

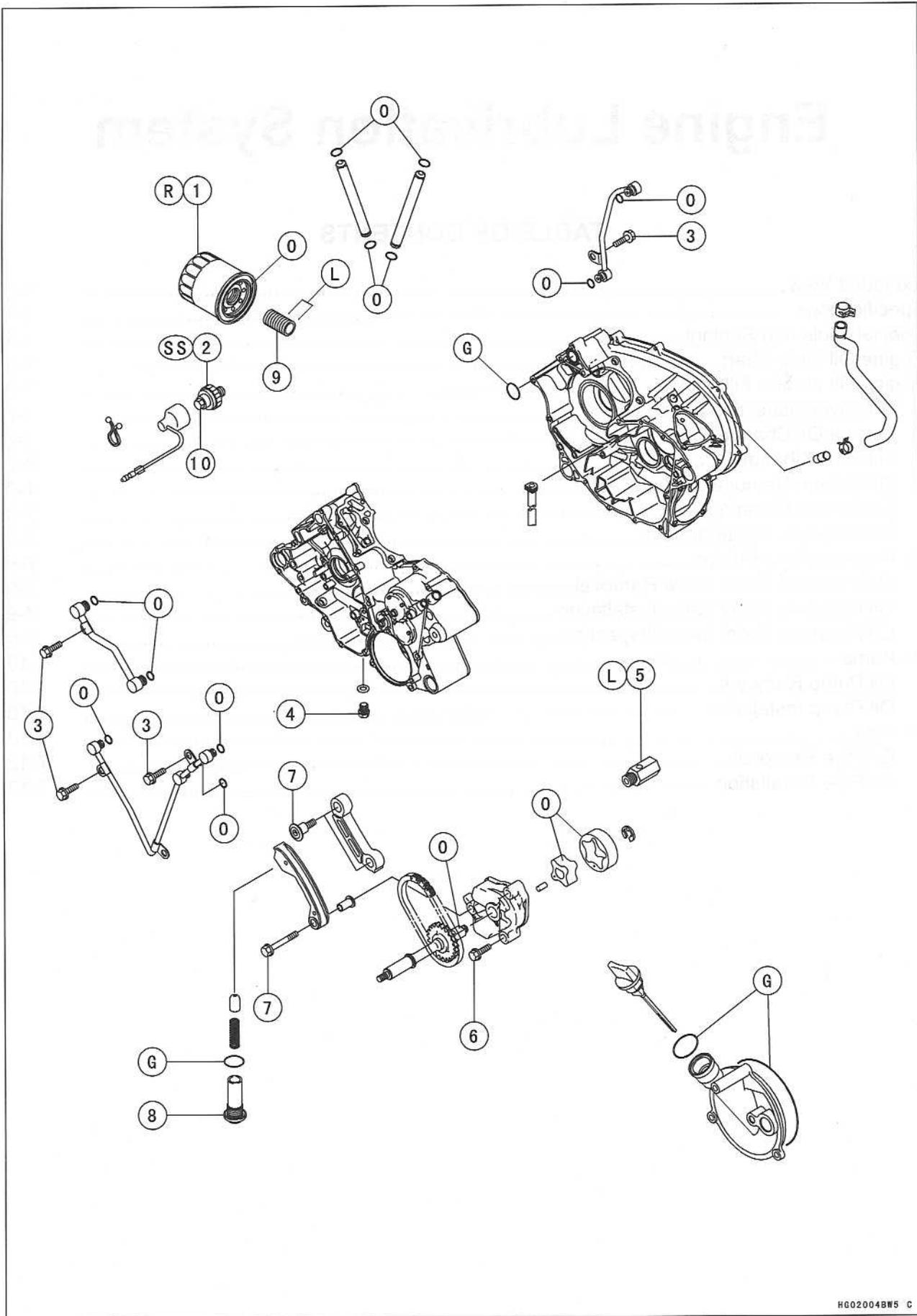
# Engine Lubrication System

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# 7-2 ENGINE LUBRICATION SYSTEM

## Exploded View



## ENGINE LUBRICATION SYSTEM 7-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Filter	18	1.8	13	R
2	Oil Pressure Switch	15	1.5	11	SS
3	Oil Pipe Bolts	8.8	0.90	78 in·lb	
4	Engine Drain Plug	20	2.0	14	
5	Oil Pressure Relief Valve	15	1.5	11	L
6	Oil Pump Bolts	8.8	0.90	78 in·lb	
7	Chain Guide Bolts	8.8	0.90	78 in·lb	
8	Oil Pump Drive Chain Tensioner Bolt	25	2.5	18	
9	Oil Filter Mounting Bolt	25	2.5	18	L (15 mm)
10	Oil Pressure Switch Terminal Bolt	1.5	0.15	13 in·lb	

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

L: Apply a non-permanent locking agent.

O: Apply engine oil.

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

R: Replacement Parts

## 7-4 ENGINE LUBRICATION SYSTEM

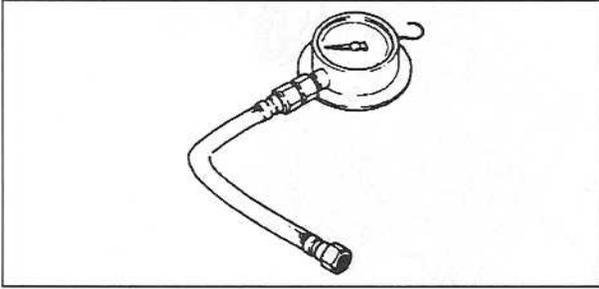
### Specifications

Item	Standard
<b>Engine Oil:</b> Grade  Viscosity Capacity	API SF or SG API SH or SJ with JASO MA SAE 10W-40 1.7 L (1.80 US qt) (when filter is not removed) 1.9 L (2.01 US qt) (when filter is removed) 2.2 L (2.33 US qt) (when engine is completely dry)
<b>Oil Pressure Measurement:</b> Oil Pressure @ 4 500 r/min (rpm), oil temp. 110°C (230°F)	480 kPa (4.9 kgf/cm <sup>2</sup> , 69.7 psi)

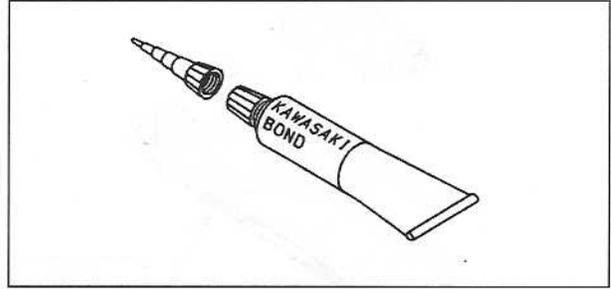
## ENGINE LUBRICATION SYSTEM 7-5

### Special Tools and Sealant

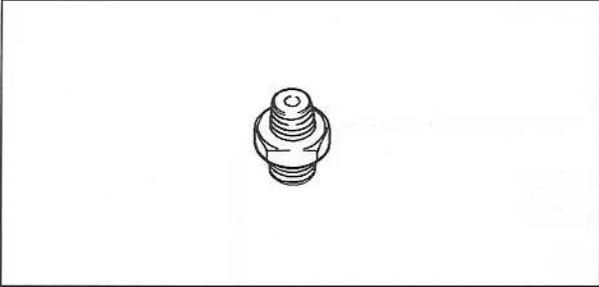
Oil Pressure Gauge, 10 kgf/cm<sup>2</sup> :  
57001-164



Kawasaki Bond (Silicone Sealant) :  
56019-120

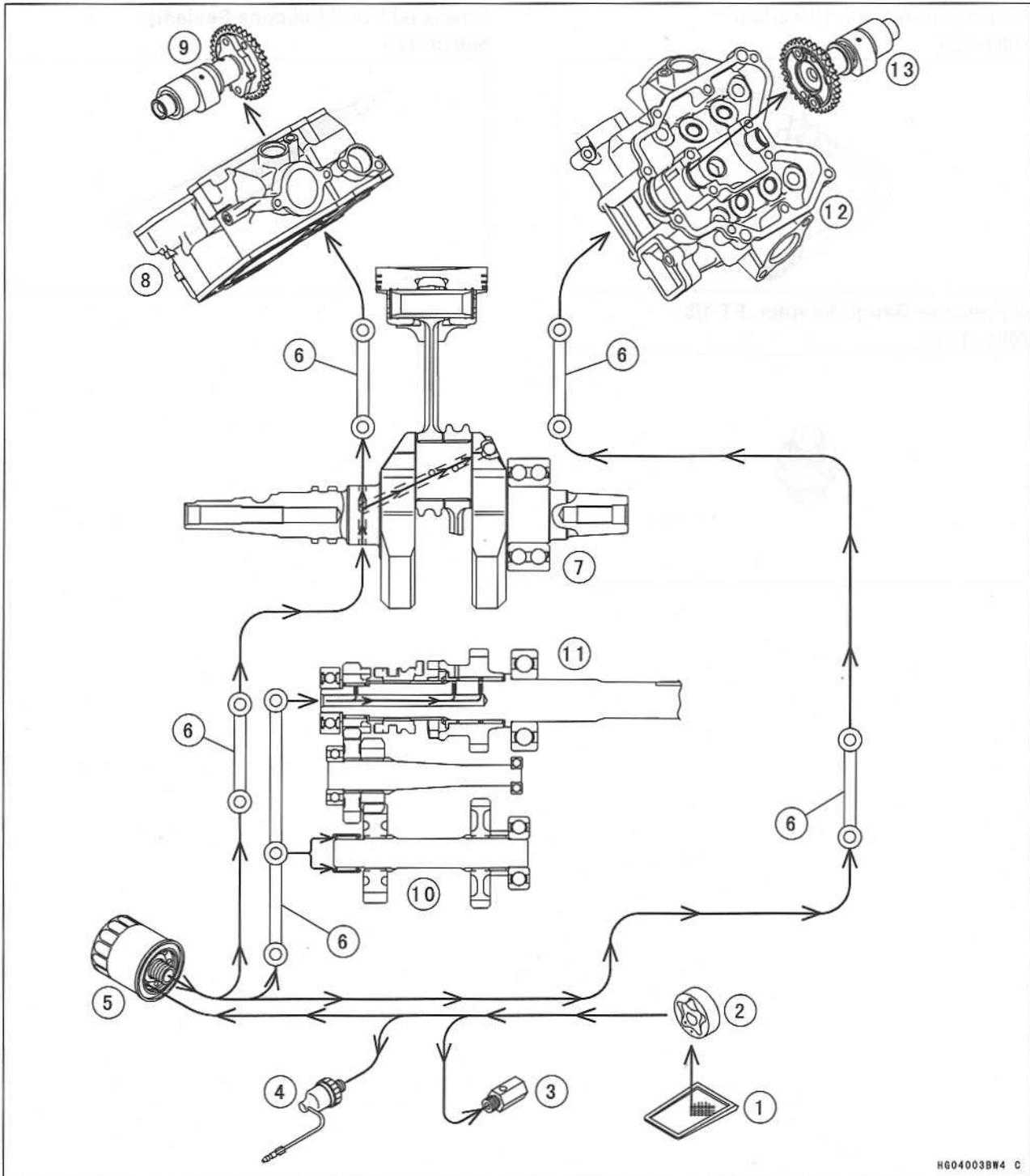


Oil Pressure Gauge Adapter, PT 1/8 :  
57001-1033



# 7-6 ENGINE LUBRICATION SYSTEM

## Engine Oil Flow Chart



HG04003BW4 C

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

## Engine Oil and Oil Filter

### **⚠ WARNING**

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

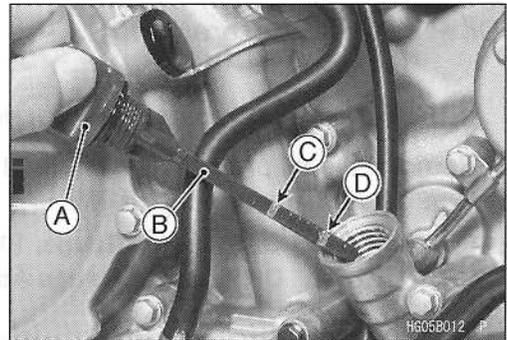
### *Oil Level Inspection*

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

### **CAUTION**

Allow the engine to idle for several minutes so that oil may reach all parts of the engine. Racing a "dry" engine may cause severe damage.

- Stop the engine and wait several minutes for all the oil to drain back to the sump.
- Unscrew the oil filler cap [A], wipe its dipstick [B] dry, and tighten it into the filler opening.
- Unscrew the oil filler cap and check the oil level. The oil level should be between the upper (H) level line [C] and lower (L) level line [D].
- ★ If the level is too high, suck the excess oil out the filler hole with a syringe or other suitable device.
- ★ If the level is too low, add oil through the filler hole. Use the same type and make of oil that is already in the engine.



### *Engine Oil Change*

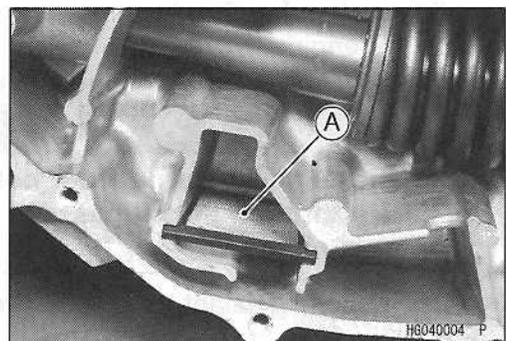
- Refer to the Engine Lubrication System in the Periodic Maintenance chapter.

### *Oil Filter Change*

- Refer to the Engine Lubrication System in the Periodic Maintenance chapter.

### *Oil Screen Removal*

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



## 7-8 ENGINE LUBRICATION SYSTEM

### Engine Oil and Oil Filter

#### Oil Screen Cleaning

- Clean the oil screen [A] thoroughly whenever it is removed for any reason.
- Clean the oil screen with a high flash-point solvent and remove any particles stuck to it.

#### **⚠ WARNING**

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

#### **NOTE**

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

#### Oil Pressure Measurement

#### **NOTE**

- Measure the oil pressure after the engine is warmed up.
  - Remove the oil pressure switch, and attach the oil pressure gauge [A] and adapter [B].
- Special Tools - Oil Pressure Gauge, 10 kgf/cm<sup>2</sup>: 57001-164**  
**Oil Pressure Gauge Adapter: 57001-1033**

#### Oil Pressure

**Standard: 480 kPa (4.9 kgf/cm<sup>2</sup>, 69.7 psi) @ 4 500 r/min (rpm), 110°C (230°F) of oil temp.**

- ★ If the oil pressure is much lower than the standard, inspect the relief valve, oil pump, and/or crankshaft bearing insert wear.
- ★ If the oil pressure is much higher than the standard, inspect the oil filter, oil screen, and other areas of the lubrication system for clogging.
- Stop the engine.
- Remove the oil pressure gauge and adapter.

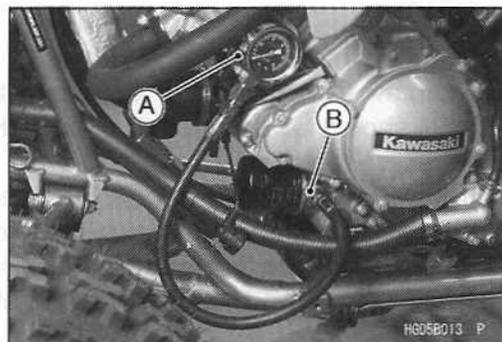
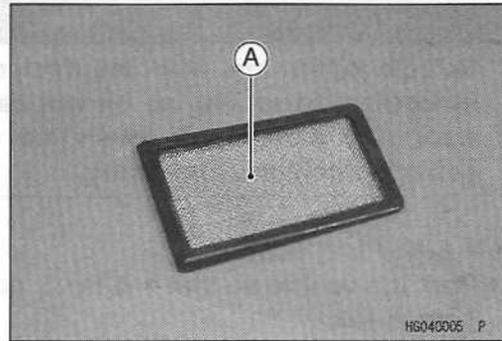
#### **⚠ WARNING**

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

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

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

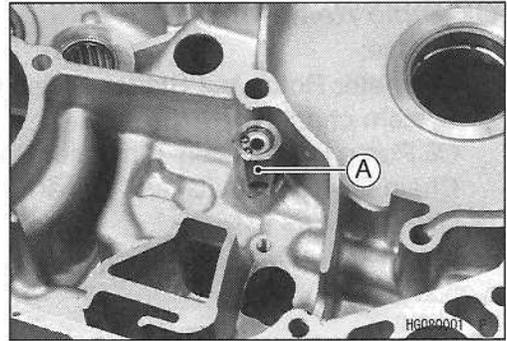
**Torque - Oil Pressure Switch: 15 N·m (1.5 kgf·m, 11 ft·lb)**  
**Oil Pressure Switch Terminal Bolt: 1.5 N·m (0.15 kgf·m, 13 in·lb)**



**Oil Pressure Relief Valve**

*Oil Pressure Relief Valve Removal*

- Split the crankcase (see Crankshaft / Transmission chapter).
- Remove the oil pressure relief valve [A].



*Oil Pressure Relief Valve Installation*

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

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

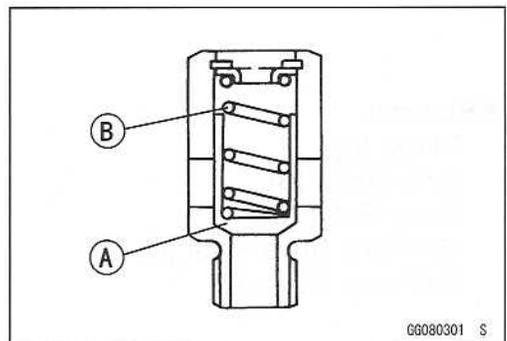
*Oil Pressure Relief Valve Inspection*

- Remove the relief valve.
- Using a wooden stick, push the inner valve to make sure that the valve [A] moves smoothly and that it returns to its original position by the force of the spring [B].

**NOTE**

○ *The relief valve cannot be disassembled and it must be inspected in the assembled state.*

- ★ If the valve movement is not smooth, wash the relief valve with high flash-point solvent, and use compressed air to remove any foreign particles from it.



**⚠ WARNING**

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

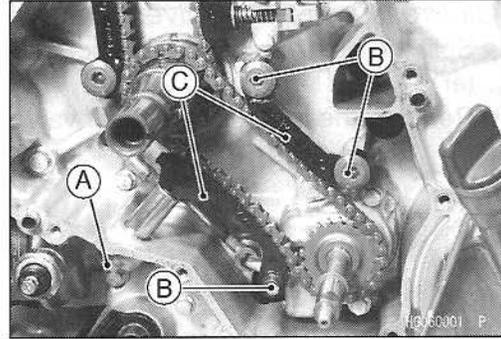
- ★ If the valve does not move smoothly even after washing it, replace the relief valve. The oil pressure relief valve is precision made with no allowance for replacement of individual parts.

## 7-10 ENGINE LUBRICATION SYSTEM

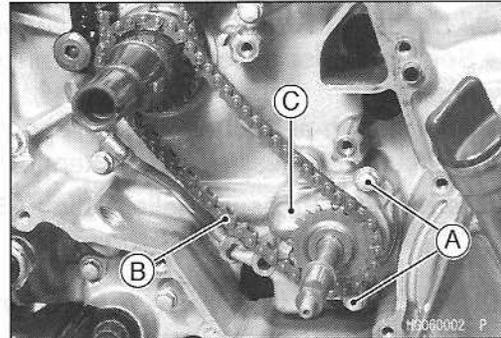
### Oil Pump

#### Oil Pump Removal

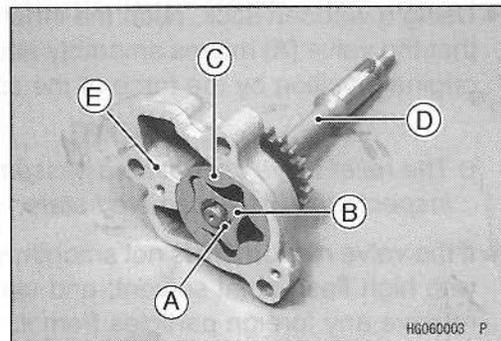
- Remove:
  - Alternator Rotor and Starter Clutch Gear (see Electrical System chapter)
  - Oil Pump Drive Chain Tensioner Bolt [A]
  - Chain Guide Bolts [B] and Collar
  - Chain Guides [C]



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



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

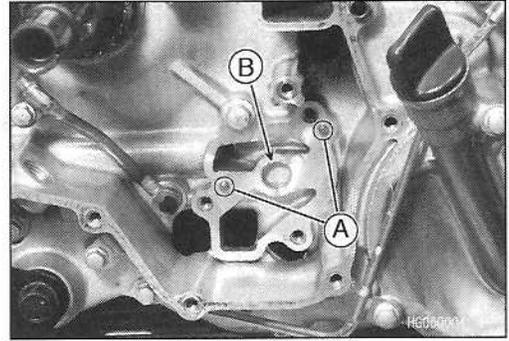


#### Oil Pump Installation

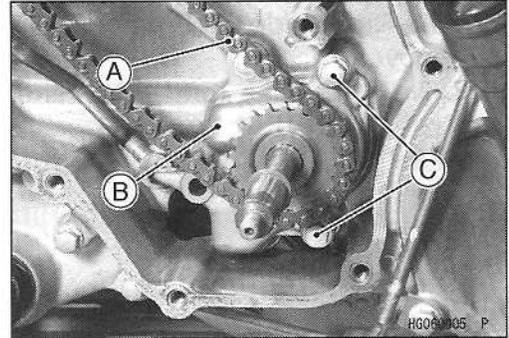
- Apply engine oil:
  - Oil Pump Shaft
  - Inner and Outer Rotors
- Install:
  - Oil Pump Drive Shaft
  - Oil Pump Cover
  - Inner Rotor
  - Outer Rotor
  - New Circlip

## Oil Pump

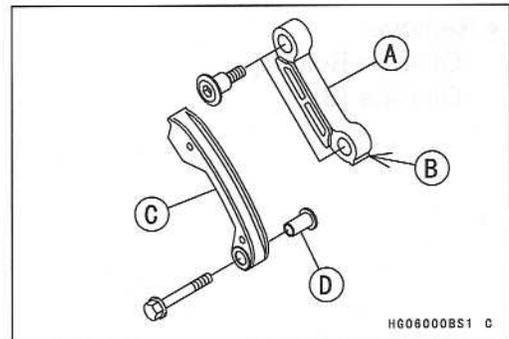
- Check to see that the dowel pins [A] are in place.
- Apply engine oil to the oil pump hole [B].



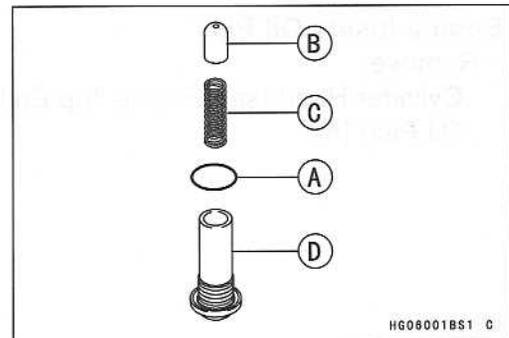
- Install the oil pump drive chain [A] with the oil pump assembly [B].
- Tighten:
  - Torque - Oil Pump Bolts [C]: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



- Install:
  - Upper Chain Guide [A] (Face the tab [B] downward.)
  - Lower Chain Guide [C] and Collar [D]
- Tighten:
  - Torque - Chain Guide Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



- Apply grease to the O-ring [A].
- Install:
  - Pin [B]
  - Spring [C]
  - O-ring [A]
  - Oil Pump Drive Chain Tensioner Bolt [D]
- Tighten:
  - Torque - Oil Pump Drive Chain Tensioner Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**



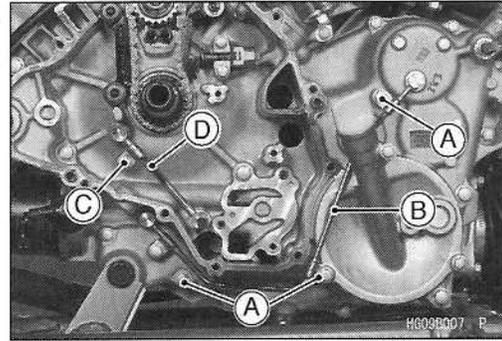
## 7-12 ENGINE LUBRICATION SYSTEM

### Oil Pipe

#### Oil Pipe Removal

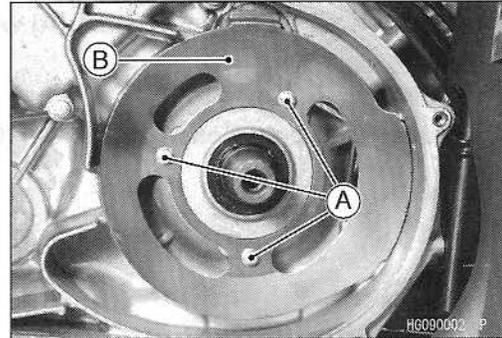
##### Engine Left Side Oil Pipe:

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

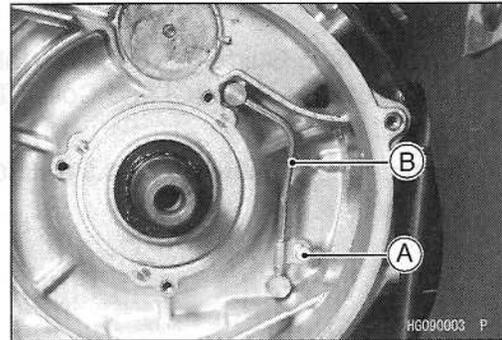


##### Engine Right Side Oil Pipe:

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

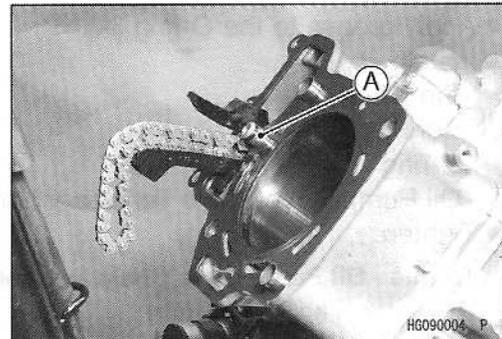


- Remove:
  - Oil Pipe Bolt [A]
  - Oil Pipe [B]



##### Engine Inside Oil Pipe:

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

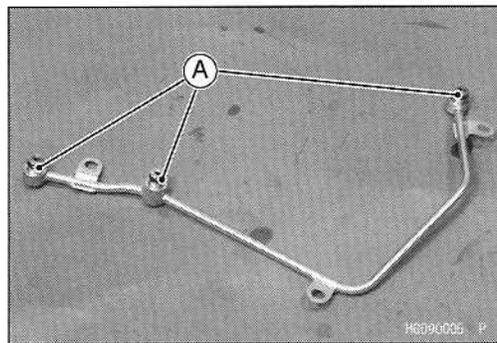


### Oil Pipe

#### *Oil Pipe Installation*

- Replace the O-ring [A] with new ones.
- Apply engine oil to the O-rings before installation.
- Tighten:

**Torque - Oil Pipe Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



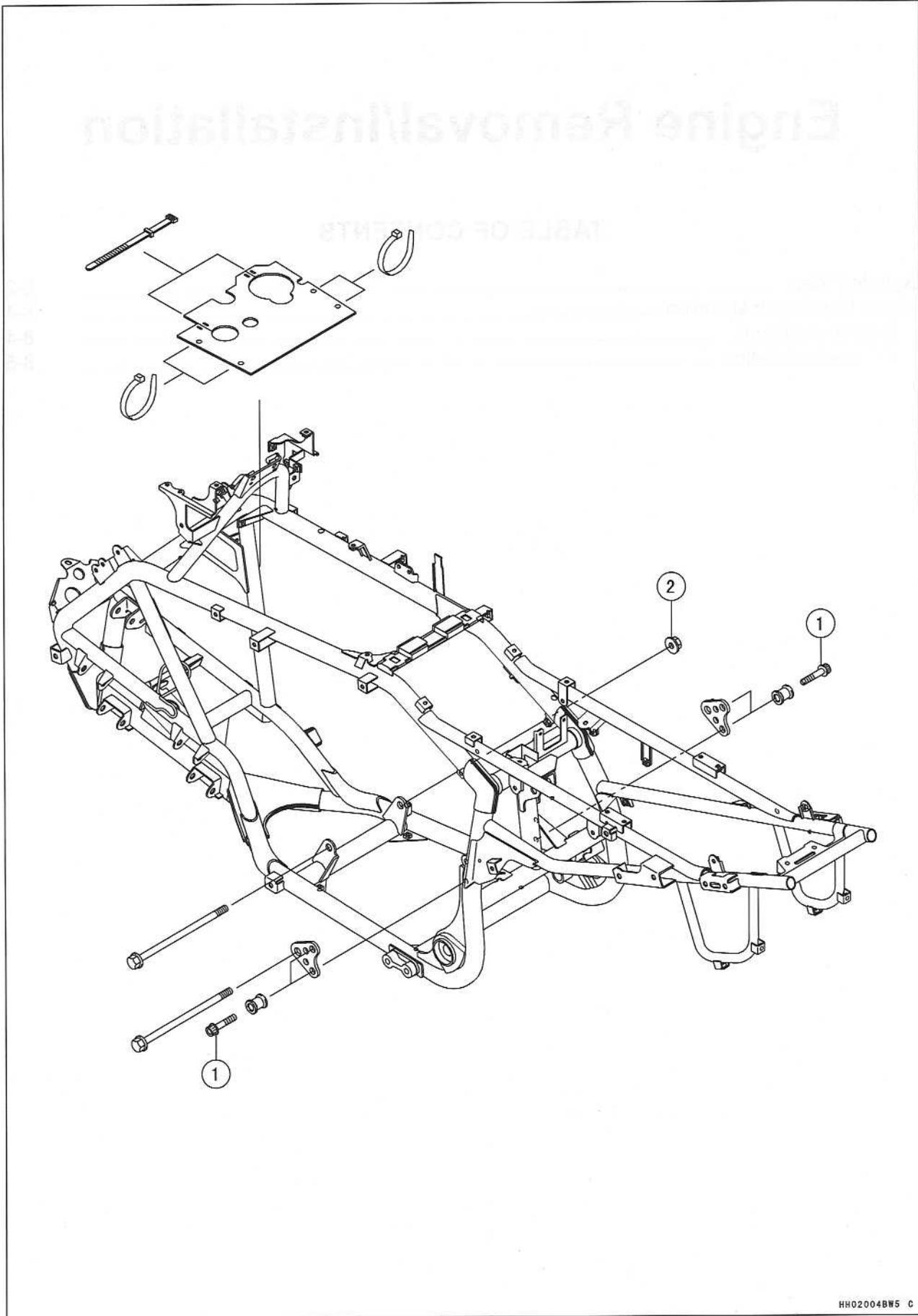
# Engine Removal/Installation

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# 8-2 ENGINE REMOVAL/INSTALLATION

## Exploded View



# ENGINE REMOVAL/INSTALLATION 8-3

## Exploded View

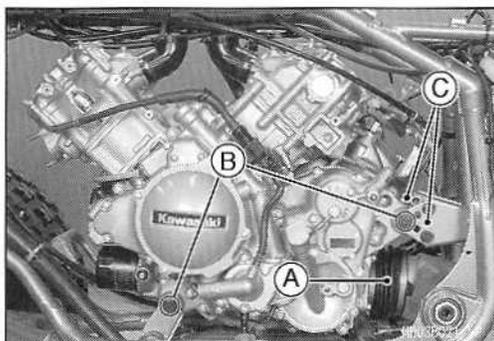
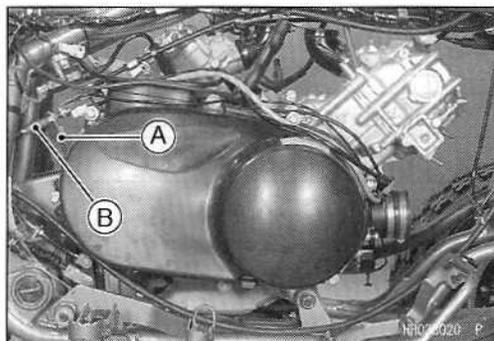
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Mounting Bracket Bolts	52	5.3	38	
2	Engine Mounting Nut	62	6.3	46	

## 8-4 ENGINE REMOVAL/INSTALLATION

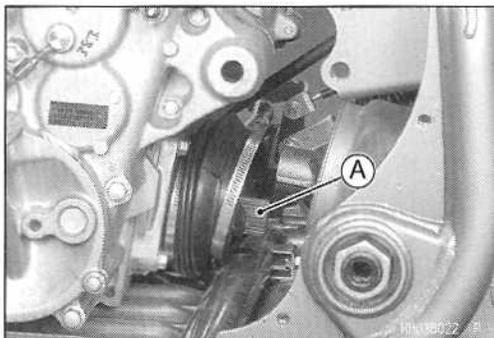
### Engine Removal/Installation

#### Engine Removal

- Remove:
  - Engine Oil (drain)
  - Coolant (drain) and Coolant Hose
  - Front Fender and Rear Fender (see Frame chapter)
  - Side Inner Covers (see Frame chapter)
  - Muffler and Exhaust Pipe (see Engine Top End chapter)
  - Carburetor (see Fuel System chapter)
  - Intake and Exhaust Converter Duct
  - Alternator Lead Connector
  - Crankshaft Sensor Lead Connector
  - Foot Guards and Guard (see Frame chapter)
  - Cable Holder [A] and Reverse Lock Cable [B] (see Crankshaft/Transmission chapter)
  - Oil Pressure Switch Lead Connector
  - Spark Plug Caps
- Remove:
  - Starter Motor Cable
  - Battery Negative Cable
  - Neutral Switch Lead Connector
  - Reverse Switch Lead Connector
  - Boot (roll up forward) [A]
  - Engine Mounting Bolts [B]
  - Engine Mounting Bracket [C]



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



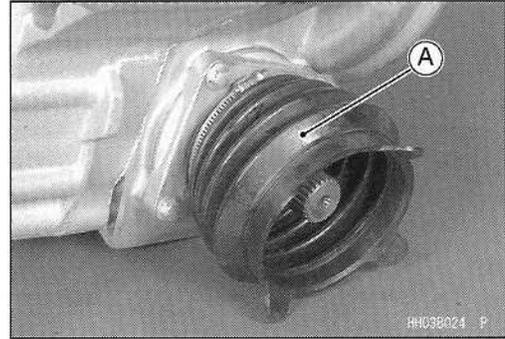
- Remove the engine as shown.



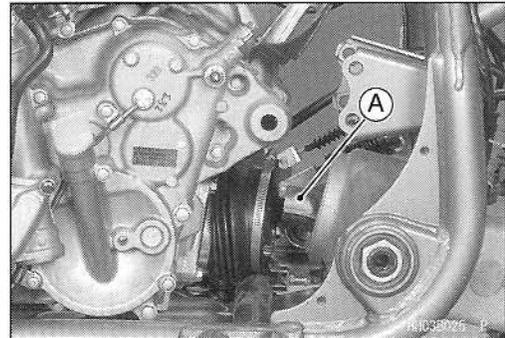
### Engine Removal/Installation

#### Engine Installation

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



- Insert the drive shaft in the rear propeller shaft joint [A].
- Tighten:
  - Torque - Engine Mounting Bracket Bolts: 52 N·m (5.3 kgf·m, 38 ft·lb)**
  - Engine Mounting Nut: 62 N·m (6.3 kgf·m, 46 ft·lb)**



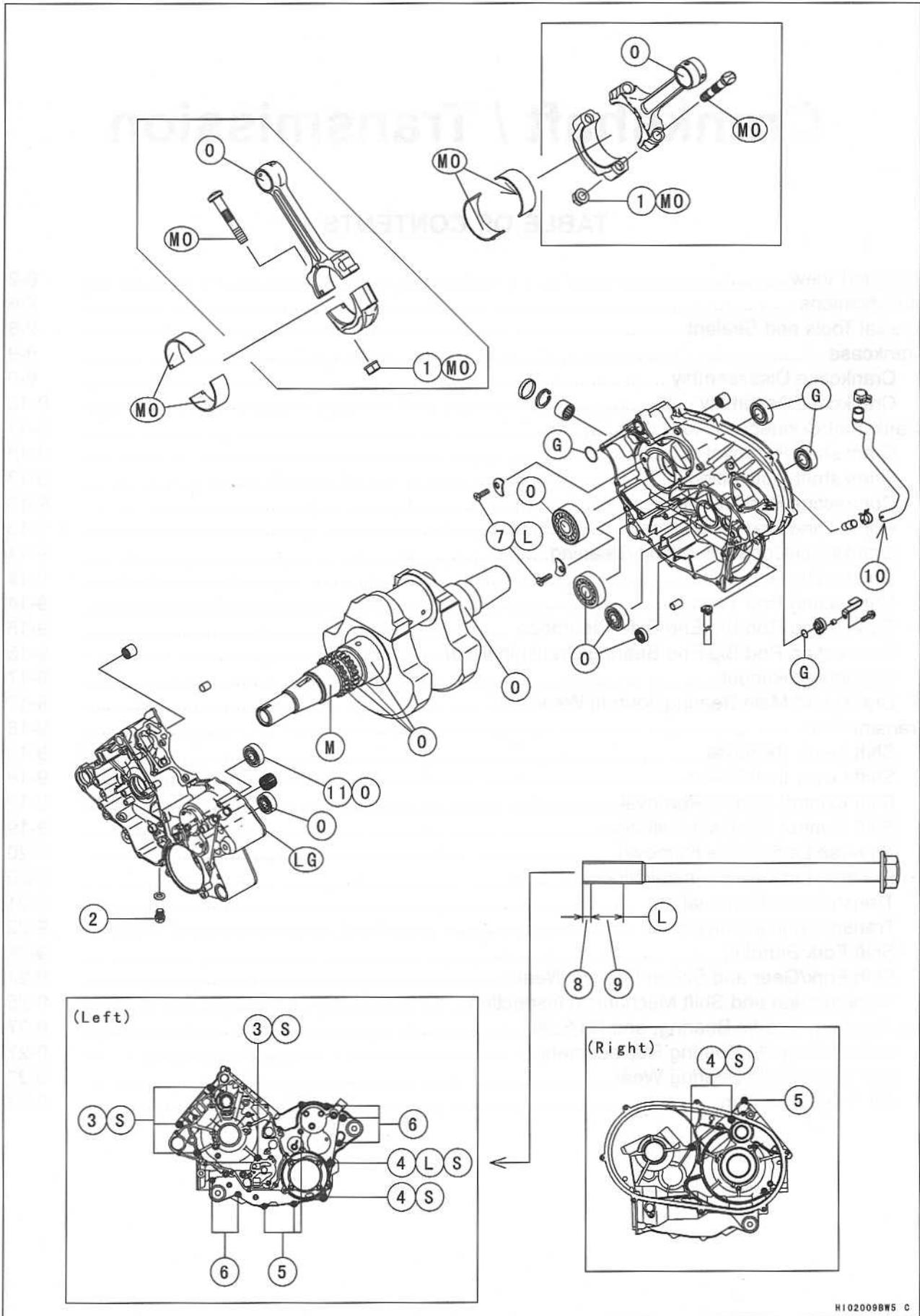
# Crankshaft / Transmission

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# 9-2 CRANKSHAFT / TRANSMISSION

## Exploded View



## CRANKSHAFT / TRANSMISSION 9-3

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Connecting Rod Big End Cap Nuts	34	3.5	25	MO
2	Engine Drain Plug	20	2.0	14	
3	Crankcase Bolts (M8) 75 mm (2.95 in.)	20	2.0	14	S
4	Crankcase Bolts (M8) 110 mm (4.33 in.)	20	2.0	14	L(1), S
5	Crankcase Bolts (M6) 40 mm (1.57 in.)	9.8	1.0	87 in·lb	
6	Crankcase Bolts (M6) 65 mm (2.56 in.)	9.8	1.0	87 in·lb	
7	Position Plate Mounting Screws	4.9	0.50	43 in·lb	L

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

9. About 12 mm (0.47 in.)

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

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

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

L: Apply a non-permanent locking agent.

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

M: Apply molybdenum disulfide grease.

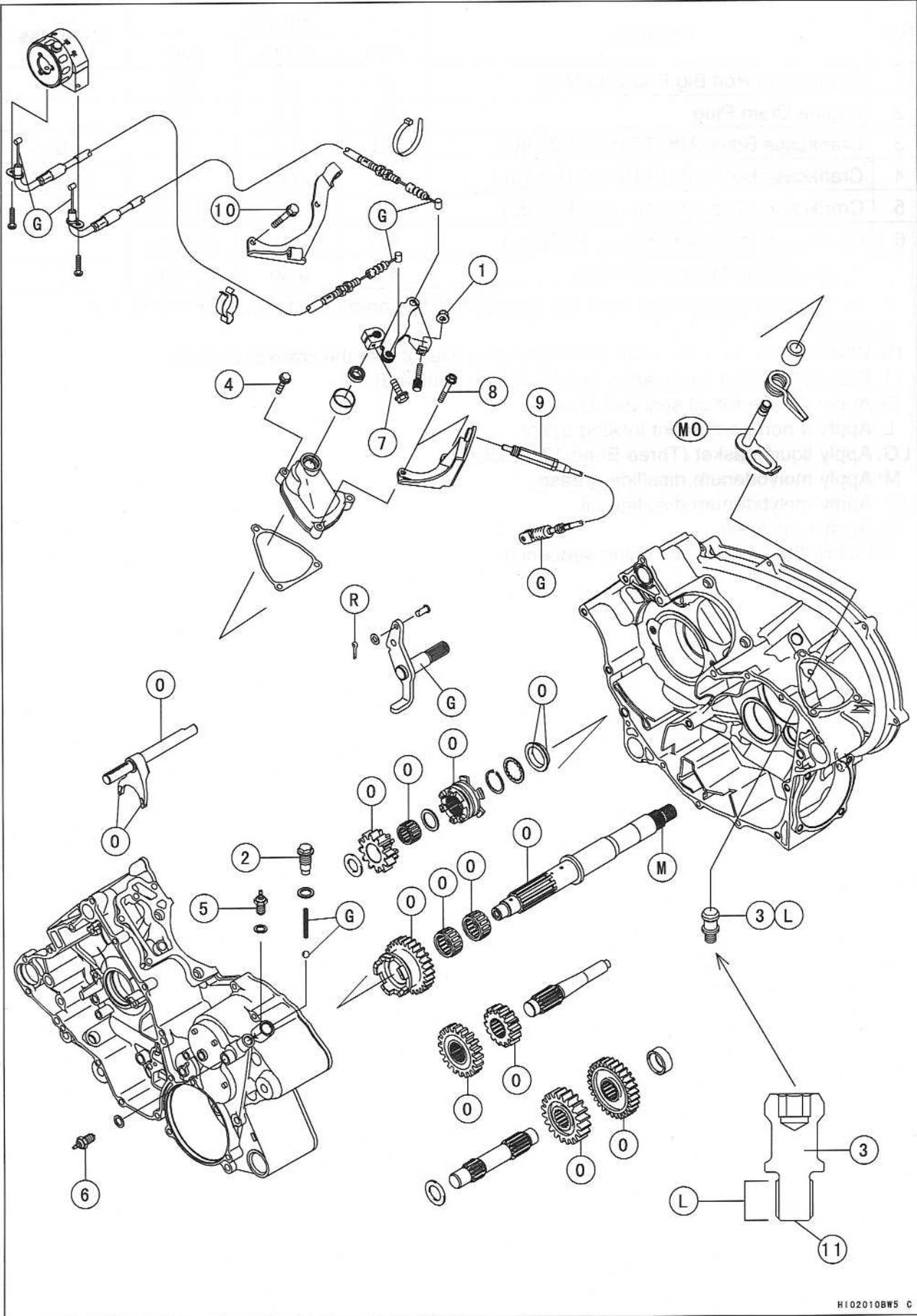
MO: Apply molybdenum disulfide oil.

O: Apply engine oil.

S: Follow the specific tightening sequence.

# 9-4 CRANKSHAFT / TRANSMISSION

## Exploded View



## CRANKSHAFT / TRANSMISSION 9-5

### Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Shift Shaft Lever Nut	8.8	0.90	78 in·lb	
2	Shift Shaft Positioning Bolt	25	2.5	18	
3	Shift Shaft Spring Bolt	25	2.5	18	L
4	Shift Shaft Cover Bolt	8.8	0.90	78 in·lb	
5	Neutral Position Switch	15	1.5	11	
6	Reverse Position Switch	15	1.5	11	
7	Shift Shaft Lever Bolt	14	1.4	10	
8	Reverse Cable Bracket Mounting Bolts	8.8	0.90	78 in·lb	
9	Reverse Cable Locknut	12	1.2	104 in·lb	
10	Cable Holder Mounting Bolts	9.8	1.0	87 in·lb	

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

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

O: Apply engine oil.

R: Replacement Parts

## 9-6 CRANKSHAFT / TRANSMISSION

### Specifications

Item	Standard	Service Limit																					
<b>Crankshaft, Connecting Rods:</b>																							
Connecting rod bend	---	TIR 0.2/100 mm (0.008/3.94 in.)																					
Connecting rod twist	---	TIR 0.2/100 mm (0.008/3.94 in.)																					
Connecting rod big end side clearance	0.16 ~ 0.46 mm (0.0063 ~ 0.0181 in.)	0.7 mm (0.028 in.)																					
Connecting rod big end bearing, insert / crankpin clearance	0.028 ~ 0.052 mm (0.0011 ~ 0.0020 in.)	0.09 mm (0.0035 in.)																					
Crankpin diameter:	39.984 ~ 40.000 mm (1.5742 ~ 1.5748 in.)	39.97 mm (1.5736 in.)																					
Marking: None	39.984 ~ 39.992 mm (1.5742 ~ 1.57449 in.)	---																					
○	39.993 ~ 40.000 mm (1.57452 ~ 1.5748 in.)	---																					
Connecting rod big end inside diameter:	43.000 ~ 43.016 mm (1.6929 ~ 1.6939 in.)	---																					
Marking: None	43.000 ~ 43.008 mm (1.6929 ~ 1.69323 in.)	---																					
○	43.009 ~ 43.016 mm (1.69326 ~ 1.6935 in.)	---																					
Connecting rod big end bearing insert thickness:																							
Brown	1.482 ~ 1.486 mm (0.05835 ~ 0.05850 in.)	---																					
Yellow	1.486 ~ 1.490 mm (0.05850 ~ 0.05866 in.)	---																					
Green	1.490 ~ 1.494 mm (0.05866 ~ 0.05882 in.)	---																					
Connecting rod big end bearing insert selection:																							
<table border="1"> <thead> <tr> <th rowspan="2">Con-rod Big End Bore Diameter Marking</th> <th rowspan="2">Crankpin Diameter Marking</th> <th colspan="2">Bearing Insert</th> </tr> <tr> <th>Size Color</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>None</td> <td>○</td> <td>Brown</td> <td>92028-1963</td> </tr> <tr> <td>None</td> <td>None</td> <td rowspan="2">Yellow</td> <td rowspan="2">92028-1962</td> </tr> <tr> <td>○</td> <td>○</td> </tr> <tr> <td>○</td> <td>None</td> <td>Green</td> <td>92028-1961</td> </tr> </tbody> </table>				Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert		Size Color	Part Number	None	○	Brown	92028-1963	None	None	Yellow	92028-1962	○	○	○	None	Green	92028-1961
Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert																					
		Size Color	Part Number																				
None	○	Brown	92028-1963																				
None	None	Yellow	92028-1962																				
○	○																						
○	None	Green	92028-1961																				
Crankshaft runout	TIR 0.04 mm (0.0016 in.) or less	TIR 0.10 mm (0.0039 in.)																					
Crankshaft main journal diameter:																							
φ42 Side	41.984 ~ 42.000 mm (1.6529 ~ 1.6535 in.)	41.96 mm (1.652 in.)																					
Crankshaft main bearing bore diameter:																							
φ42 Side	42.025 ~ 42.041 mm (1.6545 ~ 1.6552 in.)	42.08 mm (1.6567 in.)																					

## CRANKSHAFT / TRANSMISSION 9-7

### Specifications

Item	Standard	Service Limit
<b>Transmission</b>		
Shift fork ear thickness	5.9 ~ 6.0 mm (0.2322 ~ 0.2362 in.)	5.8 mm (0.228 in.)
Shifter groove width	6.05 ~ 6.15 mm (0.2382 ~ 0.2421 in.)	6.25 mm (0.246 in.)

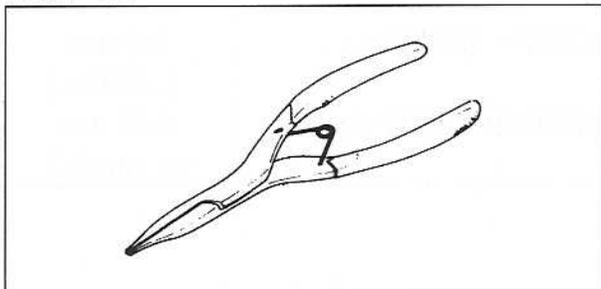
## 9-8 CRANKSHAFT / TRANSMISSION

### Special Tools and Sealant

---

Outside Circlip Pliers :

57001-144



Three Bond : 1215 (Gray)

Bearing Driver Set :

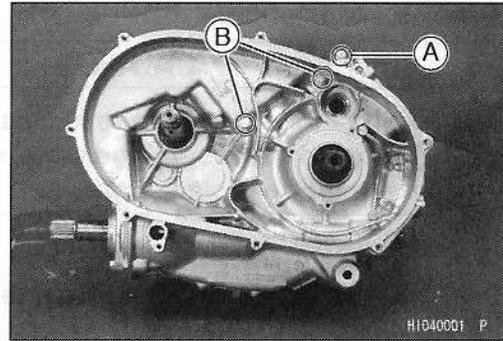
57001-1129



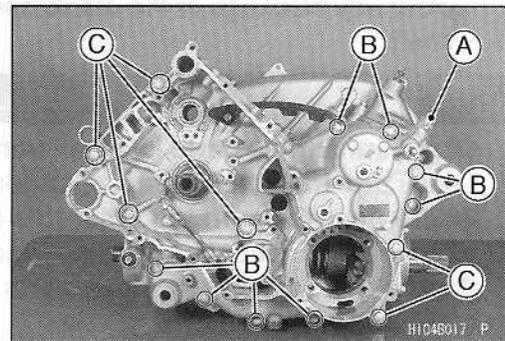
## Crankcase

### Crankcase Disassembly

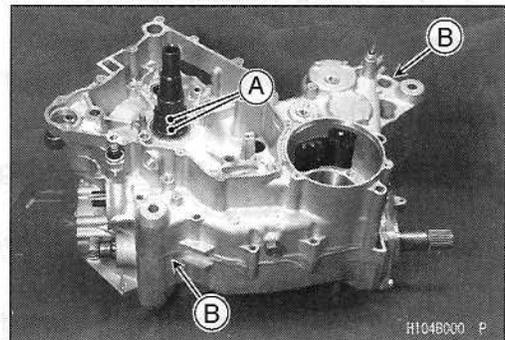
- Remove:
  - Engine (see Engine Removal/Installation chapter)
  - Starter Motor (see Electrical System chapter)
  - Oil Filter (see Engine Lubrication System chapter)
  - Cylinder Blocks and Pistons (see Engine Top End chapter)
  - Intermediate Shaft and Chain (see Engine Top End chapter)
  - Right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



- Remove:
  - Shift Shaft Positioning Bolt [A], Washer, Spring, and Steel Ball
  - Left Crankcase Bolts (M6) [B]
  - Left Crankcase Bolts (M8) [C]



- Wrap the teeth on the sprockets [A] by taping for protecting the bushing in the crankcase.
- Using the pry points [B], split the crankcase halves.
- Lift off the left crankcase half.



## 9-10 CRANKSHAFT / TRANSMISSION

### Crankcase

#### Crankcase Assembly

#### CAUTION

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

#### NOTE

- Be certain that all parts are cleaned thoroughly before assembly.
- Blow through all oil passages with compressed air to clear any blockage in the crankcase halves and crankshaft.

#### ⚠ WARNING

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

- Apply a small amount of engine oil to the transmission gears, bearings and shift fork.
- Be sure the mating surfaces of the crankcase halves are clean and dry.
- Press and insert the new ball bearings until they are bottomed.

#### Special Tool - Bearing Driver Set: 57001-1129

[A] Ball Bearing

[B] Ball Bearing (sealed side towards crankcase)

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

[C] Needle Bearing

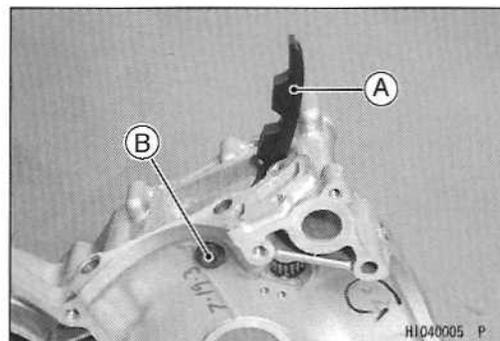
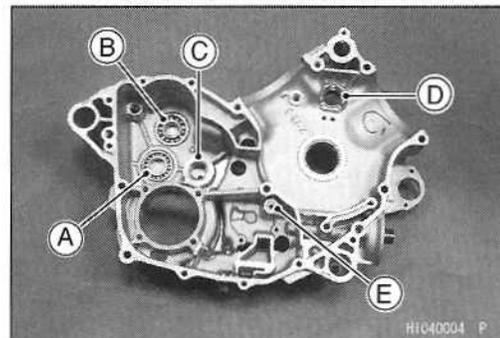
[D] Needle Bearing (Insert it from outside.)

- Apply engine oil to the bearings.
- Install:  
Oil Pressure Relief Valve [E] (see Engine Lubrication System chapter)

- Install:  
Rear Cylinder Camshaft Chain Guide [A]

- Tighten:

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



## Crankcase

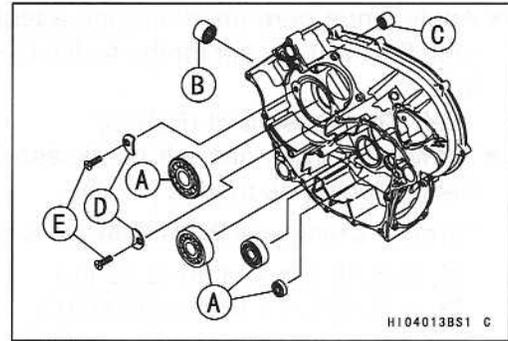
- Press and insert the new ball bearings [A] until they are bottomed.

**Special Tool - Bearing Driver Set: 57001-1129**

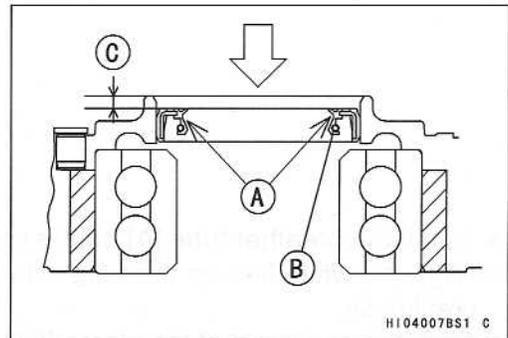
- Press and insert the new needle bearings so that the bearing surfaces are flush with the end of the hole.
  - [B] Needle Bearing
  - [C] Needle Bearing (Insert it from outside.)
- Apply engine oil to the bearings.
- Install the position plates [D].
- Apply a non-permanent locking agent to the position plate mounting screws [E].
- Tighten:

**Torque - Position Plate Mounting Screws: 4.9 N·m (0.50 kgf·m, 43 in·lb)**

- Grease the lip [A] of the oil seal [B] and press the seal 3 mm (0.12 in.) [C] inwards from the end of the boss.



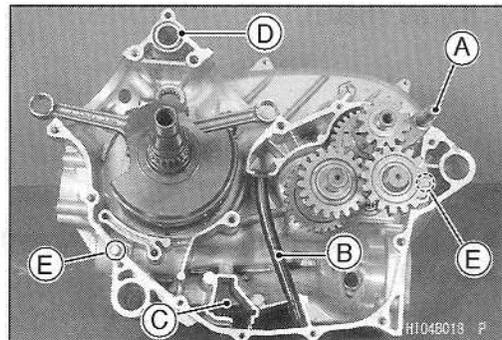
H104013BS1 C



H104007BS1 C

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

Crankshaft  
 Transmission Shafts and Shift Rod [A]  
 Oil Tube [B]  
 Oil Screen [C]  
 O-ring (Apply Grease) [D]  
 Dowel Pins [E]

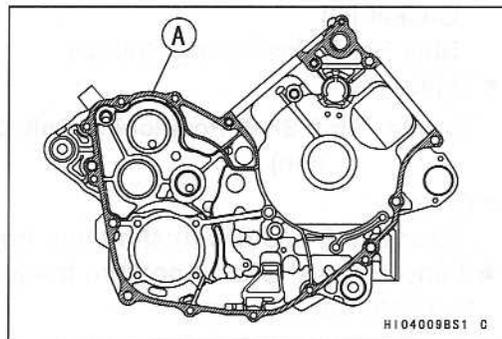


H1048013 P

- Apply liquid gasket [A] to mating surface of the left crankcase half.

**Sealant - Three Bond: 1215 (Gray)**

- Apply after, must be assembled with in 20 min.



H104009BS1 C

## 9-12 CRANKSHAFT / TRANSMISSION

### Crankcase

- Apply a non-permanent locking agent to the area [C] (12 mm, 0.47 in.) except for the tip [D] (2 ~ 3 mm, 0.08 ~ 0.12 in.).

Left Crankcase Bolt (M8) [3]

- Tighten the right and left crankcase bolts (M8) following the tightening sequence [1 ~ 8].

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

[1, 2, 5, 6] L = 75 mm (2.95 in.)

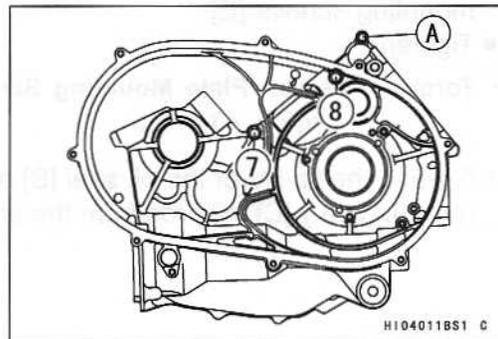
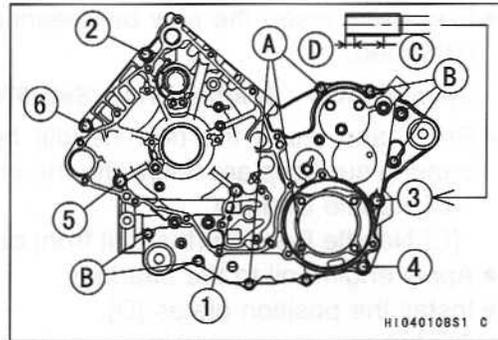
[3, 4, 7, 8] L = 110 mm (4.33 in.)

- Tighten:

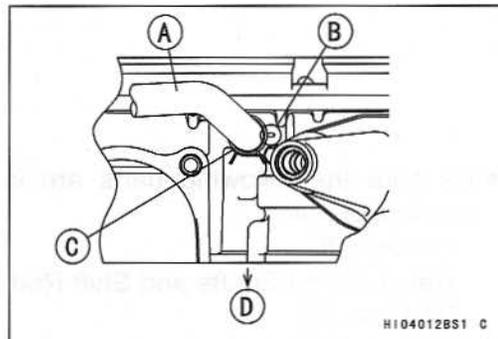
**Torque - Crankcase Bolts (M6): 9.8 N·m (1.0 kgf·m, 87 in·lb)**

[A] L = 40 mm (1.57 in.)

[B] L = 65 mm (2.56 in.)



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



- Apply grease to the steel ball [A] and spring [B].

- Install:

Steel Ball

Spring

Gasket [C]

Shift Shaft Positioning Bolt [D]

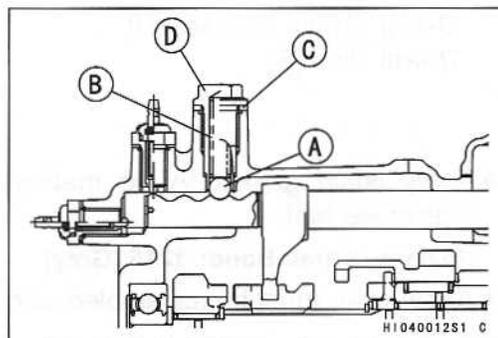
- Tighten:

**Torque - Shift Shaft Positioning Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**

- Check:

Crankshaft and driven shaft turn freely.

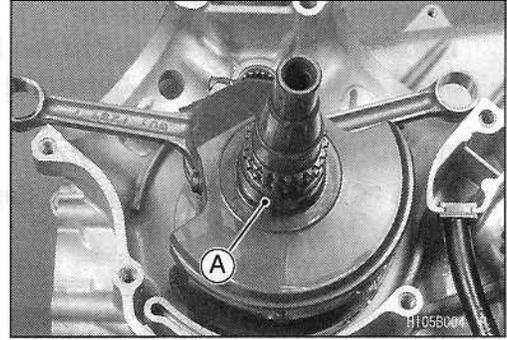
- ★ If any of the shafts do not turn freely, split the crankcase to locate the problem.



## Crankshaft/Connecting Rod

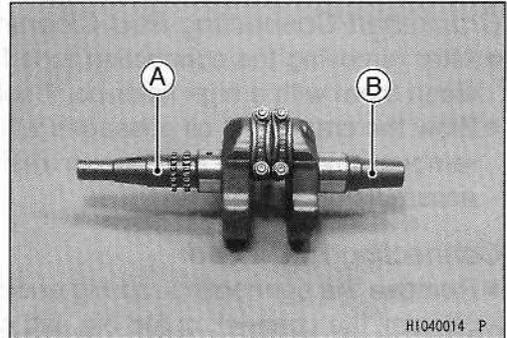
### Crankshaft Removal

- Split the crankcase (see Crankcase Disassembly).
- Remove the crankshaft [A] from the crankcase using a press.



### Crankshaft Installation

- The left shaft [A] of the crankshaft is longer than the right shaft [B].
- Apply engine oil to the both main journals.
- Insert the right crankshaft tapered end (the shorter end) into the right crankcase using a press.



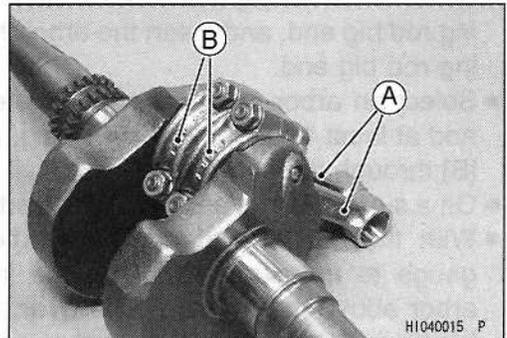
### Connecting Rod Removal

- Remove the crankshaft (see Crankshaft Removal).
- Remove the connecting rods [A] from the crankshaft.

#### NOTE

○ Mark and record the locations of the connecting rods and their big end caps [B] so that they can be installed in their original positions.

- Remove the connecting rod big end nuts, and take off the rod and cap with the bearing inserts.

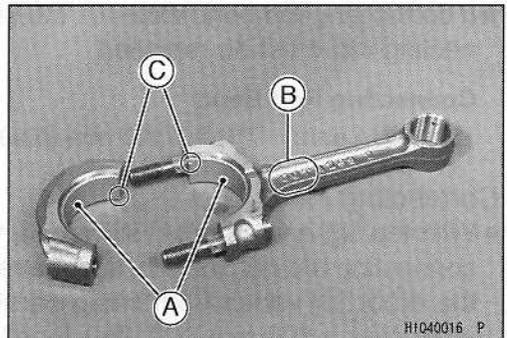


### Connecting Rod Installation

#### CAUTION

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

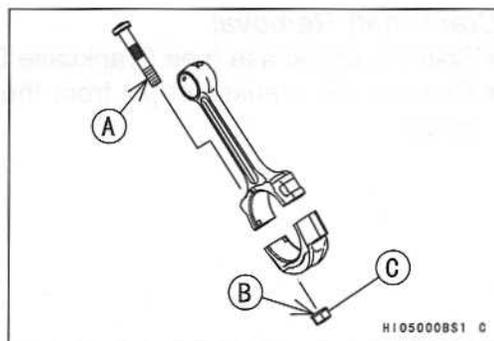
- Apply molybdenum disulfide oil:  
Inner Surface [A] of Bearing Inserts
- Face the "OUT" marks [B] of both connecting rods towards the outsides of the crankshaft.
- Fit the connecting rod cap so that the grooves [C] of the cap and connecting rod are on the same side.



## 9-14 CRANKSHAFT / TRANSMISSION

### Crankshaft/Connecting Rod

- Apply molybdenum disulfide oil:
  - Threads [A] of Connecting Rod Big End Cap Bolts
  - Seating Surface [B] of Connecting Rod Big End Cap Nuts [C]
- Tighten:
  - Torque - Connecting Rod Big End Cap Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

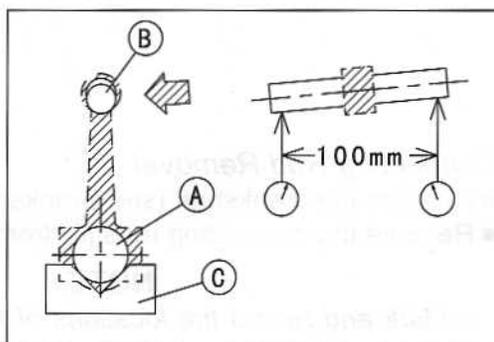


#### Crankshaft/Connecting Rod Cleaning

- After removing the connecting rods from the crankshaft, clean them with a high flash-point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

#### Connecting Rod Bend

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end cap.
  - Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
  - Select an arbor of the same diameter as the piston pin and at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
  - On a surface plate, set the big-end arbor on a V block [C].
  - With the connecting rod held vertically, use a height gauge to measure the difference in the height of the arbor above the surface plate over a 100 mm (3.94 in.) length to determine the amount of connecting rod bend.
- ★ If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

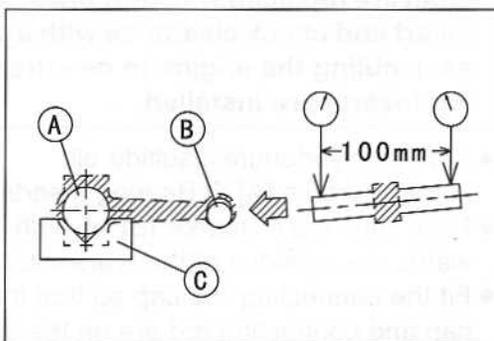


#### Connecting Rod Bend

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

#### Connecting Rod Twist

- With the big-end arbor [A] still on the V block [C], hold the connecting rod horizontally and measure the amount that the arbor [B] varies from being parallel with the surface plate over a 100 mm (3.94 in.) length of the arbor to determine the amount of connecting rod twist.
- ★ If connecting rod twist exceeds the service limit, the connecting rod must be replaced.



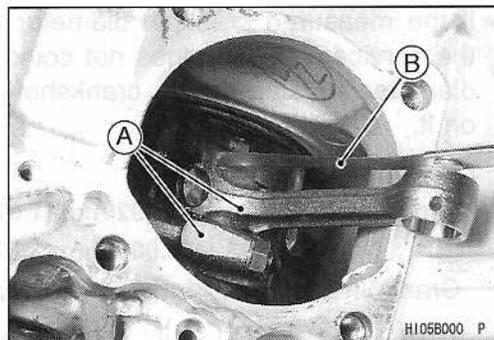
#### Connecting Rod Twist

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

**Crankshaft/Connecting Rod**

*Connecting Rod Big End Side Clearance*

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



**Connecting Rod Big End Side Clearance**

**Standard:** 0.16 ~ 0.46 mm (0.0063 ~ 0.0181 in.)

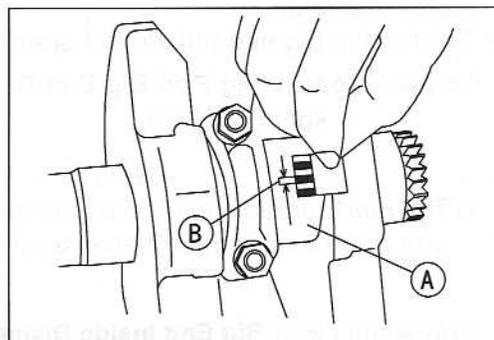
**Service Limit:** 0.7 mm (0.028 in.)

- ★ If the clearance exceeds the service limit, replace the connecting rod with new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

*Connecting Rod Big End Bearing/Crankpin Wear*

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

**Torque - Connecting Rod Big End Nuts:** 34 N·m (3.5 kgf·m, 25 ft·lb)



**NOTE**

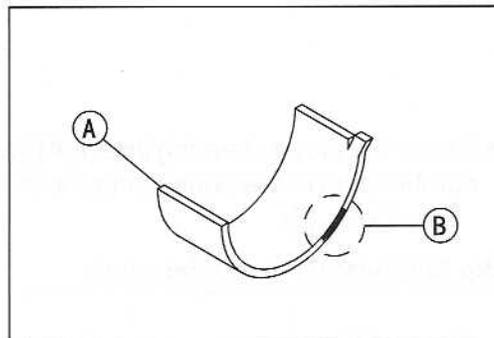
- Do not move the connecting rod and crankshaft during clearance measurement.

**Connecting Rod Big End Bearing, Insert/Crankpin Clearance**

**Standard:** 0.028 ~ 0.052 mm (0.0011 ~ 0.0020 in.)

**Service Limit:** 0.09 mm (0.0035 in.)

- ★ If the clearance is within the standard, no bearing insert replacement is required.
- ★ If the clearance is between 0.052 mm (0.0020 in.) and the service limit 0.09 mm (0.0035 in.), replace the bearing inserts [A] with inserts painted green [B]. Check insert/crankpin clearance with plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the crankpin.



**Crankpin Diameter**

**Standard:** 39.984 ~ 40.000 mm (1.5742 ~ 1.5748 in.)

**Service Limit:** 39.97 mm (1.5736 in.)

- ★ If the crankpin has worn past the service limit, replace the crankshaft with a new one.

## 9-16 CRANKSHAFT / TRANSMISSION

### Crankshaft/Connecting Rod

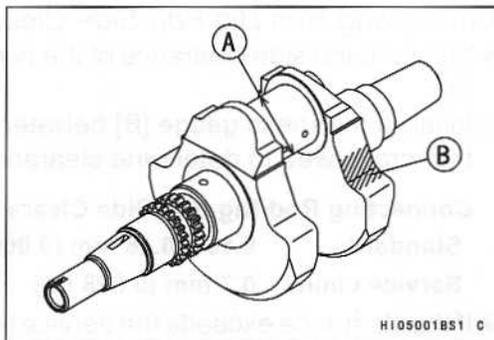
★ If the measured crankpin diameter [A] is not less than the service limit, but does not coincide with the original diameter marking on the crankshaft, make a new mark on it.

#### Crankpin Diameter Marks

None: 39.984 ~ 39.992 mm (1.5742 ~ 1.57449 in.)

○: 39.993 ~ 40.000 mm (1.57452 ~ 1.5748 in.)

Crankpin Diameter Mark [B]: "○" mark or no mark



- Measure the connecting rod big end inside diameter, and mark each connecting rod big end in accordance with the inside diameter.
- Tighten the big end nuts to the specified torque.

**Torque - Connecting Rod Big End Cap Nuts: 34 N·m (3.5 kgf·m, 25 ft·lb)**

#### NOTE

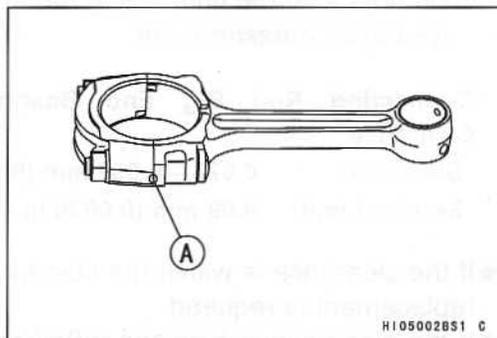
○ The mark already on the big end should almost coincide with the measurement because of little wear.

#### Connecting Rod Big End Inside Diameter Marks

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

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

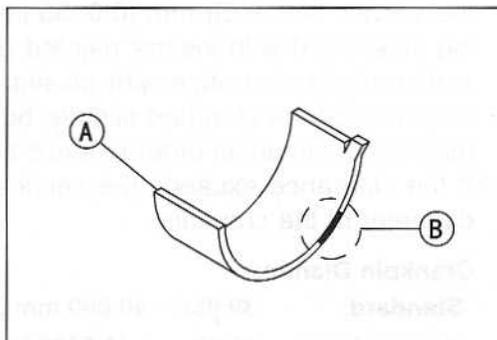
Diameter Mark [A]: "○" mark or no mark



- Select the proper bearing insert [A] in accordance with the combination of the connecting rod and crankshaft coding. Size Color [B]

#### Big End Bearing Insert Selection

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Mark	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92028-1963
None	None	Yellow	92028-1962
○	○		
○	None	Green	92028-1961



- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

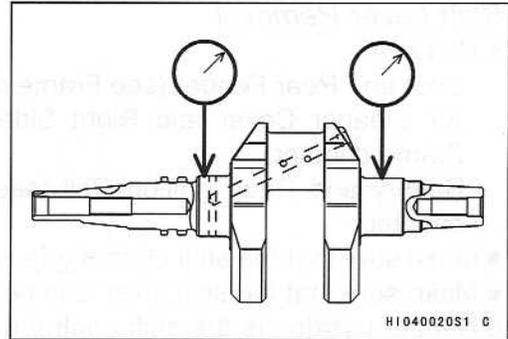
## Crankshaft/Connecting Rod

### Crankshaft Runout

- Measure the crankshaft runout.
- ★ If the measurement exceeds the service limit, replace the crankshaft.

#### Crankshaft Runout

**Standard:** TIR 0.04 mm (0.0016 in.) or less  
**Service Limit:** TIR 0.10 mm (0.0039 in.)



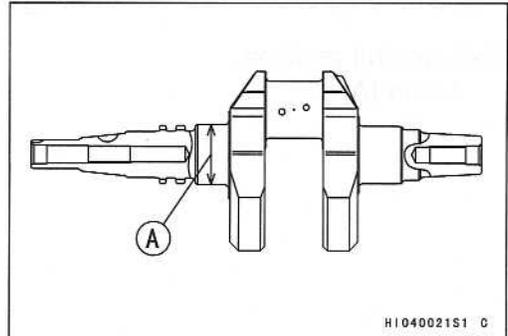
### Crankshaft Main Bearing/Journal Wear

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

#### Crankshaft Main Journal Diameter

**Standard:** 41.984 ~ 42.000 mm (1.6529 ~ 1.6535 in.)  
**Service Limit:** 41.96 mm (1.652 in.)

- ★ If any journal has worn past the service limit, replace the crankshaft with a new one.

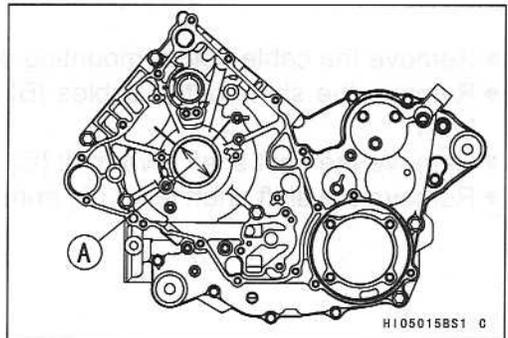


- Measure the main bearing bore diameter [A] in the crankcase halves.

#### Crankcase Main Bearing Bore Diameter

**Standard:** 42.025 ~ 42.041 mm (1.6545 ~ 1.6552 in.)  
**Service Limit:** 42.08 mm (1.6567 in.)

- ★ If there is any signs of seizure, damage, or excessive wear, replace the crankcase halves as a set.

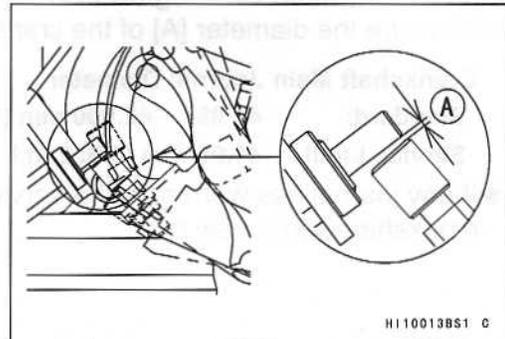
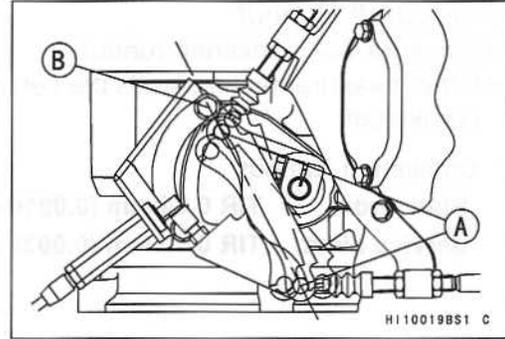


## 9-18 CRANKSHAFT / TRANSMISSION

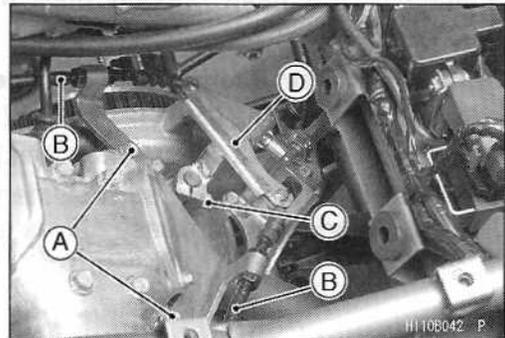
### Transmission

#### Shift Lever Removal

- Remove:
  - Seat and Rear Fender (see Frame chapter)
  - Air Cleaner Cover and Right Side Inner Cover (see Frame chapter)
  - Battery and Rear Ignition Coil (see Electrical System chapter)
- Make sure that the shift control grip is in neutral position.
- Make sure that the shift lever is in neutral position.
- Neutral position is the shift control cable lower ends [A] and reverse cable bracket mounting bolt [B] aligned state.
- At neutral position.
  - 1 mm [A]

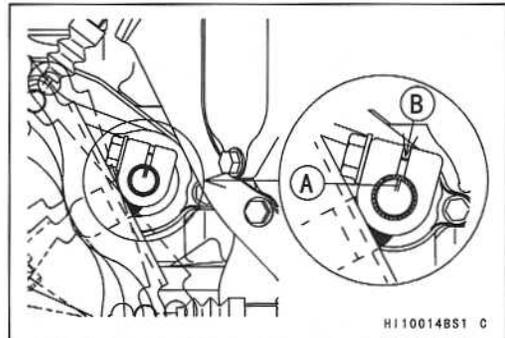


- Remove the cable holder mounting bolts [A].
- Remove the shift control cables [B] from the shift shaft lever.
- Remove the shift shaft lever bolt [C].
- Remove the shift shaft lever [D] from the shift shaft.



#### Shift Lever Installation

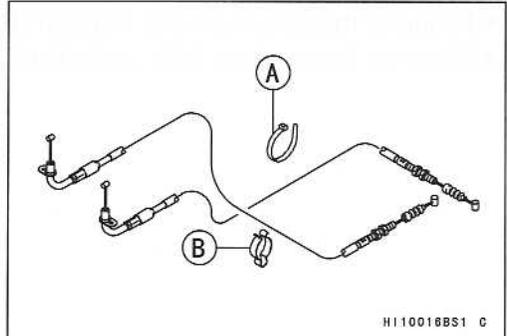
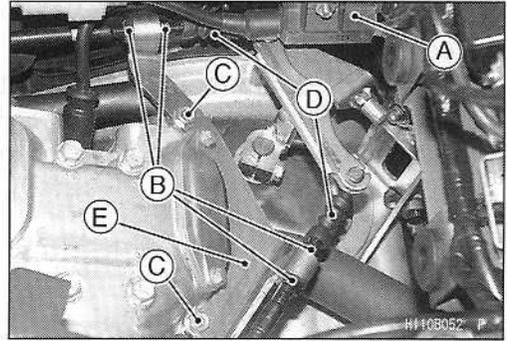
- Install the shift shaft lever to the shift shaft.
- When installing shift shaft lever, align the mark [A] on the shaft end with the slit [B] of the shift shaft lever.
- Tighten the shift shaft lever bolt.
- Torque - Shift Shaft Lever Bolt: 14 N·m (1.4 kgf·m, 10 ft·lb)**
- Install the shift control cables to the shift shaft lever.
- Install the cable holder and tighten the cable holder mounting bolts.
- Torque - Cable Holder Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Adjust the shift control cables free play (see Periodic Maintenance chapter).



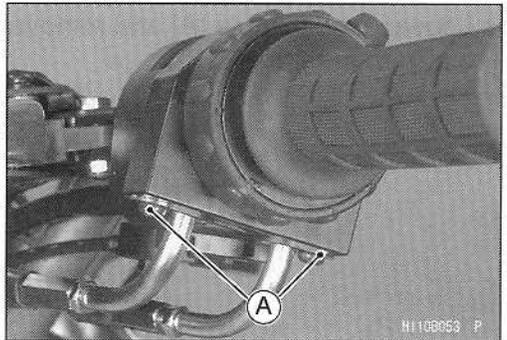
**Transmission**

*Shift Control Cables Removal*

- Remove:
  - Seat (see Frame chapter)
  - Battery and Rear Ignition Coil [A] (see Electrical System chapter)
- Loosen the adjusting nuts [B].
- Remove the cable holder mounting bolts [C].
- Remove the shift control cables [D] from the shift shaft lever.
- Remove the shift control cables from the cable holder [E].
- Remove the band [A] and clamp [B].



- Remove the shift control grip screws [A].
- Remove the shift control cables from the shift control grip.



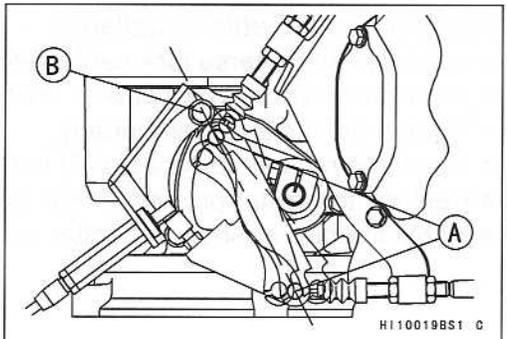
*Shift Control Cables Installation*

- Make sure that the shift lever is in neutral position.
- Neutral position is the shift control cable lower ends [A] and reverse cable bracket mounting bolt [B] aligned state.
- Lubricate the shift control cables before installation.
- Route the shift control cables correctly according to the Appendix chapter.

**⚠ WARNING**

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

- Adjust the shift control cables free play (see Periodic Maintenance chapter).

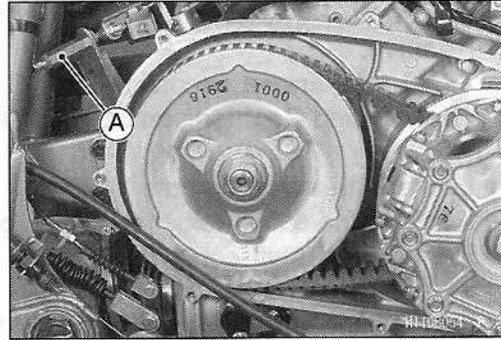


## 9-20 CRANKSHAFT / TRANSMISSION

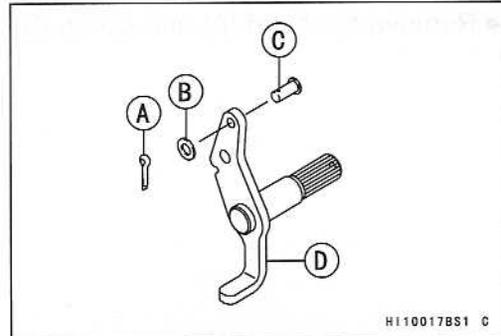
### Transmission

#### Reverse Lock Cable Removal

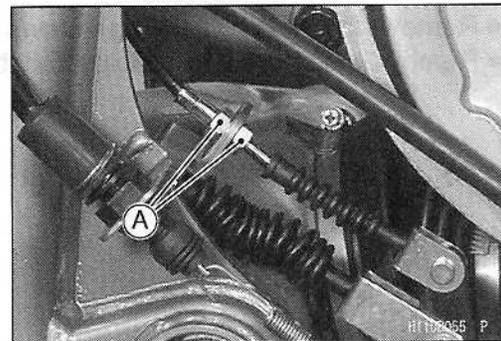
- Remove:
  - Right Foot Guard (see Frame chapter)
  - Converter Cover (see Converter System chapter)
- Remove the reverse lock cable locknut [A].



- Remove the cotter pin [A], washer [B] and pin [C].
- Remove the reverse lock cable from the lever [D].

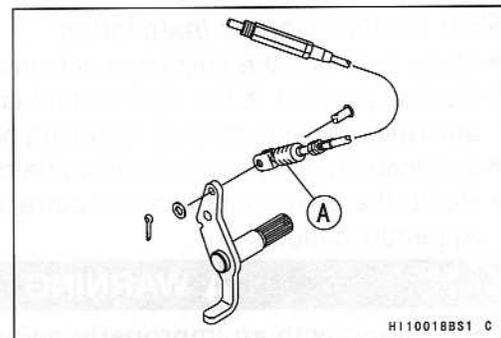


- Loosen the locknuts [A] and remove the reverse lock cable from the frame.



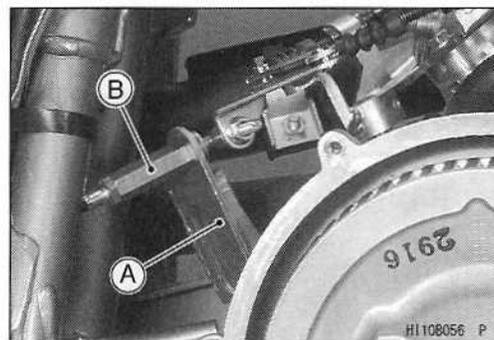
#### Reverse Lock Cable Installation

- Lubricate the reverse lock cable before installation.
- Install the reverse lock cable to the frame.
- Tighten the locknuts temporarily.
- Install the reverse lock cable [A] to the lever.
- Replace the cotter pin with a new one.
- Install the pin, washer and cotter pin.



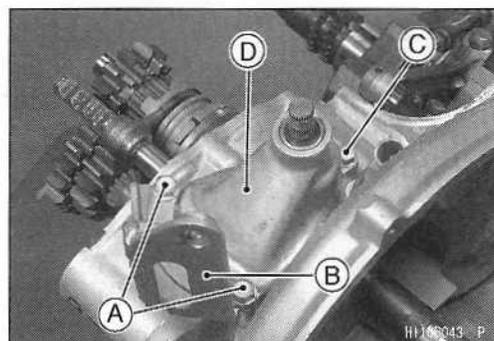
## Transmission

- Install the reverse lock cable in the reverse lock cable bracket [A].
  - Tighten the reverse lock cable locknut [B].
- Torque - Reverse Lock Cable Locknut: 12 N·m (1.2 kgf·m, 104 in·lb)**
- Tighten the locknuts securely.

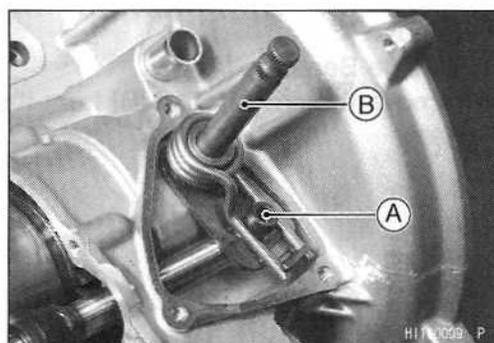


### Transmission Removal

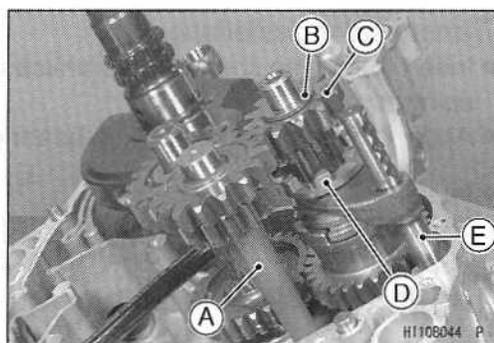
- Remove the shift lever (see Shift Lever Removal).
- Split the crankcase (see Crankcase Disassembly).
- Remove:
  - Reverse Lock Cable Bracket Mounting Bolts [A]
  - Reverse Lock Cable Bracket [B]
  - Shift Shaft Cover Bolt [C]
  - Shift Shaft Cover [D]



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



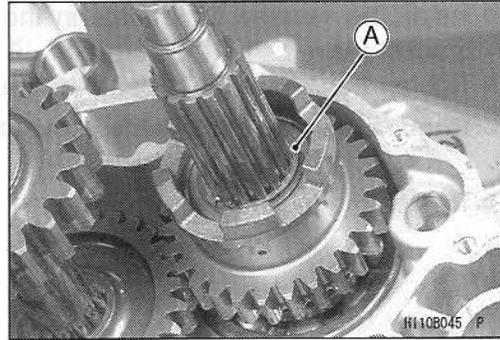
- Remove:
  - Reverse Idle Shaft [A]
  - Spacer [B]
  - Reverse Drive Gear [C], Needle Bearing and Spacer Shifter [D]
  - Shift Rod [E]



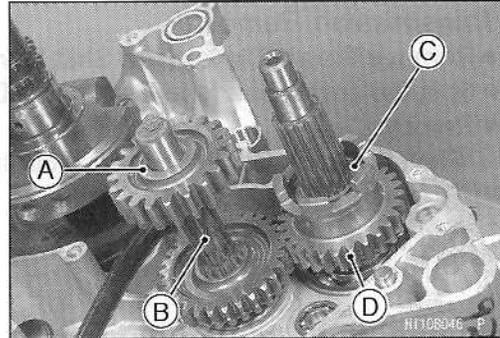
## 9-22 CRANKSHAFT / TRANSMISSION

### Transmission

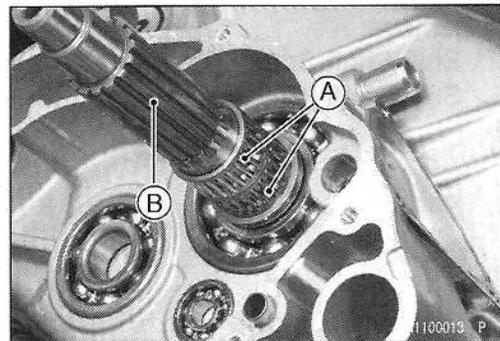
- Remove:  
Circlip [A]  
Special Tool - Outside Circlip Pliers: 57001-144



- Remove:  
Spacer [A]  
Idle Gear Assembly [B] and Spacer  
Washer and Spacer [C]  
High Gear [D]

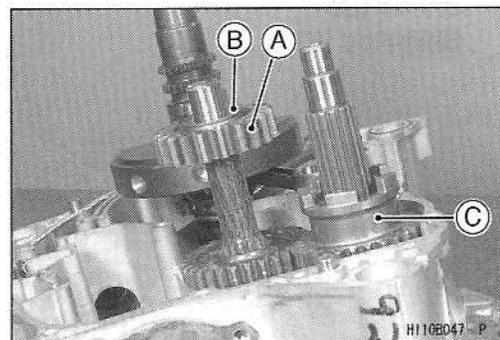


- Remove:  
Needle Bearings [A]
- Remove the driven shaft [B] from the crankcase using a press.



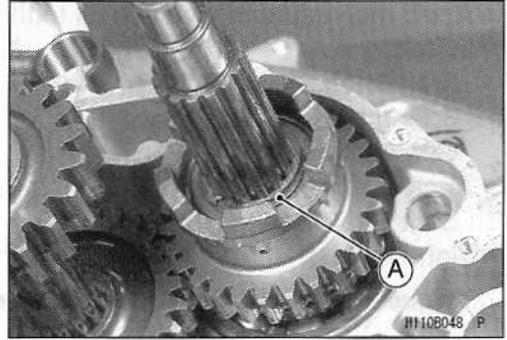
### Transmission Installation

- Insert the driven shaft in the crankcase until it is bottomed using a press.
- Apply engine oil to the needle bearings and install them.
- Install:  
Spacer and Idle Gear Assembly [A]  
Spacer [B]  
High Gear [C]

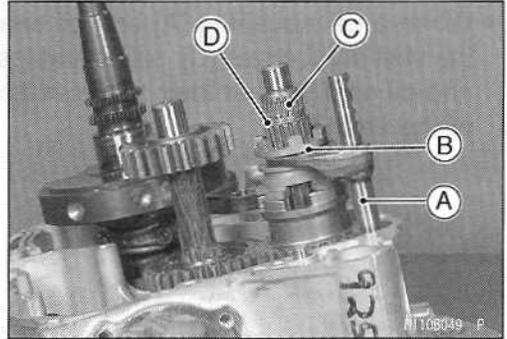


**Transmission**

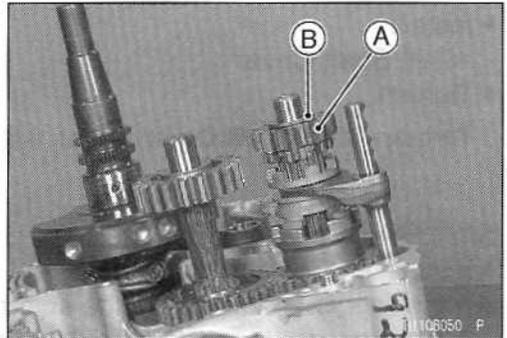
- Install:
    - Spacer
    - Toothed Washer [A]
    - Circlip
- Special Tool - Outside Circlip Pliers: 57001-144**



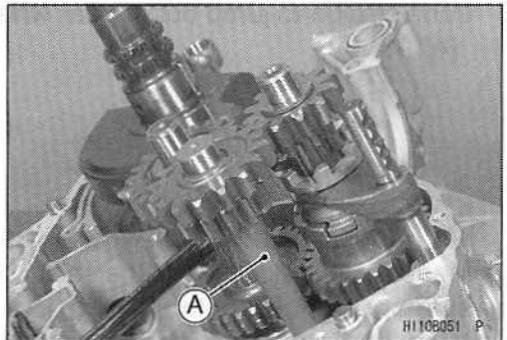
- Apply engine oil:
  - Shift Rod [A] and Shift Fork Ear [B]
  - Needle Bearing [C]
- Install:
  - Shift Rod with Shifter
  - Spacer [D]
  - Needle Bearing



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



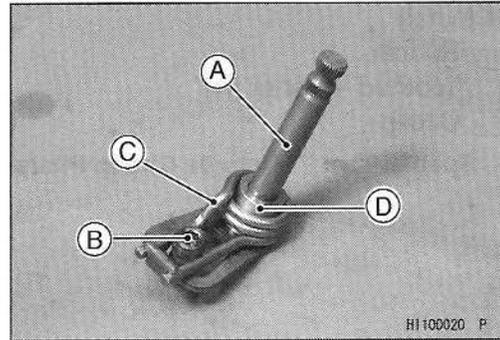
- Install:
  - Reverse Idle Shaft [A]



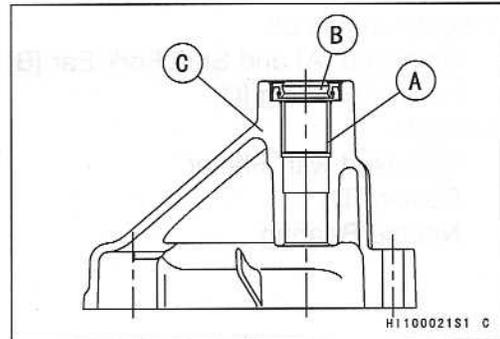
## 9-24 CRANKSHAFT / TRANSMISSION

### Transmission

- Apply molybdenum disulfide oil to the shift shaft [A].
- Install:
  - Shift Shaft Spring Bolt [B]
  - Spring [C]
  - Guide [D]
- Apply a non-permanent locking agent:
  - Shift Shaft Spring Bolt
- Tighten:
  - Torque - Shift Shaft Spring Bolt: 25 N·m (2.5 kgf·m, 18 ft·lb)**



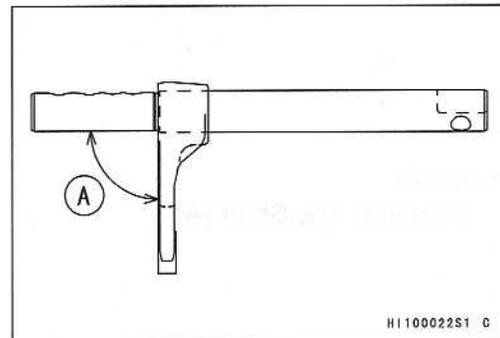
- When a new bushing [A] and oil seal [B] are installed in the shift shaft cover [C], press and insert the new bushing and oil seal so that their surfaces are flush with the end of the each hole.



- Install:
  - Shift Shaft Cover
- Tighten:
  - Torque - Shift Shaft Cover Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**

#### Shift Fork Bending

- Visually inspect the shift fork.
- ★ If the fork is bent, replace the shift rod with a new one. A bent fork could cause difficulty in shifting, or allow the transmission to jump out of gear when under power.
  - [A] 90°



#### Shift Fork/Gear and Shifter Groove Wear

- Measure the thickness of the shift fork ears [A], and measure the width [B] of the gear groove and shifter.
- ★ If the thickness of a shift fork ear is less than the service limit, the shift rod must be replaced.

##### Shift Fork Ear Thickness

**Standard:** 5.9 ~ 6.0 mm (0.2322 ~ 0.2362 in.)

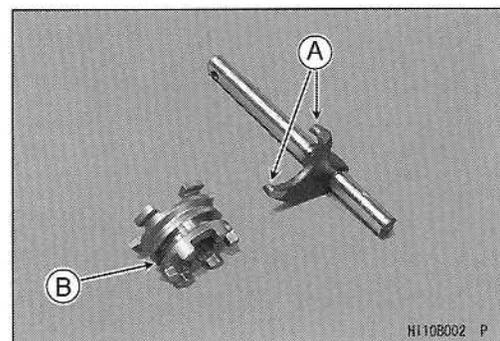
**Service Limit:** 5.8 mm (0.228 in.)

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

##### Shifter Groove Width

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

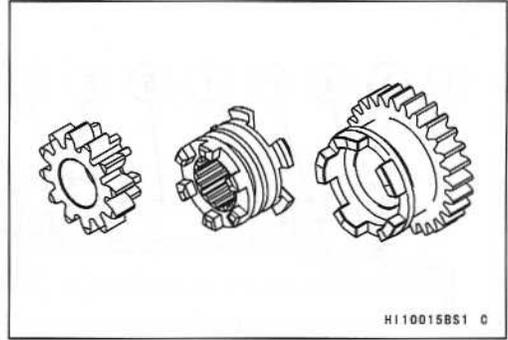
**Service Limit:** 6.25 mm (0.2460 in.)



**Transmission**

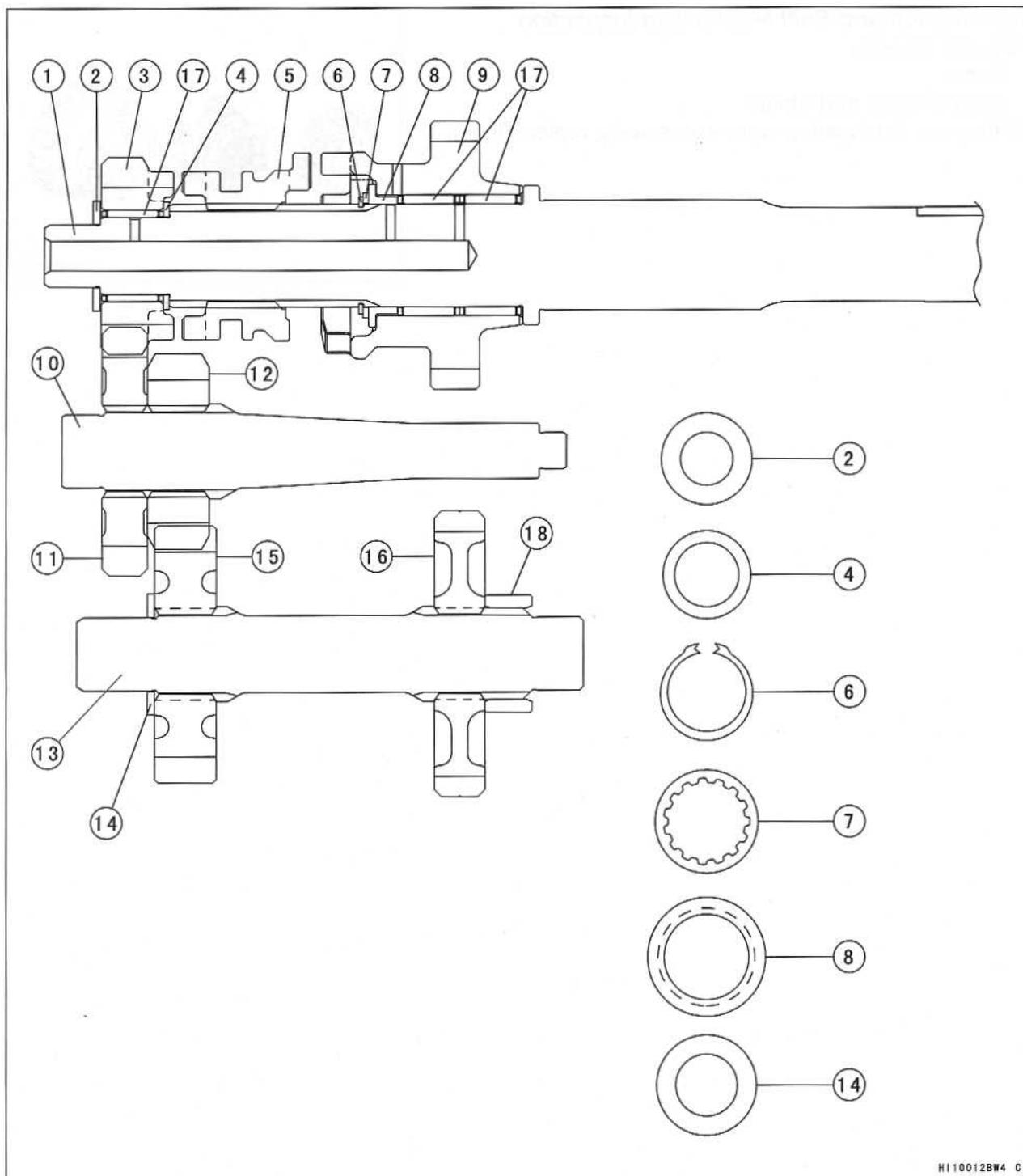
*Transmission and Shift Mechanism Inspection*

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



# 9-26 CRANKSHAFT / TRANSMISSION

## Transmission



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- |                             |                                      |
|-----------------------------|--------------------------------------|
| 1. Driven Shaft             | 10. Reverse Idle Shaft               |
| 2. Spacer (17.3 x 30 x 2.0) | 11. Reverse Driven Gear (16T)        |
| 3. Reverse Gear (12T)       | 12. Reverse Driven Output Gear (14T) |
| 4. Spacer (21.2 x 29 x 1.6) | 13. Idle Shaft                       |
| 5. Shifter                  | 14. Spacer (20.3 x 33 x 2.0)         |
| 6. Snap Ring                | 15. Driven Output Gear (20T)         |
| 7. Washer T=1.5             | 16. Driven Hi Gear (29T)             |
| 8. Spacer (28 x 39 x 8)     | 17. Needle Bearing                   |
| 9. Drive Hi Gear (27T)      | 18. Spacer (25 x 32 x 13)            |

## Ball Bearing, Needle Bearing, and Oil Seal

### Ball and Needle Bearing Replacement

#### CAUTION

**Do not remove the ball or needle bearings unless it is necessary. Removal may damage them.**

- Using a press or puller, remove the ball bearing and/or three needle bearings.

#### NOTE

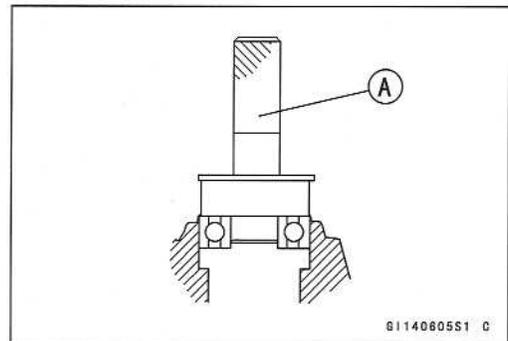
○ In the absence of the above mentioned tools, satisfactory results may be obtained by heating the case to approximately 93°C (200°F) max., and tapping the bearing in or out.

#### CAUTION

**Do not heat the case with a torch. This will warp the case. Soak the case in oil and heat the oil.**

- Using a press and the bearing driver set [A], install the new ball bearing until it stops at the bottom of its housing.
- Three new needle bearings must be pressed into the crankcase so that the end is flush with the end of the hole.

**Special Tool - Bearing Driver Set: 57001-1129**



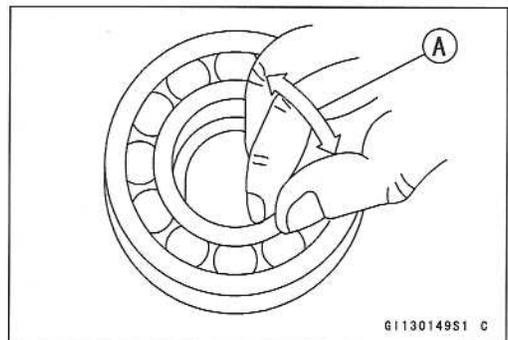
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### Ball and Needle Bearing Wear

#### CAUTION

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

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



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### Oil Seal Inspection

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

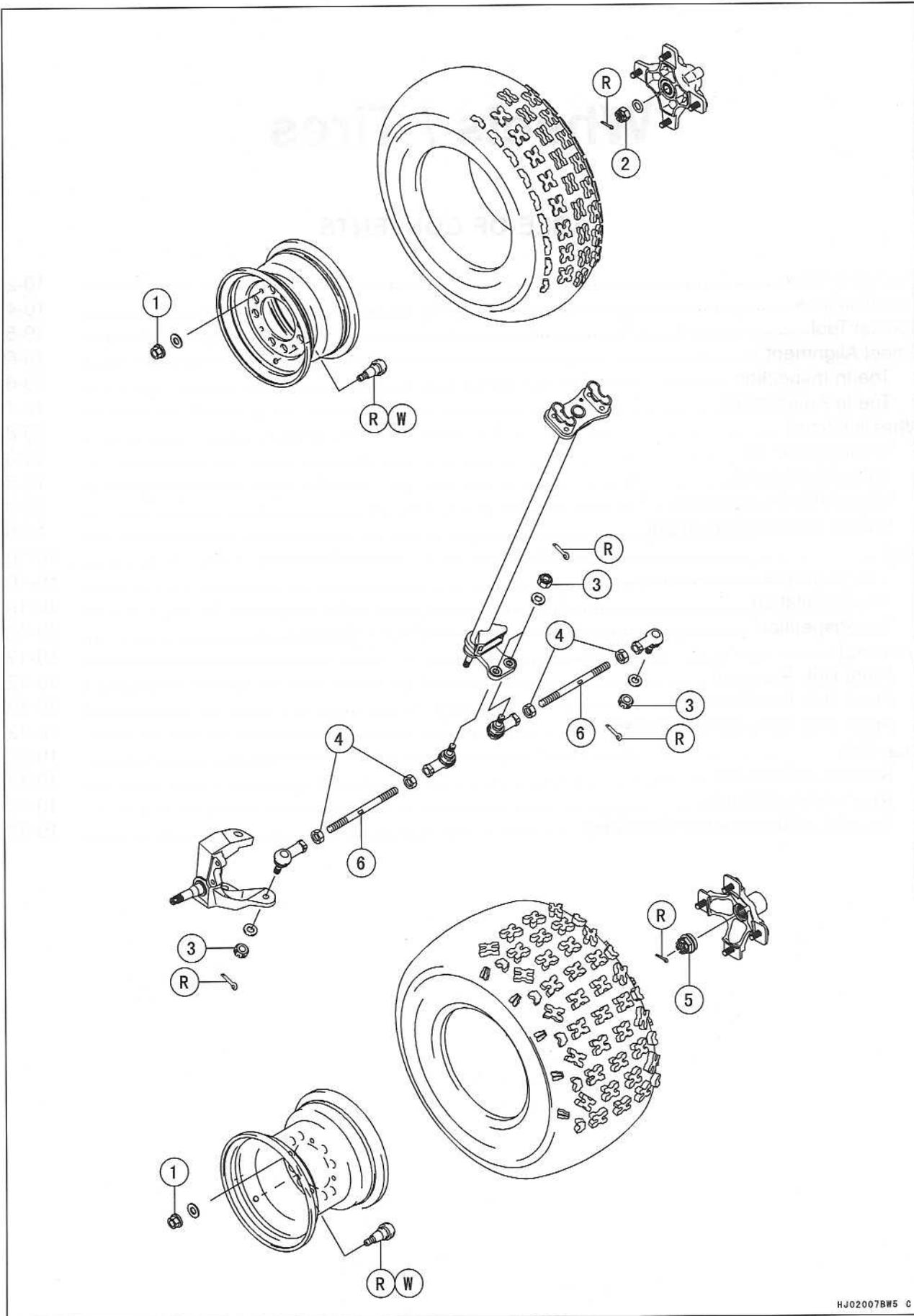
# Wheels / Tires

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# 10-2 WHEELS / TIRES

## Exploded View



**Exploded View**

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Wheel Nuts	78	8.0	58	
2	Front Axle Nuts	52	5.3	38	
3	Tie-rod End Nuts	42	4.3	31	
4	Tie-rod Adjusting Locknuts	22	2.2	16	
5	Rear Axle Nuts	265	27	195	

6. Tie-rod: Install the width across flats side to the knuckle arm.

W: Apply water or soap and water solution.

R: Replacement parts

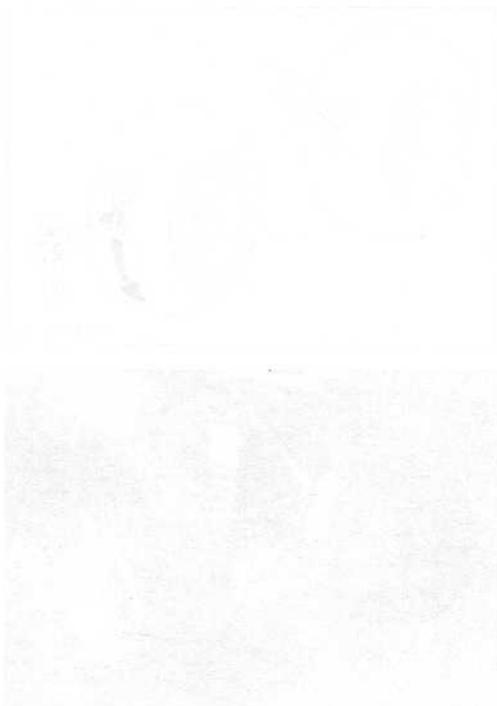
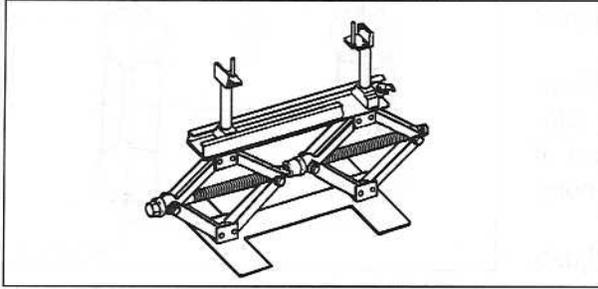
## 10-4 WHEELS / TIRES

### Specifications

Item	Standard	Service Limit	
<b>Wheel Alignment:</b>			
Toe-in of front wheels:	10 ± 10 mm (0.39 ± 0.39 in.)	---	
<b>Tires:</b>			
Standard tire:	Front	AT 22 × 7-10 HOLESHOT XC, Tubeless	---
	Rear	AT 22 × 11-10 HOLESHOT XCT, Tubeless	---
Tire air pressure (when cold):	Front	28 kPa (0.28 kgf/cm <sup>2</sup> , 4.0 psi)	---
	Rear	35 kPa (0.35 kgf/cm <sup>2</sup> , 5.0 psi)	---
Maximum tire air pressure (to seat beads, when cold)		250 kPa (2.5 kgf/cm <sup>2</sup> , 36 psi)	---
Tire tread depth:	Front	---	3 mm (0.12 in.)
	Rear	---	3 mm (0.12 in.)

Special Tool

Jack :  
57001-1238



## 10-6 WHEELS / TIRES

### Wheel Alignment

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

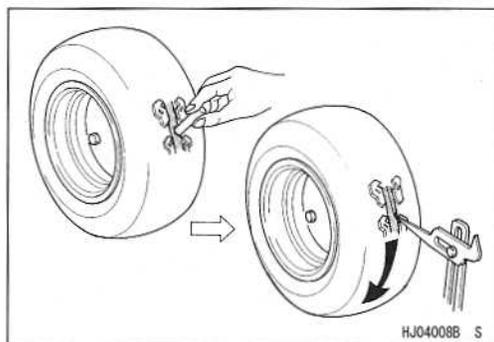
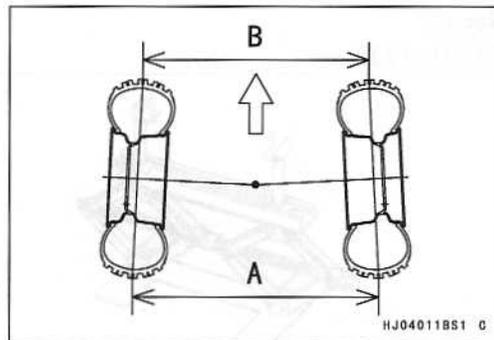
The purpose of toe-in is to prevent the front wheels from getting out of parallel at any time, and to prevent any slipping or scuffing action between the tires and the ground. If toe-in is incorrect, the front wheels will be dragged along the ground, scuffing and wearing the tread knobs.

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

$A \text{ (Rear) } - B \text{ (Front) } = \text{Amount of Toe-in}$   
(Distance A and B are measured at axle height with the vehicle sitting on the ground, or at 1G.)

#### Toe-in Inspection

- Apply a heavy coat of chalk or a paint line near the center of the front tires.
- Using a needle nose scribe, make a thin mark near the center of the chalk coating while turning the wheel.



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



#### Toe-in of Front Wheels

Standard:  $10 \pm 10 \text{ mm } (0.39 \pm 0.39 \text{ in.})$  at 1G

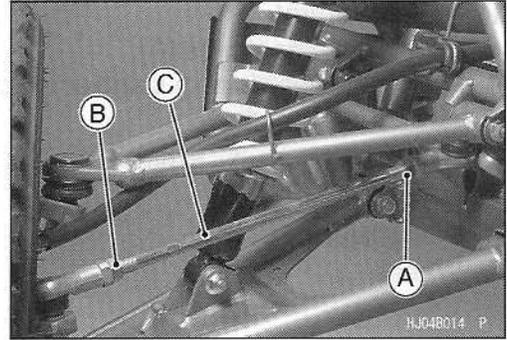
## Wheel Alignment

### Toe-in Adjustment

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

#### NOTE

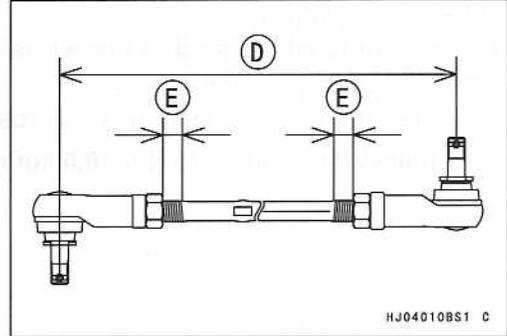
- The locknut [A] on the tie-rod has left-hand threads. Turn the locknut clockwise for loosening.
- The toe-in will be near the specified value, if the tie-rod length [D] is 386 ~ 389 mm (15.2 ~ 15.3 in.) on each tie-rod.



#### CAUTION

Adjust the tie-rod length so that the visible thread length [E] is even on both ends of the tie-rod. Uneven thread length could cause tie-rod end damage.

- Check the toe-in.
- Tighten:  
**Torque - Tie-Rod Adjusting Locknuts: 22 N·m (2.2 kgf·m, 16 ft·lb)**
- Test ride the vehicle.



## 10-8 WHEELS / TIRES

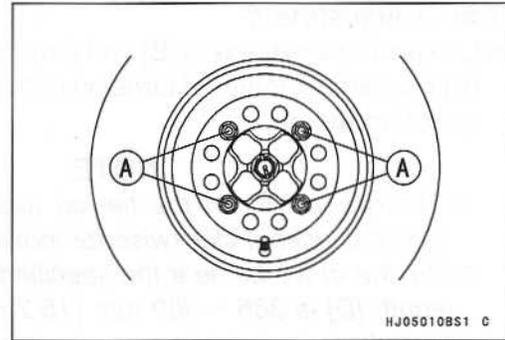
### Wheels (Rims)

#### Wheel Removal

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

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

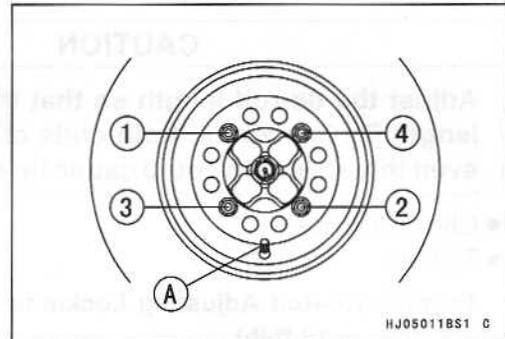
- Remove:
  - Wheel Nuts
  - Wheel



#### Wheel Installation

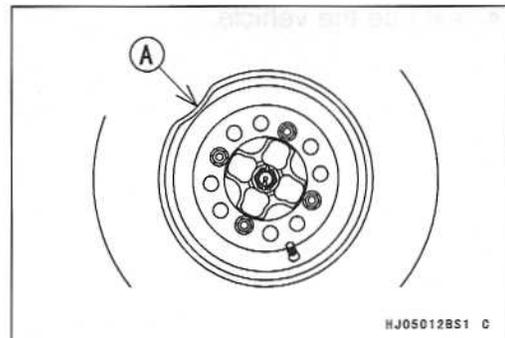
- Position the wheel so that the air valve [A] is toward the outside of the vehicle.
- Tighten the wheel nuts in a criss-cross pattern.

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

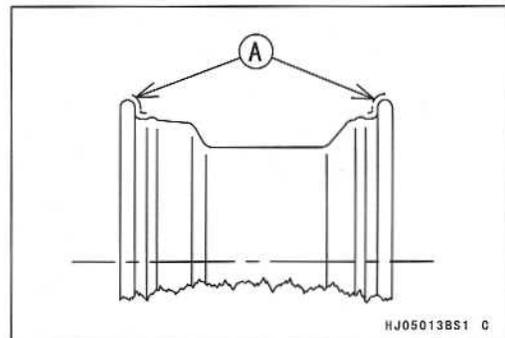


#### Wheel (Rim) Inspection

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



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



**Wheels (Rims)**

*Wheel (Rim) Replacement*

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

**CAUTION**

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

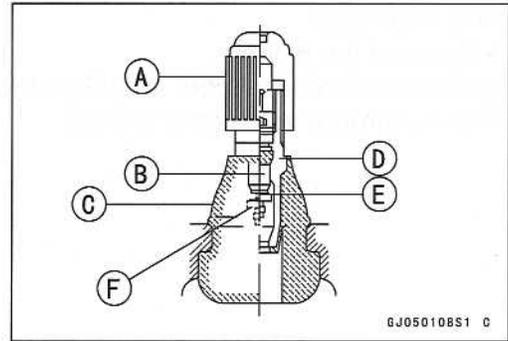
- Plastic Cap [A]
- Valve Core [B]
- Stem Seal [C]
- Valve Stem [D]
- Valve Seat [E]
- Valve Opened [F]

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

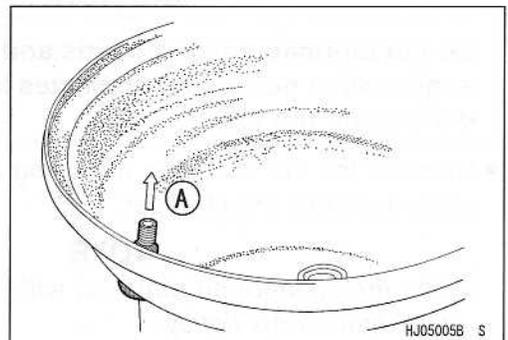
**CAUTION**

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

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



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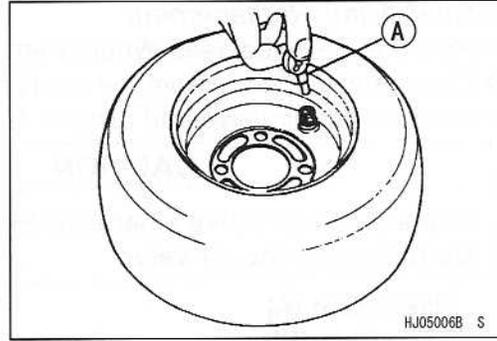
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## 10-10 WHEELS / TIRES

### Tires

#### Tire Removal

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

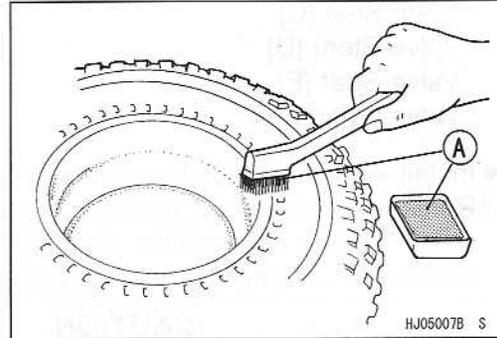


- Lubricate the tire beads and rim flanges on both sides of the wheel with a soap and water solution, or water [A]. This helps the tire beads slip off the rim flanges.

#### CAUTION

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

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



#### NOTE

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

#### Tire Installation

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

#### CAUTION

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

- Check the tire for wear and damage (see Tire Inspection).
- Lubricate the tire beads and rim flanges with a soap and water solution, or water.

#### ⚠ WARNING

**Do not use the lubricant other than a water and soap solution, or water to lubricate the tire beads and rim because it may cause tire separation.**

**Tires**

- Support the wheel rim [A] on a suitable stand [B] to prevent the tire from slipping off.
- Inflate the tire until the tire beads seat on the rim.

**Maximum Tire Air Pressure (to seat beads when cold)**  
 Front and Rear: 250 kPa (2.5 kgf/cm<sup>2</sup>, 36 psi)

**⚠ WARNING**

**Do not inflate the tire to more than the maximum tire air pressure. Overinflation can explode the tire with possibility of injury and loss of life.**

- Check to see that rim lines [A] on both sides of the tire are parallel with the rim flanges [B].
- ★ If the rim lines and the rim flanges are not parallel, deflate the tire, lubricate the sealing surfaces again, and reinflate the tire.
- After the beads are properly seated, check for air leaks.
- Apply a soap and water solution around the tire bead and check for bubbles.
- Deflate the tire to the specified pressure.
- Check the tire pressure using an air pressure gauge.

**NOTE**

○ Kawasaki provides the air pressure gauge (P/N 52005-1082) with the owner's tool kit.

**Tire Air Pressure (when cold)**

Front: 28 kPa (0.28 kgf/cm<sup>2</sup>, 4.0 psi)  
 Rear: 35 kPa (0.35 kgf/cm<sup>2</sup>, 5.0 psi)

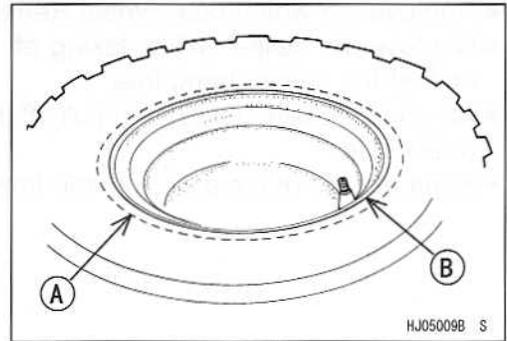
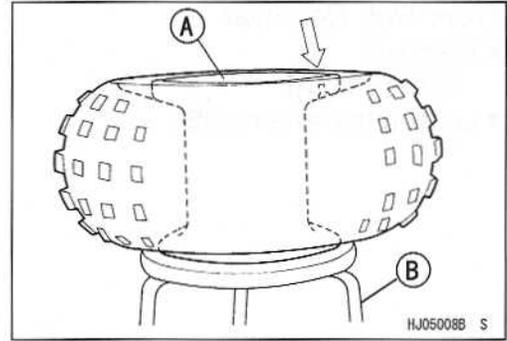
- Install the wheel (see Wheel Installation).
- Wipe off the soap and water solution on the tire and dry the tire before operation.

**⚠ WARNING**

**Do not operate the vehicle with the water and soap still around the tire beads. They will cause tire separation, and a hazardous condition may result.**

*Tire Inspection*

- Refer to the Wheels/Tires in Periodic Maintenance chapter.

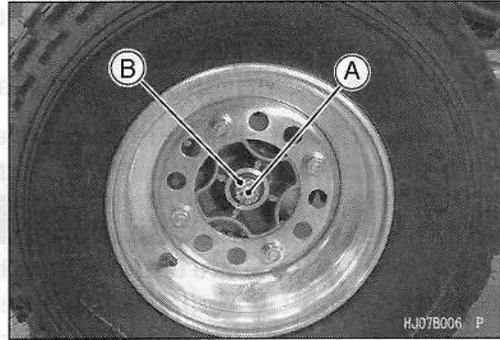


## 10-12 WHEELS / TIRES

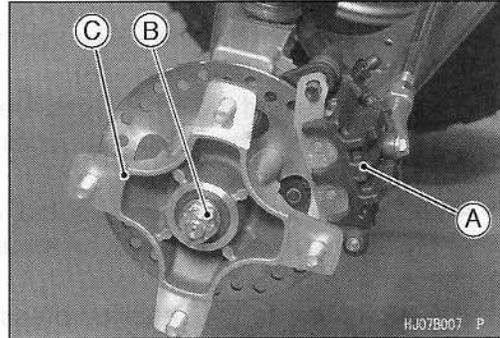
### Front Hub

#### Front Hub Removal

- Remove:
  - Cotter Pin [A]
- Loosen the axle nut [B].



- Remove the wheel (see Wheel Removal).
- Remove the caliper [A] by taking off the mounting bolts, and let the caliper hang free.
- Remove the axle nut [B] and pull off the front hub [C] and brake disc.
- Separate the brake disc from the front hub.

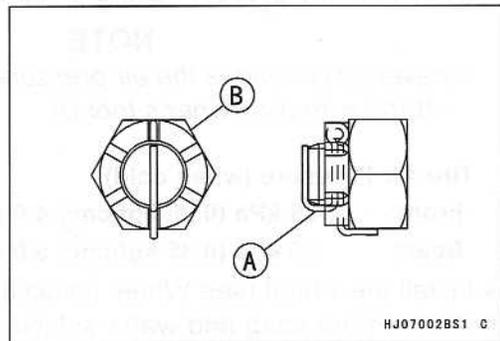


#### Front Hub Installation

- Install the brake disc (see Brakes chapter).
- Tighten:
  - **Torque - Front Axle Nut: 52 N·m (5.3 kgf·m, 38 ft·lb)**
- Insert a new cotter pin [A] and bend it over the nut [B].

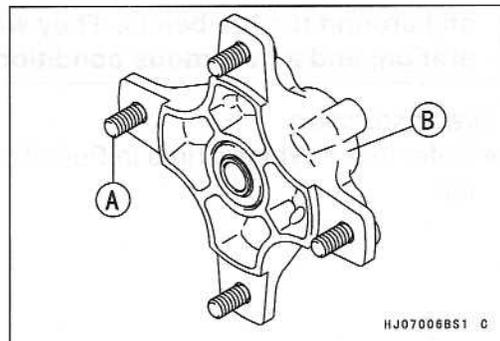
#### NOTE

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



#### Front Hub Disassembly/Assembly

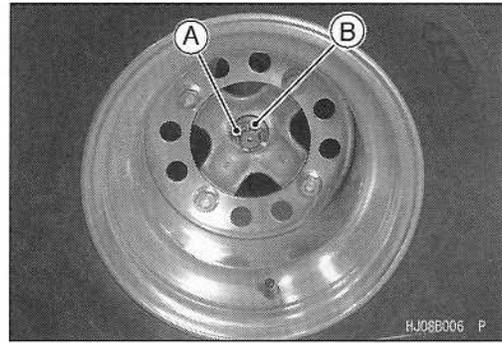
- Do not press the hub bolts [A] out.
- ★ If any hub bolt is damaged, replace the hub [B] and bolts as a unit.



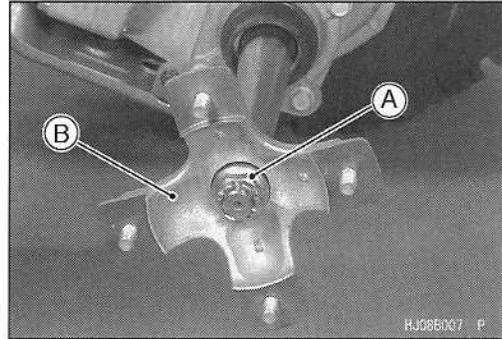
**Rear Hub**

*Rear Hub Removal*

- Remove:
  - Cotter Pin [A]
- Loosen the axle nut [B].



- Remove:
  - Wheel (see Wheel Removal)
  - Axle Nut [A]
  - Rear Hub [B]

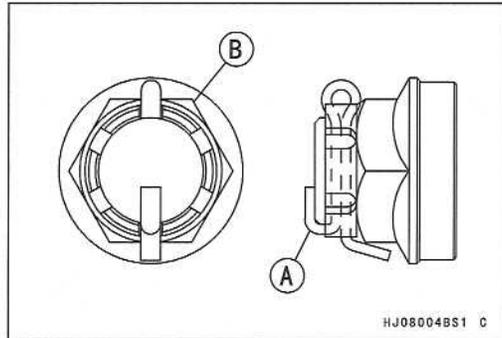


*Rear Hub Installation*

- Tighten:
  - Torque - Rear Axle Nuts: 265 N·m (27 kgf·m, 195 ft·lb)**
- Insert a new cotter pin [A] and bend it over the nut [B].

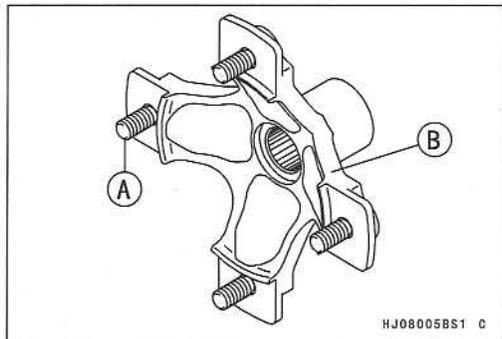
**NOTE**

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



*Rear Hub Disassembly/Assembly*

- Do not press the hub bolts [A] out.
- ★ If any hub bolt is damaged, replace the hub [B] and bolts as a unit.



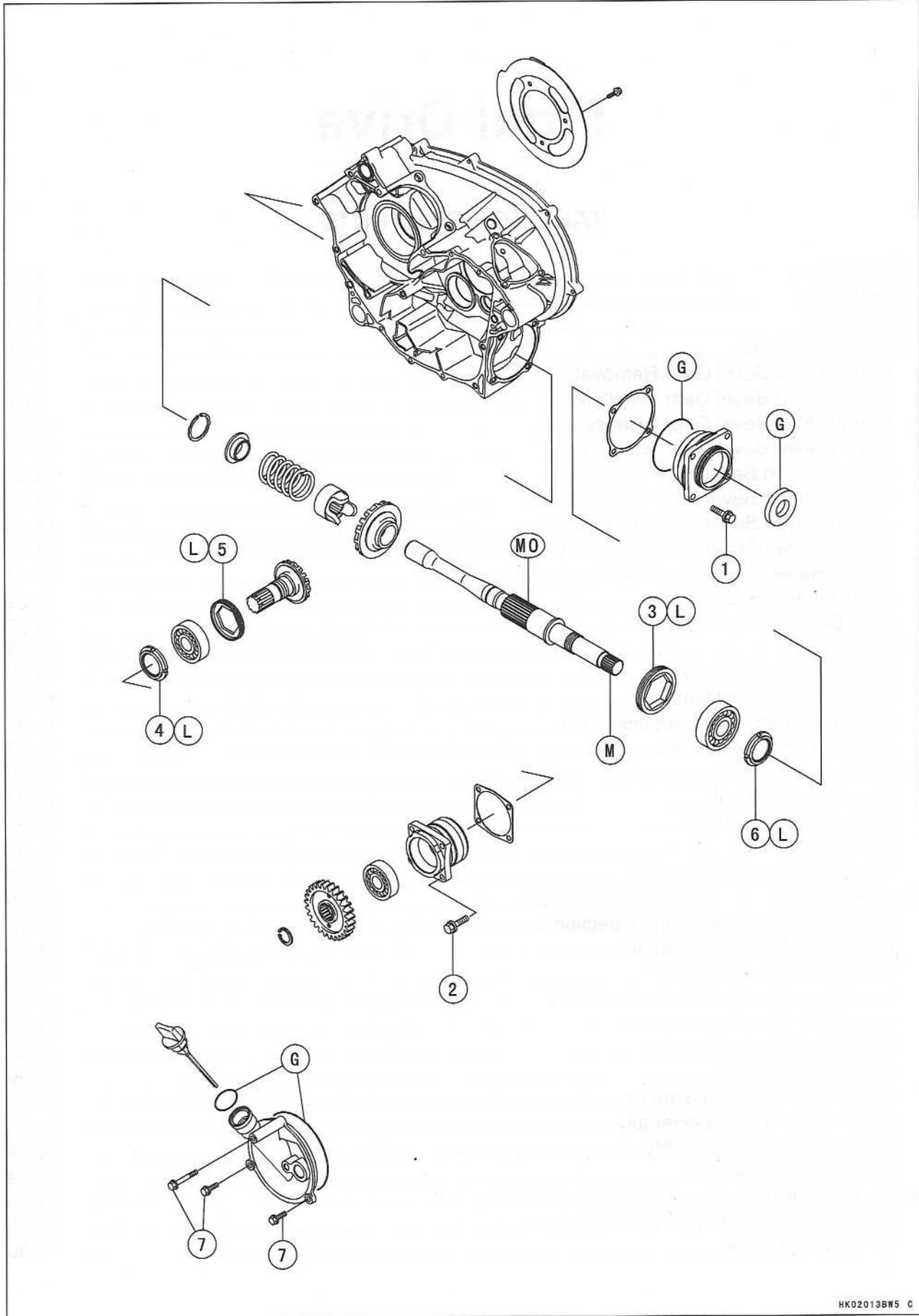
# Final Drive

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# 11-2 FINAL DRIVE

## Exploded View



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Output Driven Bevel Gear Housing Bolts	26	2.7	20	
2	Output Drive Bevel Gear Housing Bolts	26	2.7	20	
3	Bearing Holder	137	14	101	L
4	Bevel Gear Holder Nut	157	16	116	L
5	Bearing Holder	120	12	89	L
6	Output Shaft Holder Nut	157	16	116	L
7	Output Drive Bevel Gear Cover Bolts	8.8	0.90	78 in·lb	

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

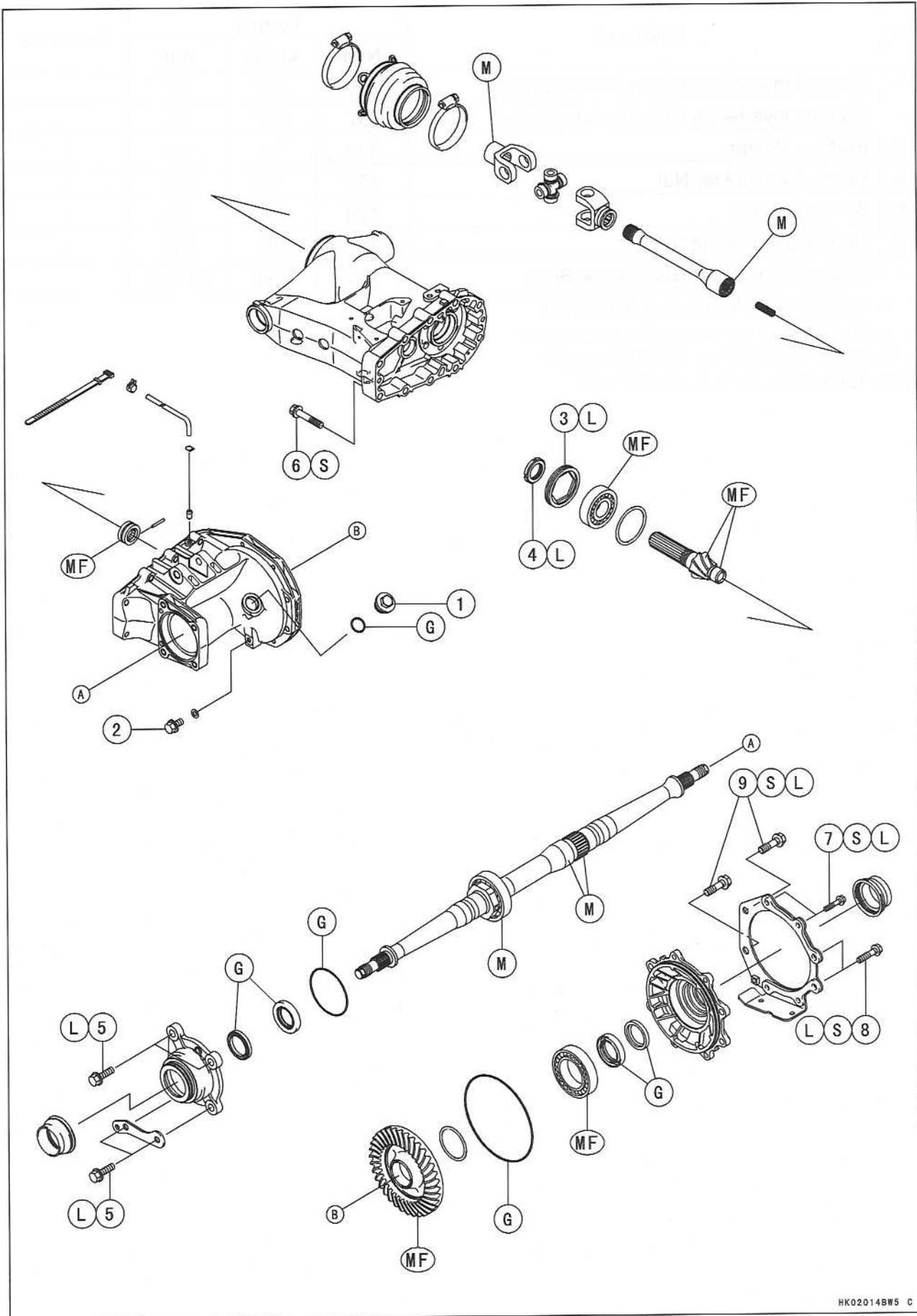
L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil.

# 11-4 FINAL DRIVE

## Exploded View



## Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Filler Cap	29	3.0	22	
2	Oil Drain Plug	20	2.0	14	
3	Pinion Gear Bearing Holder	137	14	101	L
4	Pinion Gear Bearing Holder Nut	157	16	116	L
5	Final Gear Case Left Cover Bolts	49	5.0	36	L
6	Final Gear Case Bolts	42	4.3	31	S
7	Final Gear Case Right Cover Bolts (M8)	24	2.4	17	L, S
8	Final Gear Case Right Cover Bolts (M10)	49	5.0	36	L, S
9	Final Gear Case Right Cover Bolts (M12)	94	9.6	69	L, S

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

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MF: Apply MOBIL FLUID 424 or equivalent oil.

S: Follow the specific tightening sequence.

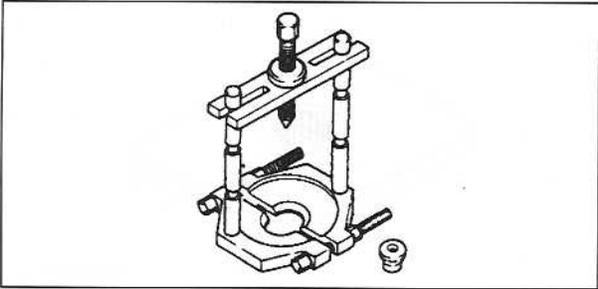
## 11-6 FINAL DRIVE

### Specifications

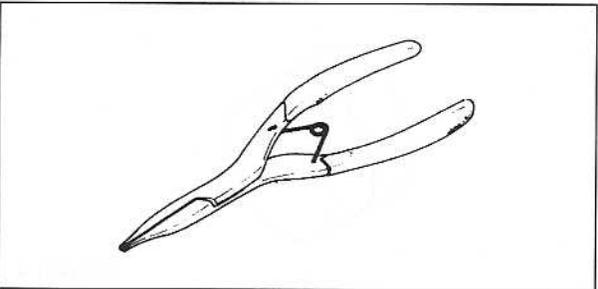
Item	Standard	Service Limit
<b>Output Bevel Gear Case</b> Output bevel gear backlash	0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.) (at output drive shaft spline)	---
<b>Rear Axle Shaft</b> Rear axle shaft runout	TIR 1 mm (0.04 in.) or less	TIR 2 mm (0.08 in.)
<b>Final Gear Case:</b> Gear case oil:		
Type	MOBIL Fluid 424 or CITGO TRANSGARD TRACTOR HYDRAULIC FLUID	---
Oil level	Filler opening bottom	---
Capacity	900 mL (0.95 US qt)	---
Final bevel gear backlash	0.07 ~ 0.14 mm (0.003 ~ 0.006 in.) (at pinion gear spline)	---

Special Tools

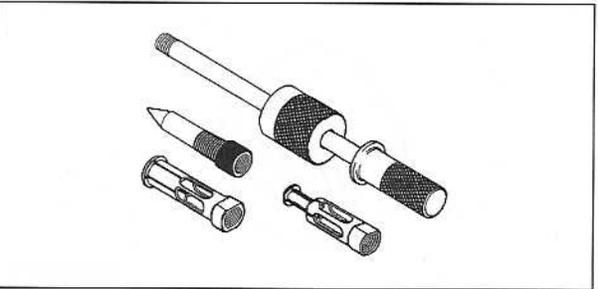
Bearing Puller :  
57001-135



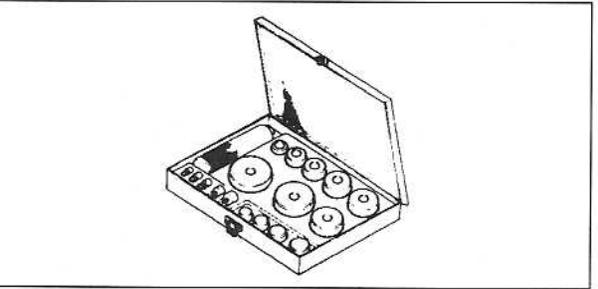
Outside Circlip Pliers :  
57001-144



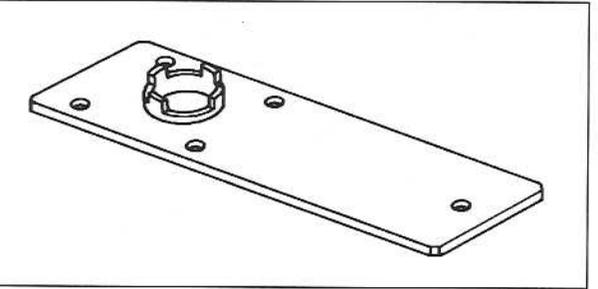
Oil Seal & Bearing Remover :  
57001-1058



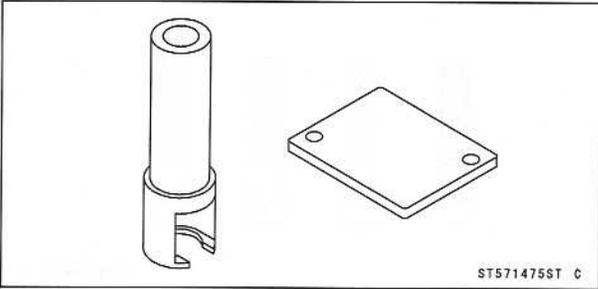
Bearing Driver Set :  
57001-1129



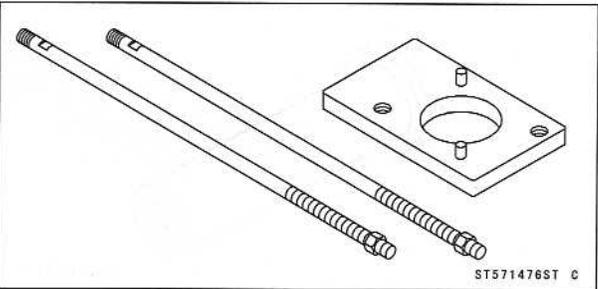
Socket Wrench :  
57001-1363



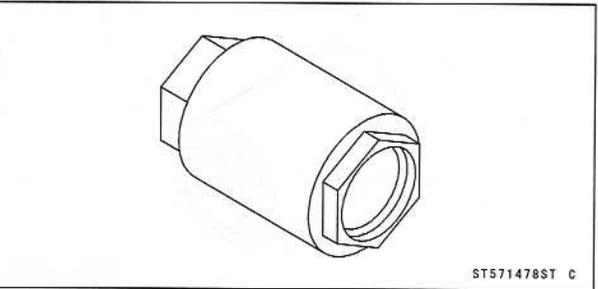
Damper Spring Compressor Set :  
57001-1475



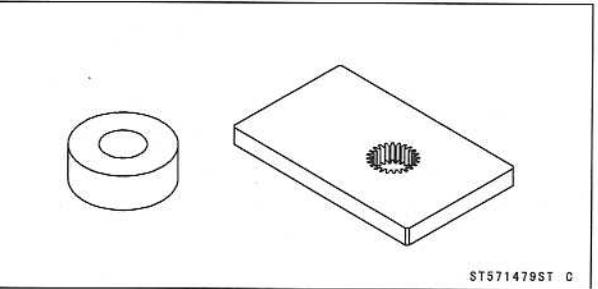
Holder & Guide Arbor :  
57001-1476



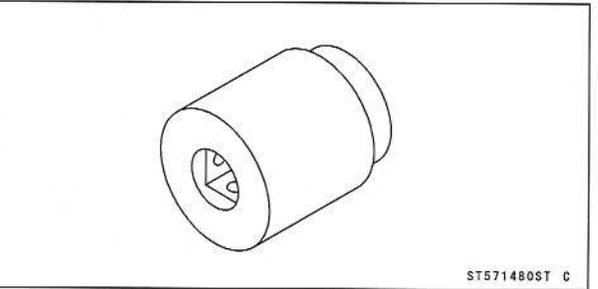
Socket Wrench, Hex 50 :  
57001-1478



Output Shaft Holder & Spacer :  
57001-1479



Pinion Gear Holder :  
57001-1480

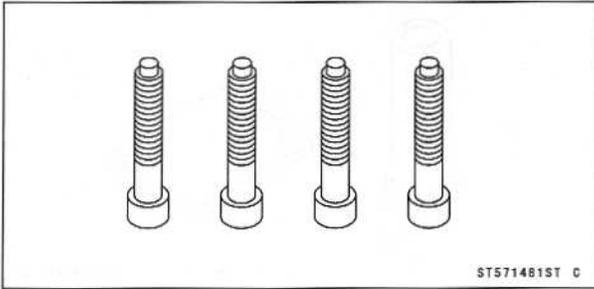


# 11-8 FINAL DRIVE

## Special Tools

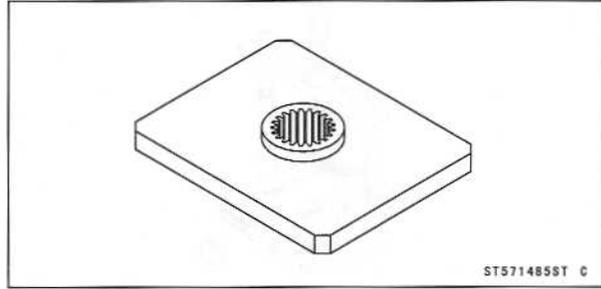
**Nut Holding Bolts :**

**57001-1481**



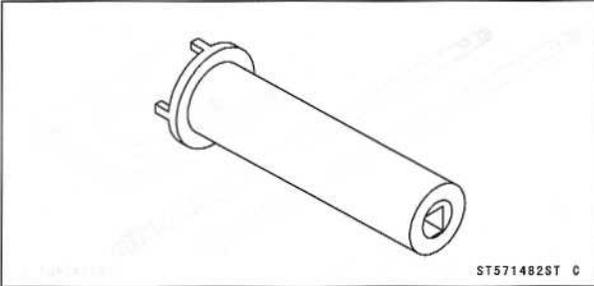
**Pinion Gear Holder :**

**57001-1485**



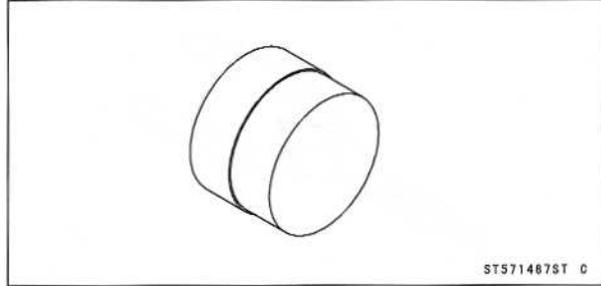
**Socket Wrench :**

**57001-1482**



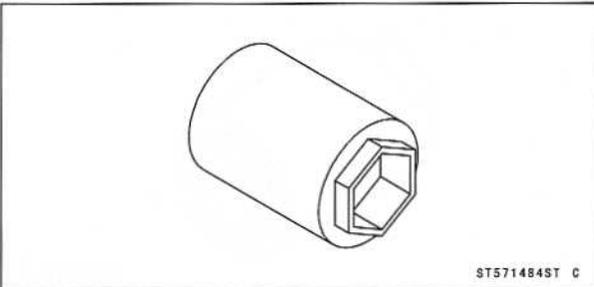
**Oil Seal Driver:**

**57001-1487**



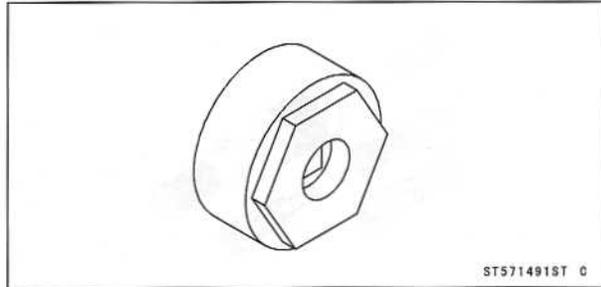
**Socket Wrench, Hex 41 :**

**57001-1484**



**Hexagon Wrench, Hex 41 :**

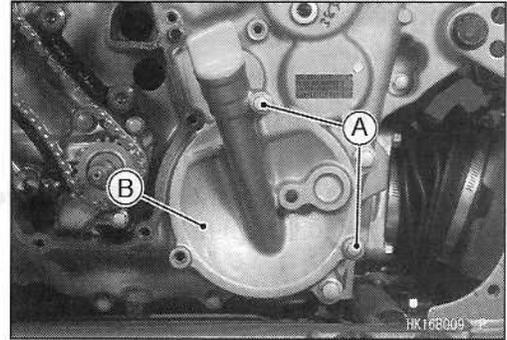
**57001-1491**



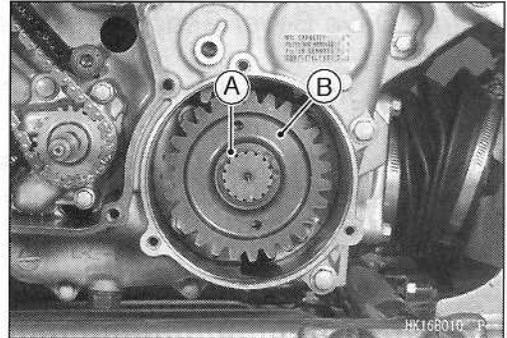
## Output Drive Bevel Gears

### Output Drive Bevel Gear Removal

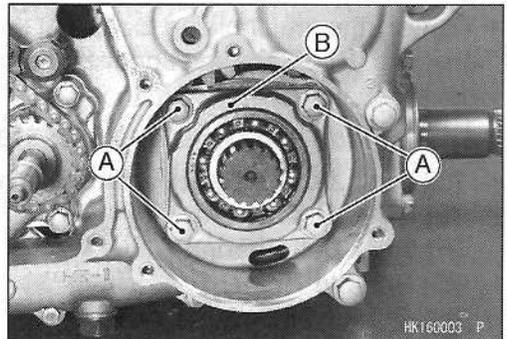
- Remove:
  - Oil Pipe (see Engine Lubrication System chapter)
  - Output Drive Bevel Gear Cover Bolts [A]
  - Output Drive Bevel Gear Cover [B]



- Remove:
  - Circlip [A]**Special Tool - Outside Circlip Pliers: 57001-144**
- Remove:
  - Output Drive Idle Gear [B]



- Remove:
  - Output Drive Bevel Gear Housing Bolts [A]
  - Output Drive Bevel Gear Housing [B]



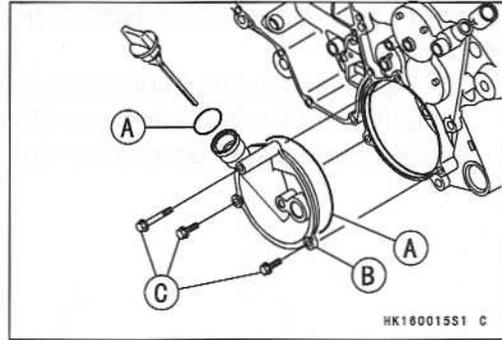
### Output Drive Bevel Gear Installation

- Install the output drive bevel gear housing.
- Tighten:
  - Torque - Output Drive Bevel Gear Housing Bolts: 26 N·m (2.7 kgf·m, 20 ft·lb)**
- Install:
  - Output Drive Idle Gear
  - New Circlip**Special Tool - Outside Circlip Pliers: 57001-144**

## 11-10 FINAL DRIVE

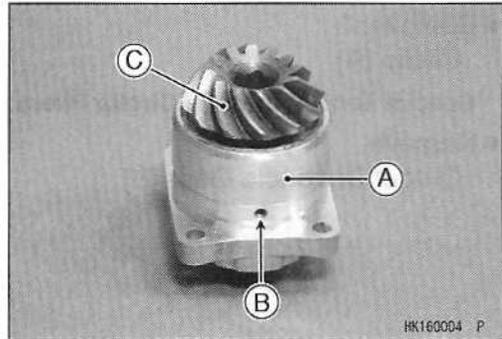
### Output Bevel Gears

- Apply grease:
  - O-rings [A]
- Install:
  - Output Drive Bevel Gear Cover [B]
- Tighten:
  - Torque - Output Drive Bevel Gear Cover Bolts [C]: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



#### Output Drive Bevel Gear Disassembly

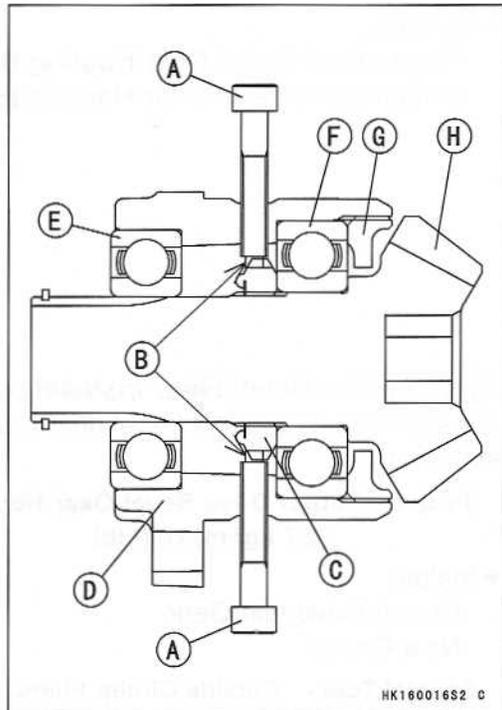
- Remove:
  - Output Drive Bevel Gear Housing [A] (see Output Drive Bevel Gear Removal)
- Look through the hole [B] in the housing.
- Turn the bevel gear [C] until the groove of the output drive bevel gear holder nut is seen.



- Tighten the nut holding bolts [A] (4) securely into the grooves [B] of the bevel gear holder nut [C] in the output drive bevel gear housing.

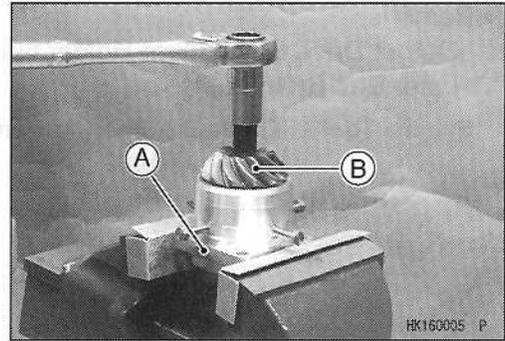
#### Special Tool - Nut Holding Bolts: 57001-1481

- [D] Output Drive Bevel Gear Housing
- [E] Outer Ball Bearing
- [F] Inner Ball Bearing
- [G] Bearing Holder
- [H] Output Drive Bevel Gear



## Output Bevel Gears

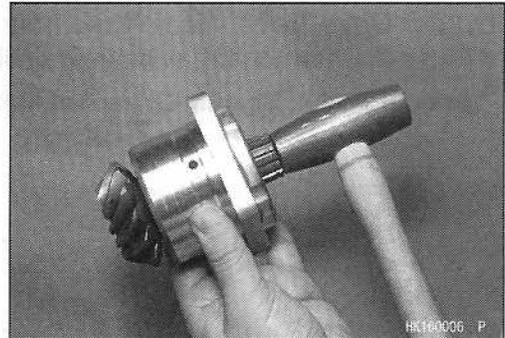
- Hold the output drive bevel gear housing [A] in a vise.
- Loosen the bevel gear [B] using an Allen wrench about four rotations.
- Remove one nut holding bolt, and look at through the hole.
- ★ If the groove of the bevel gear holder nut is not seen, loosen the other three bolts.



- Drive the gear shaft end using a copper mallet until the grooves of the bearing holder nut can be seen again.
- Retighten the nut holding bolts (4) securely into the groove of the bevel gear holder nut in the output drive bevel gear housing.

**Special Tool - Nut Holding Bolts: 57001-1481**

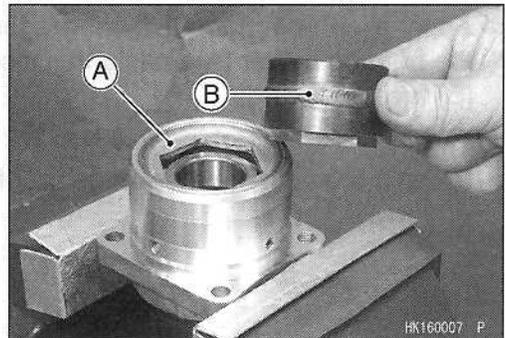
- Repeat the above procedure, and remove the bevel gear from the housing.



- Remove the bearing holder [A] using the hexagon wrench [B].

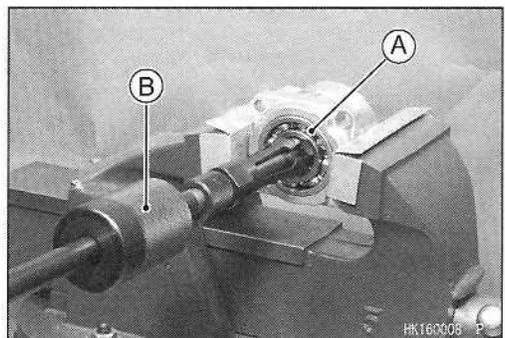
**Special Tool - Hexagon Wrench, Hex 41: 57001-1491**

- If the holder seems too difficult to break free, apply heat to softer the locking agent.



- Remove:  
Outer Ball Bearing [A]

**Special Tool - Oil Seal & Bearing Remover [B]:  
57001-1058**

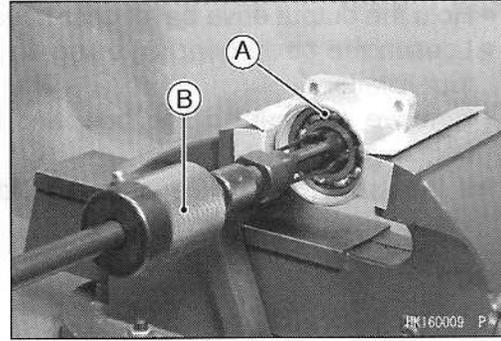


## 11-12 FINAL DRIVE

### Output Bevel Gears

- Remove:
  - Output Drive Bevel Gear Holder Nut
  - Inner Ball Bearing [A]

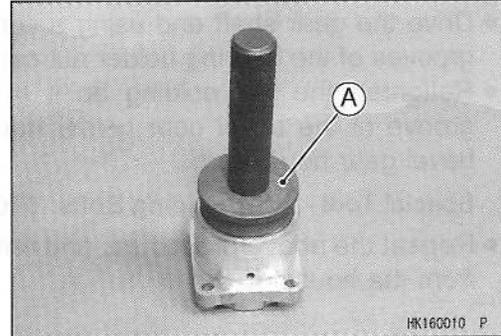
**Special Tool - Oil Seal & Bearing Remover [B]:**  
57001-1058



#### *Output Drive Bevel Gear Assembly*

- Press the new inner ball bearing until it is bottomed.

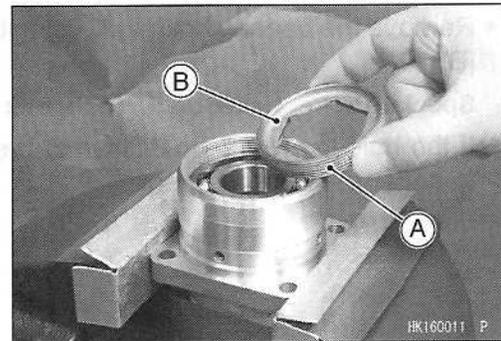
**Special Tool - Bearing Driver Set [A]:** 57001-1129



- Apply a non-permanent locking agent to the threads of the bearing holder [A] and tighten it so that the deep side [B] faces outward.

**Torque - Bearing Holder: 120 N·m (12 kgf·m, 89 ft·lb)**

- Press the output drive bevel gear until it is bottomed.



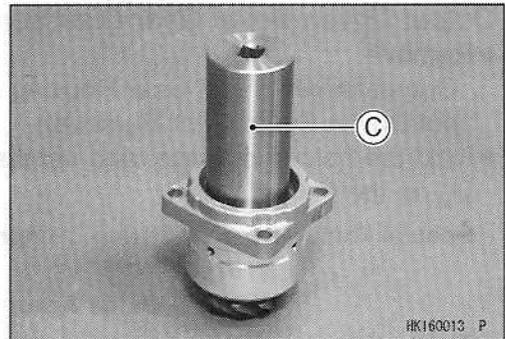
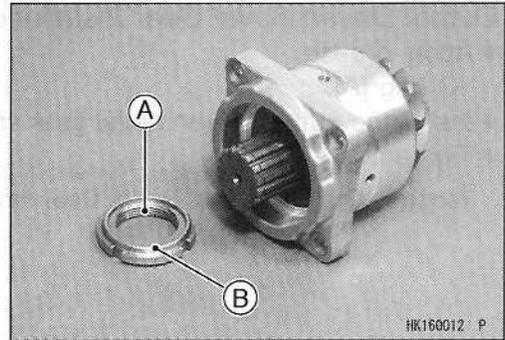
## Output Bevel Gears

- Apply a non-permanent locking agent to the threads of the bevel gear holder nut [A] and tighten it so that the projection side [B] faces outward.

**Special Tool - Socket Wrench: 57001-1482 [C]**

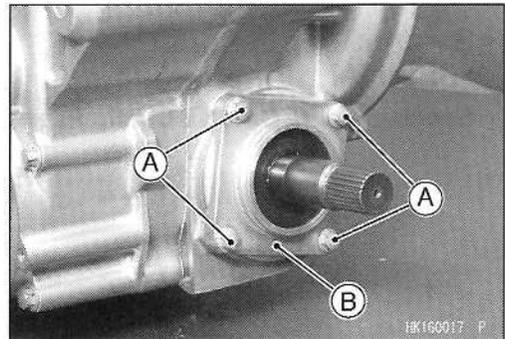
**Torque - Bevel Gear Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)**

- Press the new outer ball bearing until it is bottomed.

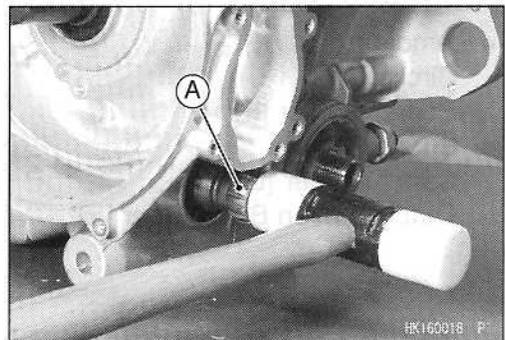


### Output Driven Bevel Gear Removal

- Remove:
  - Swingarm (see Suspension chapter) and Propeller Shaft (see this chapter) or Engine (see Engine Removal/Installation chapter)
  - Output Driven Bevel Gear Housing Bolts [A]
  - Output Driven Bevel Gear Housing [B]



- Tap lightly the front end [A] of the output driven bevel gear shaft using a plastic mallet.
- The output driven bevel gear shaft assembly comes off with the housing.

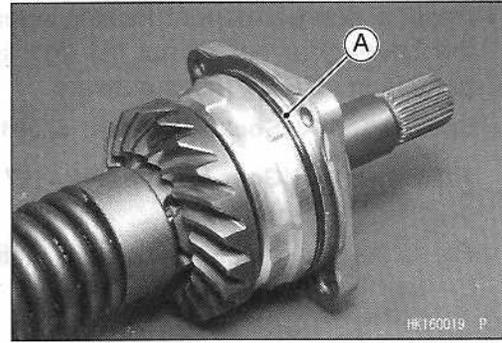


## 11-14 FINAL DRIVE

### Output Bevel Gears

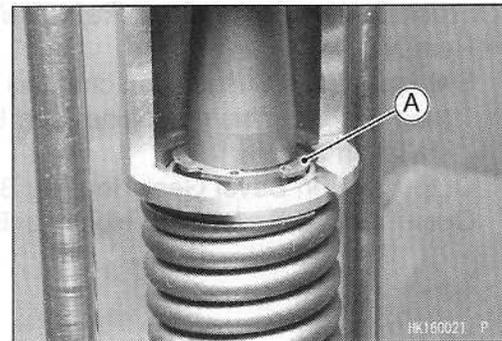
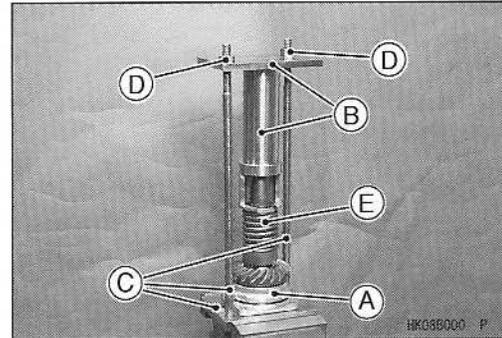
#### Output Driven Bevel Gear Installation

- Apply grease:
  - O-ring [A]
- Install the output driven bevel gear shaft assembly.
- Tighten:
  - Torque - Output Driven Bevel Gear Housing Bolts: 26 N·m (2.7 kgf·m, 20 ft·lb)**

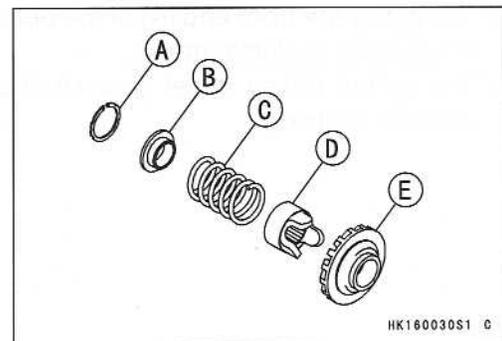


#### Output Driven Bevel Gear Disassembly

- Remove:
  - Output Driven Bevel Gear Housing Assembly (see Output Driven Bevel Gear Removal)
- Hold the holder in a vise, and set the housing assembly [A] on the holder.
  - Special Tools - Damper Spring Compressor Set [B]: 57001-1475**
  - Holder & Guide Arbor [C]: 57001-1476**
- Tighten the nuts [D] and compress the damper spring [E].
- Remove:
  - Circlip [A]
  - Special Tool - Outside Circlip Pliers: 57001-144**



- Remove:
  - Circlip [A]
  - Spring Holder [B]
  - Spring [C]
  - Cam Damper [D]
  - Output Driven Bevel Gear [E]

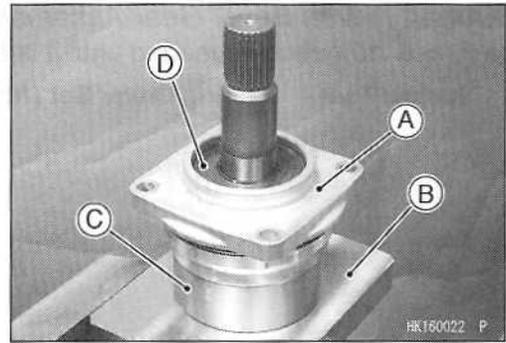


**Output Bevel Gears**

- Hold the housing assembly [A] with the output shaft holder [B] & spacer [C] in a vise.

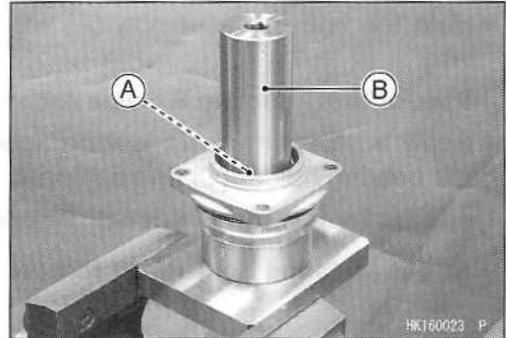
**Special Tool - Output Shaft Holder & Spacer: 57001-1479**

- Remove:  
Oil Seal [D]



- Remove:  
Output Shaft Holder Nut [A]

**Special Tool - Socket Wrench [B]: 57001-1482**



- Hold the housing assembly [A] with the holder [B] in a vise.

**Special Tool - Holder & Guide Arbor : 57001-1476**

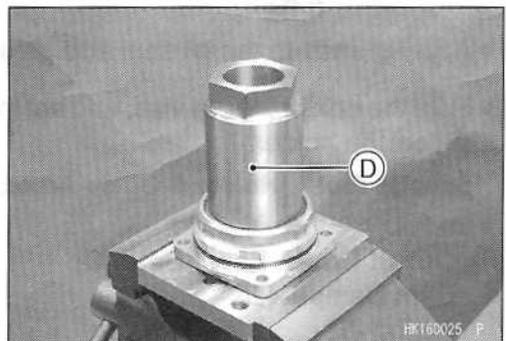
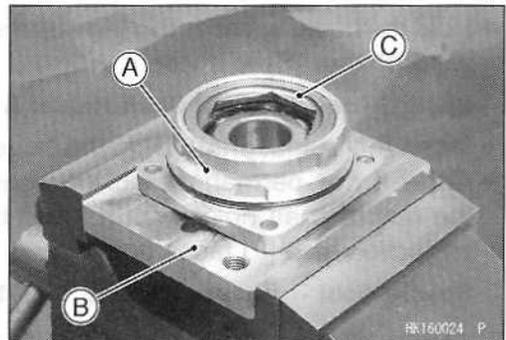
- Remove:  
Bearing Holder [C]

**Special Tool - Socket Wrench [D], Hex 50: 57001-1478**

- If the holder seems too difficult to break free, apply heat to softer the locking agent.

- Remove:  
Ball Bearing

**Special Tool - Oil Seal & Bearing Remover: 57001-1058**



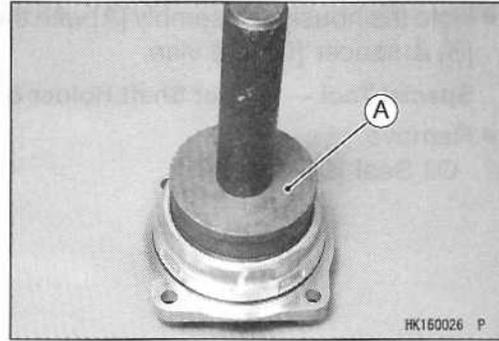
## 11-16 FINAL DRIVE

### Output Bevel Gears

#### Output Driven Bevel Gear Assembly

- Press the new ball bearing until it is bottomed.

**Special Tool - Bearing Driver Set [A]: 57001-1129**



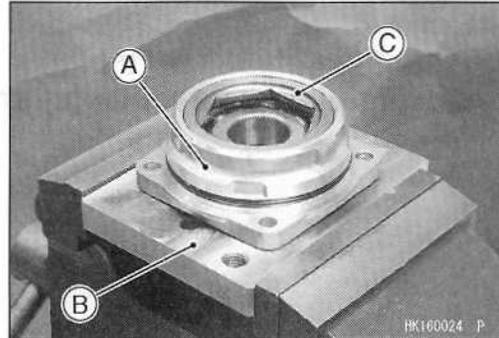
- Hold the housing assembly [A] with the holder [B] in a vise.

**Special Tool - Holder & Guide Arbor: 57001-1476**

- Apply a non-permanent locking agent to the threads of the bearing holder [C] and tighten it.

**Special Tool - Socket Wrench, Hex 50: 57001-1478**

**Torque - Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)**



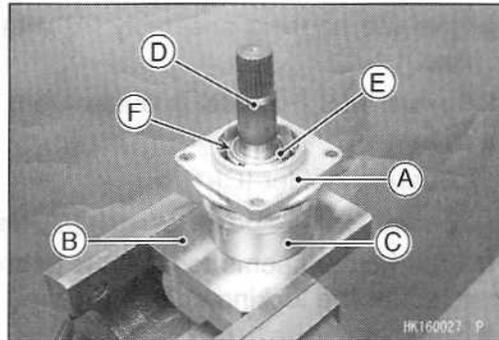
- Hold the housing assembly [A] with the output shaft holder [B] & spacer [C] in a vise.

**Special Tool - Output Shaft Holder & Spacer: 57001-1479**

- Insert the output shaft [D] in the housing.
- Apply a non-permanent locking agent to the threads of the output shaft holder nut [E] and tighten it so that the projection side [F] faces outward.

**Special Tool - Socket Wrench: 57001-1482**

**Torque - Output Shaft Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)**

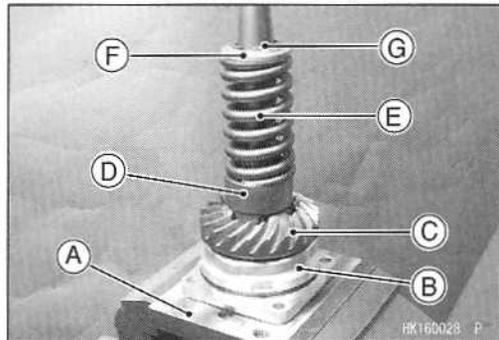


- Apply grease to the oil seal and press it.

- Hold the holder [A] in a vise, and set the housing assembly [B] on the holder.

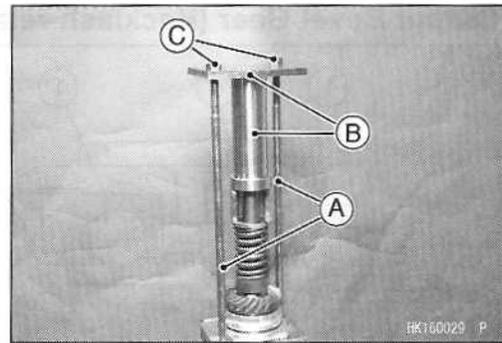
**Special Tool - Holder & Guide Arbor: 57001-1476**

- Install:
  - Output Driven Bevel Gear [C]
  - Cam Damper [D]
  - Spring [E]
  - Spring Holder [F]
  - Circlip [G]



**Output Bevel Gears**

- Install:
  - Guide Bars [A]
  - Damper Spring Compressor Set [B]
- Special Tools - Holder & Guide Arbor: 57001-1476**
- Damper Spring Compressor Set: 57001-1475**



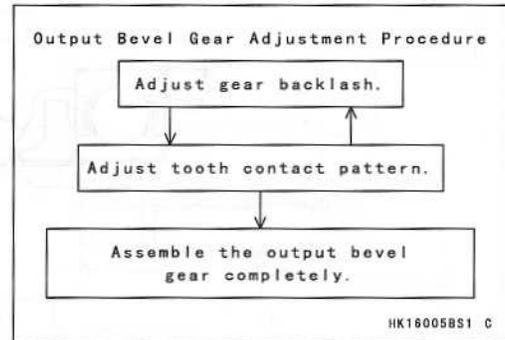
- Tighten the nuts [C] and compress the damper spring.
- Install:
  - Circlip
- Special Tool - Outside Circlip Pliers: 57001-144**

*Output Bevel Gears Adjustment*

The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.

When replacing any one of the backlash-related parts, be sure to check and adjust the backlash and tooth contact. First adjust the backlash, and then tooth contact by replacing shims.

These two adjustments are of critical importance and must be carried out in the correct sequence, using the procedures shown.



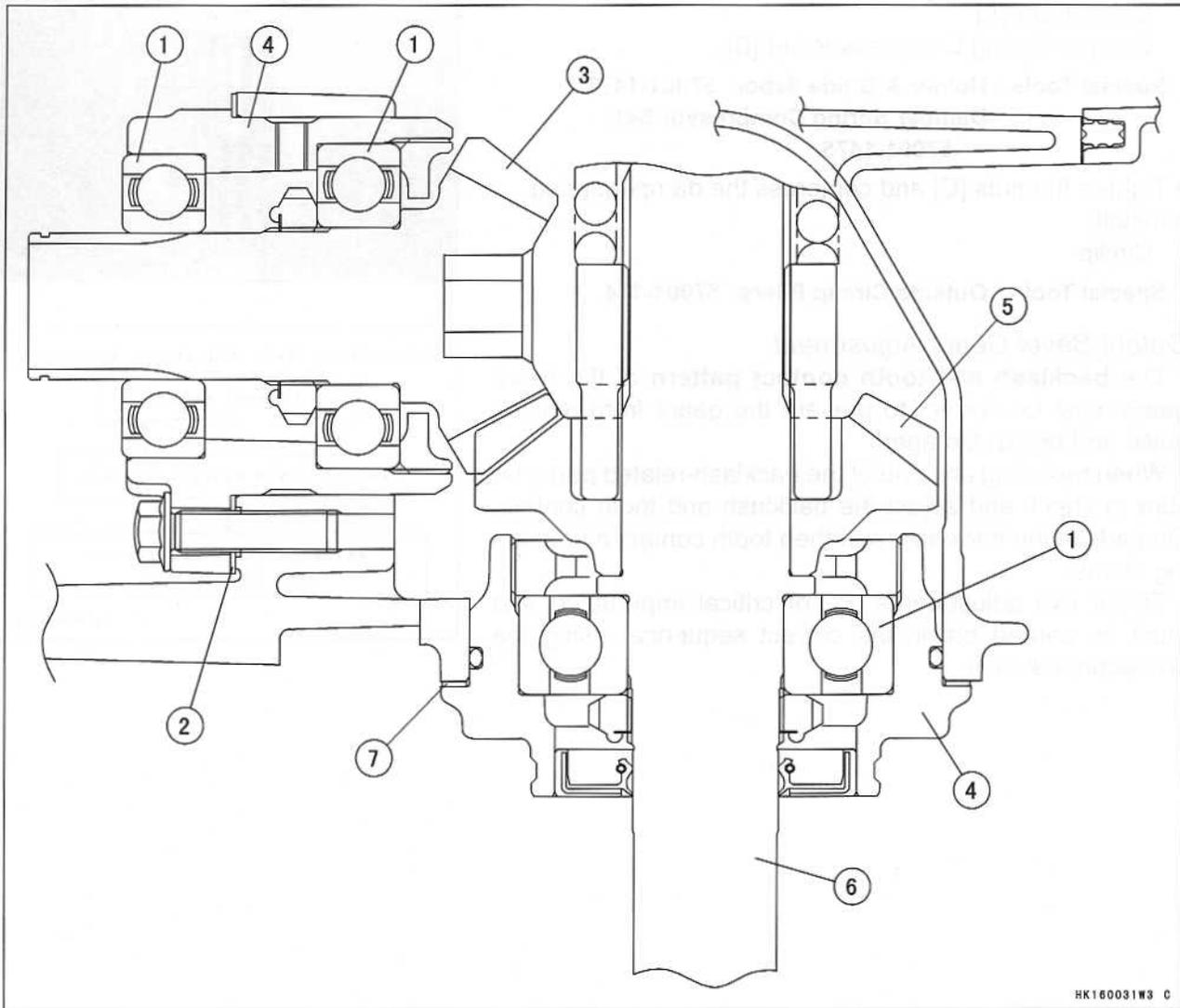
HK160029 P

HK160058S1 C

# 11-18 FINAL DRIVE

## Output Bevel Gears

### Output Bevel Gear (Backlash-related Parts)



HK160031W3 C

- 1. Ball Bearings
- 2. Drive Bevel Gear Shims
- 3. Output Drive Bevel Gear
- 4. Bearing Housings

- 5. Output Driven Bevel Gear
- 6. Output Driven Shaft
- 7. Driven Bevel Gear Shims

## Output Bevel Gears

### Drive Bevel Gear Shims for Tooth Contact Adjustment

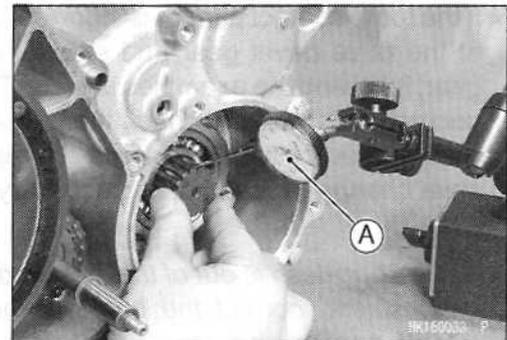
Thickness	Part Number
0.15 mm (0.006 in.)	92180-1311
0.2 mm (0.008 in.)	92180-1312
0.5 mm (0.020 in.)	92180-1313
0.8 mm (0.031 in.)	92180-1314
1.0 mm (0.039 in.)	92180-1351
1.2 mm (0.047 in.)	92180-1352

### Driven Bevel Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1307
0.2 mm (0.008 in.)	92180-1308
0.5 mm (0.020 in.)	92180-1309
0.8 mm (0.031 in.)	92180-1310
1.0 mm (0.039 in.)	92180-1349
1.2 mm (0.047 in.)	92180-1350

### Bevel Gear Backlash Adjustment

- The amount of backlash is influenced by driven bevel gear position more than by drive bevel gear position.
- Remove the output drive idle gear (see Output Drive Bevel Gear Removal).
- Set up a dial gauge [A] against the output drive shaft spline groove to check gear backlash.
- To measure the backlash, turn the shaft clockwise and counterclockwise slightly so as not to move the mate gear. A rod can be inserted through the lower hole of the housing and into contact with driven gear. This may help to hold it still. The difference between the highest and lowest gauge reading is the amount of backlash.
- ★ If the backlash is not within the limit, replace the shim(s) at the driven bevel gear.
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



### Output Bevel Gear Backlash

Standard: 0.05 ~ 0.11 mm (0.0020 ~ 0.0043 in.) (at output drive shaft spline)

## 11-20 FINAL DRIVE

### Output Bevel Gears

#### Tooth Contact Adjustment

○ Tooth contact location is influenced by drive gear position more than by driven gear position.

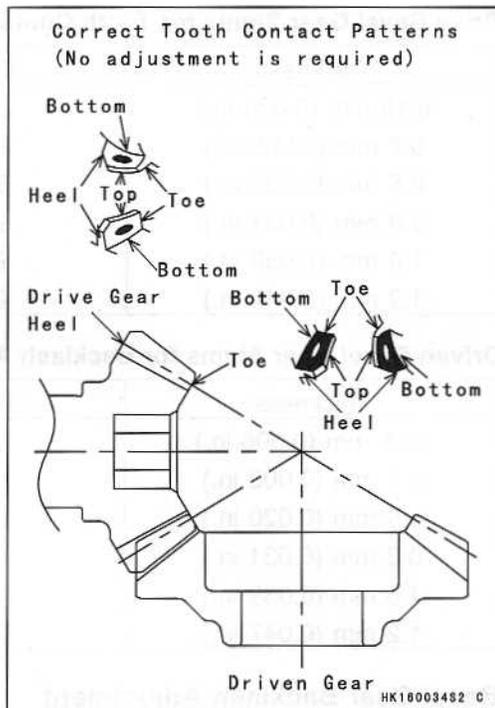
- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth on the output driven bevel gear.

#### NOTE

- Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- The checking compound must be smooth and firm with the consistency of tooth paste.
- Special compounds are available from automotive supply stores for the purpose of checking differential gear tooth patterns and contact. Use this for checking the bevel gears.
- Turn the output driven shaft for 3 or 4 turns in the drive and reverse (coast) directions, while creating a drag on the drive bevel gear shaft.
- Check the drive pattern and coast pattern of the bevel gear teeth. The tooth contact patterns of both drive and coast sides should be centrally located between the top and bottom of the tooth, and a little closer to the toe of the tooth.
- ★ If the tooth contact pattern is incorrect, replace the shim(s) at the drive bevel gear and shim(s) at the driven bevel gear, following the examples shown. Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shims are replaced. Repeat the shim change procedure as necessary.

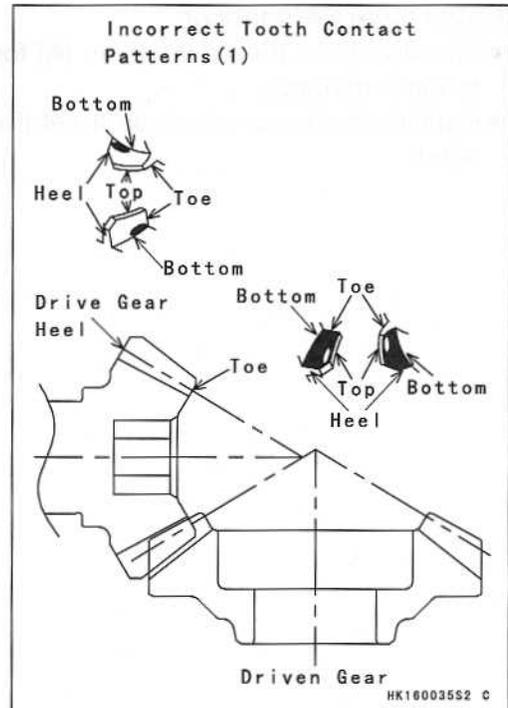
#### NOTE

- If the backlash is out of the standard range after changing shims, correct the backlash before checking the tooth contact pattern.

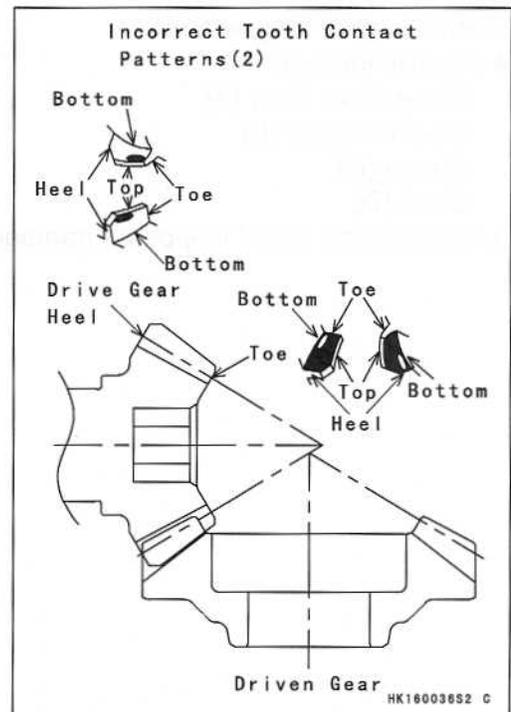


**Output Bevel Gears**

Example 1: Decrease the thickness of the drive bevel gear shim(s) by 0.1 mm (0.004 in.), and/or increase the thickness of the driven bevel gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.



Example 2: Increase the thickness of the drive bevel gear shim(s) by 0.1 mm (0.004 in.), and/or decrease the thickness of the driven bevel gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.

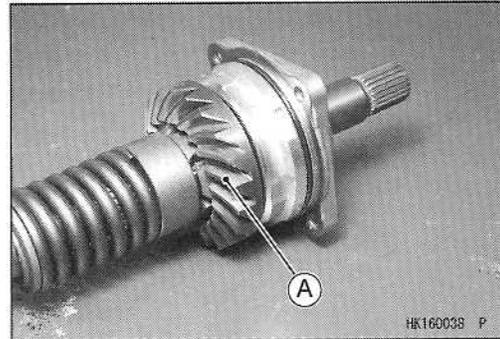
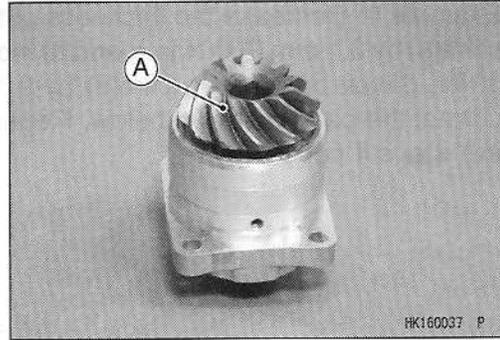


## 11-22 FINAL DRIVE

### Output Bevel Gears

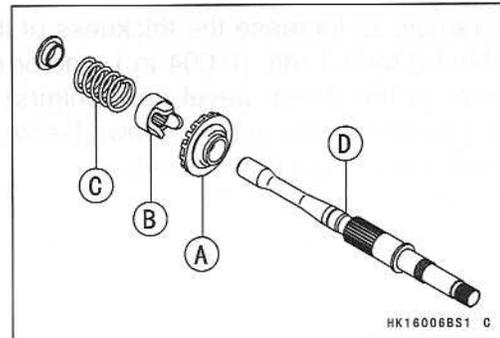
#### *Bevel Gears Inspection*

- Visually check the bevel gears [A] for scoring, chipping, or other damage.
- ★ Replace the bevel gears as a set if either gear is damaged.



#### *Cam Damper Inspection*

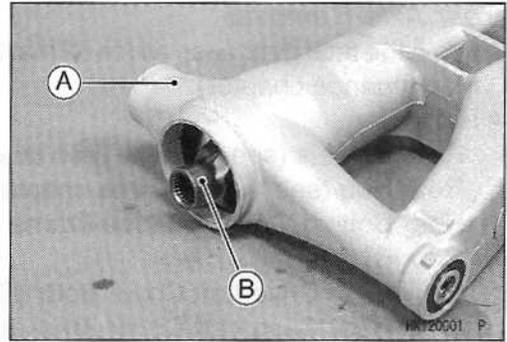
- Visually inspect:
  - Bevel Gear Cam [A]
  - Cam Follower [B]
  - Spring [C]
  - Shaft [D]
- ★ Replace any part if it appears damaged.



## Propeller Shaft

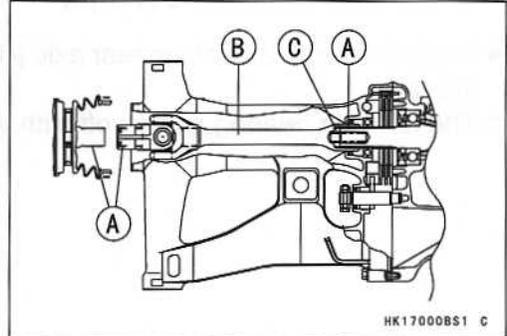
### Propeller Shaft Removal

- Drain the final gear case oil (see Final Drive in the Periodic Maintenance chapter).
- Remove:
  - Swingarm [A] (see Suspension chapter)
  - Propeller Shaft [B]



### Propeller Shaft Installation

- Wipe the old grease off the front and rear end splines [A] of the propeller shaft [B] and apply new molybdenum disulfide grease in those.
- Be sure to install the spring [C] on the pinion gear nut of the final gear case.
- Install the propeller shaft while aligning the splines.

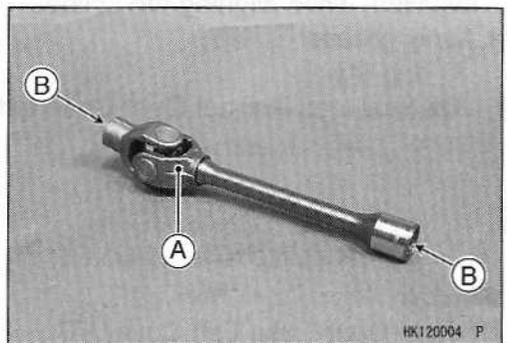


### Propeller Shaft Joint Boot Inspection

- Refer to the Final Drive in the Periodic Maintenance chapter.

### Propeller Shaft Inspection

- Remove the propeller shaft (see Propeller Shaft Removal).
- Check that the universal joint [A] works smoothly without rattling or sticking.
  - ★ If it does rattle or stick, the universal joint is damaged. Replace the propeller shaft with a new one.
- Visually inspect the splines [B] on the propeller shaft.
  - ★ If they are badly worn, chipped, or loose, replace the propeller shaft.
- Also, inspect the splines on the rear end of the output shaft and the pinion gear joint in the final gear case.
  - ★ If splines are badly worn, chipped, or loose, replace the output shaft and the pinion gear joint.

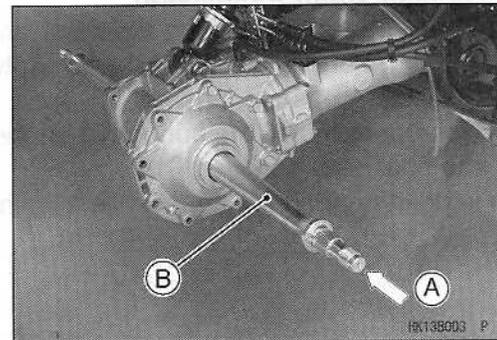
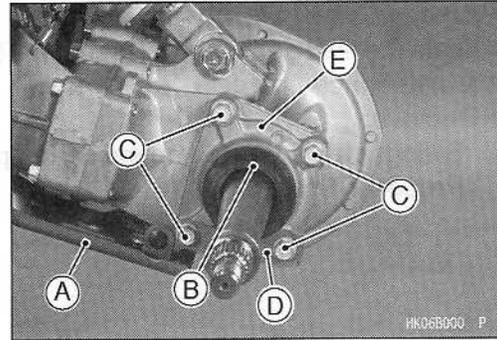


# 11-24 FINAL DRIVE

## Rear Axle

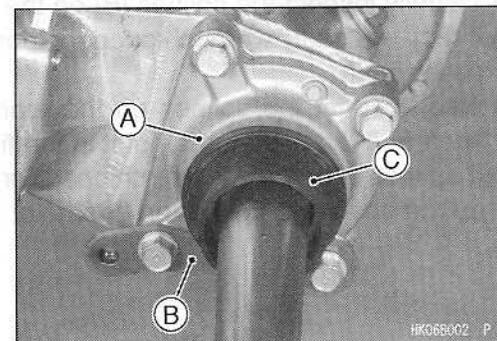
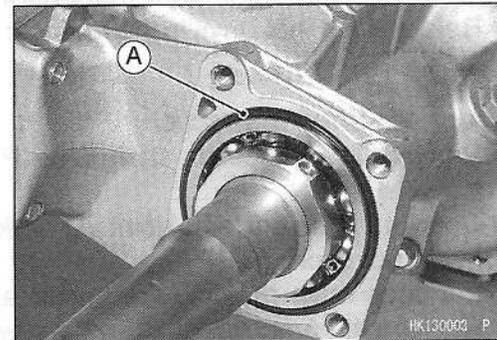
### Rear Axle Removal

- Drain the final gear case oil (see Final Drive in the Periodic Maintenance chapter).
- Remove:
  - Rear Wheels (see Wheels/Tires chapter)
  - Rear Hub (see Wheels/Tires chapter)
  - Rear Bottom Guard [A] (see Frame chapter)
  - Cap [B]
  - Final Gear Case Left Cover Bolts [C]
  - Final Gear Case Left Cover Bracket [D]
  - Final Gear Case Left Cover [E]
- Tap [A] the right end of the rear axle [B] and pull it out from the left.
- The left axle bearing comes off with the axle.



### Rear Axle Installation

- Install the rear axle from the left side with the left bearing installed, while aligning the splines.
- Apply grease:
  - O-ring [A]
  - Oil Seal Lips in Final Gear Case Left Cover
- Install:
  - Final Gear Case Left Cover [A]
  - Final Gear Case Left Cover Bracket [B]
- Apply a non-permanent locking agent to the cover bolts, and tighten them.  
**Torque - Final Gear Case Left Cover Bolts : 49 N·m (5.0 kgf·m, 36 ft·lb)**
- Install the cap [C].



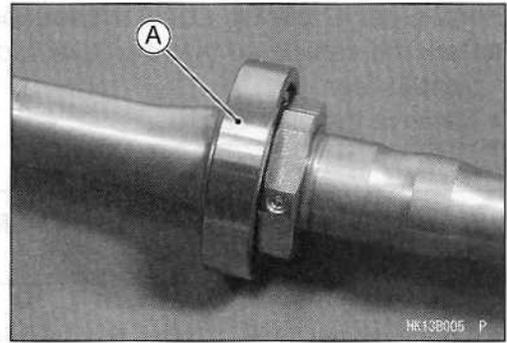
**Rear Axle**

*Ball Bearing Wear*

**CAUTION**

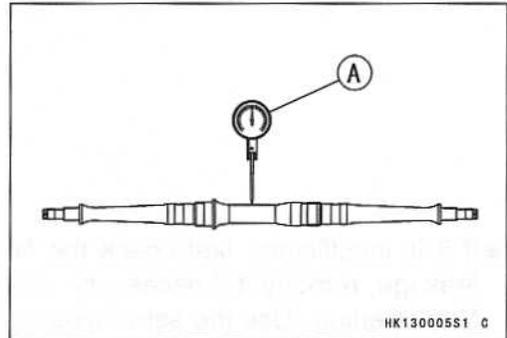
**Do not remove the bearing [A] for inspection. Removal may damage it.**

- Check the ball bearing.
- Since the ball bearing is made to extremely close tolerances, the wear must be judged by feel rather than measurement.
- Spin the bearing by hand to check its condition.
- ★ If the bearing is noisy, does not spin smoothly, or has any rough spots, replace the rear axle shaft.



*Rear Axle Runout Inspection*

- Visually inspect the axle for damage.
- ★ If the axle is damaged or bent, replace it.
- Set the rear axle in an alignment jig or on V blocks, and place a dial gauge [A] against the middle point.
- Turn the axle slowly. The difference between the highest and lowest dial gauge readings is the axle runout (TIR).
- ★ If the runout exceeds the service limit, replace the axle.



**Rear Axle Shaft Runout**

**Standard: TIR 1 mm (0.04 in.) or less**  
**Service Limit: TIR 2 mm (0.08 in.)**



## 11-26 FINAL DRIVE

### Final Gear Case

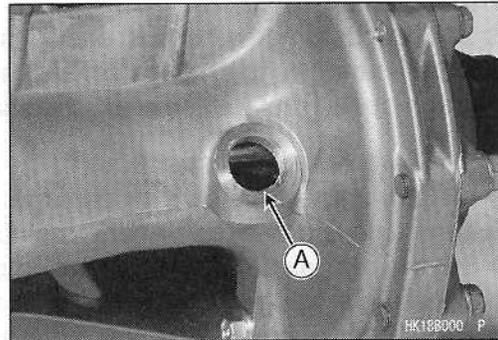
#### *Final Gear Case Oil Level Inspection*

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

#### **CAUTION**

**Be careful not to allow any dirt or foreign materials to enter the gear case.**

- Check the oil level. The oil level should come to the bottom of the filler opening [A].



★ If it is insufficient, first check the final gear case for oil leakage, remedy it if necessary, and add oil through the filler opening. Use the same type and brand of oil that is already in the final gear case.

- Apply grease to the O-ring.
- Be sure the O-ring is in place.

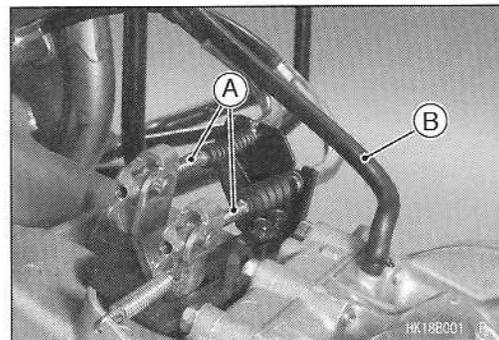
**Torque - Oil Filler Cap: 29 N·m (3.0 kgf·m, 22 ft·lb)**

#### *Final Gear Case Oil Change*

- Refer to the Final Drive in the Periodic Maintenance chapter.

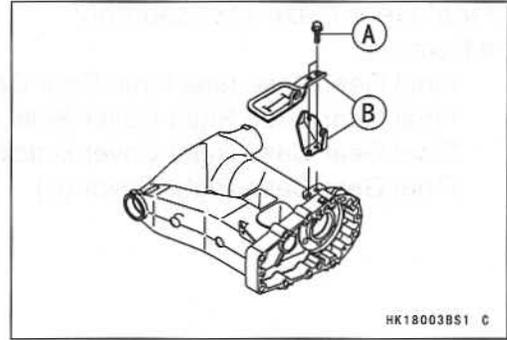
#### *Final Gear Case Removal*

- Remove:
  - Lower Rear Shock Absorber Mounting Bolts, Nuts and Washers (see Suspension chapter)
  - Rear Brake Cable Ends [A] (see Brake chapter)
  - Final Gear Case Breather Hose [B]
  - Rear Bottom Guard (see Frame chapter)

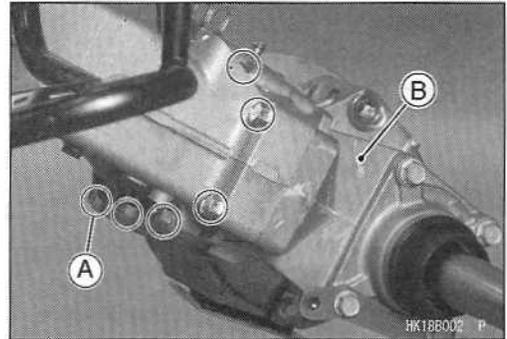


**Final Gear Case**

- Remove:
  - Brake Cable Mount Bolts [A]
  - Brake Cam Lever Cover and Cable Mount [B]

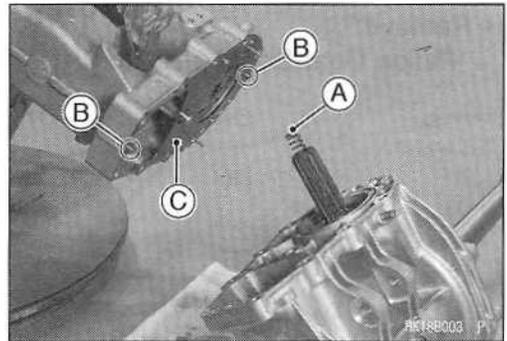


- Remove:
  - Final Gear Case Bolts [A] (10)
  - Final Gear Case [B]

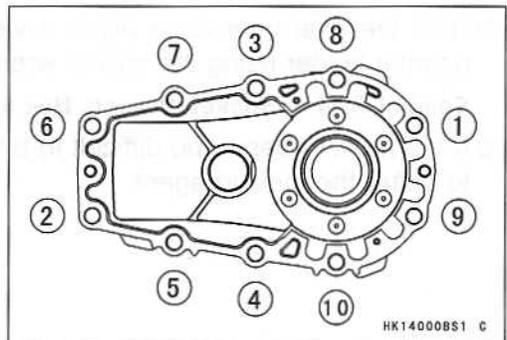


*Final Gear Case Installation*

- Install:
  - Spring [A]
  - Dowel Pins [B]
  - New Gasket [C] (see Brake System chapter)
- Insert the pinion gear shaft of the final gear case in the plate assembly.
- Align the splines by rotating the axle shaft.



- Tighten the final gear case bolts following the tightening sequence [110].
- Torque - Final Gear Case Bolts: 42 N·m (4.3 kgf·m, 31 ft·lb)**

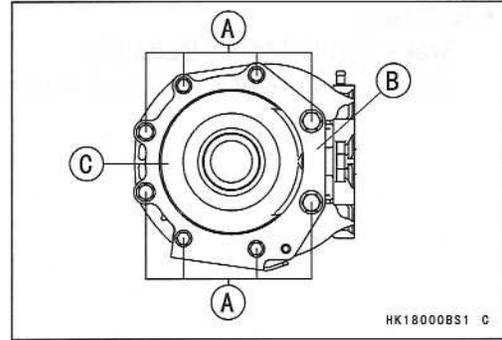


# 11-28 FINAL DRIVE

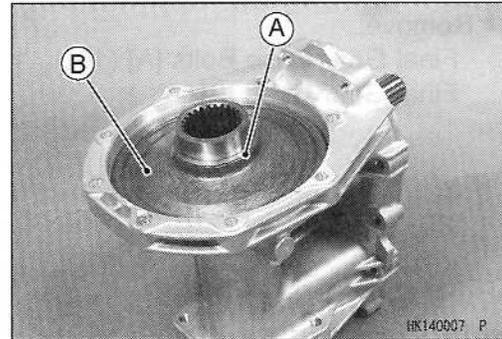
## Final Gear Case

### Final Gear Case Disassembly

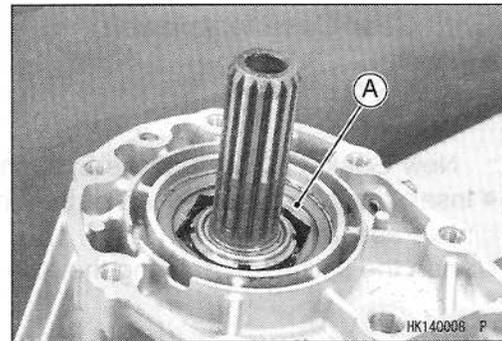
- Remove:
  - Final Gear Case (see Final Gear Case Removal)
  - Final Gear Case Right Cover Bolts [A]
  - Final Gear Case Right Cover Bracket [B]
  - Final Gear Case Right Cover [C]



- Remove:
  - Shim(s) [A]
  - Ring Gear [B]



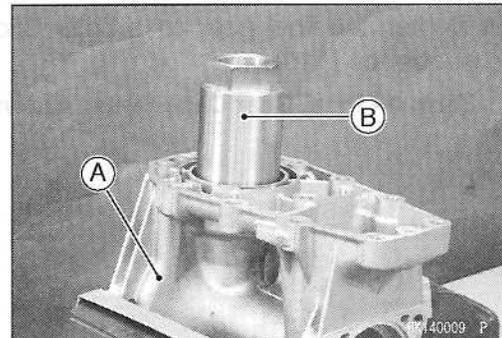
- Remove:
  - Pinion Gear Bearing Holder [A]



○ Hold the final gear case [A] in a vise, and remove the bearing holder using the socket wrench [B].

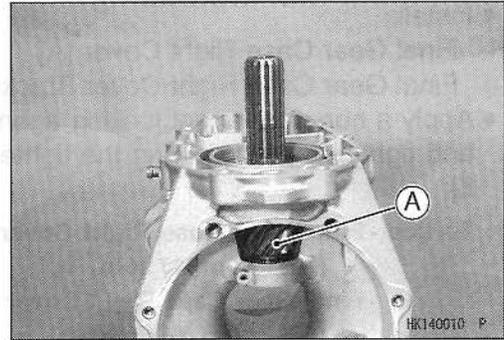
**Special Tool - Socket Wrench, Hex 50: 57001-1478**

○ If the holder seems too difficult to break free, apply heat to softer the locking agent.



**Final Gear Case**

- Remove:
  - Pinion Gear Unit [A]
  - Shim(s)

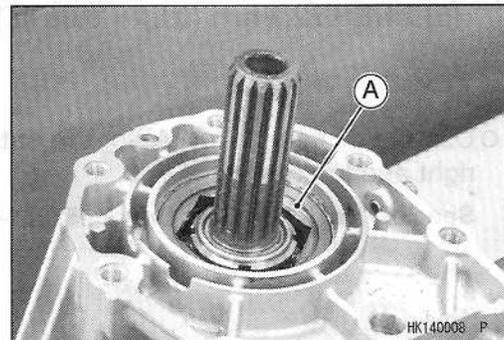


*Final Gear Case Assembly*

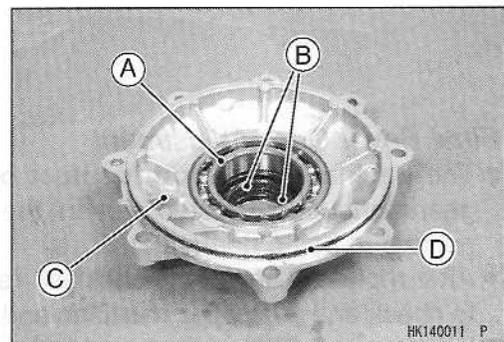
- Visually check the pinion gear and ring gear for scoring, chipping, or other damage.
- ★ Replace the bevel gear as a set if either gear is damaged since they are lapped as a set in the factory to get the best tooth contact.
- Install:
  - Shim(s)
  - Pinion Gear Unit
- Be sure to check and adjust the bevel gear backlash and tooth contact when any of the backlash-related parts are replaced (see Final Bevel Gear Adjustment).
- Apply a non-permanent locking agent to the pinion gear bearing holder [A], and tighten it.

**Special Tool - Socket Wrench, Hex 50: 57001-1478**

**Torque - Pinion Gear Bearing Holder: 137 N·m (14 kgf·m, 101 ft·lb)**



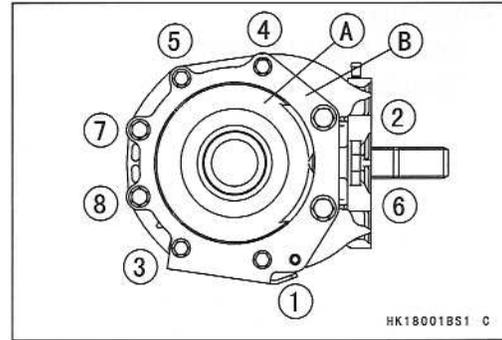
- Inspect:
  - Ball Bearing [A] (see Bearing and Oil Seal section)
  - Oil Seals [B] (see Bearing and Oil Seal section)
- ★ If they are damaged, replace the final gear case right cover [C].
- Apply grease to the oil seal lips and O-ring [D].



# 11-30 FINAL DRIVE

## Final Gear Case

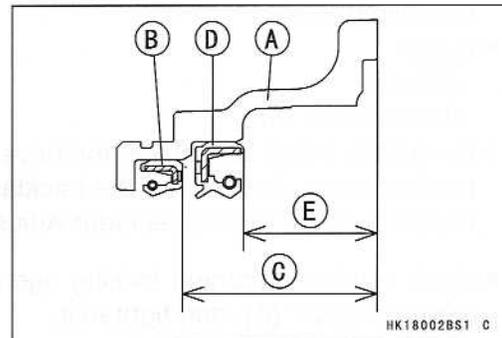
- Install:
  - Final Gear Case Right Cover [A]
  - Final Gear Case Right Cover Bracket [B]
- Apply a non-permanent locking agent to the cover bolts, and tighten them following the tightening sequence [1 ~ 8].
  - Torque - Final Gear Case Right Cover Bolts (M8): 24 N·m (2.4 kgf·m, 17 ft·lb)**
  - Final Gear Case Right Cover Bolts (M10): 49 N·m (5.0 kgf·m, 36 ft·lb)**
  - Final Gear Case Right Cover Bolts (M12): 94 N·m (9.6 kgf·m, 69 ft·lb)**



- Install:
  - Final Gear Case Left Cover
  - Rear Axle (see Rear Axle Installation)

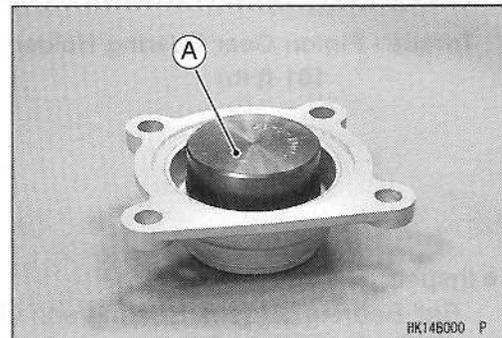
### Oil Seal Installation

- Press the oil seals in the right and left covers to the specified positions as shown.
  - [A] Left Cover
  - [B] Outside Oil Seal
  - [C] 31.5 ~ 32.5 mm (1.24 ~ 1.28 in.)
  - [D] Inside Oil Seal
  - [E] 21.3 ~ 22.3 mm (0.84 ~ 0.88 in.)



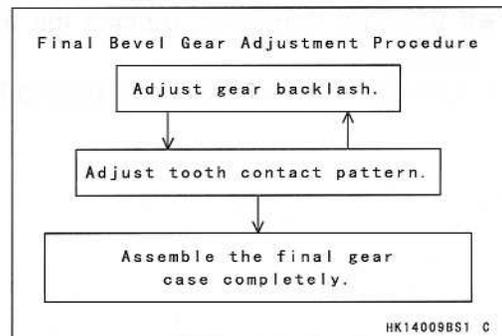
- Use the oil seal driver [A] for the outside oil seals of the right and left covers.

**Special Tool - Oil Seal Driver: 57001-1487**



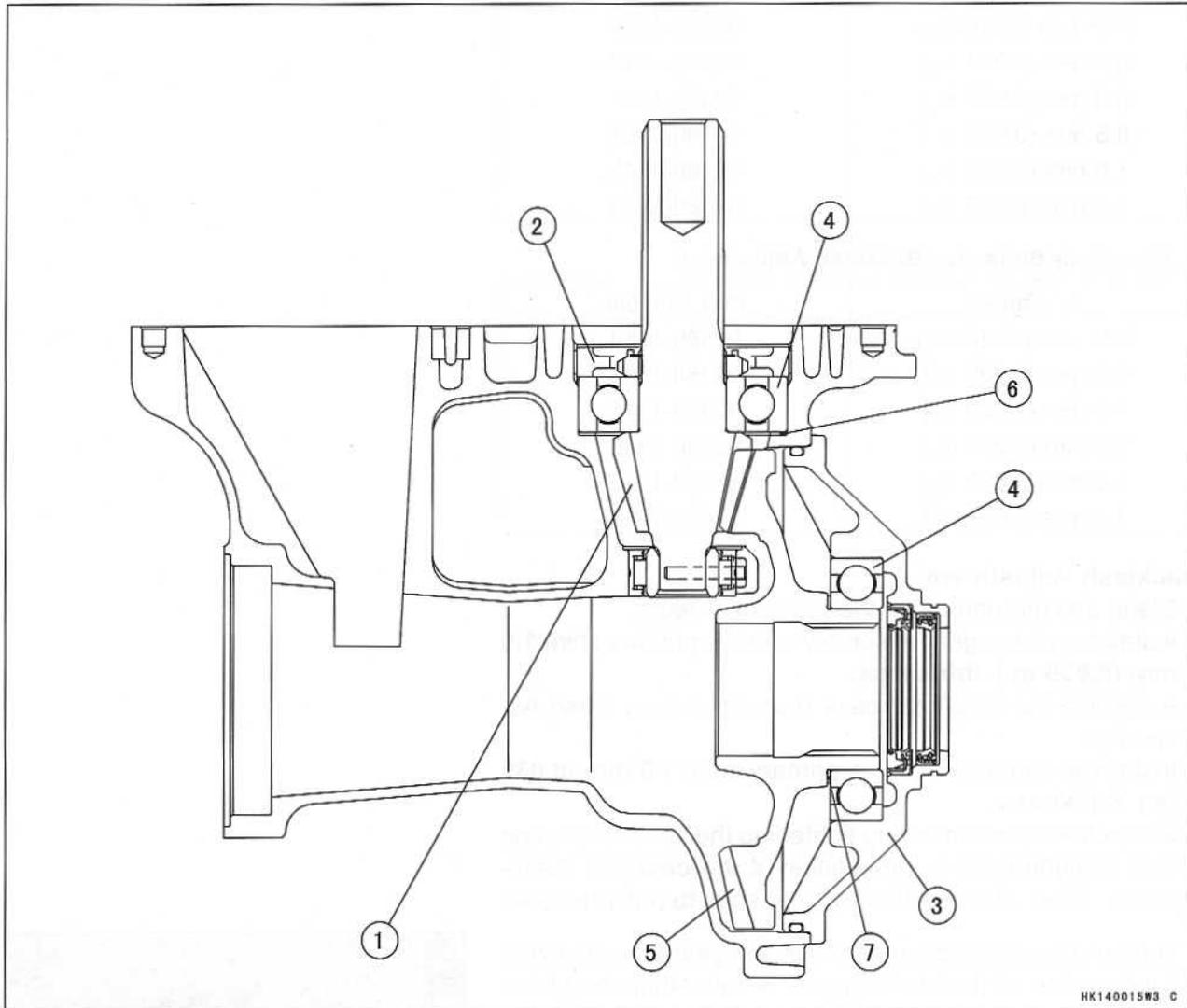
### Final Bevel Gear Adjustment

- The **backlash** and **tooth contact pattern** of the bevel gears must be correct to prevent the gears from making noise and being damaged.
- After replacing any of the backlash-related parts, be sure to check and adjust the backlash and tooth contact of the bevel gears. First, adjust backlash, and then tooth contact by replacing shims.
- The amount of backlash is influenced by the ring gear position more than by the pinion gear position.
- Tooth contact locations is influenced by the pinion gear position more than by the ring gear position.



Final Gear Case

Final Gear Case (Backlash-related Parts)



HK140015W3 C

- 1. Pinion Gear
- 2. Pinion Gear Bearing Holder
- 3. Gear Case Right Cover
- 4. Ball Bearings

- 5. Ring Gear
- 6. Pinion Gear Shim(s)
- 7. Ring Gear Shim(s)

# 11-32 FINAL DRIVE

## Final Gear Case

### 6. Pinion Gear Shims for Tooth Contact Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1320
0.2 mm (0.008 in.)	92180-1319
0.5 mm (0.020 in.)	92180-1321
0.8 mm (0.031 in.)	92180-1322
1.0 mm (0.039 in.)	92180-1345
1.2 mm (0.047 in.)	92180-1346

### 7. Ring Gear Shims for Backlash Adjustment

Thickness	Part Number
0.15 mm (0.006 in.)	92180-1318
0.2 mm (0.008 in.)	92180-1316
0.5 mm (0.020 in.)	92180-1317
0.8 mm (0.031 in.)	92180-1315
1.0 mm (0.039 in.)	92180-1343
1.2 mm (0.047 in.)	92180-1344

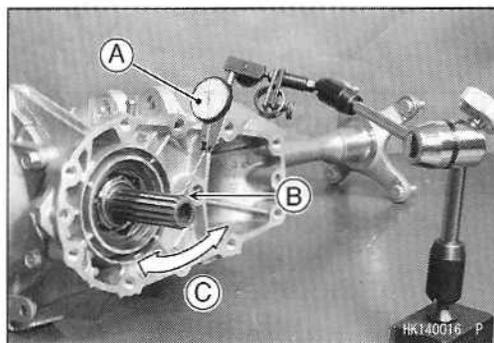
### Backlash Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Install the pinion gear assembly with the primary shim **1.0 mm (0.039 in.) thickness**.
- Assemble the final gear case (see Final Gear Case Assembly).
- Install the ring gear with the primary shim **1.0 mm (0.039 in.) thickness**.
- Check the backlash during tightening the cover bolts, and stop to tighten them immediately if the backlash disappears. Then, change the ring gear shim to a thinner one.
- Temporarily, install the rear axle in the gear case and hold it with a vise so that the ring gear is lower than the pinion gear.
- Mount a dial gauge [A] so that the tip of the gauge is against the splined portion [B] of the pinion gear joint.
- To measure the backlash, move the pinion gear shaft back and forth [C] while holding the rear axle steady. The difference between the highest and the lowest gauge reading is the amount of backlash.
- Measure backlash at three locations equally spaced on the splines.

#### Final Bevel Gear Backlash :

**0.07 ~ 0.14 mm (0.003 ~ 0.006 in.) at pinion gear spline**

- ★ If the backlash is not within the limit, replace the ring gear shim(s). To increase backlash, decrease the thickness of the shim(s). To decrease backlash, increase the thickness of the shim(s).
- ★ Change the thickness a little at a time.
- Recheck the backlash, and readjust as necessary.



## Final Gear Case

### Tooth Contact Adjustment

- Clean any dirt and oil off the bevel gear teeth.
- Apply checking compound to 4 or 5 teeth of the pinion gear.

#### NOTE

- Apply checking compound to the teeth in a thin, even coat with a fairly stiff paint brush. If painted too thickly, the exact tooth pattern may not appear.
- The checking compound must be smooth and firm, with the consistency of tooth paste.
- Special compounds are available at automotive supply stores for the purpose of checking differential gear tooth patterns and contact.

- Assemble the final gear case (see Final Gear Case Assembly).
- Turn the pinion gear for one revolution in the drive and reverse (coast) direction, while creating drag on the ring gear.
- Remove the ring gear and pinion gear unit to check the drive pattern and coast pattern of the bevel gear teeth.
- The tooth contact patterns of both (drive and coast) sides should be centrally located between the top and bottom of the tooth. The drive pattern can be a little closer to the toe and the coast pattern can be a somewhat longer and closer to the toe.
- ★ If the tooth contact pattern is incorrect, replace the pinion gear shim(s), following the examples shown.
- Then erase the tooth contact patterns, and check them again. Also check the backlash every time the shim(s) are replaced. Repeat the shim change procedure as necessary.

#### NOTE

- If the backlash is out of the standard range after changing the pinion gear shim(s), change the ring gear shim(s) to correct the backlash before checking the tooth contact pattern.

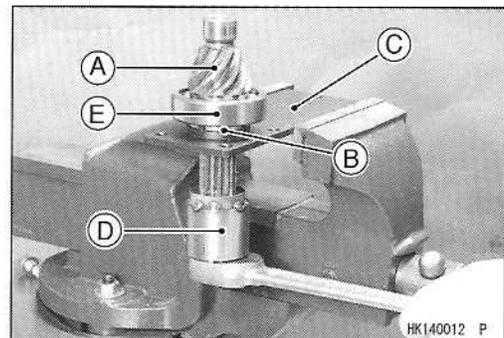
### Pinion Gear Unit Disassembly

- Remove:  
Pinion Gear Unit [A] (see Final Gear Case Disassembly)
- Hold the pinion gear bearing holder nut [B] with the socket wrench [C] in a vise, and loosen the pinion gear shaft using the pinion gear holder [D].

**Special Tools - Socket Wrench: 57001-1363**  
**Pinion Gear Holder: 57001-1480**

- Remove the ball bearing [E] as necessary.

**Special Tool - Bearing Puller: 57001-135**



## 11-34 FINAL DRIVE

### Final Gear Case

#### Pinion Gear Unit Assembly

○ The pinion gear and ring gear are lapped as a set in the factory to get the best tooth contact. They must be replaced as a set.

● Visually inspect the bearing for abrasion, color change, or other damage.

★ If there is any doubt as to the condition of a bearing, replace the bearing.

● Be sure to check and adjust the bevel gear backlash and tooth contact, when any of the backlash-related parts are replaced.

● Press the bearing [A] on the pinion gear until it is bottomed.

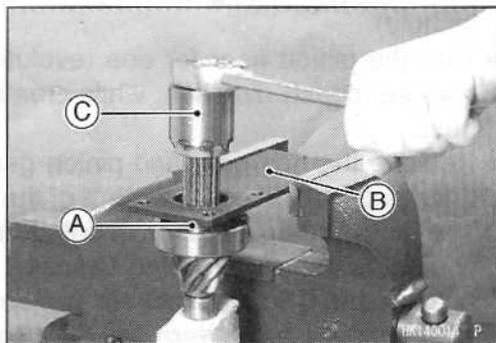
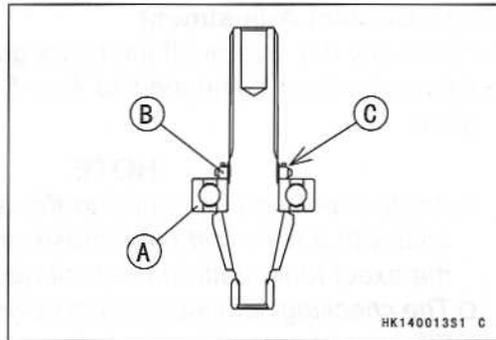
● Install the pinion gear bearing holder nut [B] so that the projection [C] faces outward.

● Apply a non-permanent locking agent to the pinion gear bearing holder nut [A], and tighten it.

**Special Tools - Socket Wrench [B]: 57001-1363**

**Pinion Gear Holder [C]: 57001-1480**

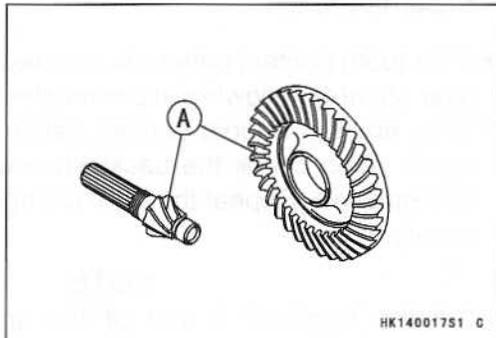
**Torque - Pinion Gear Bearing Holder Nut: 157 N·m (16 kgf·m, 116 ft·lb)**



#### Bevel Gear Inspection

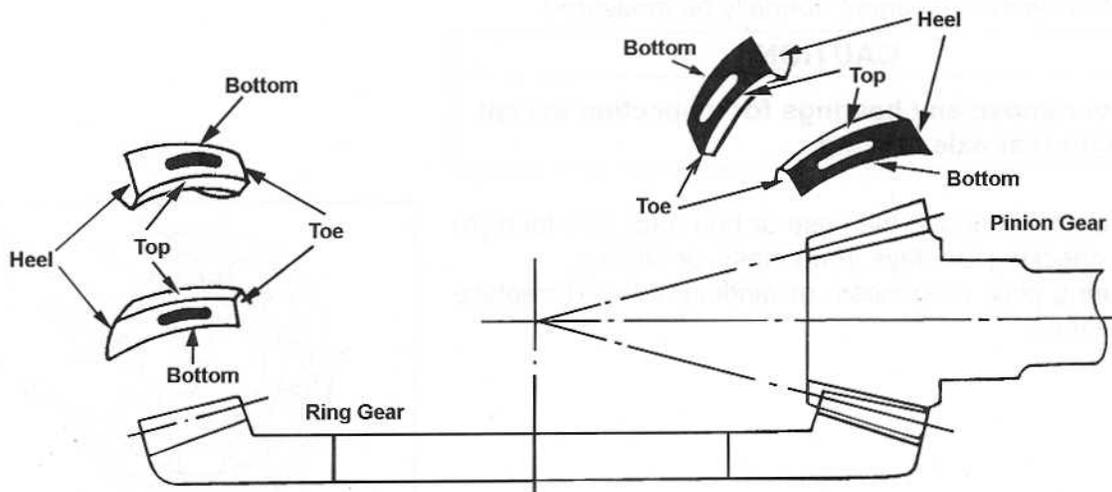
● Visually check the bevel gears [A] for scoring, chipping, or other damage.

★ Replace the bevel gears as a set if either gear is damaged.



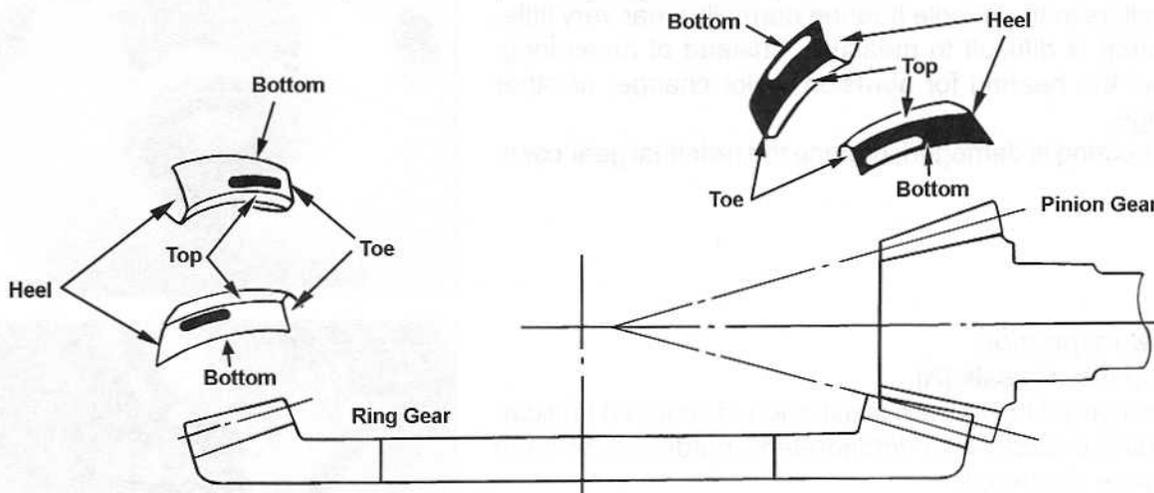
Final Gear Case

Correct Tooth Contact Pattern: No adjustment is required.

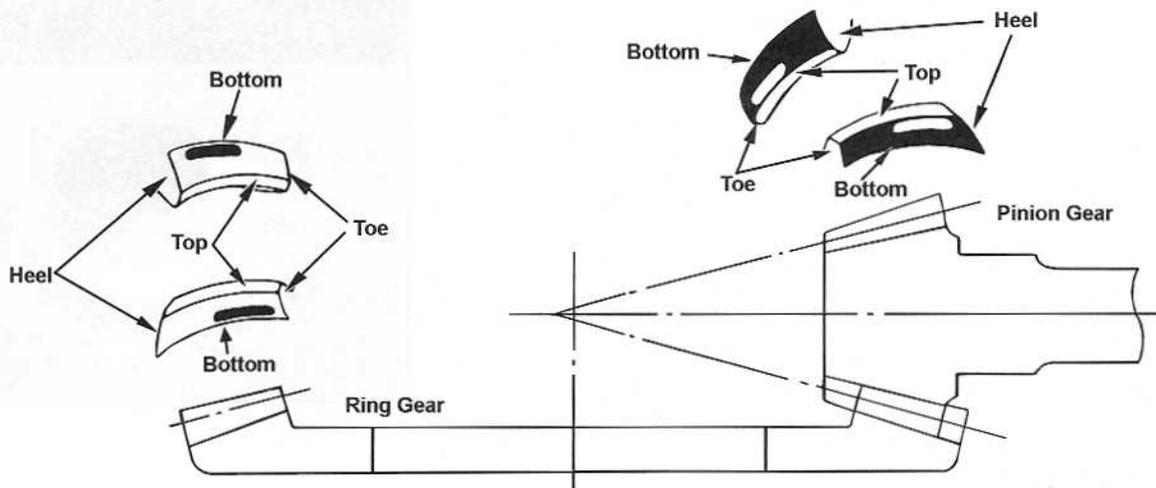


Incorrect Tooth Contact Patterns

Example 1 : Decrease the thickness of the ring gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.



Example 2 : Increase the thickness of the ring gear shim(s) by 0.1 mm (0.004 in.) to correct the pattern shown below. Repeat in 0.1 mm (0.004 in.) steps if necessary.



## 11-36 FINAL DRIVE

### Bearing and Oil Seal

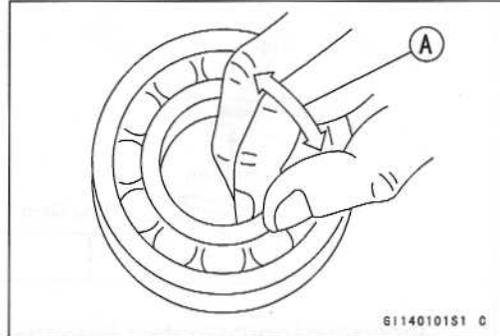
#### *Ball or Needle Bearing Inspection*

Since the bearings are made to extremely close tolerances, the clearance cannot normally be measured.

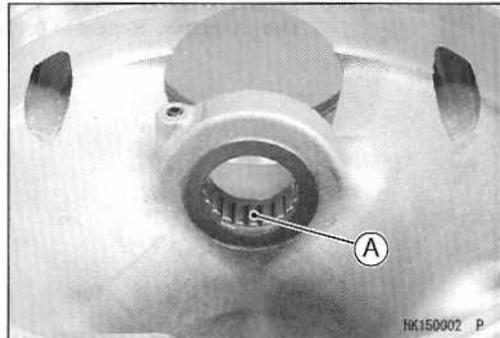
#### CAUTION

**Do not remove any bearings for inspection except the right rear axle bearing.**

- Turn each bearing in the case or hub back and forth [A] while checking for plays, roughness, or binding.
- ★ If bearing play, roughness, or binding is found, replace the bearing.



- Check the needle bearings [A] in the final gear case.
- The rollers in the needle bearing normally wear very little, and wear is difficult to measure. Instead of measuring, inspect the bearing for abrasion, color change, or other damage.
- ★ If the bearing is damaged, replace the rear final gear case.



#### *Oil Seal Inspection*

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

