

## 12. CRANKCASE/TRANSMISSION

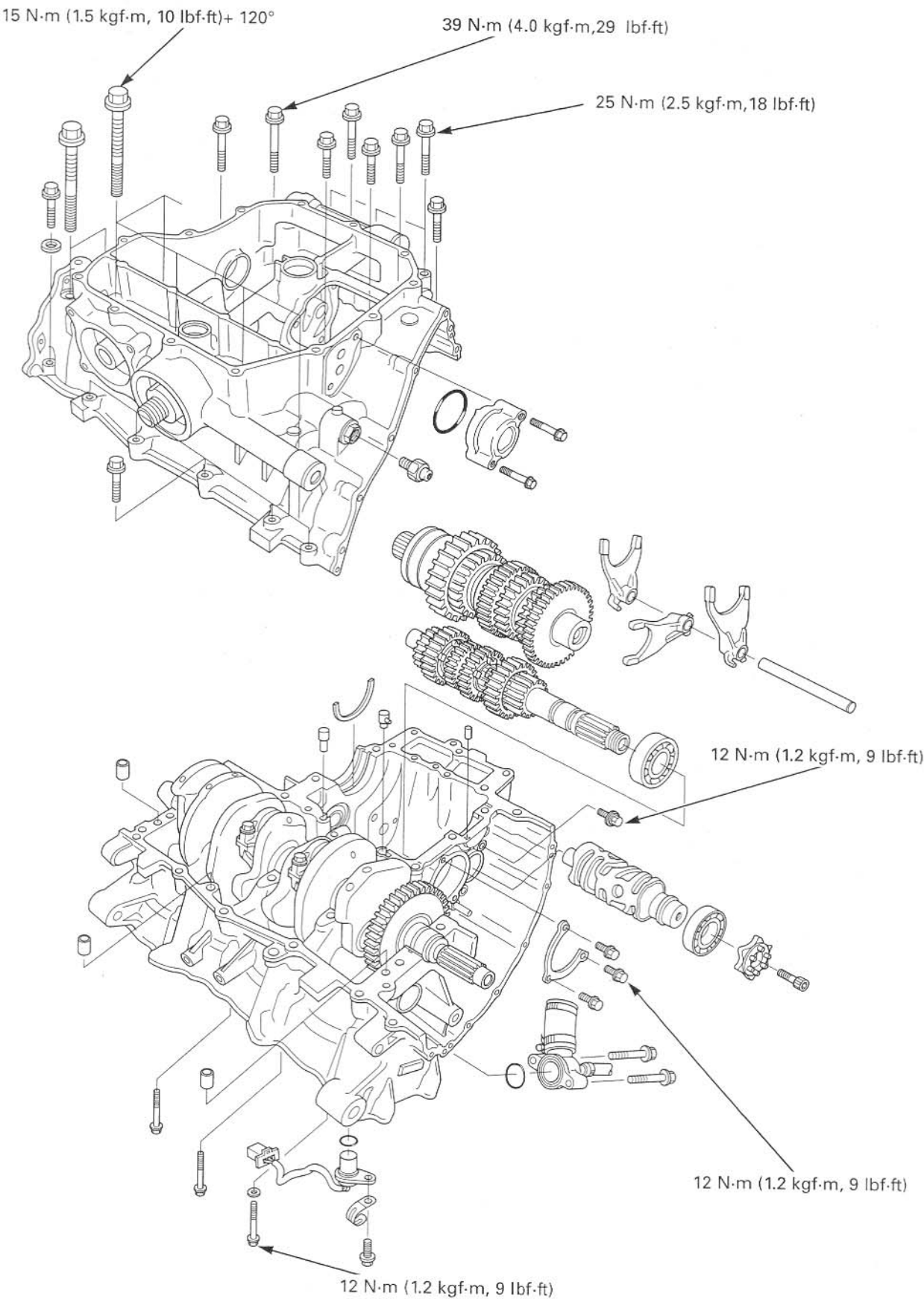
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**CRANKCASE/TRANSMISSION**

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**COMPONENT LOCATION**



## SERVICE INFORMATION

### GENERAL

- The crankcase must be separated to service the following:
  - Transmission
  - Crankshaft (page 13-5)
  - Piston/connecting rod/cylinder (page 13-13)
- The following components must be removed before separating the crankcase:
  - Engine (page 8-5)
  - Clutch (page 10-7)/gearshift linkage (page 10-22)
  - Starter clutch (page 10-17)
  - Flywheel (page 11-5)
  - Cylinder head (page 9-13)
  - Oil pan (page 5-6), oil pump (page 5-8) and oil cooler (page 5-12)
  - Starter motor (page 19-6)
  - Water pump (page 7-15)
- Be careful not to damage the crankcase mating surfaces when servicing.
- Prior to assembling the crankcase halves, apply sealant to their mating surfaces. Wipe off excess sealant thoroughly.

### SPECIFICATIONS

Unit: mm (in)

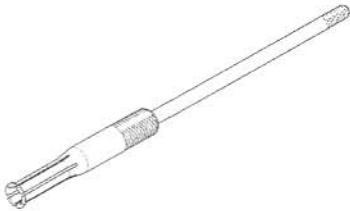
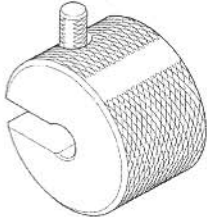
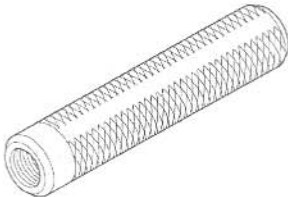
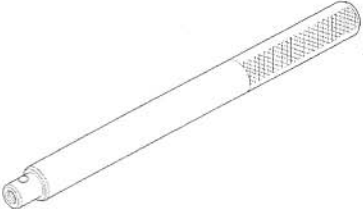
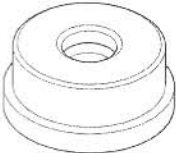

ITEM			STANDARD	SERVICE LIMIT
Shift fork	I.D.		12.000 – 12.018 (0.4724 – 0.4731)	12.03 (0.474)
	Claw thickness		5.93 – 6.00 (0.233 – 0.236)	5.9 (0.23)
Shift fork shaft O.D.			11.957 – 11.968 (0.4707 – 0.4712)	11.95 (0.470)
Transmission	Gear I.D.	M5, M6	28.000 – 28.021 (1.1024 – 1.1032)	28.04 (1.104)
		C1	24.000 – 24.021 (0.9449 – 0.9457)	26.04 (1.025)
		C2, C3, C4	31.000 – 31.025 (1.2205 – 1.2215)	31.04 (1.222)
	Gear busing O.D.	M5, M6	27.959 – 27.980 (1.1007 – 1.1016)	27.94 (1.100)
		C2	30.955 – 30.980 (1.2187 – 1.2197)	30.94 (1.218)
		C3, C4	30.950 – 30.975 (1.2185 – 1.2195)	30.93 (1.218)
	Gear-to-bushing clearance	M5, M6	0.020 – 0.062 (0.0008 – 0.0024)	0.10 (0.004)
		C2	0.020 – 0.070 (0.0008 – 0.0028)	0.10 (0.004)
		C3, C4	0.025 – 0.075 (0.0010 – 0.0030)	0.11 (0.004)
	Gear bushing I.D.	M5	24.985 – 25.006 (0.9837 – 0.9845)	25.016 (0.9849)
		C2	27.985 – 28.006 (1.1018 – 1.1026)	28.021 (1.1032)
	Mainshaft O.D.	at M5	24.967 – 24.980 (0.9830 – 0.9835)	24.96 (0.983)
	Countershaft O.D.	at C2	27.967 – 27.980 (1.1011 – 1.1016)	27.96 (1.101)
	Bushing to shaft clearance	M5	0.005 – 0.039 (0.0002 – 0.0015)	0.06 (0.002)
		C2	0.005 – 0.039 (0.0002 – 0.0015)	0.06 (0.002)

### TORQUE VALUES

Mainshaft bearing set plate bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	Apply a locking agent to the threads
Gearshift drum bearing set bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	
Lower crankcase sealing bolt	28 N·m (2.8 kgf·m, 20 lbf·ft)	See page 12-16: replace with a new one
Crankcase 6 mm bolt	12 N·m (1.2 kgf·m, 9 lbf·ft)	
8 mm bolt	25 N·m (2.5 kgf·m, 18 lbf·ft)	
8 mm bolt (main journal bolt)	15 N·m (1.5 kgf·m, 10 lbf·ft) + 120°	
10 mm bolt	39 N·m (4.0 kgf·m, 29 lbf·ft)	
Neutral switch	12 N·m (1.2 kgf·m, 9 lbf·ft)	

## CRANKCASE/TRANSMISSION

### TOOLS

<p>Bearing remover set, 20 mm 07936-3710600</p> 	<p>Remover weight 07741-0010201</p>  <p>or 07936-371020A (U.S.A. only)</p>	<p>Remover handle 07936-3710100</p> 
<p>Driver 07949-3710001</p> 	<p>Attachment, 42 x 47 mm 07746-0010300</p> 	<p>Pilot, 20 mm 07746-0040500</p> 

## TROUBLESHOOTING

### Hard to shift

- Improper clutch operation
- Incorrect engine oil weight
- Bent shift fork
- Bent shift fork shaft
- Bent shift fork claw
- Damaged shift drum cam groove
- Bent gearshift spindle

### Transmission jumps out of gear

- Worn gear dogs
- Worn gear shifter groove
- Bent shift fork shaft
- Broken shift drum stopper arm (page 10-23)
- Broken shift drum stopper arm spring (page 10-23)
- Worn or bent shift forks
- Broken gearshift spindle return spring (page 10-23)

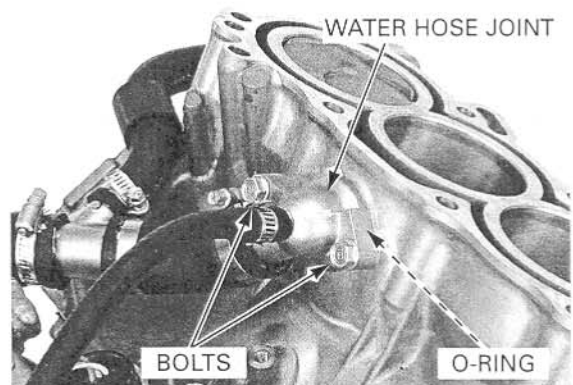
### Excessive engine noise

- Worn or damaged transmission gear
- Worn or damaged transmission bearings

## CRANKCASE SEPARATION

Refer to Service Information See page 12-3 for removal of necessary parts before separating the crankcase.

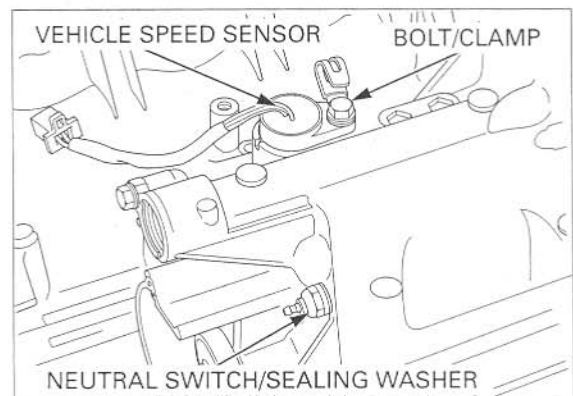
Remove the bolts, water hose joint and O-ring.



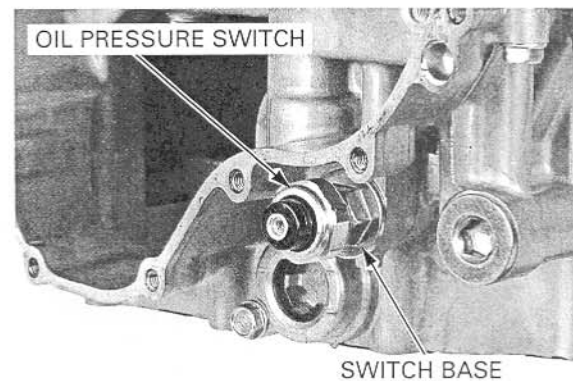
*Remove the vehicle speed sensor before separating the crankcase. Do not separate or assemble the crankcase with the vehicle speed sensor installed.*

Remove the bolt, clamp and vehicle speed sensor from the crankcase.

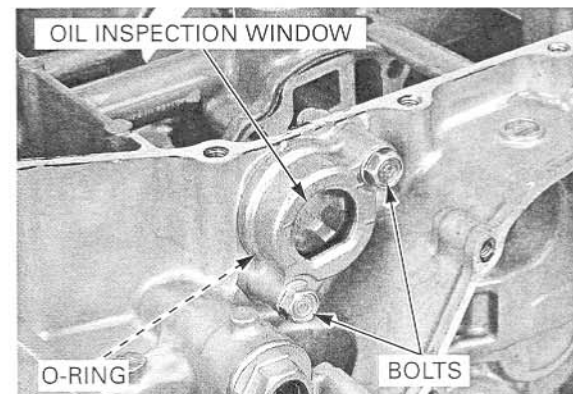
Remove the neutral switch and sealing washer from the crankcase.



Remove the oil pressure switch while holding the switch base.

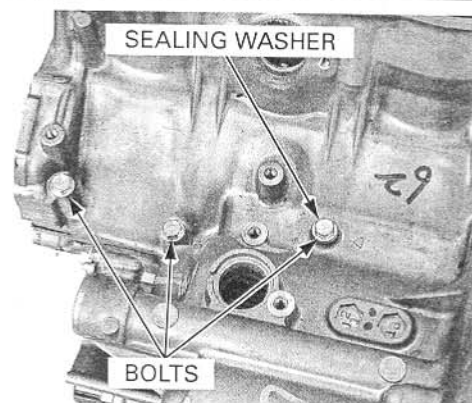


Remove the bolts, oil inspection window and O-ring from the crankcase.



## CRANKCASE/TRANSMISSION

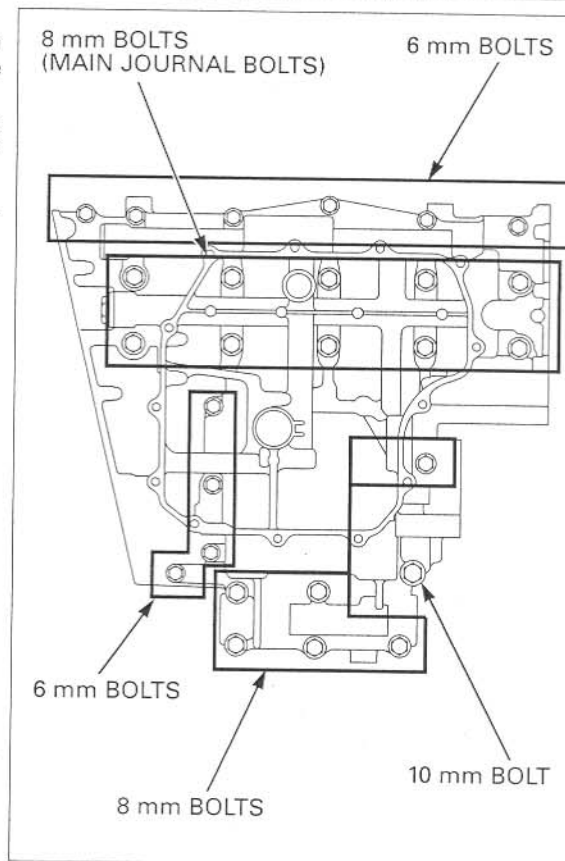
Loosen the three bolts in two to three steps.  
Remove the bolts and sealing washer.



Place the engine up side down.  
Loosen the 10 mm bolt, 8 mm bolts (six) and 6 mm (ten) bolts in a crisscross pattern in two to three steps.

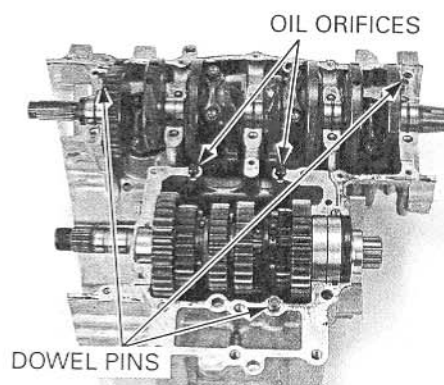
Loosen the 8 mm bolts (main journal bolts) in a criss-cross pattern in two to three steps, then remove the bolts.

Separate the lower crankcase from the upper crankcase.



Remove the three dowel pins and two oil orifices.

Clean any sealant off from the crankcase mating surface.

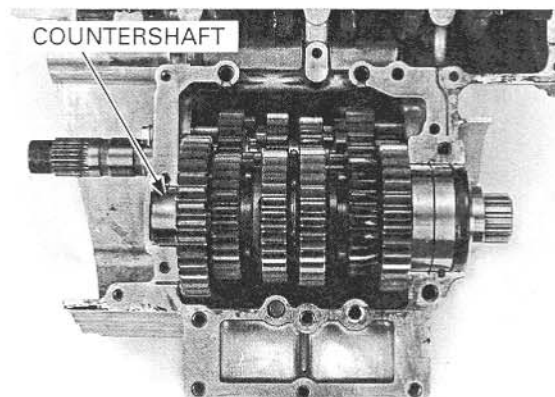


## SHIFT FORK/SHIFT DRUM/ TRANSMISSION

### REMOVAL/DISASSEMBLY

Separate the crankcase halves (page 12-5).

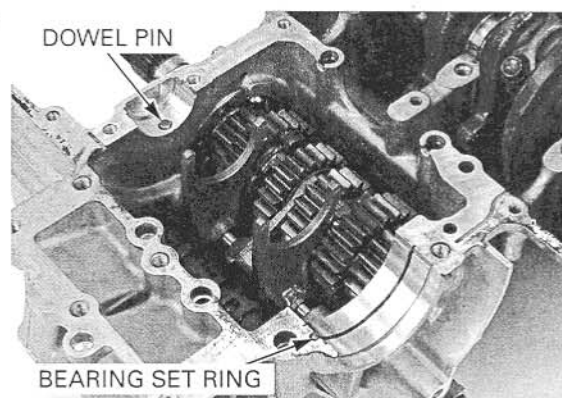
Remove the countershaft assembly.



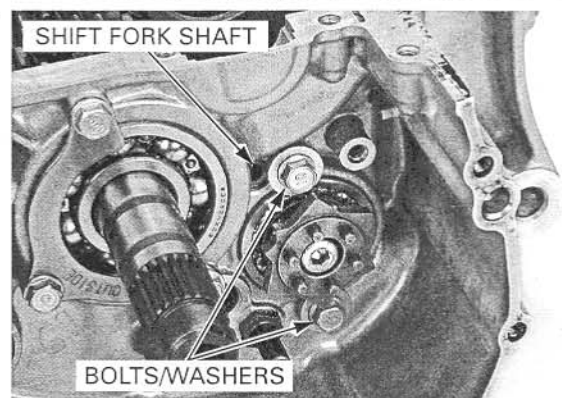
Remove the dowel pin and countershaft bearing set ring.

Disassemble the countershaft.

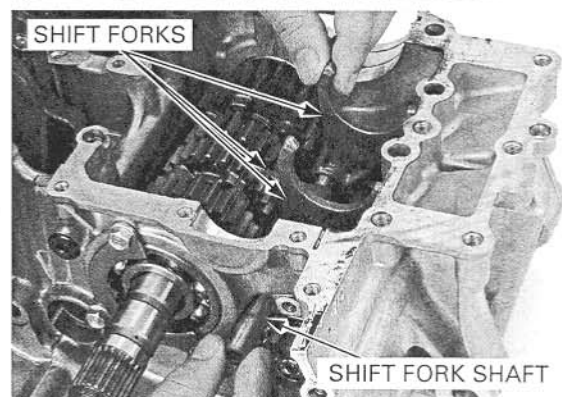
Clean all disassembled parts in solvent thoroughly.



Remove the shift drum bearing set plate bolts/washers.



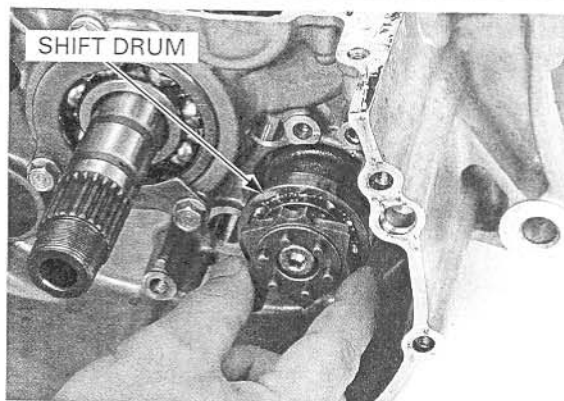
Remove the fork shaft and shift forks.



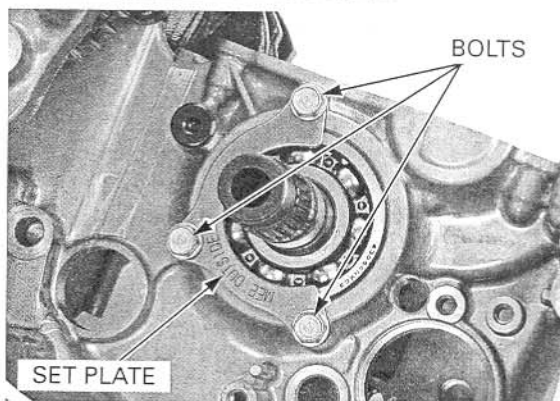


## CRANKCASE/TRANSMISSION

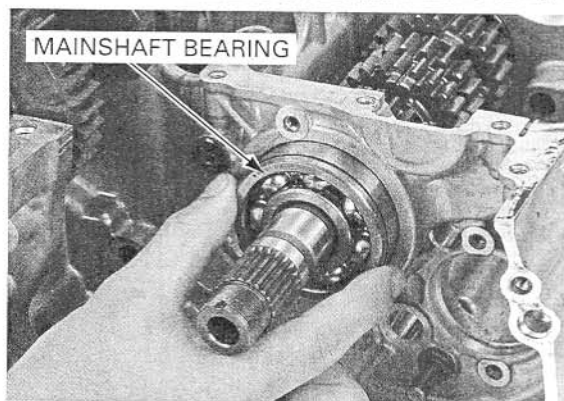
Remove the shift drum assembly.



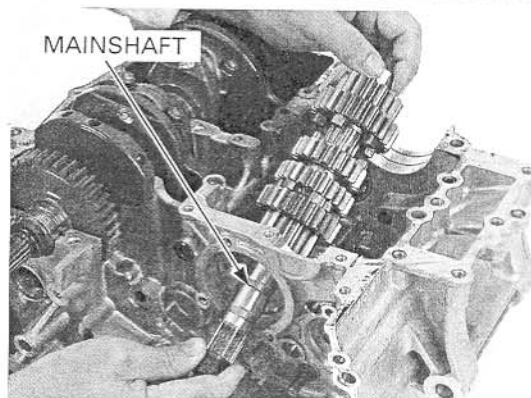
Remove the mainshaft bearing set plate bolts and plate.



Remove the mainshaft bearing from the crankcase.  
Check the mainshaft bearing for smooth rotation,  
abnormal wear or damage.



Remove the mainshaft assembly.  
Disassemble the mainshaft.  
Clean all disassembled parts in solvent thoroughly.





### SHIFT DRUM/SHIFT FORK INSPECTION

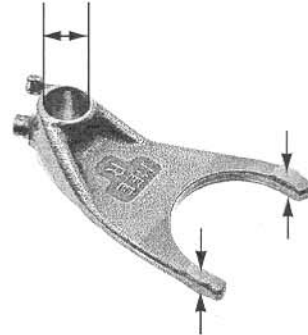
Check the shift fork guide pin for abnormal wear or damage

Measure the shift fork I.D.

**SERVICE LIMIT: 12.03 mm (0.474 in)**

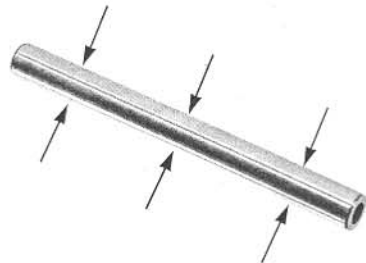
Measure the shift fork claw thickness.

**SERVICE LIMIT: 5.9 mm (0.23 in)**



Measure the shift fork shaft O.D.

**SERVICE LIMIT: 11.95 mm (0.470 in)**



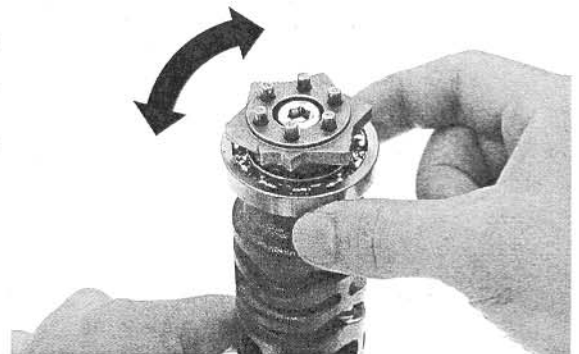
Inspect the shift drum guide grooves for abnormal wear or damage.

Turn the outer race of the shift drum bearing with your finger.

The bearing should turn smoothly and freely without excessive play.

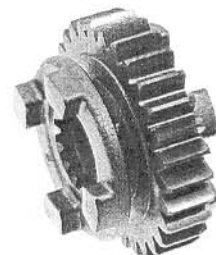
Also check that the bearing inner race fits tightly on the shift drum.

If necessary, replace the bearing.



### TRANSMISSION INSPECTION

Check the gear shifter groove for abnormal wear or damage.



## CRANKCASE/TRANSMISSION

Check the gear dogs, dog holes and teeth for abnormal wear or lack of lubrication.

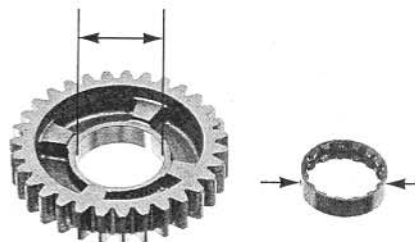
Measure the I.D. of each gear.

### SERVICE LIMITS:

M5, M6: 28.04 mm (1.104 in)

C1: 26.04 mm (1.025 in)

C2, C3, C4: 31.04 mm (1.222 in)



Measure the O.D. of each gear bushing.

### SERVICE LIMITS:

M5, M6: 27.94 mm (1.100 in)

C2: 30.94 mm (1.218 in)

C3, C4: 30.93 mm (1.218 in)

Measure the I.D. of each gear bushing.

### SERVICE LIMITS:

M5: 25.016 mm (0.9849 in)

C2: 28.021 mm (1.1032 in)

Calculate the gear-to-bushing clearance.

### SERVICE LIMITS:

M5, M6: 0.10 mm (0.004 in)

C2: 0.10 mm (0.004 in)

C3, C4: 0.11 mm (0.004 in)

Check the mainshaft and countershaft for abnormal wear or damage.

Measure the mainshaft O.D. at the M5 gear.

**SERVICE LIMIT: 24.96 mm (0.983 in)**

Measure the countershaft O.D. at the C2 gear.

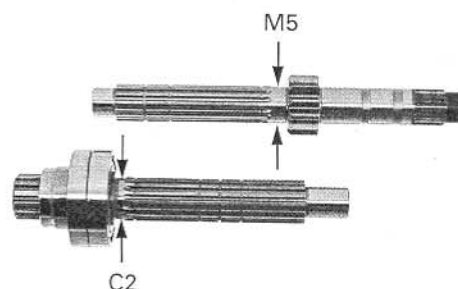
**SERVICE LIMIT: 27.96 mm (1.101 in)**

Calculate the gear bushing-to-shaft clearance.

### SERVICE LIMITS:

M5: 0.06 mm (0.002 in)

C2: 0.06 mm (0.002 in)



### Countershaft bearing

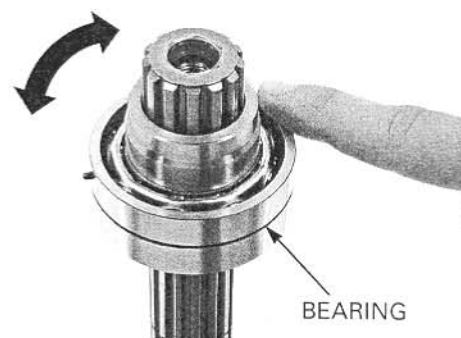
Turn the outer race of countershaft bearing with your finger.

The bearing should turn smoothly and quietly.

Also check that the bearing inner race fits tightly on the shaft.

Replace the countershaft, collar, and bearing as an assembly, if the race does not turn smoothly, quietly, or fits loosely on the countershaft.

- The countershaft bearing cannot be replaced. If the countershaft bearing is faulty, replace the countershaft as an assembly.

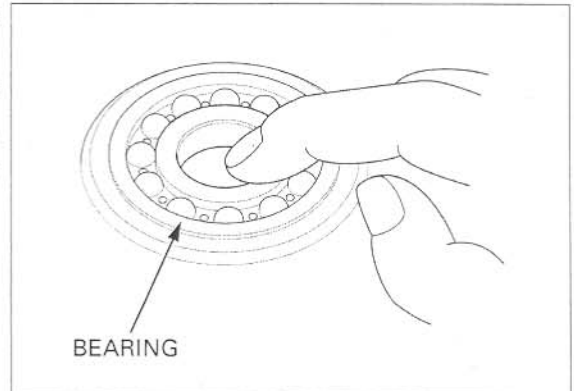


### Mainshaft bearing

Turn the inner race of the mainshaft bearings with your finger:

The bearings should turn smoothly and quietly. Also check that the outer race of the bearing fits tightly in the crankcase.

Replace the bearings if the inner race does not turn smoothly, quietly, or if the outer race fit loosely in the crankcase.



### MAINSHAFT BEARING REPLACEMENT

Remove the crankshaft/ (page 13-5) and piston (page 13-13).

Remove the mainshaft bearing using the special tools as shown.

#### TOOLS:

Bearing remover set, 20 mm

Remover weight

Remover handle

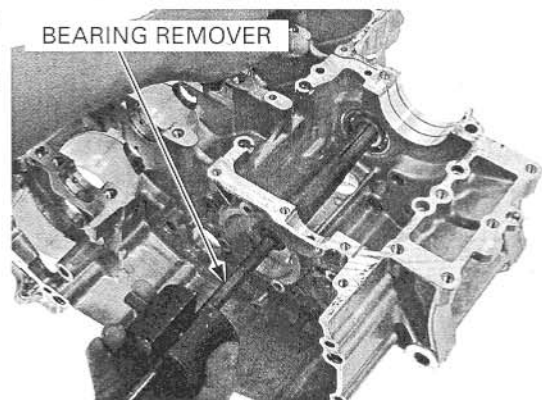
07936-3710600

07741-0010201 or

07936-371020A

(U.S.A. only)

07936-3710100



*Drive in the new bearing squarely with the marking side facing toward the inside of the crankcase.*

Drive new bearing into the left crankcase using the special tools.

#### TOOLS:

Driver

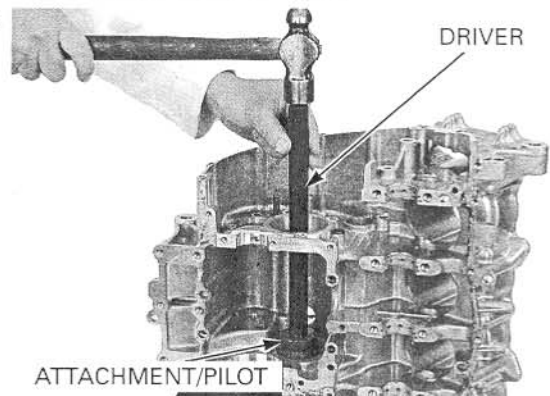
Attachment, 42 x 47 mm

Pilot, 20 mm

07949-3710001

07746-0010300

07746-0040500

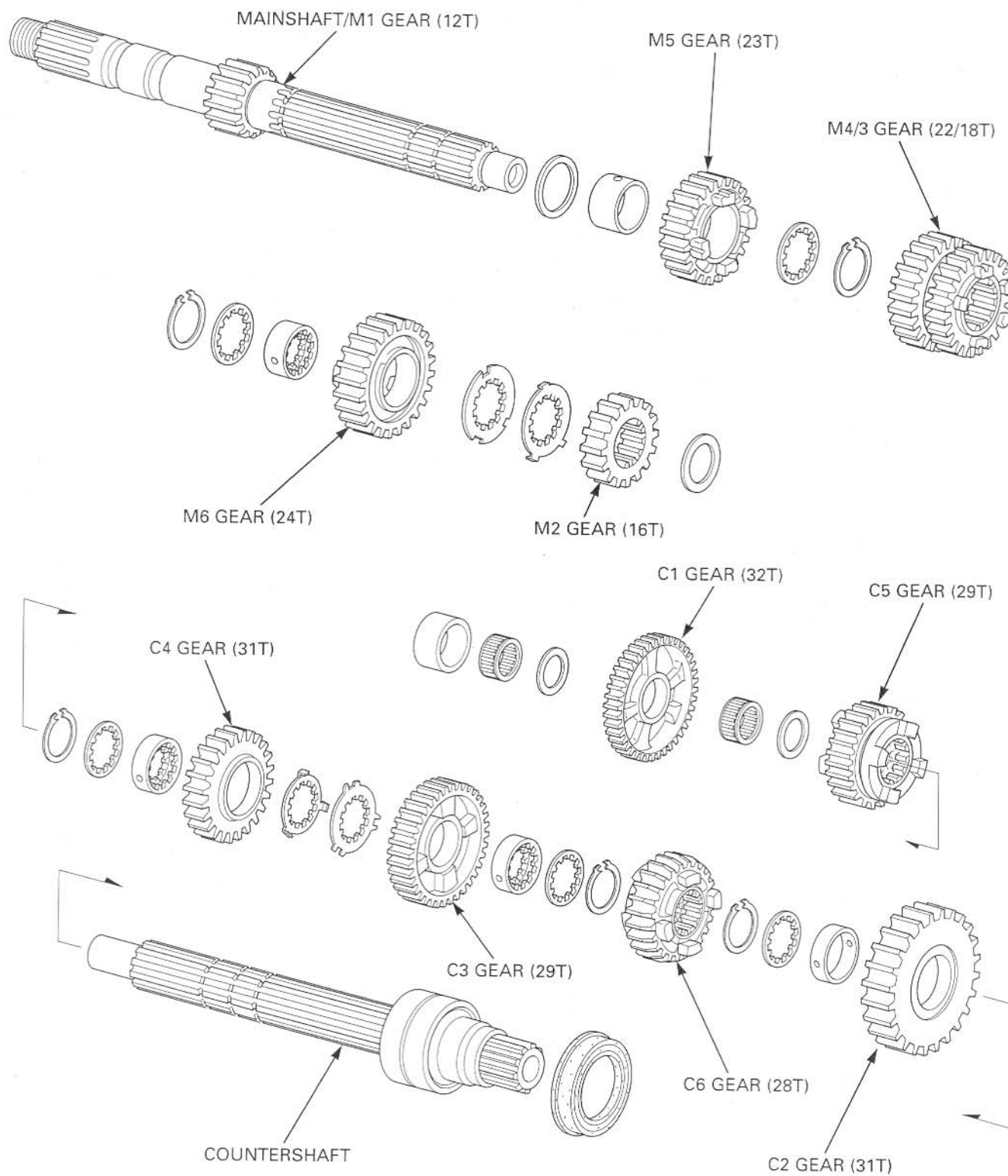


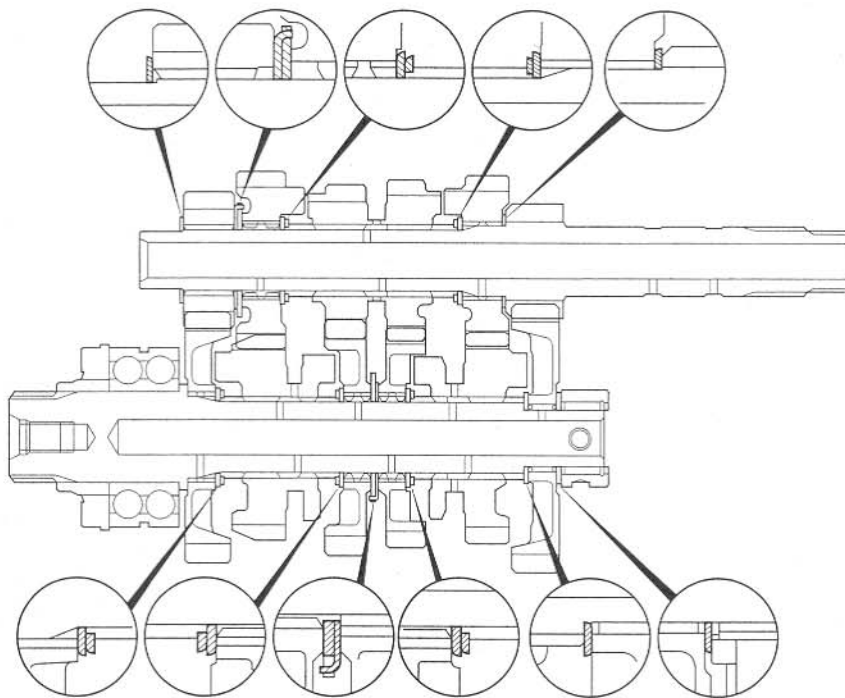
## CRANKCASE/TRANSMISSION

### TRANSMISSION ASSEMBLY

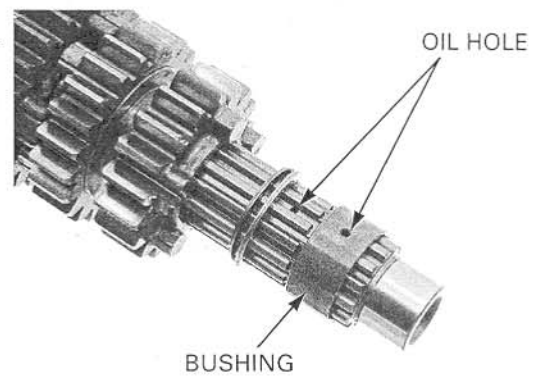
Apply molybdenum oil solution to the gear teeth, sliding surface, shifter grooves and bushings.

Assemble the mainshaft and countershaft.

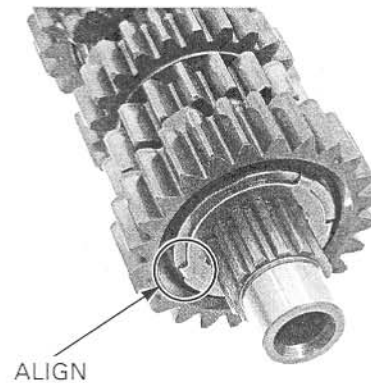




Assemble the transmission gear and shafts.  
Coat each gear with clean engine oil and check for smooth movement.  
Align the oil holes in the M6 bushing and mainshaft, and the C3, C4 spline bushings and countershaft.



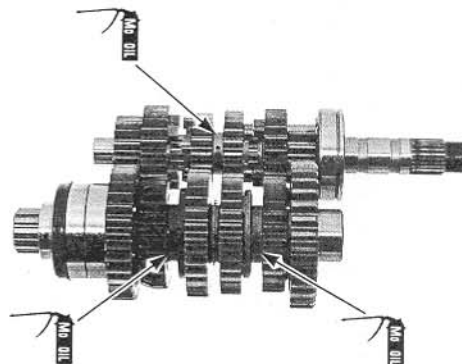
- Align the lock washer tabs with the spline washer grooves.
- Always install the thrust washer and snap ring with the chamfered (rolled) edge facing away from the thrust load.
- Install the snap ring so that its end gap aligns with the groove of the splines.
- Make sure that the snap ring is fully seated in the shaft groove after installing it.



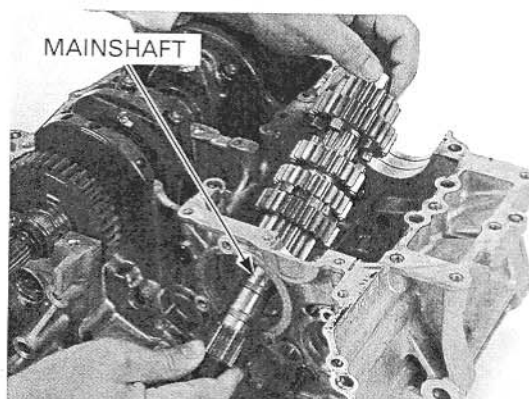
## CRANKCASE/TRANSMISSION

### INSTALLATION

Apply molybdenum oil solution to the shift fork grooves in the M3/4, C5 and C6 gear.

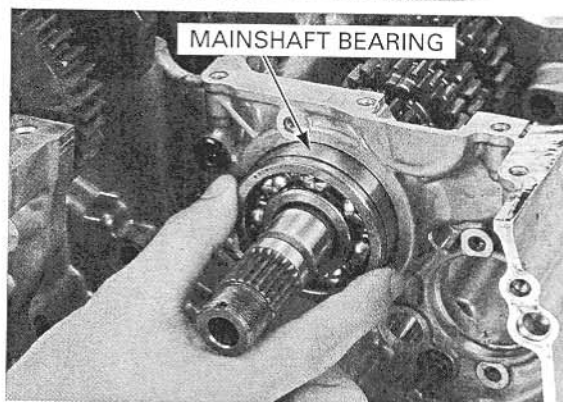


Install the mainshaft into the crankcase.



*Install the bearing into the crankcase with the marked side facing out.*

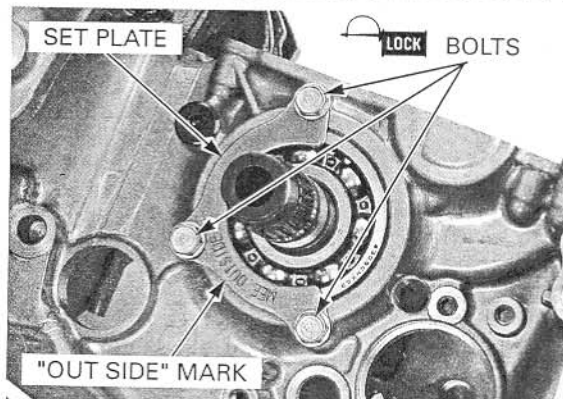
Install the mainshaft bearing into the crankcase.



Apply a locking agent to the set plate bolt threads. Install the mainshaft bearing set plate with its "OUT SIDE" mark facing out.

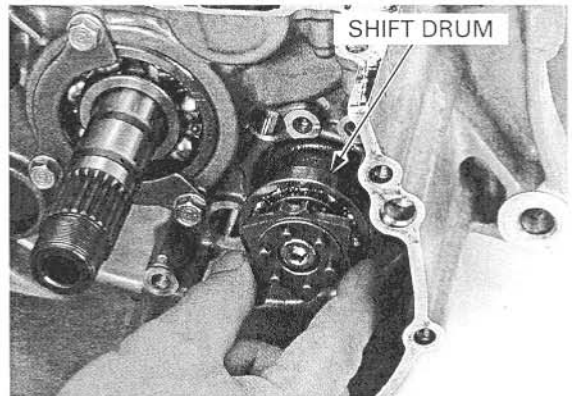
Tighten the set plate bolts to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**



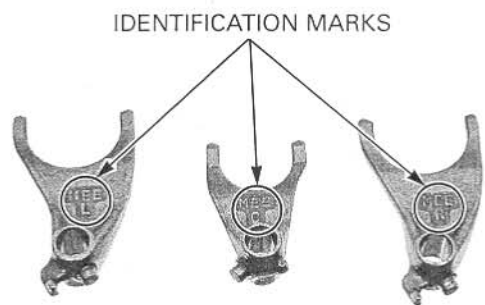
## CRANKCASE/TRANSMISSION

Install the shift drum assembly into the crankcase.

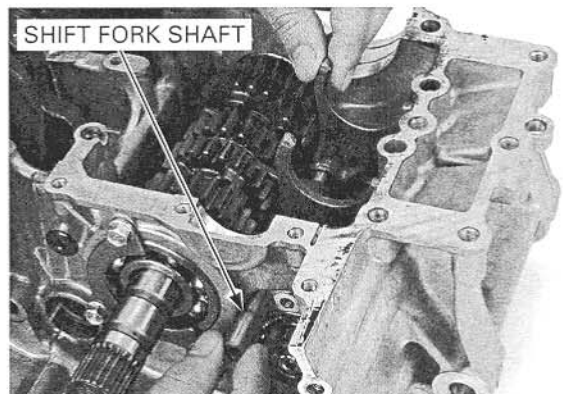


The shift forks have the following identification marks:

- "L" for left
- "R" for right
- "C" for center



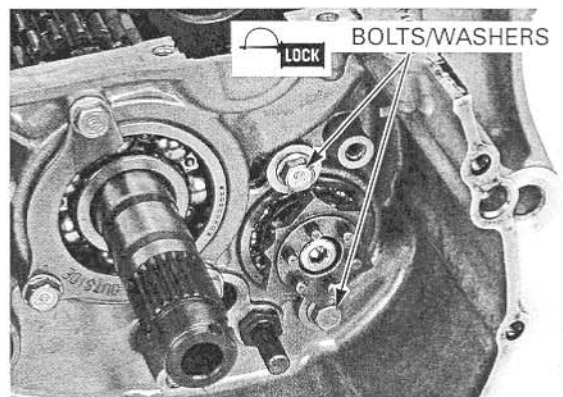
Install the shift forks into the shift drum guide grooves with the identification marks facing toward the right side of the engine and insert the fork shaft.



Apply a locking agent to the threads of the bolts/washers.

Tighten the bolts/washers to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

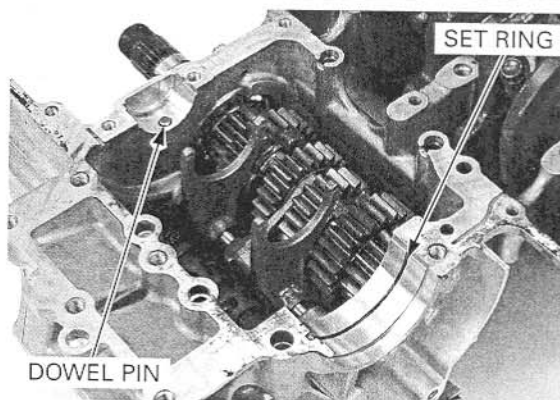




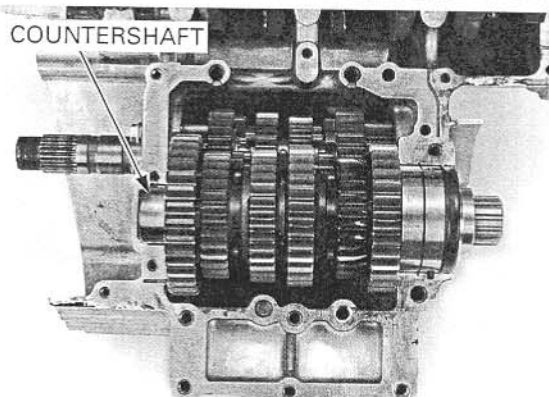
## CRANKCASE/TRANSMISSION

Install the dowel pin in the upper crankcase hole.

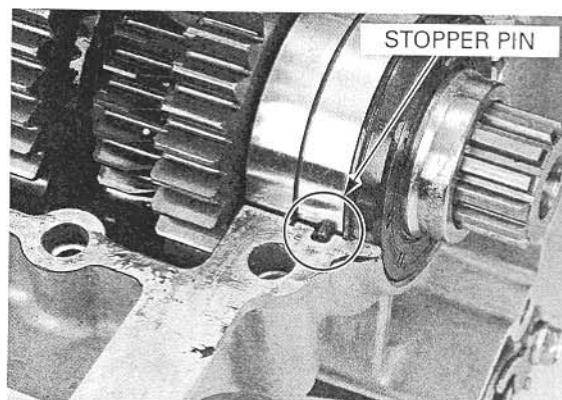
Install the countershaft bearing set ring into the upper crankcase groove.



Install the countershaft by aligning the countershaft bearing groove with the set ring on the crankcase, and bearing cap hole with the dowel pin.

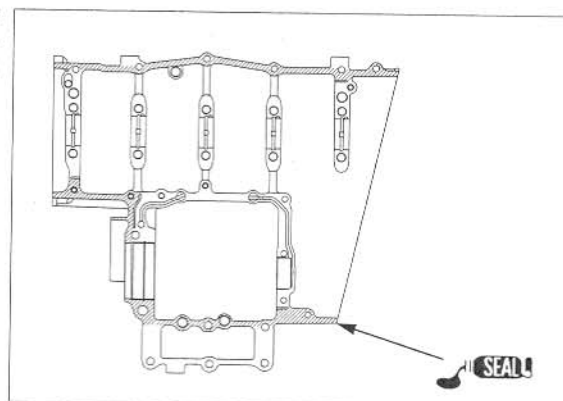


Also align the countershaft bearing stopper pin with the groove in the crankcase.



## CRANKCASE ASSEMBLY

Apply a light, but thorough, coating of liquid sealant to the crankcase mating surface. Do not apply sealant to the crankcase 8 mm bolt (main journal bolt) area and the oil passage area as shown.

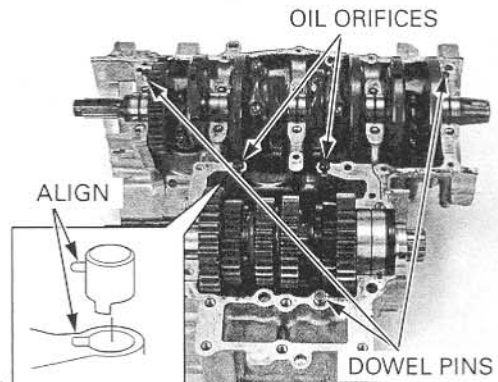


## CRANKCASE/TRANSMISSION

Install the three dowel pins.  
Install the oil orifices in the upper crankcase.

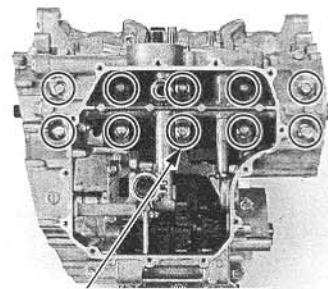
**NOTE:**

- Right oil orifice: Align its pin with the crankcase groove as shown.
- Left oil orifice: Align its cut-out with the crankcase.



- Tighten the crankcase 8 mm bolts (main journal bolts) using the Plastic Region Tightening Method described below.
- Do not reuse the crankcase 8 mm bolts (main journal bolts), because the correct axial tension will not be obtained.
- The crankcase 8 mm bolts (main journal bolts) are pre-coated with an oil additive for axial tension stability. Do not remove the oil additive from the new 8 mm bolts (main journal bolts) surface.

Install the lower crankcase onto the upper crankcase.



CRANKCASE 8 mm BOLTS  
(MAIN JOURNAL BOLTS)

**PLASTIC REGION TIGHTENING METHOD:**

Install new crankcase 8 mm bolts (main journal 8 mm bolts).

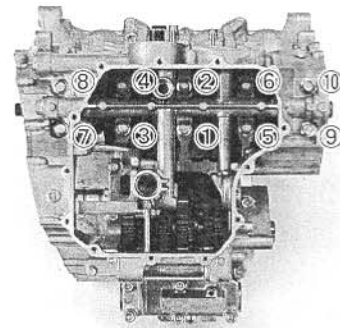
Loosely install all the crankcase bolts.

Make sure the upper and lower crankcase are seated securely.

Tighten the crankcase 8 mm bolts (main journal bolts) as follow:

Tighten the crankcase 8 mm bolts (main journal bolts) in numerical order in the illustration in two to three steps to the specified torque.

Further tighten the crankcase 8 mm bolts (main journal bolts) 120-degrees.



**TORQUE:** 15 N·m (1.5 kgf·m, 10 lbf·ft) + 120°

## CRANKCASE/TRANSMISSION

Tighten the 10 mm bolt to the specified torque.

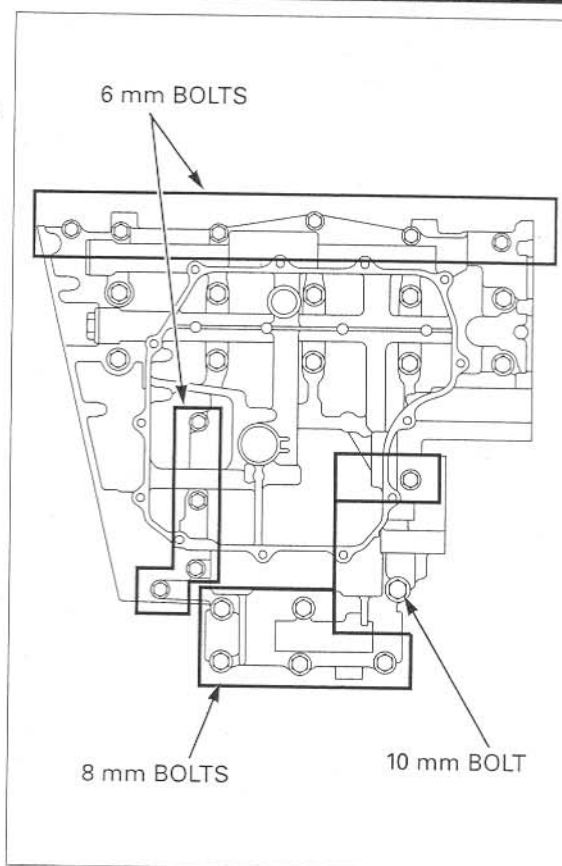
**TORQUE: 39 N·m (4.0 kgf·m, 29 lbf·ft)**

From the inside to outside, tighten the 6 mm bolts and 8 mm bolts to the specified torque.

**TORQUE:**

**8 mm bolt: 25 N·m (2.5 kgf·m, 18 lbf·ft)**

**6 mm bolt: 12 N·m (1.2 kgf·m, 9 lbf·ft)**

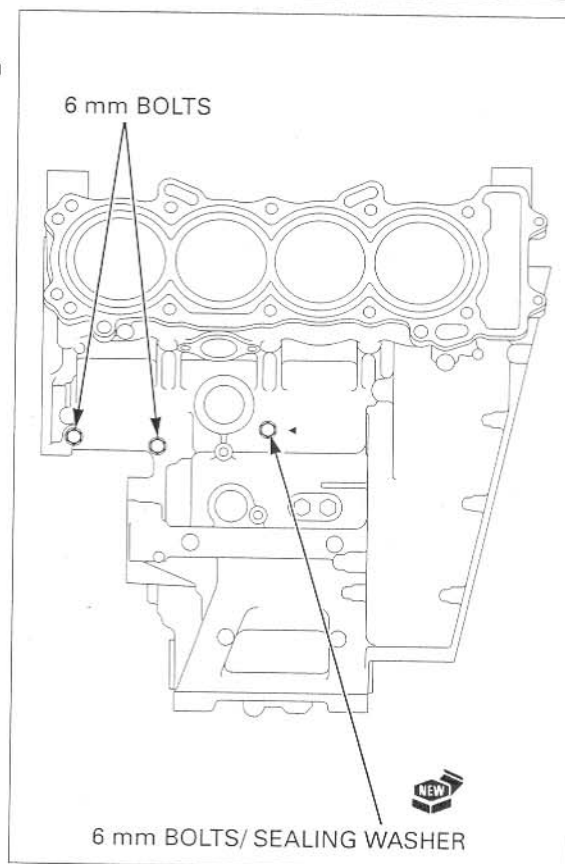


Place the engine with the lower side down.

*The sealing washer locations are indicated on the upper crankcase using the '△' mark.*

Install the upper crankcase three 6 mm bolts with a new sealing washer.

Tighten the 6 mm bolts securely.



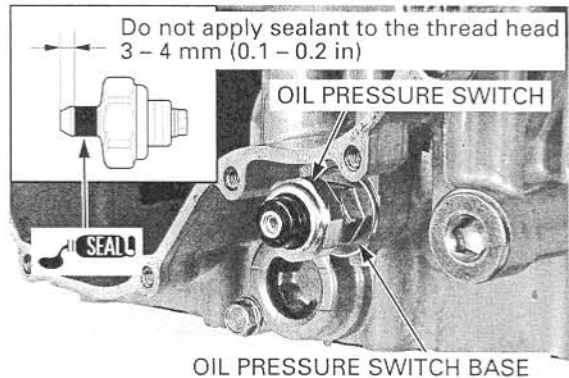
## CRANKCASE/TRANSMISSION

Apply oil to a new O-ring and install it into the oil inspection window groove.  
Install the oil inspection window onto the lower crankcase.  
Install and tighten the bolts securely.



Apply a sealant to the oil pressure switch threads as shown.  
Tighten the oil pressure switch to the specified torque while holding the switch base.

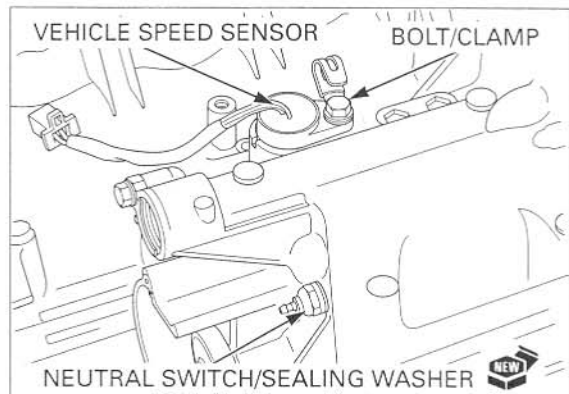
**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**



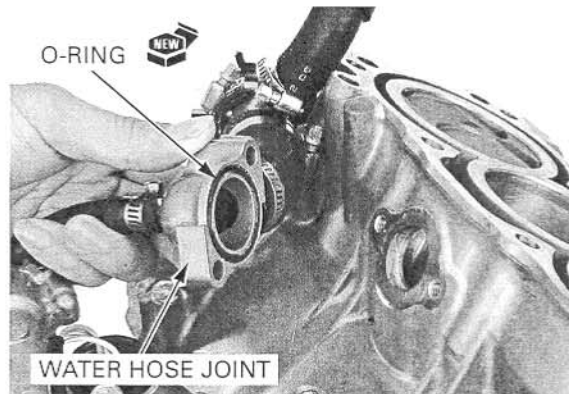
Install the vehicle speed sensor, tighten the bolt and clamp securely.

Tighten the neutral switch with a new sealing washer to the specified torque.

**TORQUE: 12 N·m (1.2 kgf·m, 9 lbf·ft)**



Install a new O-ring into the groove of the water hose joint.  
Install the water hose joint to the cylinder block.



## CRANKCASE/TRANSMISSION

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Tighten the bolts securely.

Install the removed parts in the reverse order of removal.

