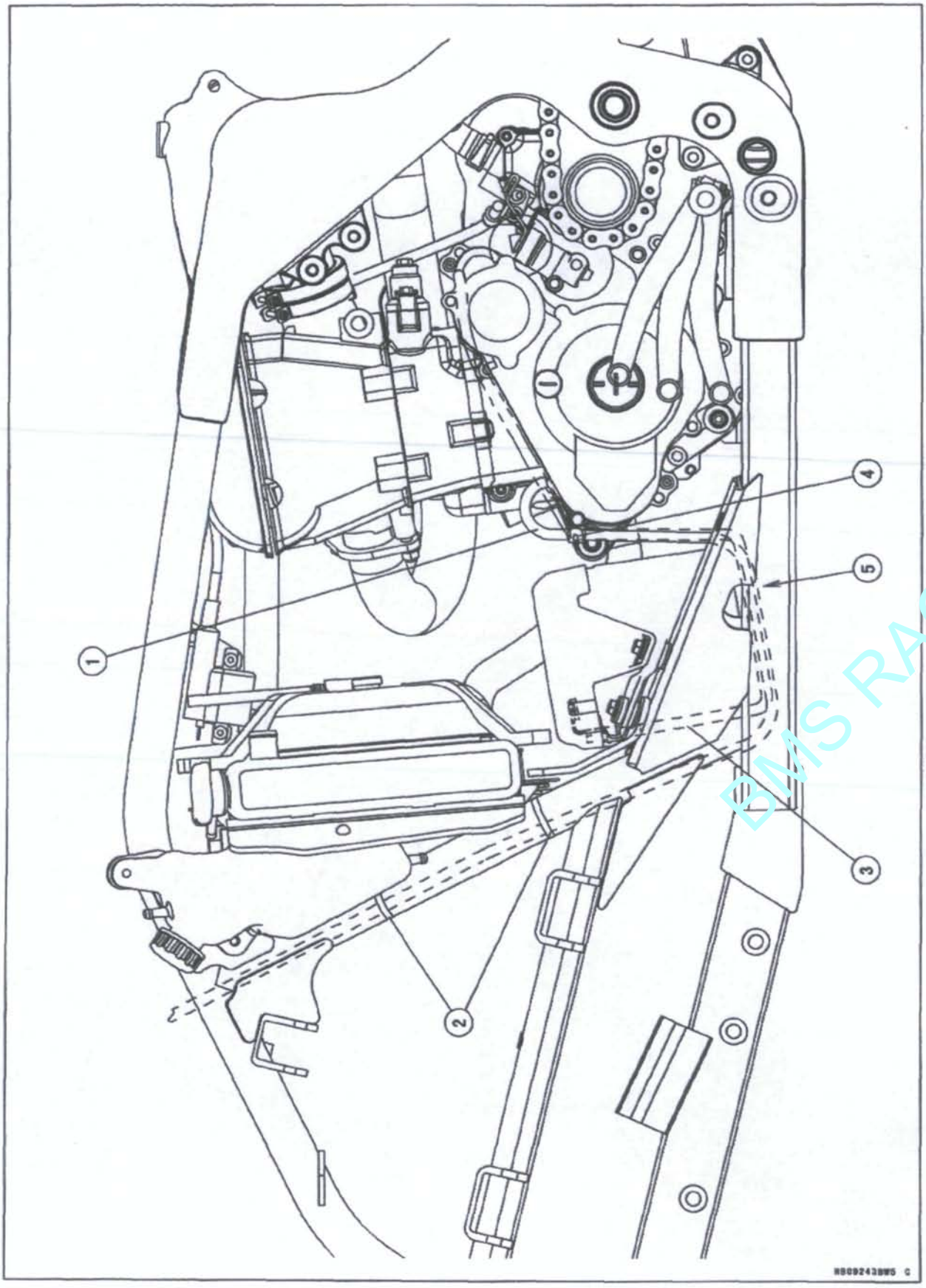
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Main Harness
2. Radiator Fan Breather Hose
3. Run the radiator fan breather hose into the guide of the radiator screen.
4. Radiator Fan Motor Lead Connector
5. Run the main harness, radiator fan motor lead and fan motor breather hose into the guide of the radiator fan.
6. Clamps
7. Reserve Tank Hose
8. Coolant Overflow Hose

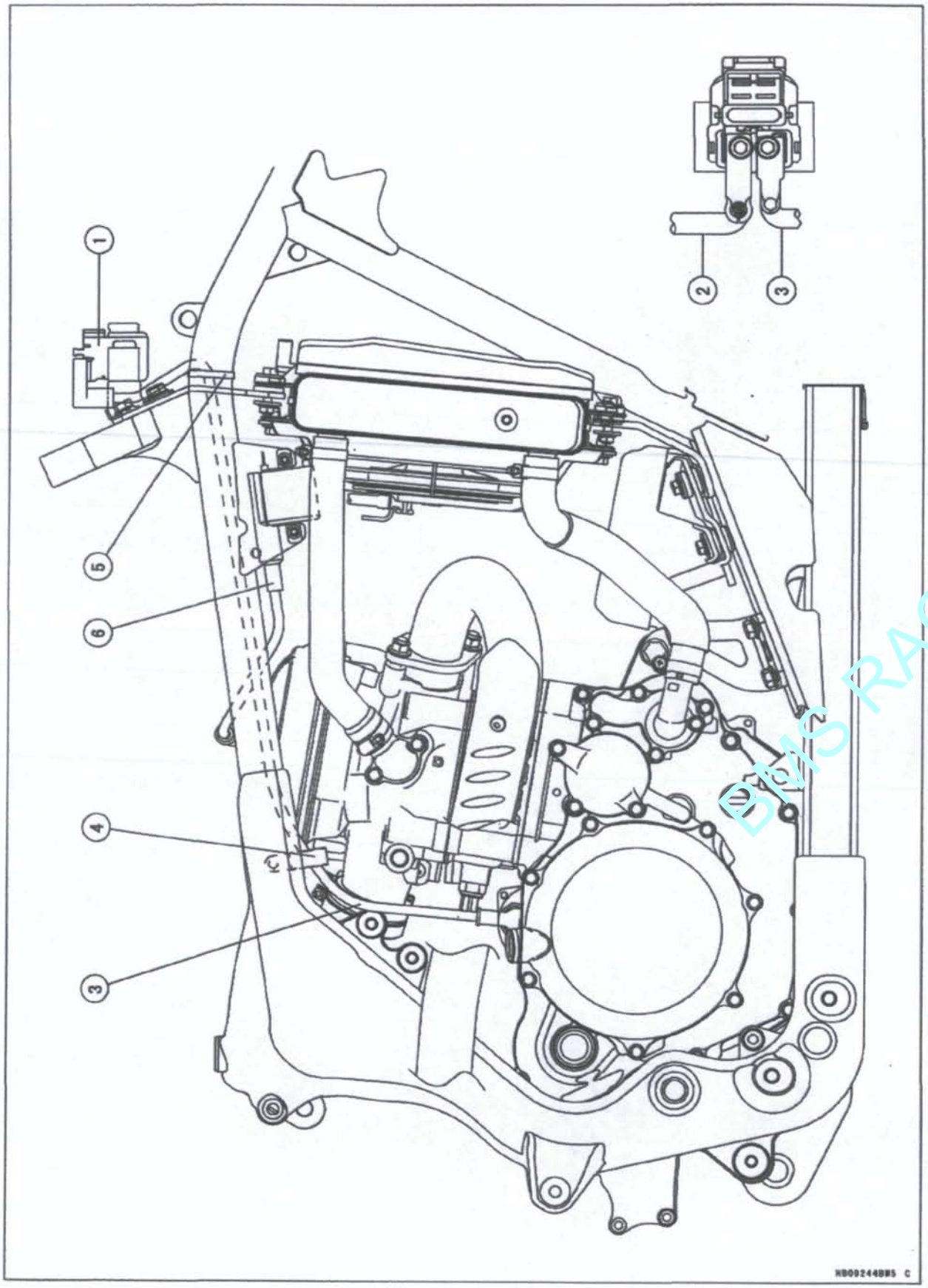
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Alternator/Crankshaft Senseor Lead
2. Bands (Clamp the alternator/crankshaft sensor lead.)
3. Battery Negative (–) Cable
4. Clamp (Clamp the alternator/crankshaft sensor lead.)
5. Run the alternator/crankshaft sensor lead and battery negative (–) cable under the battery case.

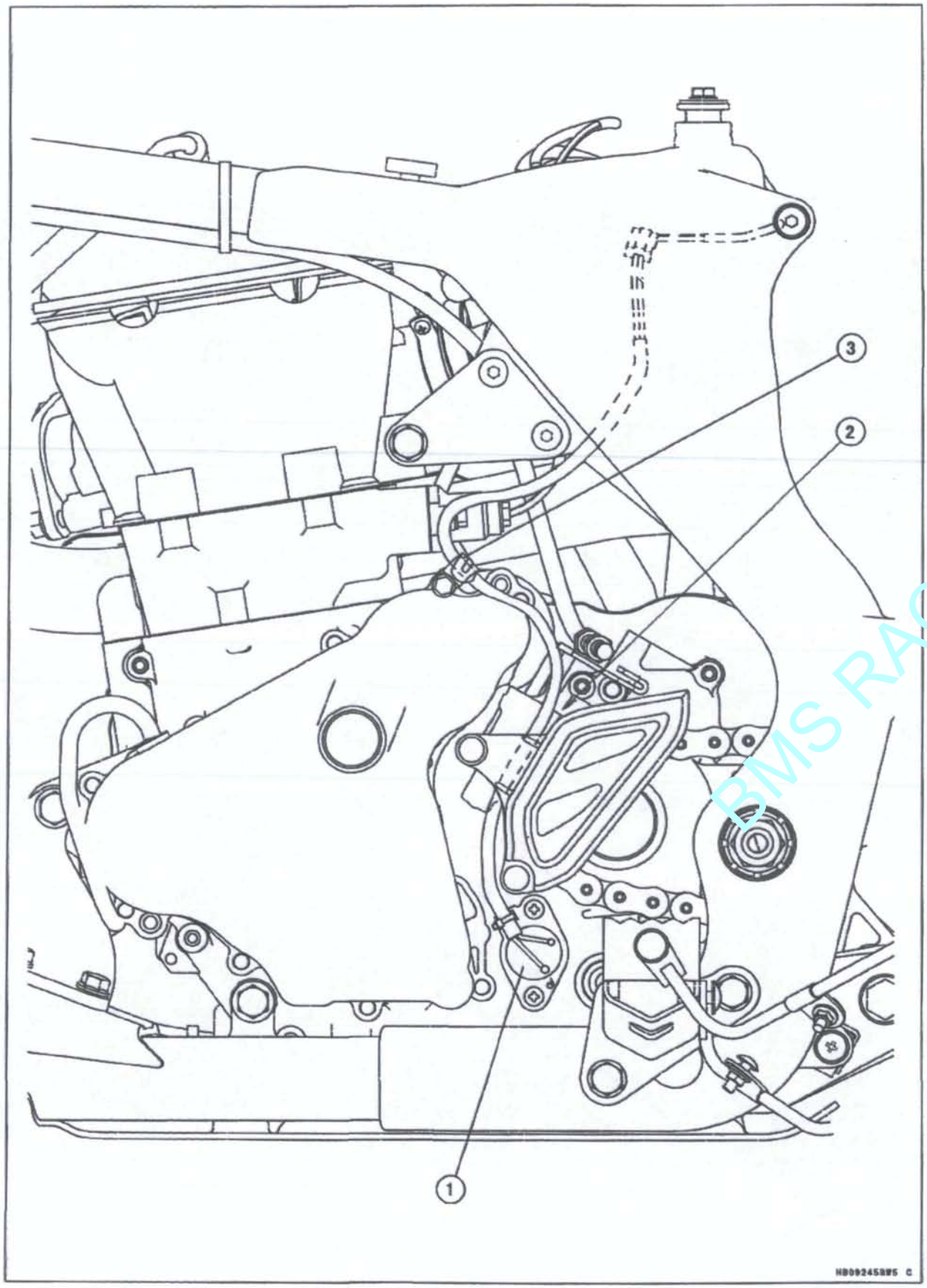
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Starter Relay
2. Battery Positive (+) Cable
3. Starter Motor Cable
4. Clamp (Clamp the starter motor cable and main harness)
5. Band (Clamp the starter motor cable and main harness)
6. Ignition Coil

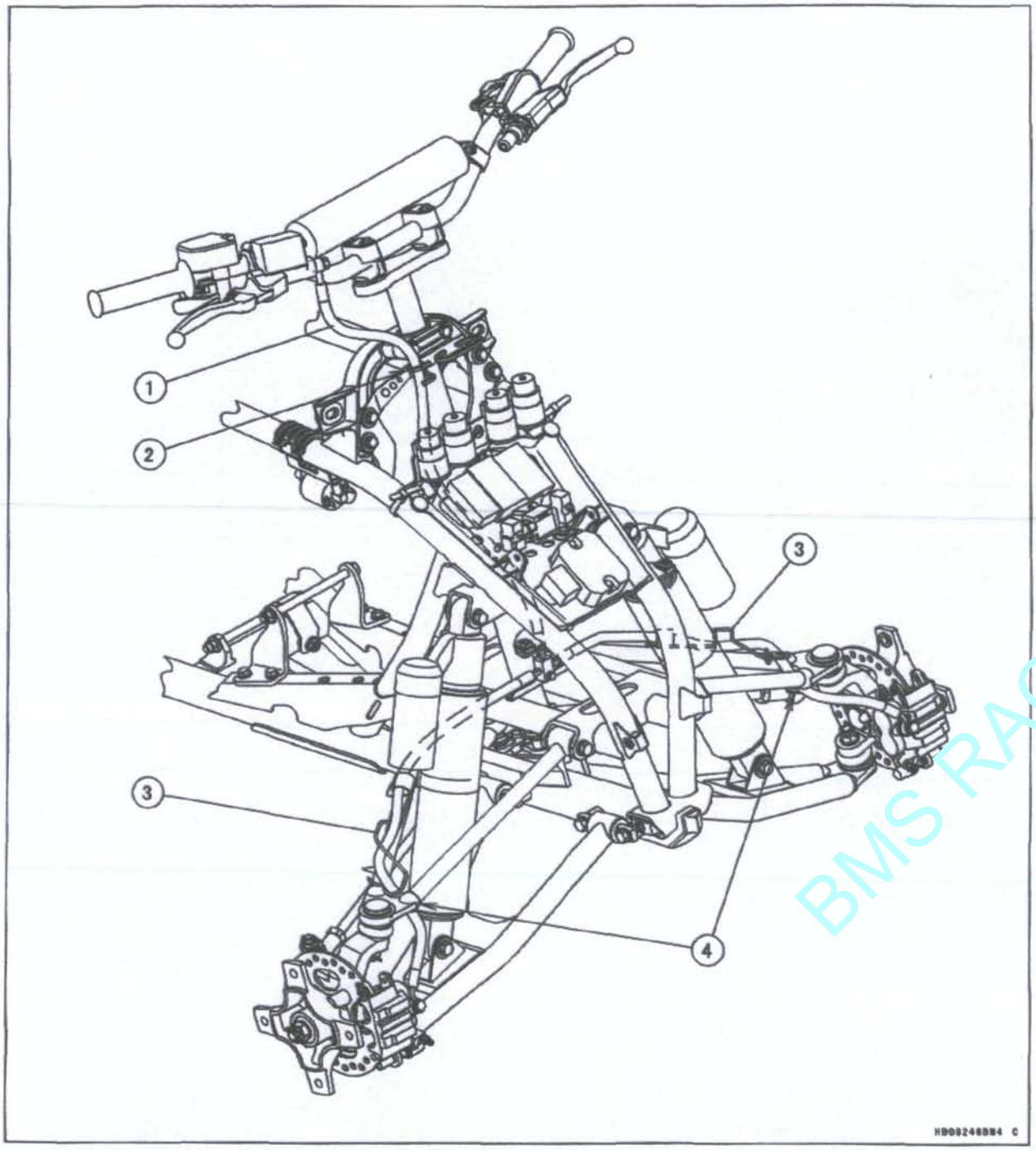
Cable, Wire and Hose Routing



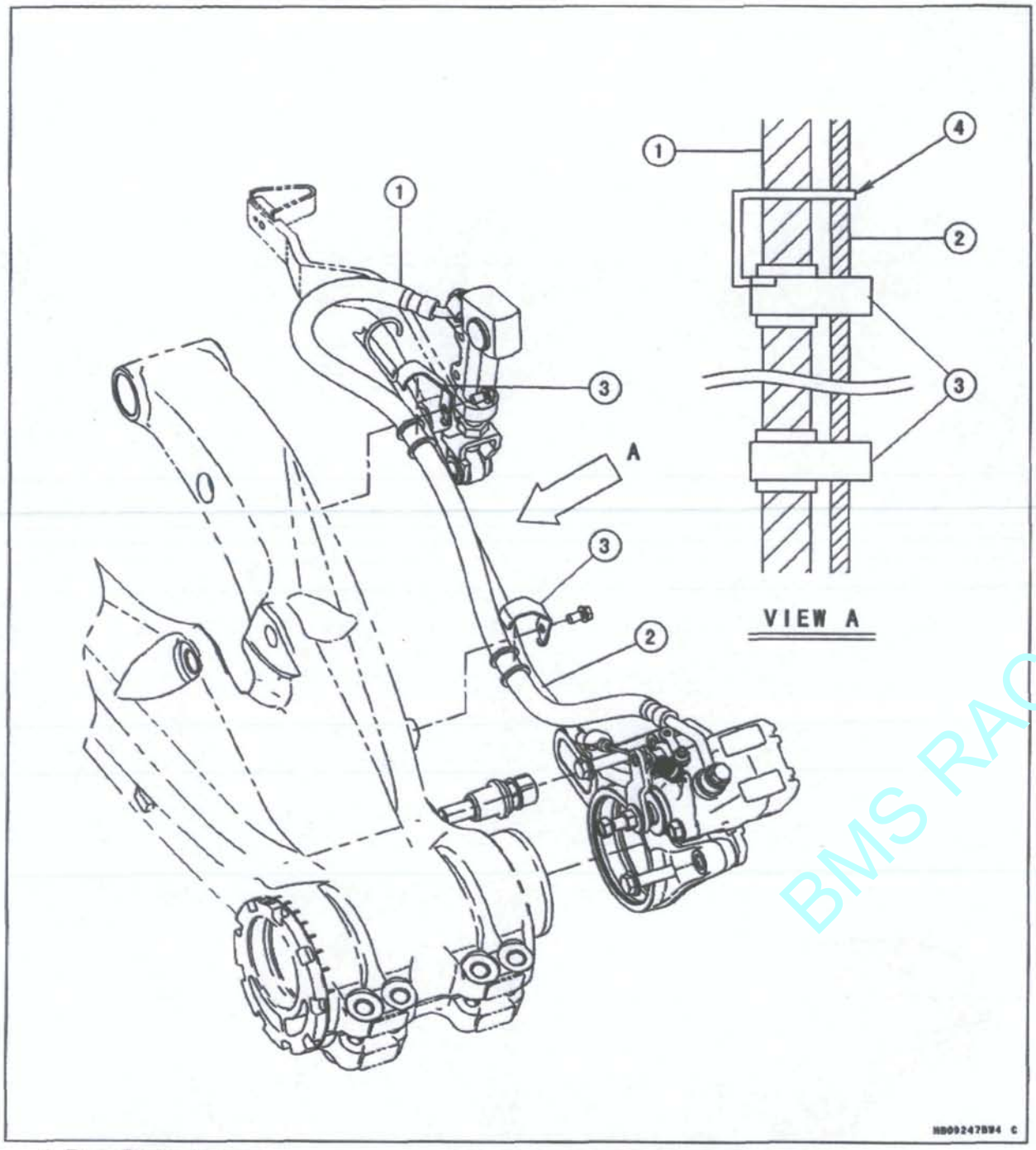
Cable, Wire and Hose Routing

1. Neutral/Reverse Switch
2. Run the neutral/reverse switch lead into the guide of the engine sproket cover.
3. Clamp (Clamp the neutral/reverse switch lead.)

Cable, Wire and Hose Routing

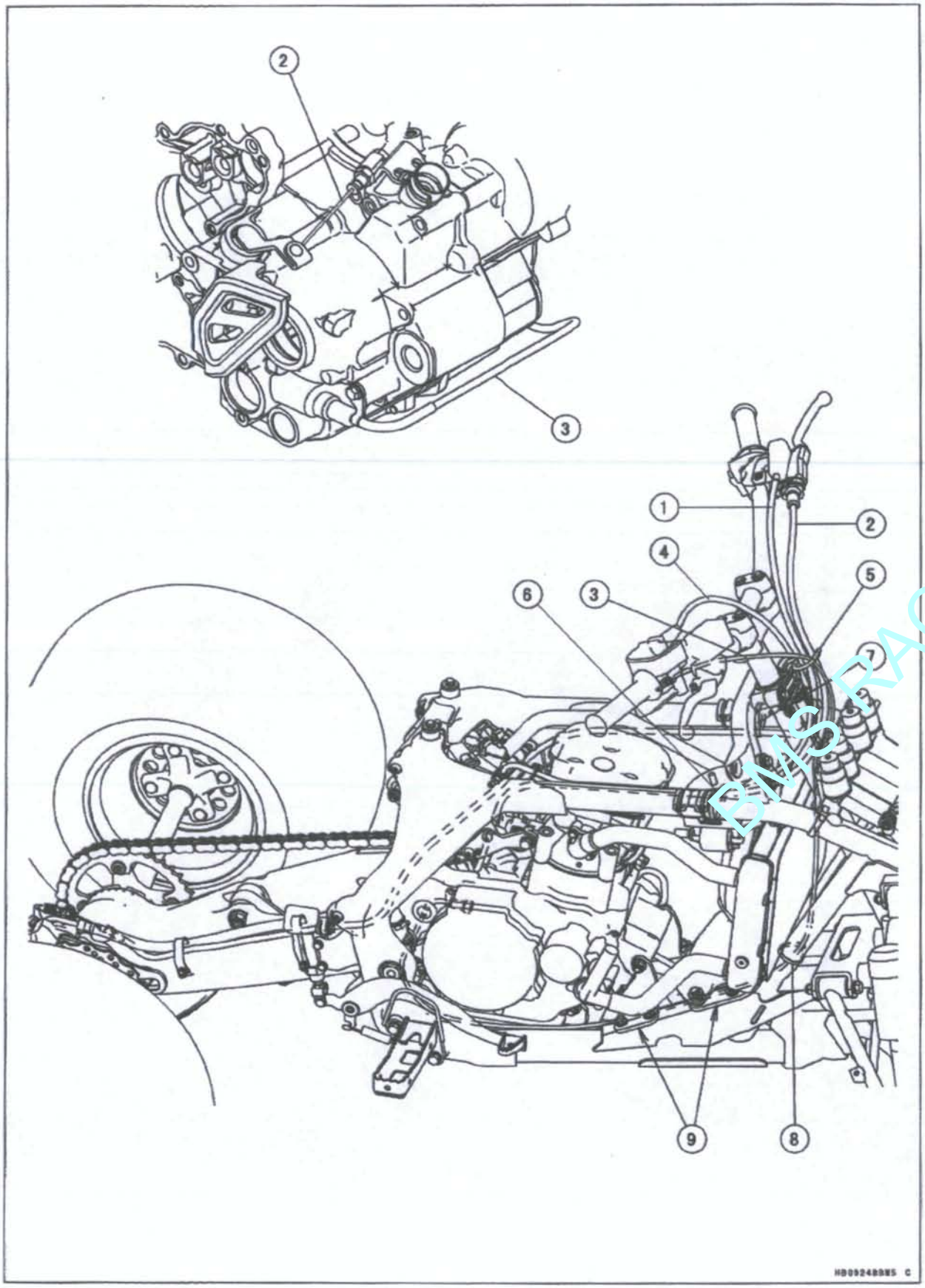


1. Front Brake Hose
2. Run the front brake hose into the steering stem clamp bracket.
3. Clamp the brake hoses.
4. Run the front brake hoses under the upper suspension arm.



1. Rear Brake Hose
2. Parking Brake Cable
3. Clamp (Clamp the rear breke hose and parking brake cable.)
4. Run the rear brake and parking brake hoses into the guide of the clamp.

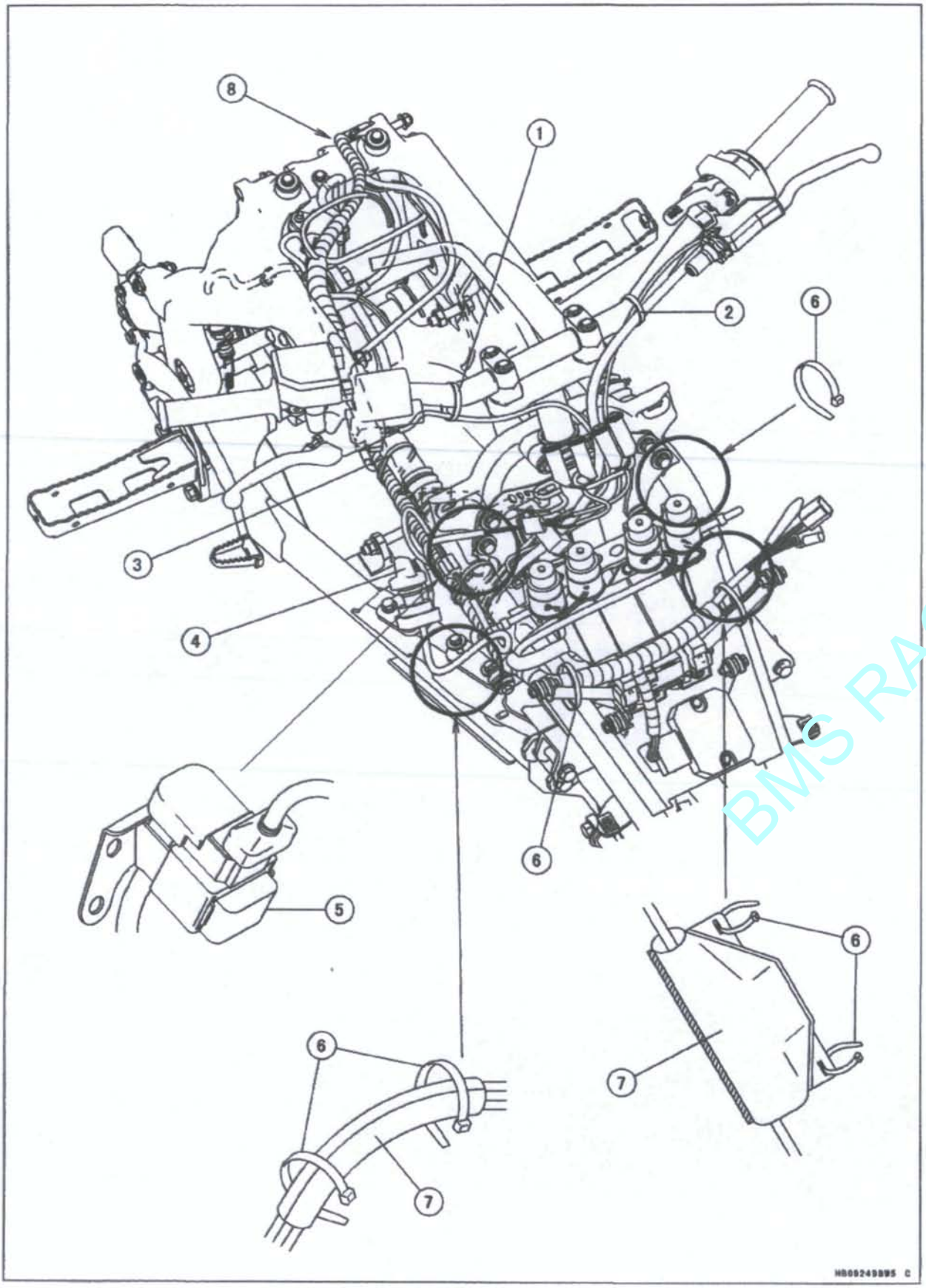
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Parking Brake Cable
2. Clutch Cable
3. Reverse Cable
4. Throttle Cable
5. Run the parking brake, clutch, reverse and throttle cable into the steering stem clamp bracket.
6. Band (Clamp the clutch cable and throttle cable at the lower of frame pipe.)
7. Band (Clamp the parking brake cable and starter cable.)
8. Band (Clamp the reverse cable.)
9. Run the reverse cable under the battery case and right front engine bracket.)

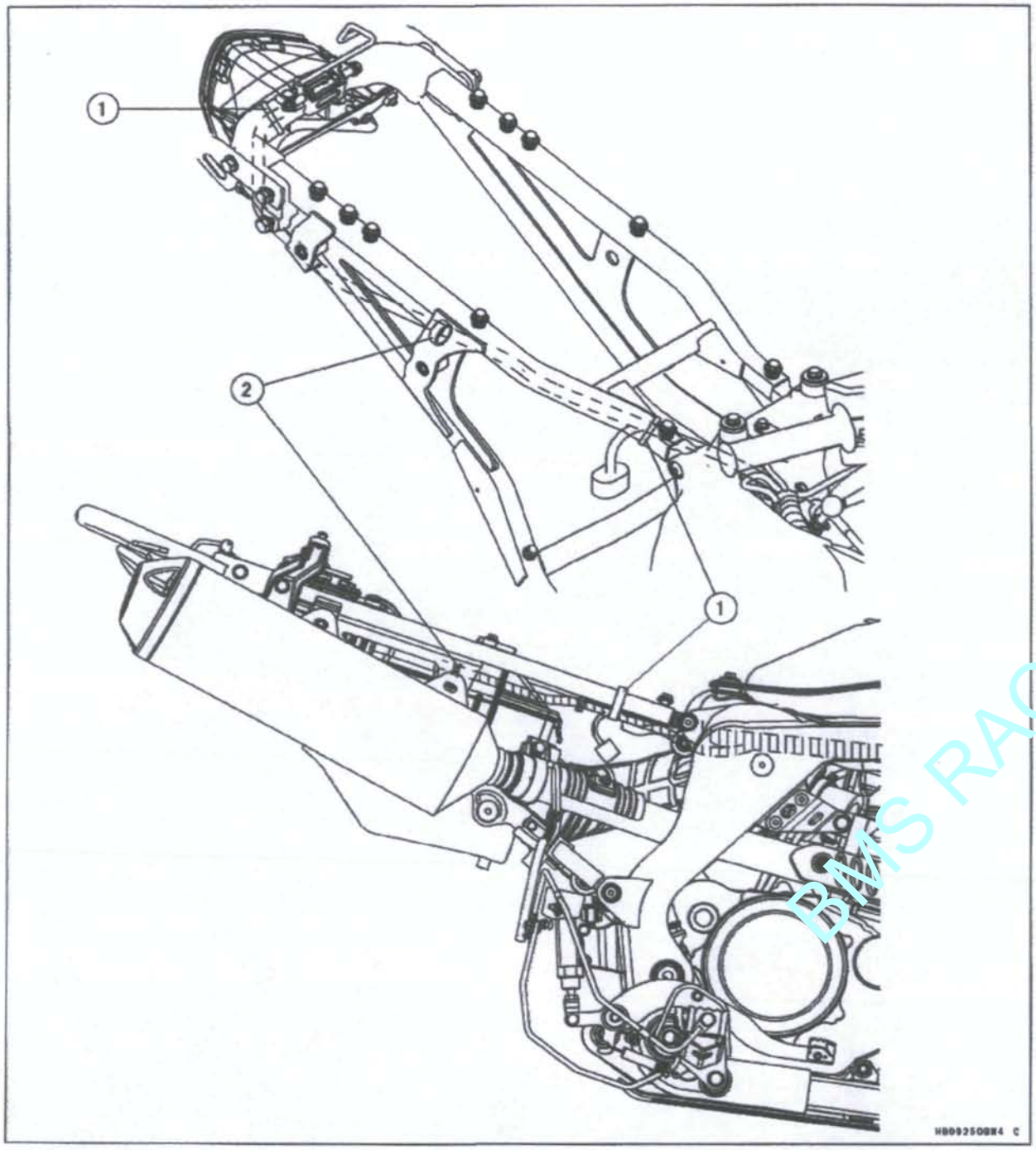
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

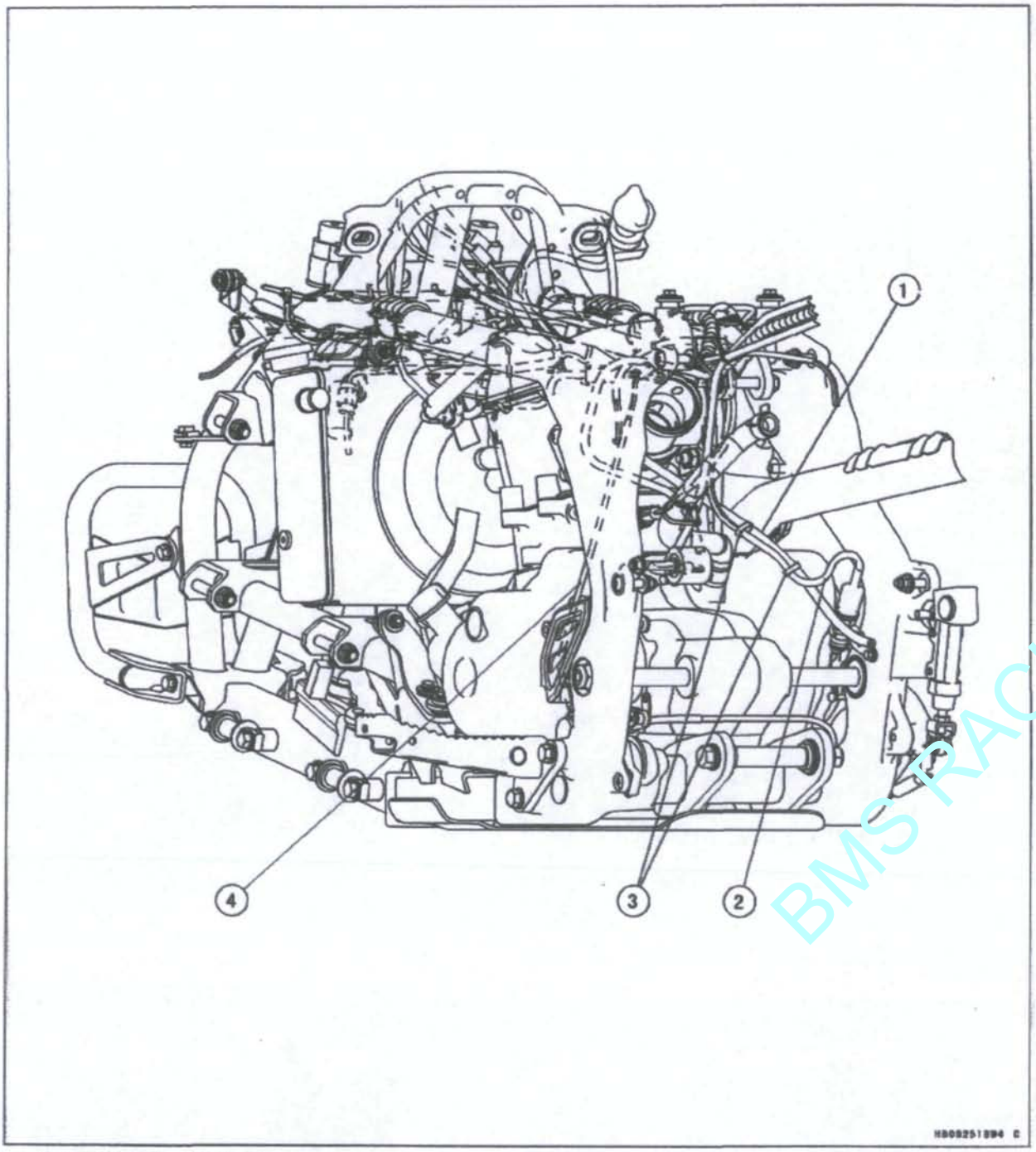
1. Band (Clamp the front brake light switch lead.)
2. Band (Clamp the starter lockout switch and left handlebar switch lead.)
3. Band (Clamp the main harness.)
4. Ignition Switch
5. Starter Relay
6. Bands
7. Cover
8. Run the main harness over the frame.

Cable, Wire and Hose Routing



1. Bands
2. Clamp

Cable, Wire and Hose Routing



1. Parking Brake Cable
2. Rear Brake Light Switch Lead
3. Band (Clamp the parking brake cable and rear brake light switch.)
4. Neutral and Reverse Switch Lead

NOTE

- *Refer to the Fuel System chapter for most of DFI trouble shooting guide.*
- *This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

Engine Doesn't Start, Starting Difficulty:

Starter motor not rotating:
- Starter lockout switch or neutral switch trouble
- Starter motor trouble
- Battery voltage low
- Starter relay not contacting or operating
- Starter button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

Starter motor rotating but engine doesn't turn over:
- Starter clutch trouble
- Vehicle-down sensor (DFI) coming off

Engine won't turn over:
- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Transmission gear or bearing seizure
- Camshaft seizure
- Starter idle gear seizure

No fuel flow:
- No fuel in tank
- Fuel pump trouble
- Fuel filter clogged
- Fuel line clogged

Engine flooded:
- Clean spark plug and adjust plug gap
- Starting technique faulty
(When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

No spark; spark weak:
- Vehicle-down sensor (DFI) coming off
- Ignition switch not ON
- Engine stop switch turned OFF
- Clutch lever not pulled in or gear not in neutral
- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- IC igniter in ECU trouble
- Neutral or starter lockout switch trouble
- Crankshaft sensor trouble
- Ignition switch or engine stop switch shorted
- Wiring shorted or open
- Fuse blown

Fuel/air mixture incorrect:
- Air passage clogged
- Air cleaner clogged, poorly sealed, or missing

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)

Poor Running at Low Speed:

Spark weak:
- Battery voltage low
- Spark plug dirty, broken, or maladjusted
- Ignition coil wiring trouble
- Ignition coil not in good contact
- Spark plug incorrect
- IC igniter in ECU trouble
- Crankshaft sensor trouble
- Ignition coil trouble

Fuel/air mixture incorrect:
- Air passage clogged
- Air cleaner clogged, poorly sealed, or missing
- Fuel tank air vent obstructed
- Fuel pump trouble
- Throttle body assy holder loose
- Air cleaner duct loose

Compression low:
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive

Cylinder head warped
Cylinder head gasket damaged
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Other:
IC igniter in ECU trouble
Throttle body assy not synchronizing
Engine oil viscosity too high
Drive train trouble
Brake dragging
Engine overheating
Clutch slipping

Poor Running or No Power at High Speed:

Firing incorrect:
Spark plug dirty, broken, or maladjusted
Ignition coil wiring trouble
Ignition coil not in good contact
Spark plug incorrect
Camshaft position trouble
IC igniter in ECU trouble
Crankshaft sensor trouble
Ignition coil trouble

Fuel/air mixture incorrect:
Air cleaner clogged, poorly sealed, or missing
Air cleaner O-ring damaged
Air cleaner duct loose
Water or foreign matter in fuel
Throttle body assy holder loose
Fuel to injector insufficient (DFI)
Fuel tank air vent obstructed
Fuel line clogged
Fuel pump trouble

Compression low:
Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston ring bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head gasket damaged
Cylinder head warped
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Knocking:
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
IC igniter in ECU trouble
Crankshaft sensor trouble

Miscellaneous:
Throttle valve won't fully open
Brake dragging
Clutch slipping
Engine overheating
Engine oil level too high
Engine oil viscosity too high
Drive train trouble

Overheating:

Firing incorrect:
Spark plug dirty, broken, or maladjusted
Spark plug incorrect
IC igniter in ECU trouble

Fuel/air mixture incorrect:
Throttle body assy holder loose
Air cleaner duct loose
Air cleaner poorly sealed, or missing
Air cleaner O-ring damaged
Air cleaner clogged

Compression high:
Carbon built up in combustion chamber

Engine load faulty:
Clutch slipping
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

Gauge incorrect:
Water temperature sensor broken

Coolant incorrect:
Coolant level too low
Coolant deteriorated
Wrong coolant mixed ratio

Cooling system component incorrect:
Radiator fin damaged
Radiator clogged
Radiator cap trouble
Radiator fan relay trouble
Fan motor broken
Fan blade damaged
Water pump not turning
Water pump impeller damaged

Over Cooling:

Gauge incorrect:
Water temperature sensor broken

Cooling system component incorrect:
Radiator fan relay trouble

Troubleshooting Guide

Clutch Operation Faulty:

Clutch slipping:
- Friction plate worn or warped
- Steel plate worn or warped
- Clutch spring broken or weak
- Clutch hub or housing unevenly worn
- No clutch lever play
- Clutch inner cable trouble
- Clutch release mechanism trouble

Clutch not disengaging properly:
- Clutch plate warped or too rough
- Clutch spring compression uneven
- Engine oil deteriorated
- Engine oil viscosity too high
- Engine oil level too high
- Clutch housing frozen on drive shaft
- Clutch hub nut loose
- Clutch hub spline damaged
- Clutch friction plate installed wrong
- Clutch lever play excessive
- Clutch release mechanism trouble

Gear Shifting Faulty:

Doesn't go into gear; shift pedal doesn't return:
- Clutch not disengaging
- Shift fork bent or seized
- Gear stuck on the shaft
- Gear positioning lever binding
- Shift return spring weak or broken
- Shift return spring pin loose
- Gear positioning lever spring broken
- Gear positioning lever broken
- Ratchet pawl broken

Jumps out of gear:
- Shift fork ear worn, bent
- Gear groove worn
- Gear dogs and/or dog holes worn
- Shift drum groove worn
- Gear positioning lever spring weak or broken
- Shift fork guide pin worn
- Drive shaft, output shaft, and/or gear splines worn

Overshifts:
- Gear positioning lever spring weak or broken

Abnormal Engine Noise:

Knocking:
- IC igniter in ECU trouble
- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Spark plug incorrect
- Overheating

Piston slap:
- Cylinder/piston clearance excessive
- Cylinder, piston worn
- Connecting rod bent
- Piston pin, piston pin hole worn

Valve noise:
- Valve clearance incorrect
- Valve spring broken or weak
- Camshaft bearing worn
- Valve lifter worn

Other noise:
- Connecting rod small end clearance excessive
- Connecting rod big end clearance excessive
- Piston ring/groove clearance excessive
- Piston ring worn, broken, or stuck
- Piston ring groove worn
- Piston seizure, damage
- Cylinder head gasket leaking
- Exhaust pipe leaking at cylinder head connection
- Crankshaft runout excessive
- Engine mount loose
- Crankshaft bearing worn
- Primary gear worn or chipped
- Camshaft chain tensioner trouble
- Camshaft chain, sprocket, guide worn
- Alternator rotor loose

Abnormal Drive Train Noise:

Clutch noise:
- Clutch housing/friction plate clearance excessive
- Clutch housing gear worn
- Wrong installation of outside friction plate

Transmission noise:
- Bearings worn
- Transmission gear worn or chipped
- Metal chips jammed in gear teeth
- Engine oil insufficient

Drive line noise:
- Drive chain adjusted improperly
- Drive chain worn
- Rear and/or engine sprocket worn
- Chain lubrication insufficient
- Rear wheels misaligned

Abnormal Frame Noise:

Front fork noise:
- Oil insufficient or too thin
- Spring weak or broken

Rear shock absorber noise:
- Shock absorber damaged

Disc brake noise:
- Pad installed incorrectly
- Pad surface glazed
- Disc warped
- Caliper trouble

Other noise:
Bracket, nut, bolt, etc. not properly mounted or tightened

Oil Pressure Warning Light Goes On:

Engine oil pump damaged
Engine oil screen clogged
Engine oil filter clogged
Engine oil level too low
Engine oil viscosity too low
Camshaft bearing worn
Crankshaft bearing worn
Oil pressure switch damaged
Wiring faulty
Relief valve stuck open
O-ring at the oil passage in the crankcase damaged

Exhaust Smokes Excessively:

White smoke:
Piston oil ring worn
Cylinder worn
Valve oil seal damaged
Valve guide worn
Engine oil level too high

Black smoke:
Air cleaner clogged

Brown smoke:
Air cleaner duct loose
Air cleaner O-ring damaged
Air cleaner poorly sealed or missing

Handling and/or Stability Unsatisfactory:

Handlebar hard to turn:
Cable routing incorrect
Hose routing incorrect
Wiring routing incorrect
Steering stem nut too tight
Steering stem bearing damaged
Steering stem bearing lubrication inadequate
Steering stem bent
Tire air pressure too low

Handlebar shakes or excessively vibrates:
Tire worn
Swingarm pivot bearing worn
Rim warped, or not balanced
Wheel bearing worn
Handlebar holder bolt loose
Steering stem nut loose
Rear axle runout excessive
Engine mounting bolt loose

Handlebar pulls to one side:
Frame bent
Wheel misalignment
Swingarm bent or twisted
Swingarm pivot shaft runout excessive
Steering maladjusted

Shock absorption unsatisfactory:
(Too hard)
Shock absorber adjustment too hard
Tire air pressure too high
Tire air pressure too low
Shock absorber adjustment too soft
Shock absorber oil leaking

Brake Doesn't Hold:

Air in the brake line
Pad or disc worn
Brake fluid leakage
Disc warped
Contaminated pad
Brake fluid deteriorated
Primary or secondary cup damaged in master cylinder
Master cylinder scratched inside

Battery Trouble:

Battery discharged:
Charge insufficient
Battery faulty (too low terminal voltage)
Battery lead making poor contact
Load excessive (e.g., bulb of excessive wattage)
Ignition switch trouble
Alternator trouble
Wiring faulty
Regulator/rectifier trouble

Battery overcharged:
Alternator trouble
Regulator/rectifier trouble
Battery faulty