FINAL REDUCTION/TRANSMISSION SYSTEM

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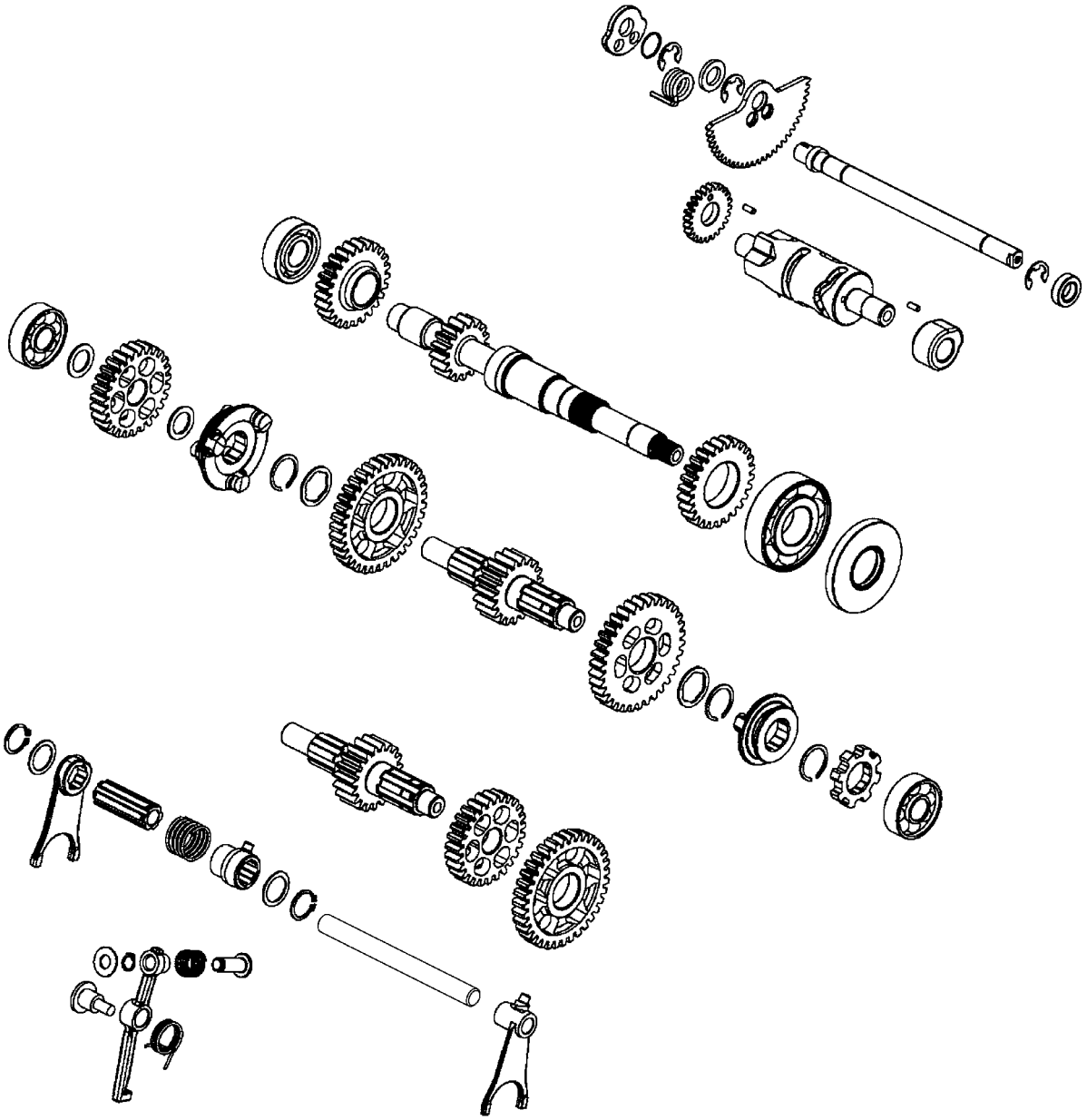
11



SERVICE INFORMATION

GENERAL INSTRUCTIONS

- The bevel gear and output shaft can be serviced with the engine installed in the frame.

SPECIAL TOOL

Y-type holder	A120E00056
Bearing puller	A120E00037
Bearing drive	A120E00014
Nut wrench	A120E00066

TORQUE VALUES

Crankcase bolt	1.2 kgf-m (12 N-m, 8.6 lbf-ft)	Apply engine oil
Drive bevel gear nut	14 kgf-m (140 N-m, 100.8 lbf-ft)	Apply engine oil
Driven bevel gear nut	14 kgf-m (140 N-m, 100.8 lbf-ft)	Apply engine oil
Stopper lever boss nut	3 kgf-m (30 N-m, 21.6 lbf-ft)	
Stopper lever bolt	2.5 kgf-m (25 N-m, 18 lbf-ft)	
Shift cam stopper plug	4.8 kgf-m (48 N-m, 35 lbf-ft)	
Output shaft bearing nut	11 kgf-m (110 N-m, 79.2 lbf-ft)	Apply engine oil

TROUBLESHOOTING

Engine starts but motorcycle won‘t move

- Damaged transmission
- Seized or burnt transmission

Oil leaks

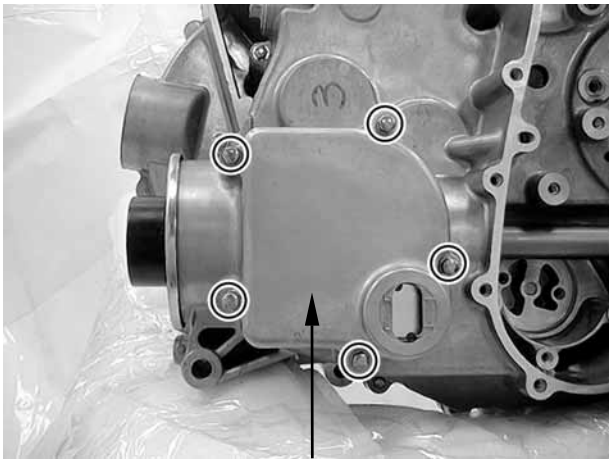
- Oil too rich
- Worn or damaged oil seal

SECONDARY DRIVE/DRIVEN BEVEL GEAR REMOVAL/INSPECTION/INSTALLATION

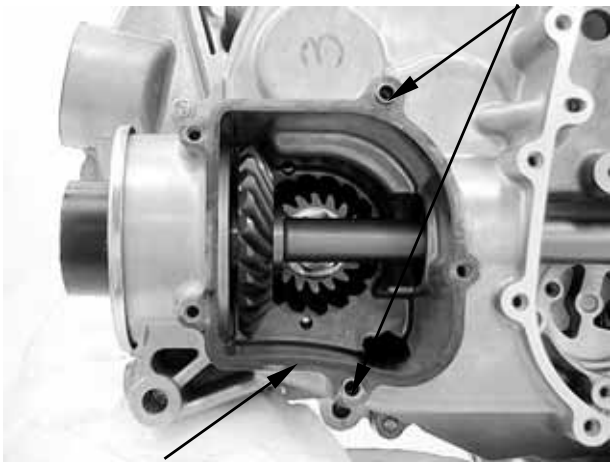
REMOVAL

Drain engine oil into a clean container. (Refer to the "**ENGINE OIL**" section in the chapter 3).
Move the engine assembly forward (refer to the "ENGINE REMOVAL" section in the chapter 6) or remove the rear propeller (refer to the "**REAR PROPELLER SHAFT DISASSEMBLY/INSPECTION/ ASSEMBLY**" section in the chapter 13).

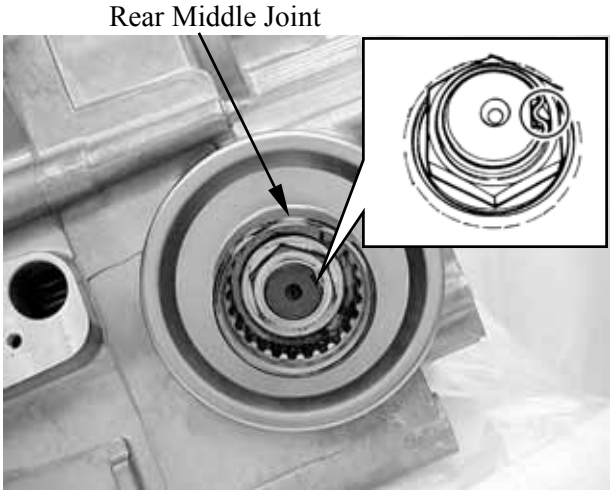
Remove the five bolts, then remove the bevel gear case cover.


Bevel Gear Case Cover

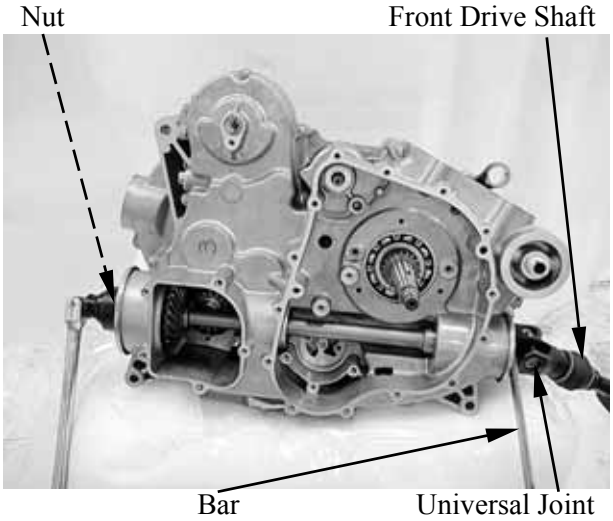
Remove the two dowel pins and gasket.



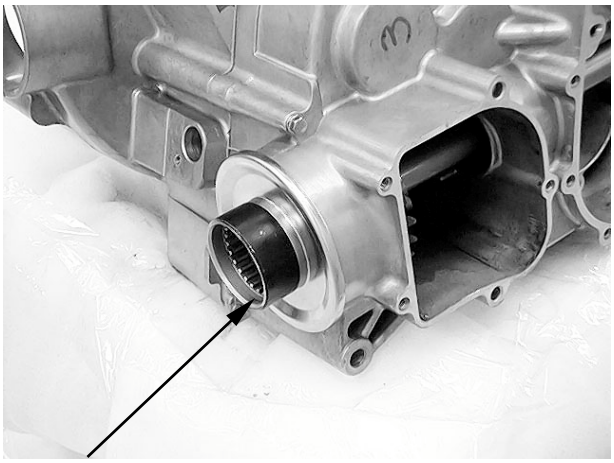
Using a chisel, unlock the nut in the rear middle joint.



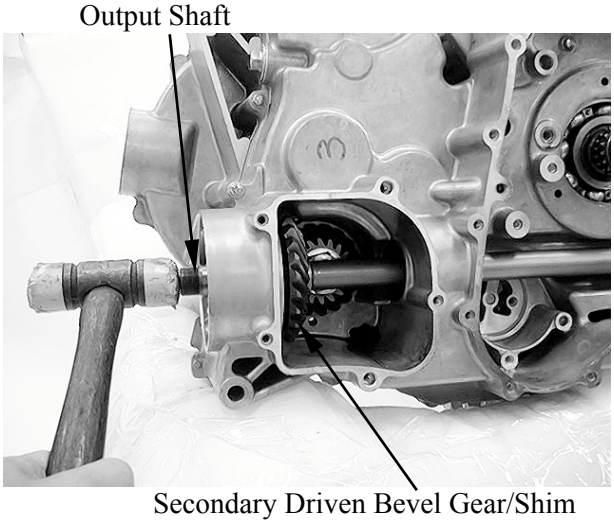
Install the front drive shaft.
Hold universal joint nut by using a suitable bar, then remove the rear propeller shaft nut.



Remove the rear middle joint.



Tap the output shaft by using a rubber hammer, then remove the output shaft, secondary driven bevel gear and shim.



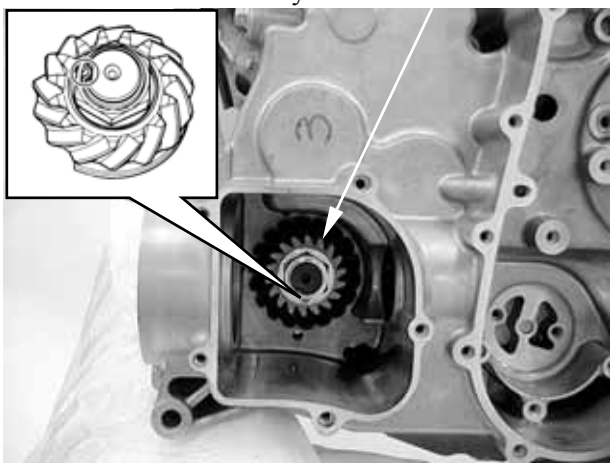
Using a chisel, unlock the nut.

Hold the driven pulley by using the special tool (refer to the "DRIVE PULLEY, DRIVE V-BELT AND DRIVEN PULLEY REMOVAL/INSPECTION/INSTALLATIO N" section in the chapter 10), then remove the nut.

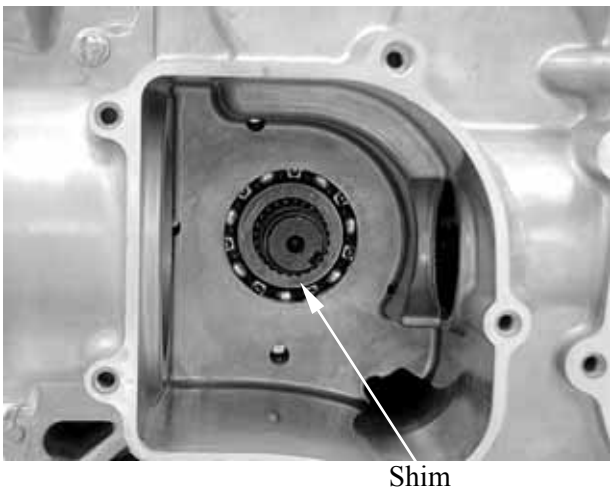
Special tool:
Y-type holder A120E00056

Remove the secondary drive bevel gear.

Secondary Drive Bevel Gear/Shim



Remove the shim.



Shim

INSPECTION

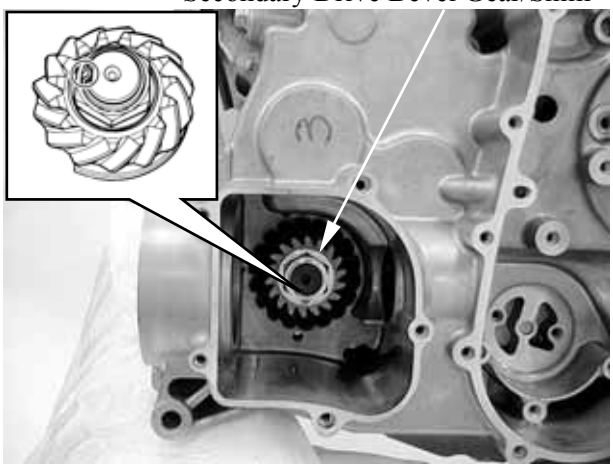
Check the drive/driven bevel gear teeth for pitting, galling and wear.

Inspect the rear middle joint splines for wear or damage.

Inspect the output shaft splines for wear or damage.

INSTALLATION

Secondary Drive Bevel Gear/Shim



Install the shim and secondary drive bevel gear.
Holder the driven pulley by using the special tool, then install and tighten the nut to the specified torque.

Torque:
14 kgf-m (140 N-m, 100.8 lbf-ft) Apply oil

Special tool:
Y-type holder A120E00056

Stake the nut with a center punch.

Install the output shaft, secondary driven bevel gear and shim

Install the rear middle joint.

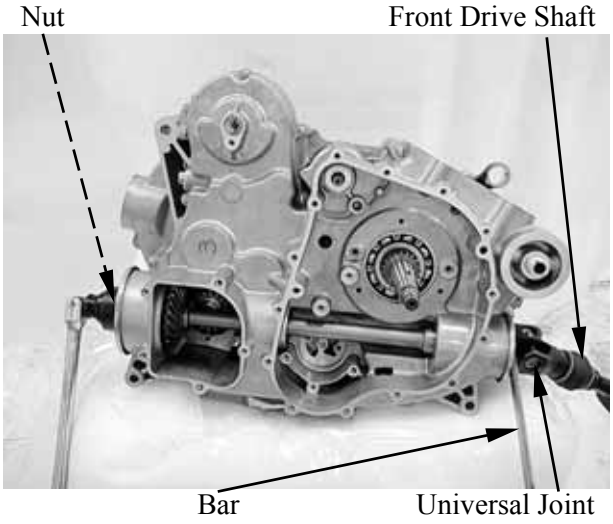
Install the front drive shaft.

Hold universal joint nut by using a suitable bar, then install and tighten the rear middle joint nut to the specified torque.

Torque:

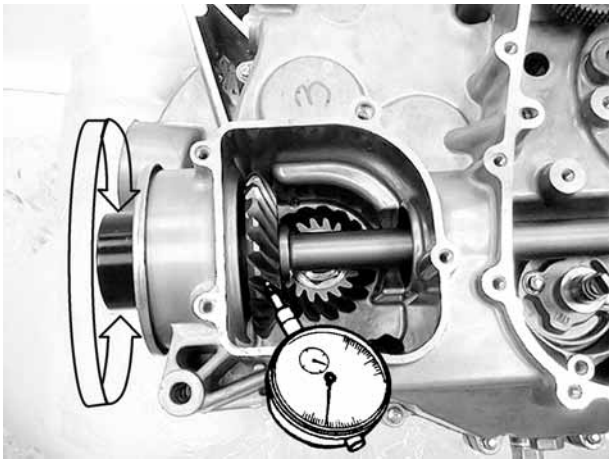
14 kgf-m (140 N-m, 100.8 lbf-ft) Apply oil

Remove the front drive shaft.



SECONDARY GEAR SHIMS ADJUSTMENT

Set a dial gauge on the driven bevel gear as shown.



Measure the backlash by turning the rear propeller shaft in each direction, reading the total backlash on the dial gauge. If the backlash is not within specification, the shim must be changed and the backlash should be rechecked until correct. Refer to the chart for appropriate shim thickness.

Bevel gear backlash

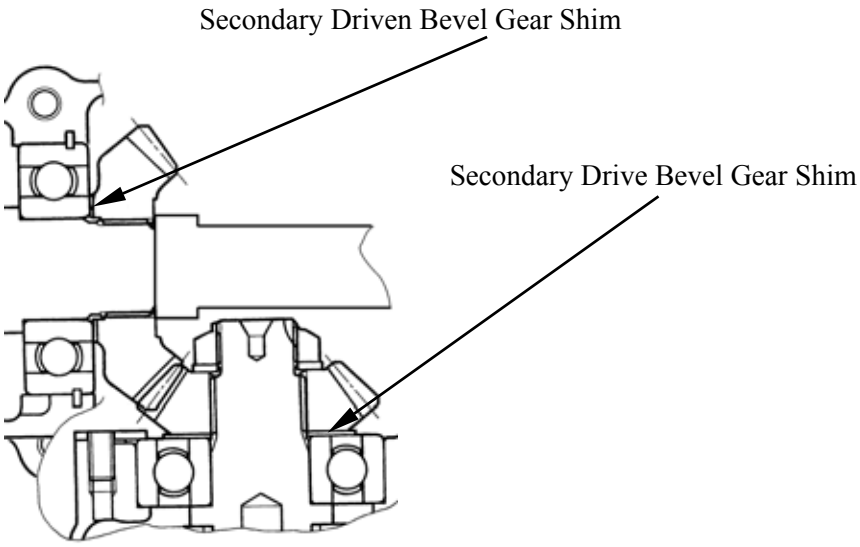
Standard: 0.03 - 0.15 mm (0.001 – 0.006 in)

* Adjust the backlash by referring to the chart at the right and using the thickness of the removed shims ad a guide.

Backlash	Shim adjustment
Under 0.03 mm (0.001 in)	Decrease shim thickness
0.03 – 0.15 mm (0.001 – 0.006 in)	Correct
Over 0.15 mm (0.006 in)	Increase shim thickness

Drive/Driven bevel gear shims:

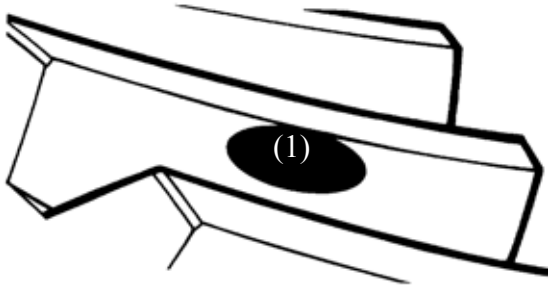
A: 0.6 mm (0.024 in)
B: 0.65 mm (0.026 in)
C: 0.7 mm (0.028 in)
D: 0.75 mm (0.03 in)
E: 0.8 mm (0.032 in)
F: 0.85 mm (0.034 in)
G: 0.9 mm (0.036 in)
H: 0.95 mm (0.038 in)
I: 1 mm (0.04 in)
J: 1.05 mm (0.042 in)
K: 1.1 mm (0.044 in)
L: 1.15 mm (0.046 in)

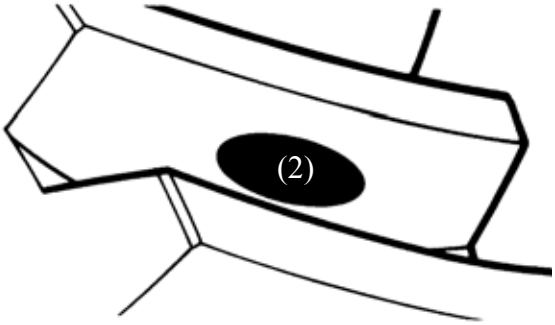


TOOTH CONTACT

After backlash adjustment is carried out, the tooth contact must be checked. Pay attention to the following procedures:

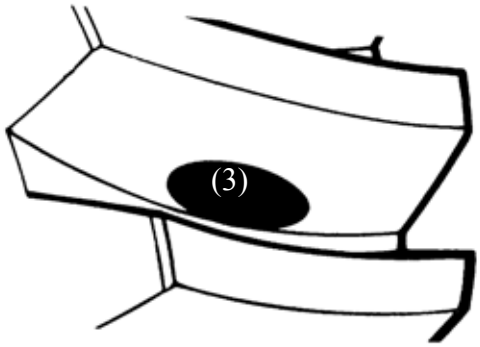
- Remove the driven bevel gear.
- Clean and degrease several teeth of the drive and driven bevel gears.
  Apply a coating of machinist's layout dye or paste to several teeth of the driven bevel gear.
- Install the driven bevel gear.
- Rotate the rear propeller shaft several turns in both directions.
- Remove the driven bevel gear and inspect the coated teeth of the drive bevel gear. The tooth contact pattern should be as shown in (1), (2) and (3).
- If tooth contact is found to be correct (example (2)), then to complete installation.





(1): Incorrect (contact at tooth top)
(2): Correct
(3): Incorrect (contact at tooth root)

- If tooth contact is found to be incorrect (examples (1) and (3)), the shim thickness between the drive bevel gear and driven bevel gear must be changed and the tooth contact rechecked until correct.



✳ Make sure to check the backlash after the tooth contact has been adjusted, since it may have changed. Adjust the tooth contact and backlash until they are both within specification. If the correct tooth contact cannot be maintained when adjusting the backlash, replace the drive and driven bevel gears.

Tooth contact	Drive bevel gear shim adjustment	Driven bevel gear shim adjustment
Contact at tooth top	Increase shim thickness	Increase shim thickness
Contact at tooth root	Decrease shim thickness	Decrease shim thickness

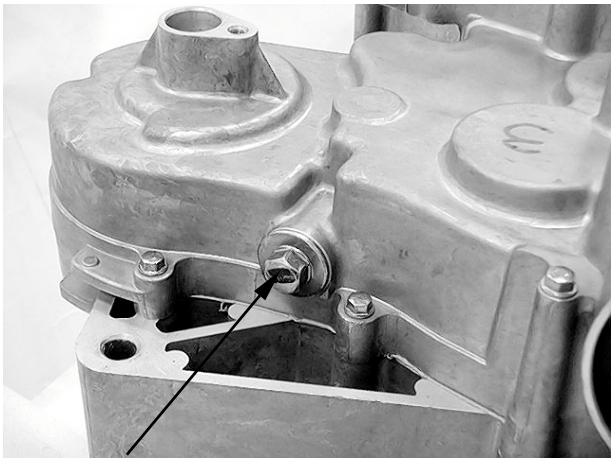
RIGHT CRANKCASE REMOVAL/INSTALLATION

REMOVAL

Remove the cam chain (refer to the "**CAM CHAIN REMOVAL/INSPECTION/ INSTALLATION**" section in the chapter 8)

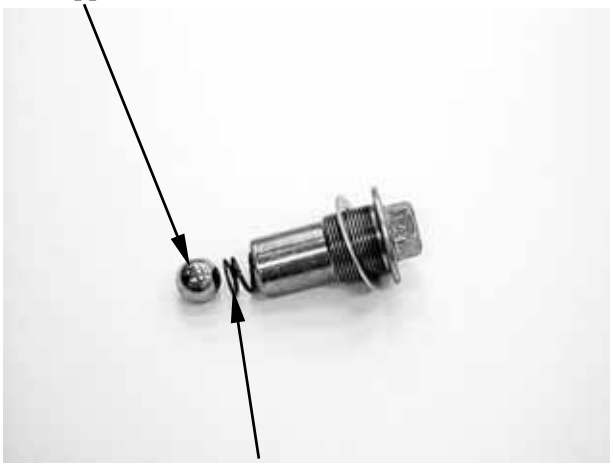
Remove the secondary drive and driven bevel gear (refer to the "**SECONDARY DRIVE/DRIVEN BEVEL GEAR REMOVAL/INSPECTION/ INSTALLATION**" section in this chapter).

Remove the stopper plug and washer.

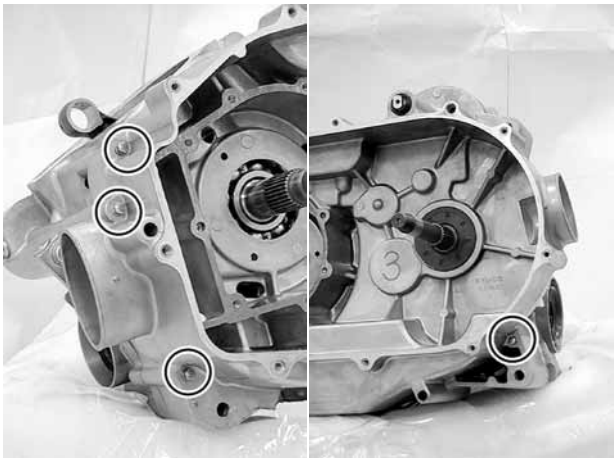


Stopper Plug

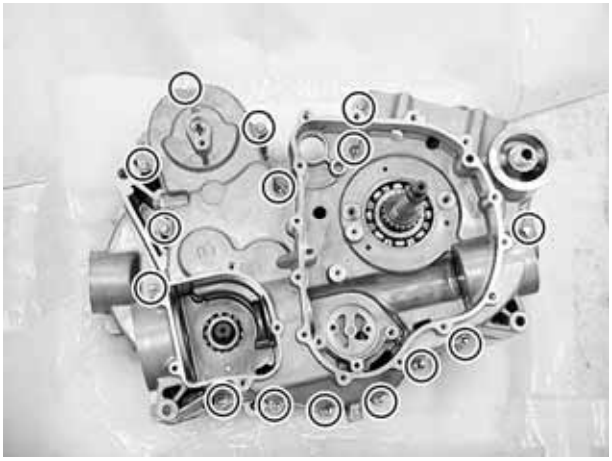
Remove the spring and shift cam stopper.



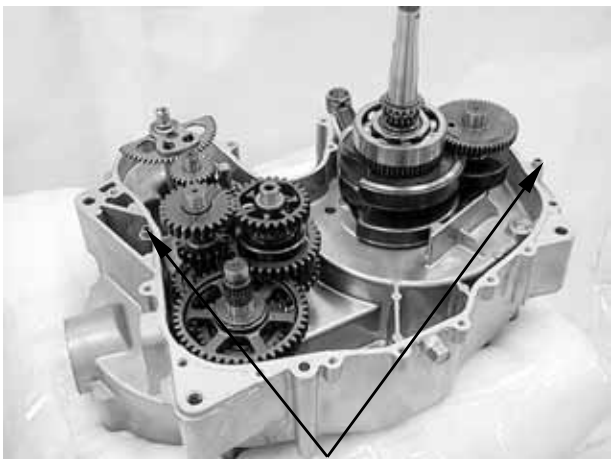
Remove the four bolts from left crankcase.



Remove the fifteen bolts from right crankcase.



Remove the two dowel pins.



Dowel Pins

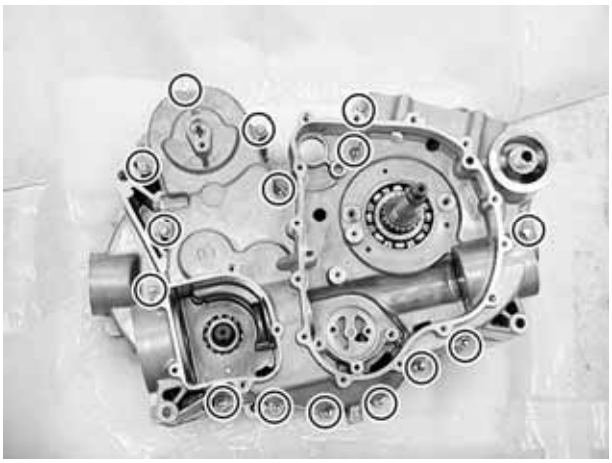
INSTALLATION

Apply a light but through coating of liquid gasket (Threebond 1215 or equivalent) to all crankcase mating surfaces except the oil passage area.

Install the right crankcase and tighten the bolts in a crisscross pattern in 2 or 3 steps.

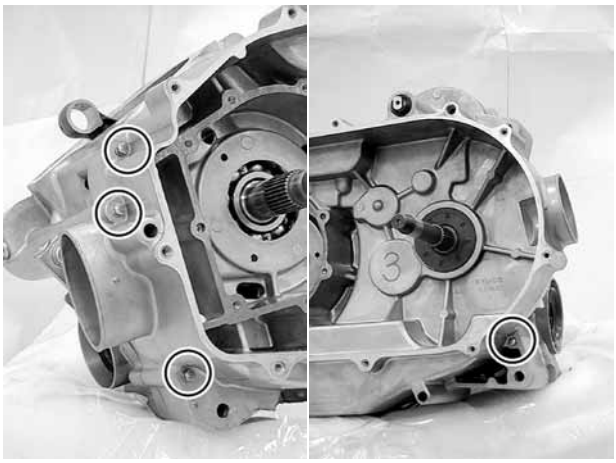
Torque:

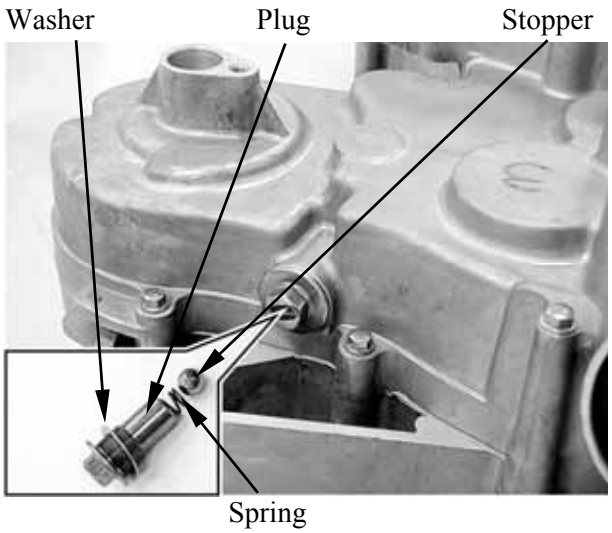
1.2 kgf-m (12 N-m, 8.6 lbf-ft) Apply oil



Install and tighten the bolts in a crisscross pattern in 2 or 3 steps

Torque:
1.2 kgf-m (12 N-m, 8.6 lbf-ft) Apply oil





Install the stopper, spring, washer and plug. Tighten the stopper plug to the specified torque.

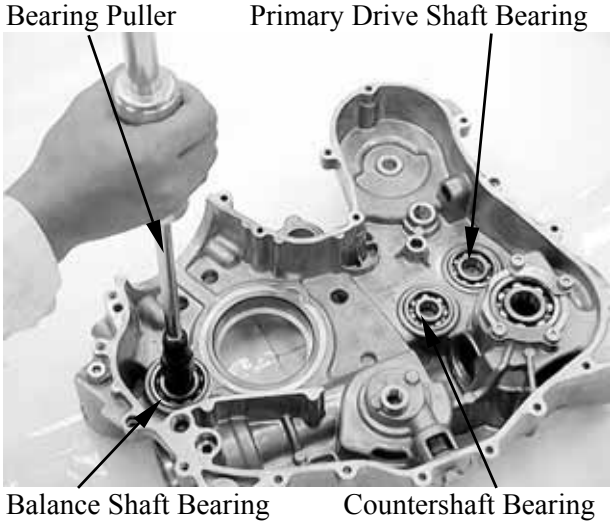
Torque: 4.8 kgf-m (48 N-m, 35 lbf-ft)

BEARING REPLACEMENT IN THE RIGHT CRANKCASE

BALANCE SHAFT/COUNTERSHAFT/ PRIMARY DRIVE SHAFT BEARING REPLACEMENT

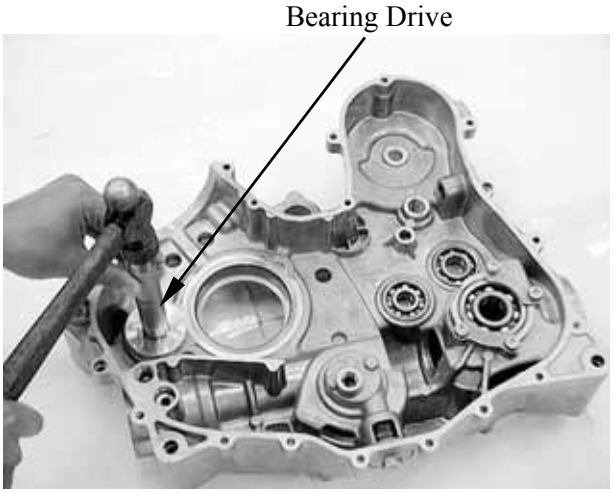
Remove the balance shaft/countershaft/primary drive shaft bearing by using the special tool.

Special tool:
Bearing puller A120E00037



Install the new balance shaft/countershaft/primary drive shaft bearing by using the special tool.

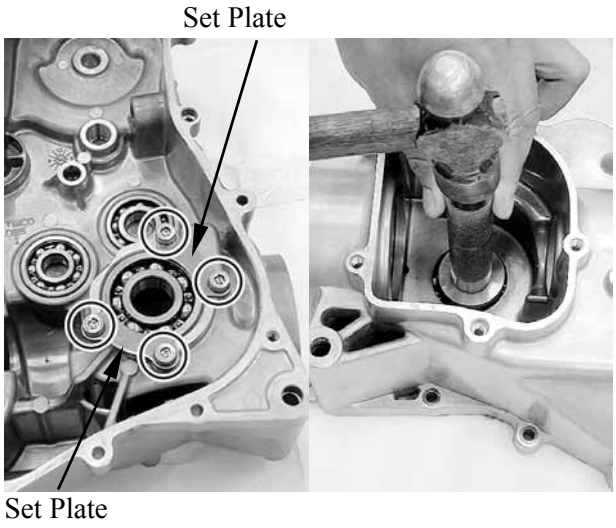
Special tool:
Bearing driver A120E00014



DRIVE SHAFT BEARING REPLACEMENT

Remove the four bolts and two set plates.

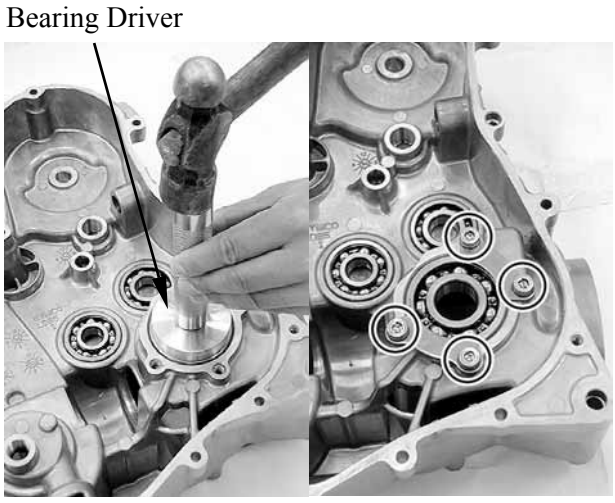
Remove the bearing.



Install the new bearing by using the special tool.

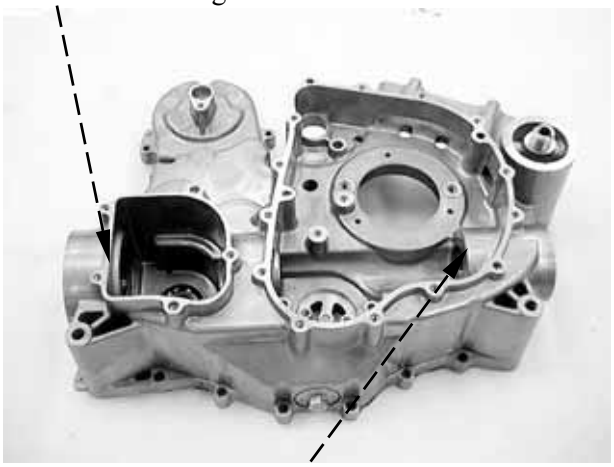
Special tool:
Bearing driver A120E00014

Install the set plates and tighten the new bolts.



OUTPUT SHAFT FRONT/REAR BEARING REPLACEMENT

✳ The output shaft bearings can be replaced when the crankcase is assembly.

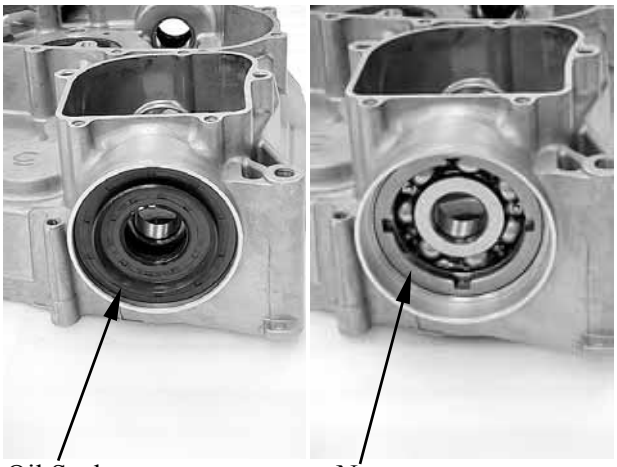


REAR SIDE BEARING

Remove the oil seal.

Remove the nut by using the special tool.

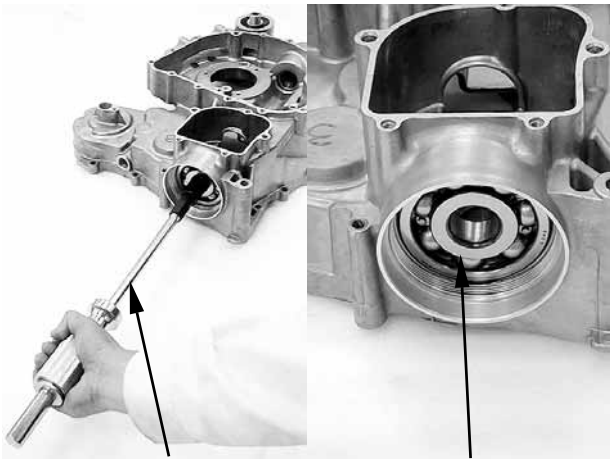
Special tool:
Nut wrench A120E00066



Remove the bearing by using the special tool.

Special tool:
Bearing Puller A120E00037

Install the new bearing.

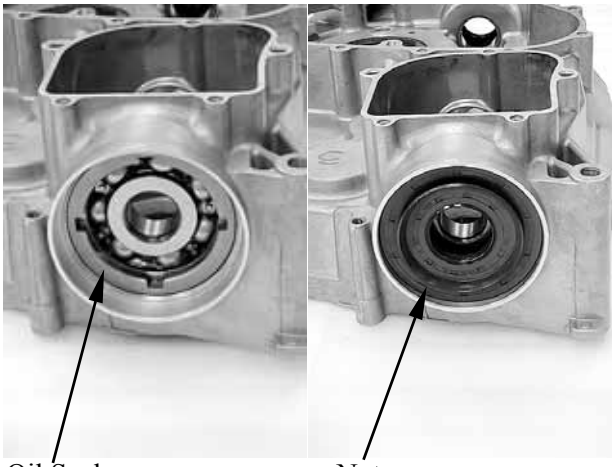


Install and tighten the nut to the specified torque by using the special tool.

Torque: 11 kgf-m (110 N-m, 79.2 lb-ft)

Special tool:
Nut wrench A120E00066

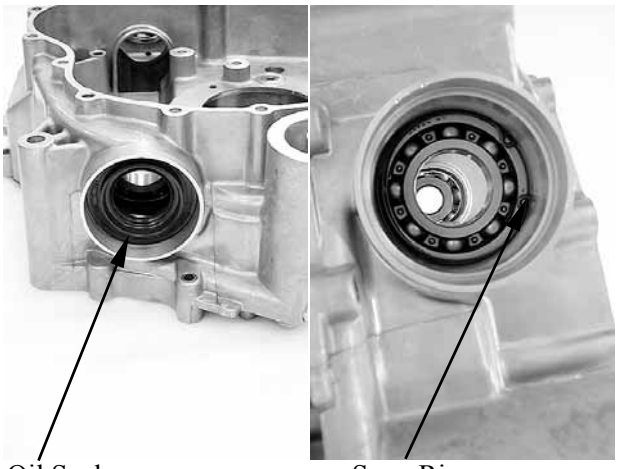
Apply clean engine oil to the new oil seal lip then install the oil seal.



FRONT SIDE BEARING

Remove the oil seal.

Remove the snap ring.

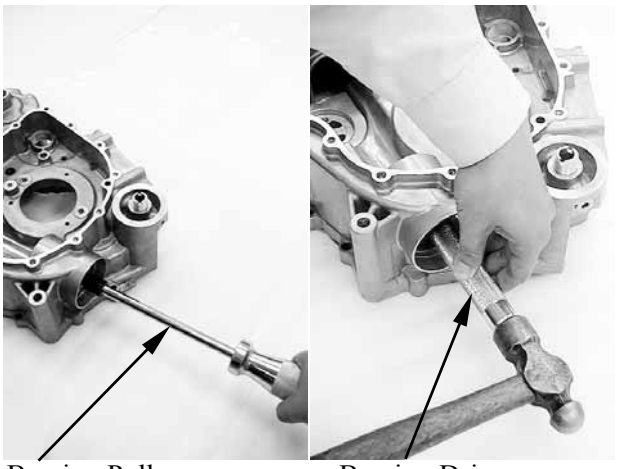


Remove the bearing by using the special tool.

Special tool:
Bearing Puller A120E00037

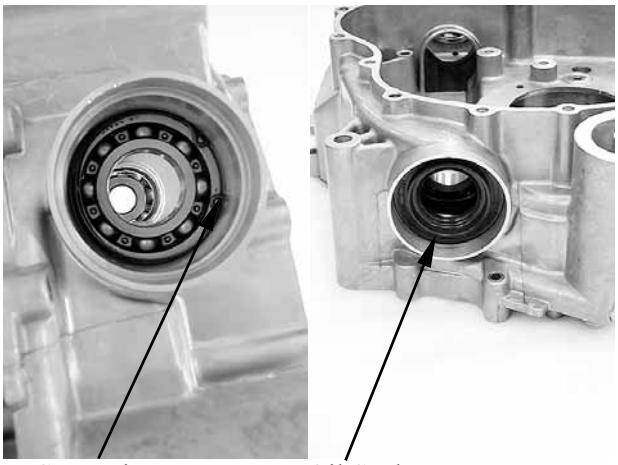
Install the new bearing by using the special tool.

Special tool:
Bearing driver A120E00014



Install the snap ring.

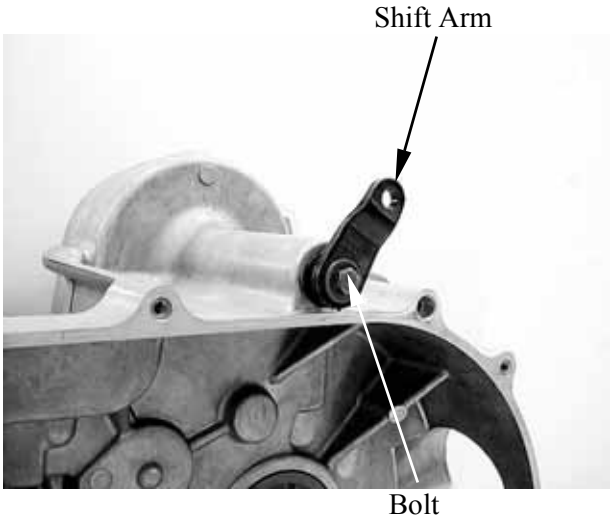
Apply clean engine oil to the new oil seal lip then install the new seal.



TRANSMISSION REMOVAL/INSPECTION/ INSTALLATION

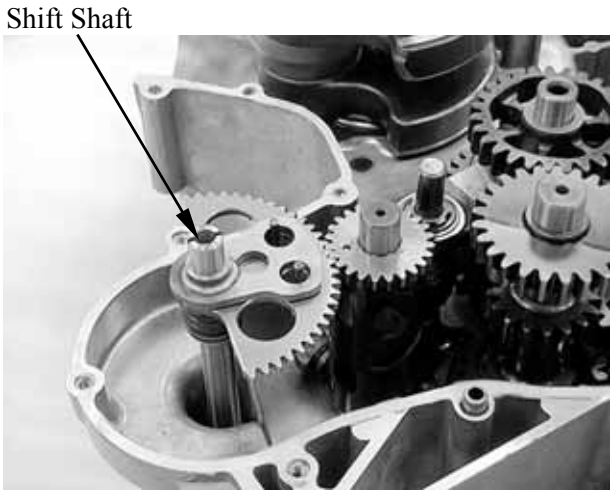
REMOVAL

Remove the bolt and then remove the shift arm.



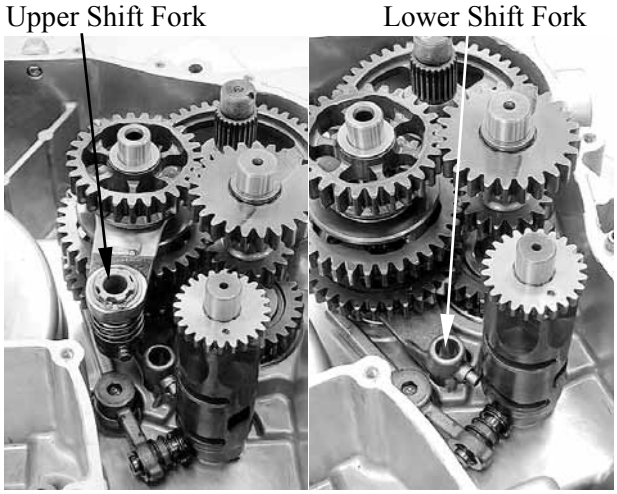
Remove the right crankcase (refer to the "**RIGHT CRANKCASE REMOVAL/INSTALLATION**" section in this chapter)

Remove the shift shaft.

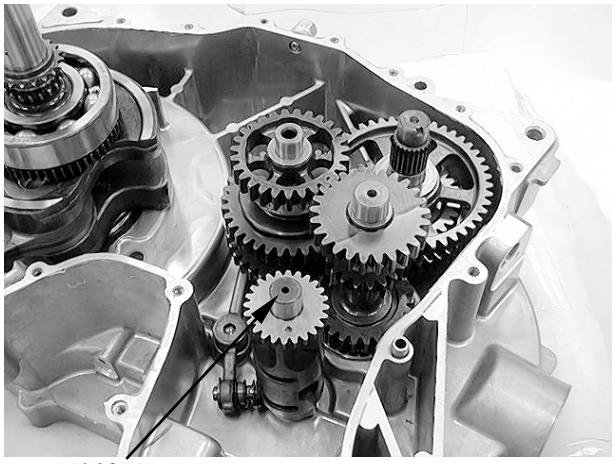


Remove the transmission guide bar.

Remove the upper shift fork.
Remove the lower shift fork.



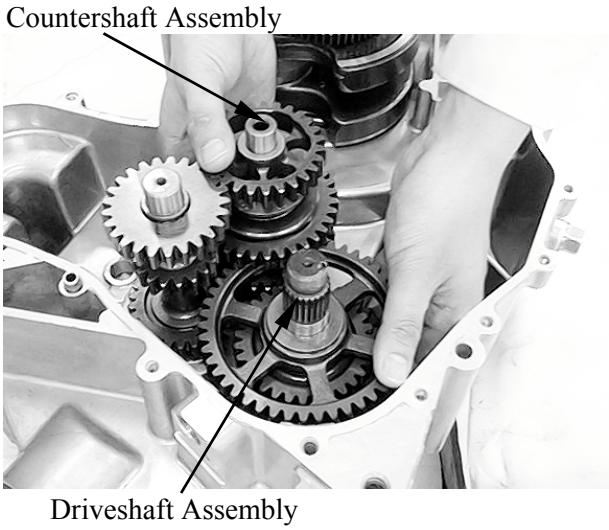
Remove the shift cam.



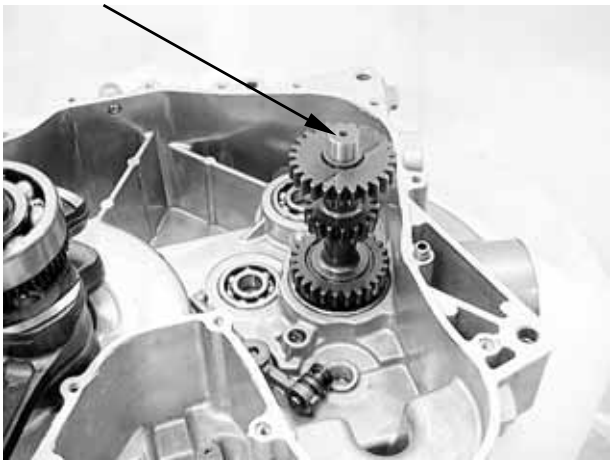
Remove the countershaft and driveshaft as an assembly.

Disassemble the countershaft and the driveshaft.

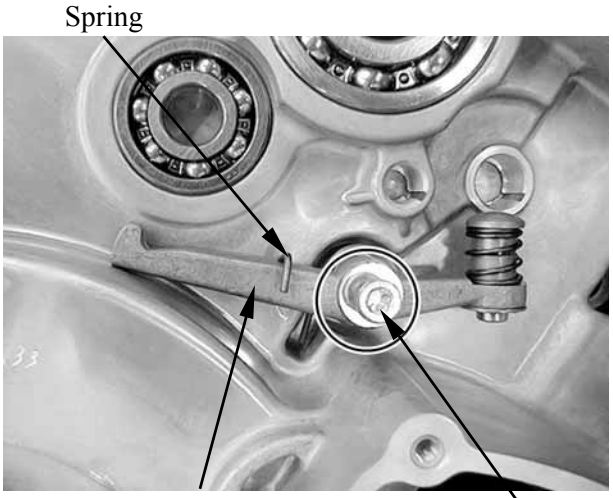
✳ Keep track of the disassembled parts (gears, washer and clip) by stacking them on a tool or slipping them onto a piece of wire.



Remove the primary drive shaft.



Remove the bolt/washer, then remove the stopper lever and spring.



INSPECTION

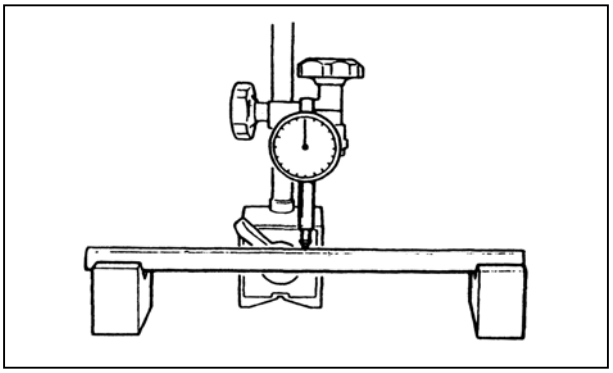
Guide bar

Measure the guide bar runout.
Out of specification → Replace.

Service Limit:

Less than 0.03 mm (0.0012 in)

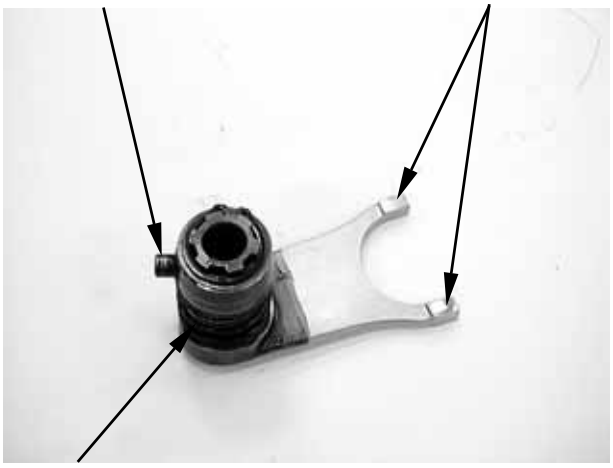
✳ Do not attempt to straighten a bent guide bar.



Upper shift fork

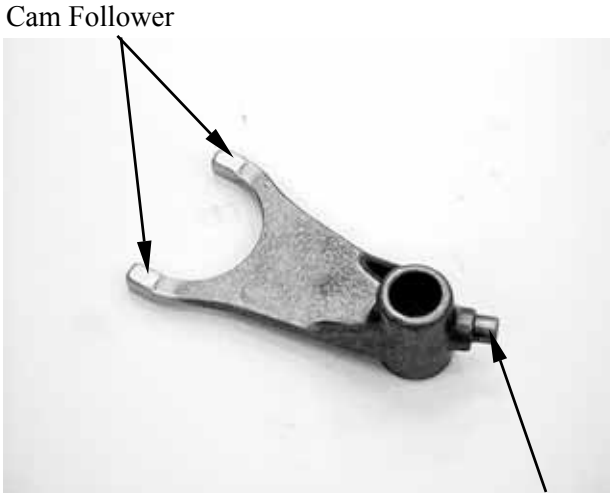
Inspect the shift fork cam follower and shift fork pawl.
Scoring/beads/wear → Replace a set.

Inspection the spring.
Cracks or damage→ Replace a set..



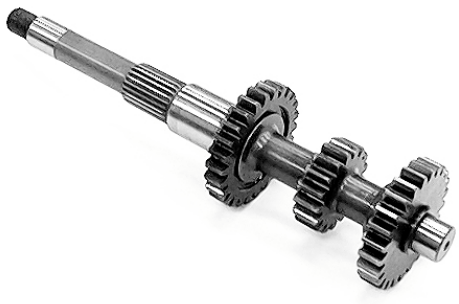
Lower shift fork

Inspect the shift fork cam follower and shift fork pawl.
Scoring/beads/wear → Replace.



Primary drive shaft

Check the gear teeth for blue discoloration, pitting or wear.



Stopper lever

Check the stopper lever pawl for bends, damage or wear.

Inspect the spring for cracks or damage.

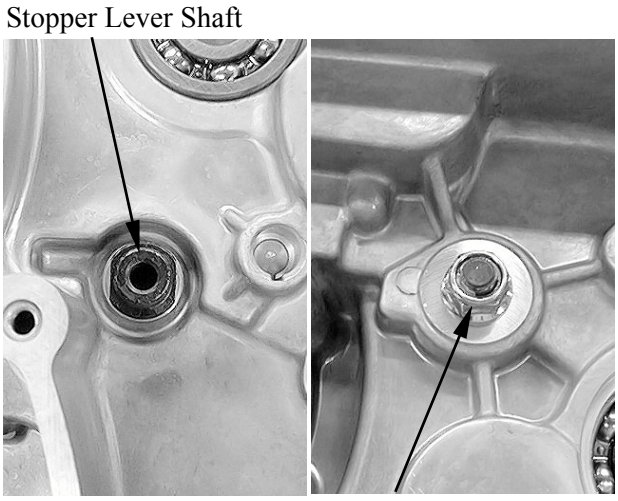
Check the shift cam groove and shift cam gear.
Wear or damage → Replace.

Inspect shift shaft gear.
Damage → Replace.
Inspect shift shaft.
Damage/bends/wear → Replace.
Check the return spring for fatigue or damage.

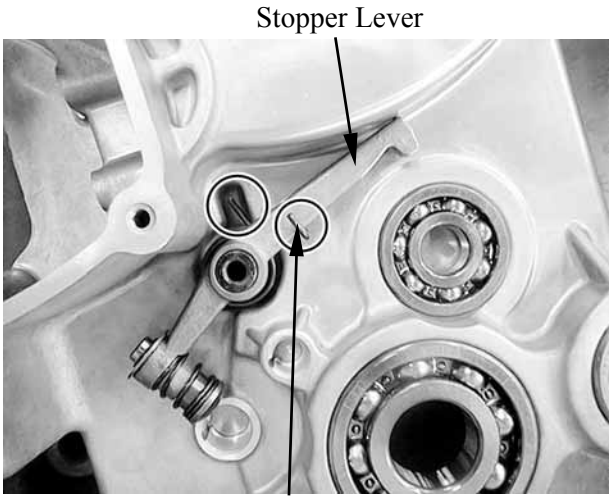
INSTALLATION

Make sure the shaft nut specified torque in the V-belt compartment while holds the stopper lever shaft.

Torque: 3 kgf-m (30 N-m, 21.6 lbf-ft)



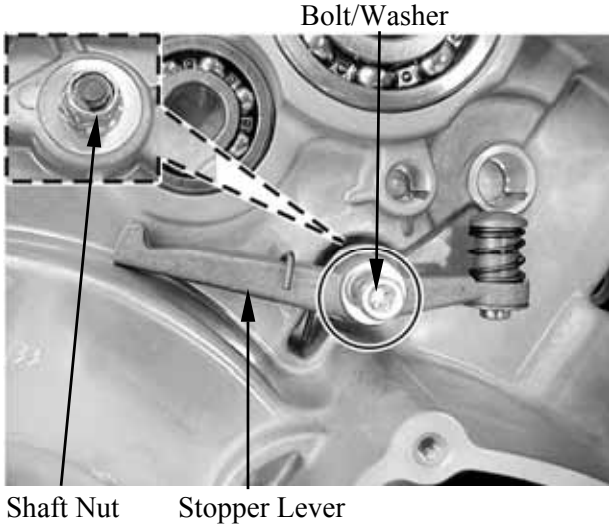
Hook the spring onto the hook part of the stopper lever, squeeze the spring in to the groove of the left crankcase.



Install the washer and a new bolt.

Tighten the bolt to the specified torque while holds the shaft nut in the drive V-belt compartment.

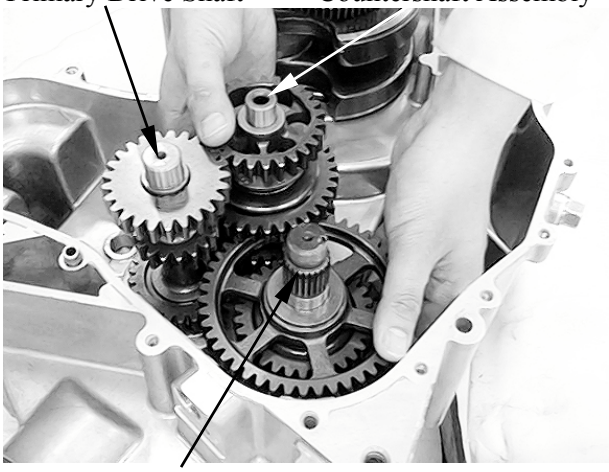
Torque: 2.5 kgf-m (25 N-m, 18 lbf-ft)



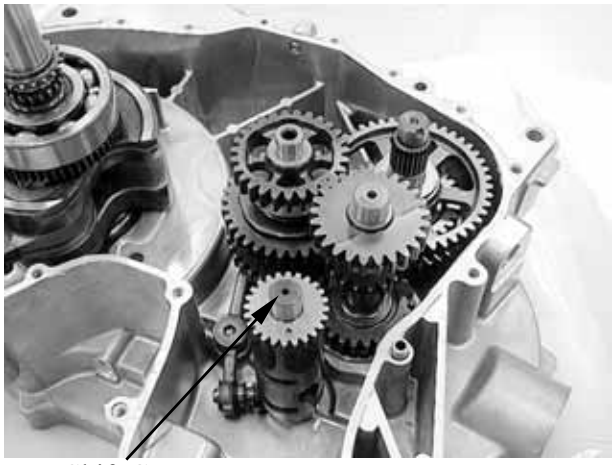
Apply clean engine oil to the countershaft assembly, driveshaft assembly and primary drive shaft.

Install the primary drive shaft.

Install the countershaft and drive shaft assemblies as a set into the left crankcase.



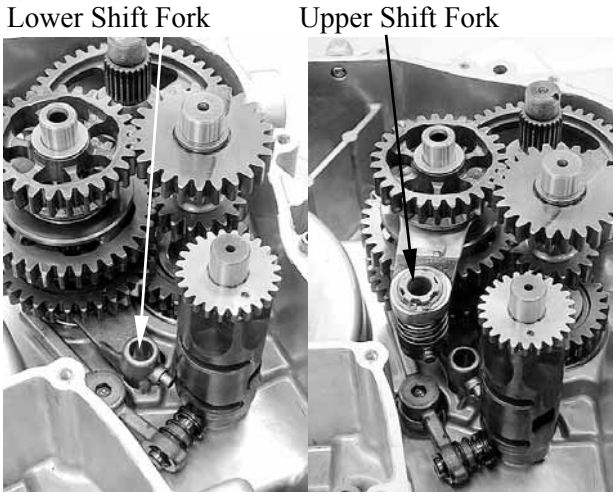
Apply clean engine oil to the shift cam, then install the shift cam.



Apply clean engine oil to the gearshift fork, sliding surface and gearshift fork pawl.

Install the lower gearshift fork into the clutch dog (countershaft) and shift cam grooves with its “LDB5” mark facing down.

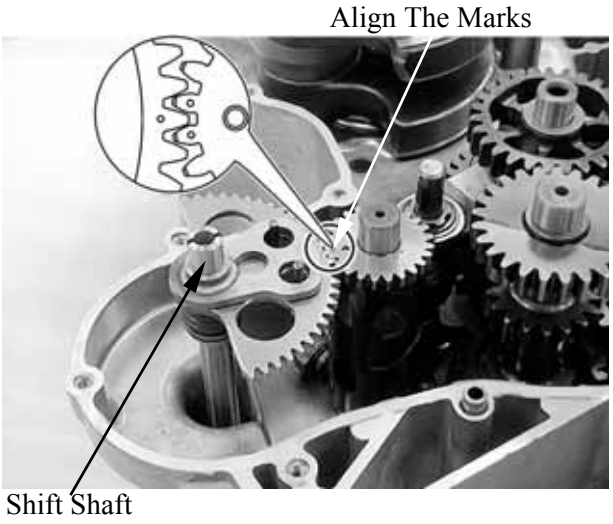
Install the upper gearshift fork into the clutch dog (countershaft) and shift cam grooves with its “LDB5” mark facing up.



Apply clean engine oil to the guide bar, install the guide bar.

Install the shift shaft.

* Align the mark on the shift shaft gear with the mark on the shift cam gear.



Check the transmission operation.
Unsmooth operation → Repair.

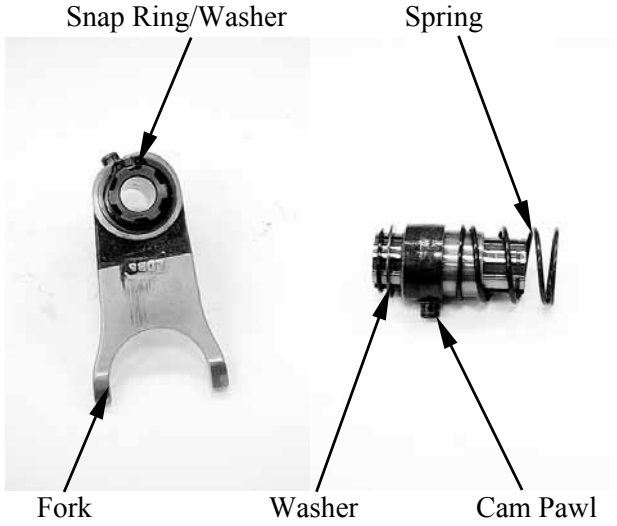
UPPER SHIFT FORK DISASSEMBLY/ASSEMBLY

DISASSEMBLY

Remove the upper shift fork (refer to the "**TRANSMISSION REMOVAL/INSPECTION/ INSTALLATION**" section in this chapter)

Remove the snap ring, washer and fork.

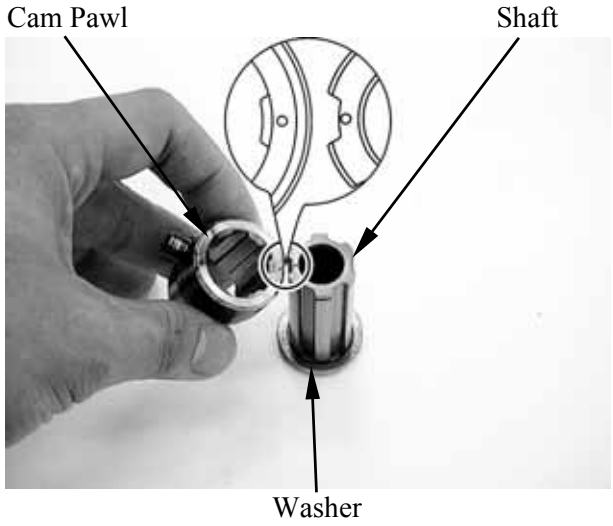
Remove the spring, cam pawl and washer.



ASSEMBLY

Install the washer and cam pawl.

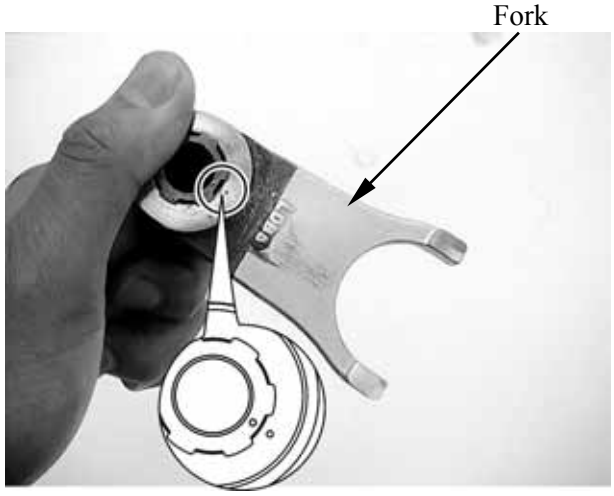
* Align the mark on the cam pawl with the mark on the shaft.



Install the spring.
Install the fork.

* Align the mark on the fork with the mark on the shaft.

Install the washer and snap ring.



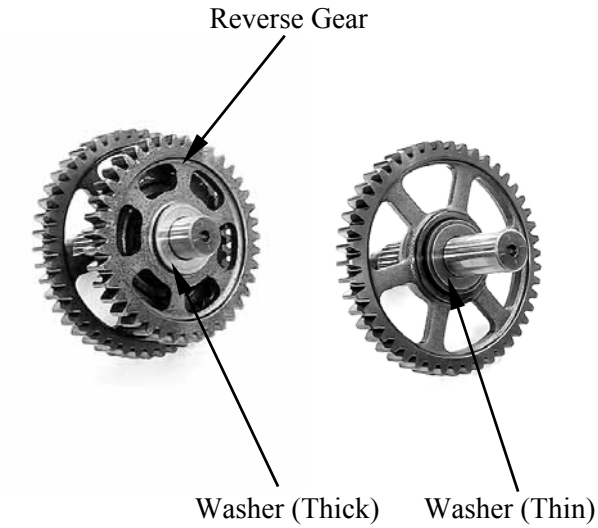
DRIVE SHAFT DISASSEMBLY/ASSEMBLY/ INSPECTION

DISASSEMBLY

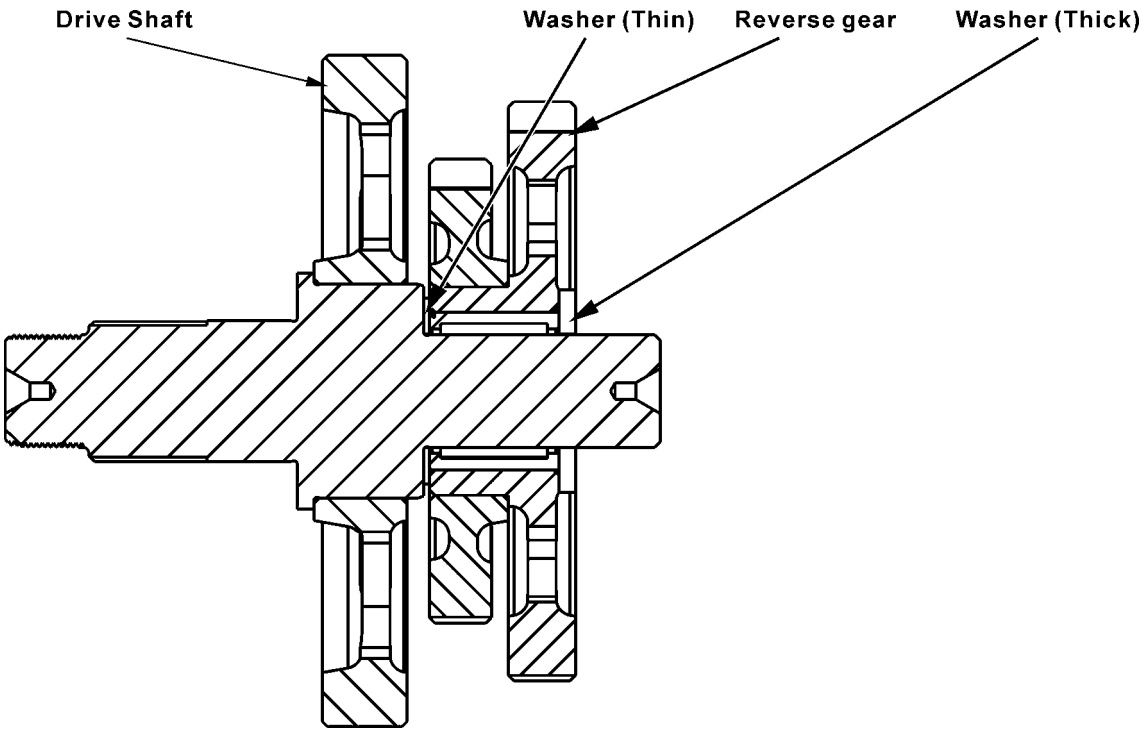
Remove the drive shaft assembly (refer to the "**TRANSMISSION REMOVAL/INSPECTION/ INSTALLATION**" section in this chapter).

Remove the washer (thick) and reverse gear.

Remove the washer (thin).



ASSEMBLY/INSPECTION



Inspect the gear teeth.
Blue discoloration/pitting/wear → Replace.

Inspect the needle bearing in the reverse gear.
Wear/damage → Replace.

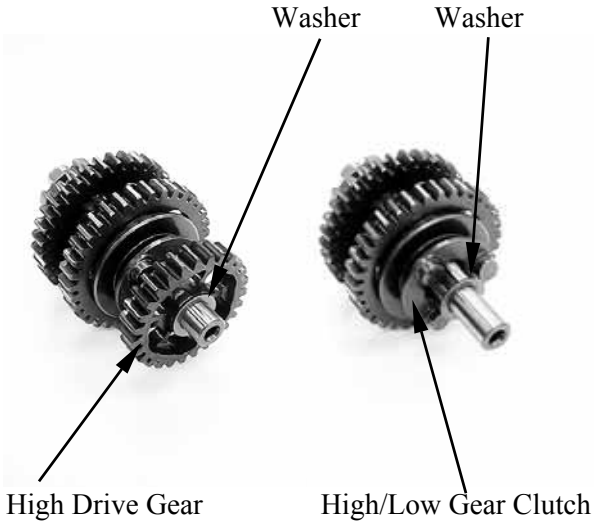
COUNTERSHAFT DISASSEMBLY/ASSEMBLY/ INSPECTION

DISASSEMBLY

Remove the countershaft assembly (refer to the "**TRANSMISSION REMOVAL/INSPECTION/ INSTALLATION**" section in this chapter).

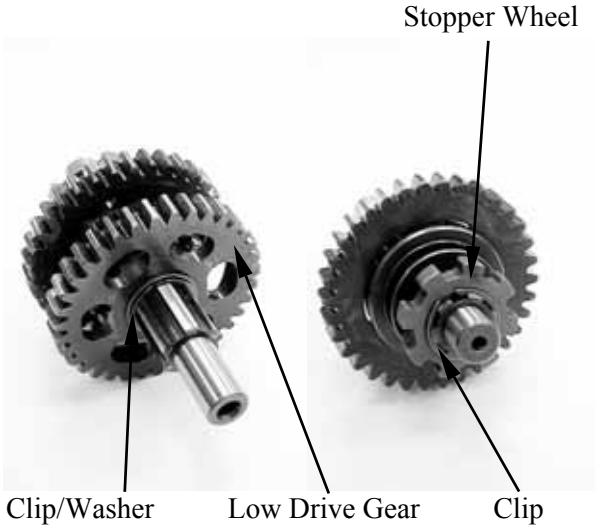
Remove the washer and high drive gear.

Remove the high/low gear clutch dog



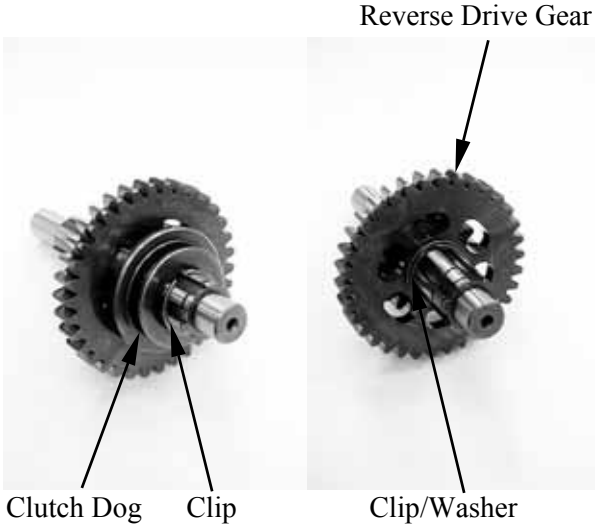
Remove the clip, then remove the washer and low drive gear.

Remove the clip, then remove the stopper wheel.

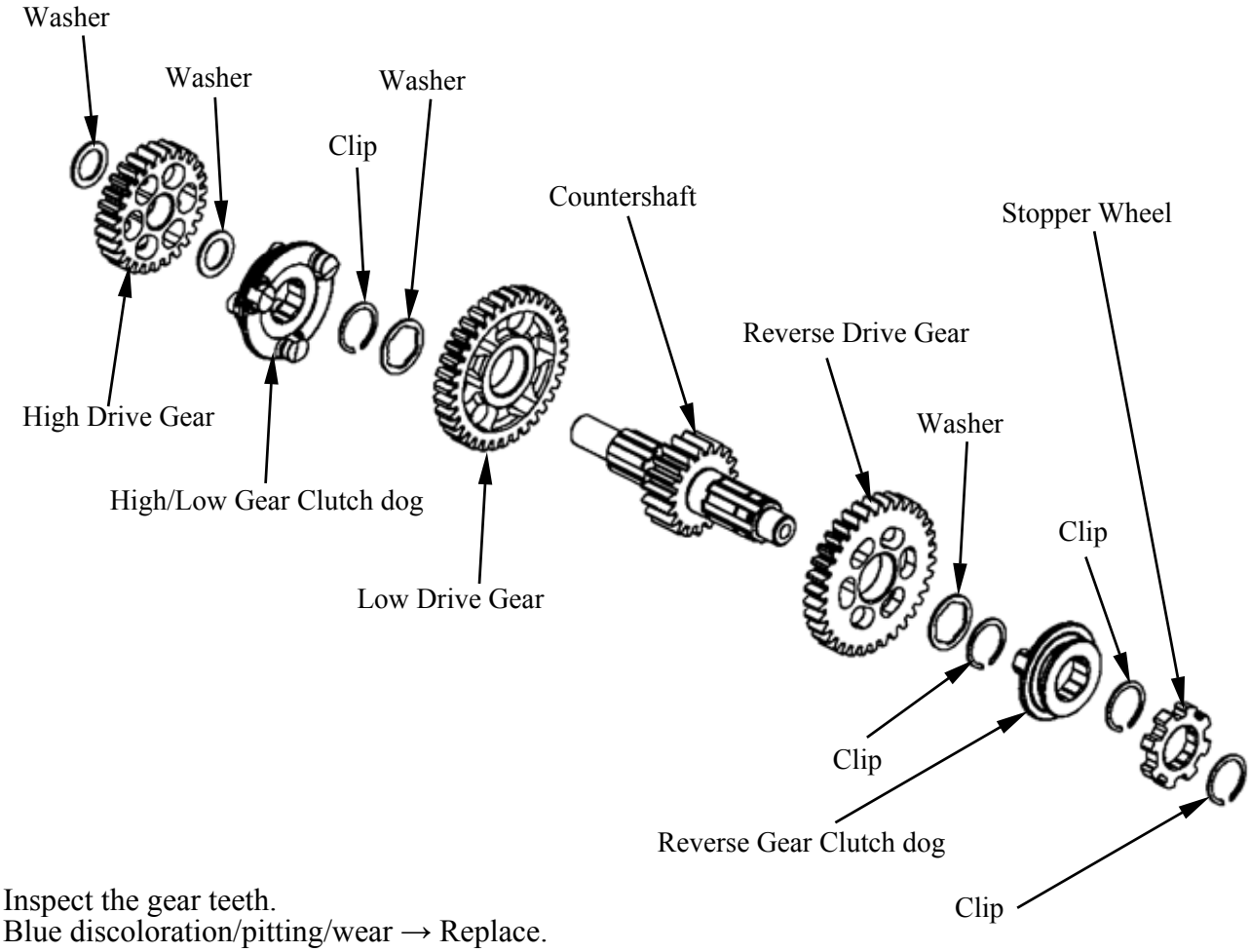


Remove the clip, then remove reverse gear clutch dog.

Remove the clip, then remove the washer and reverse drive gear.



ASSEMBLY/INSPECTION



Inspect the gear teeth.
Blue discoloration/pitting/wear → Replace.

Inspect the mated dogs.
Rounded edges/cracks/missing portions
→ Replace.