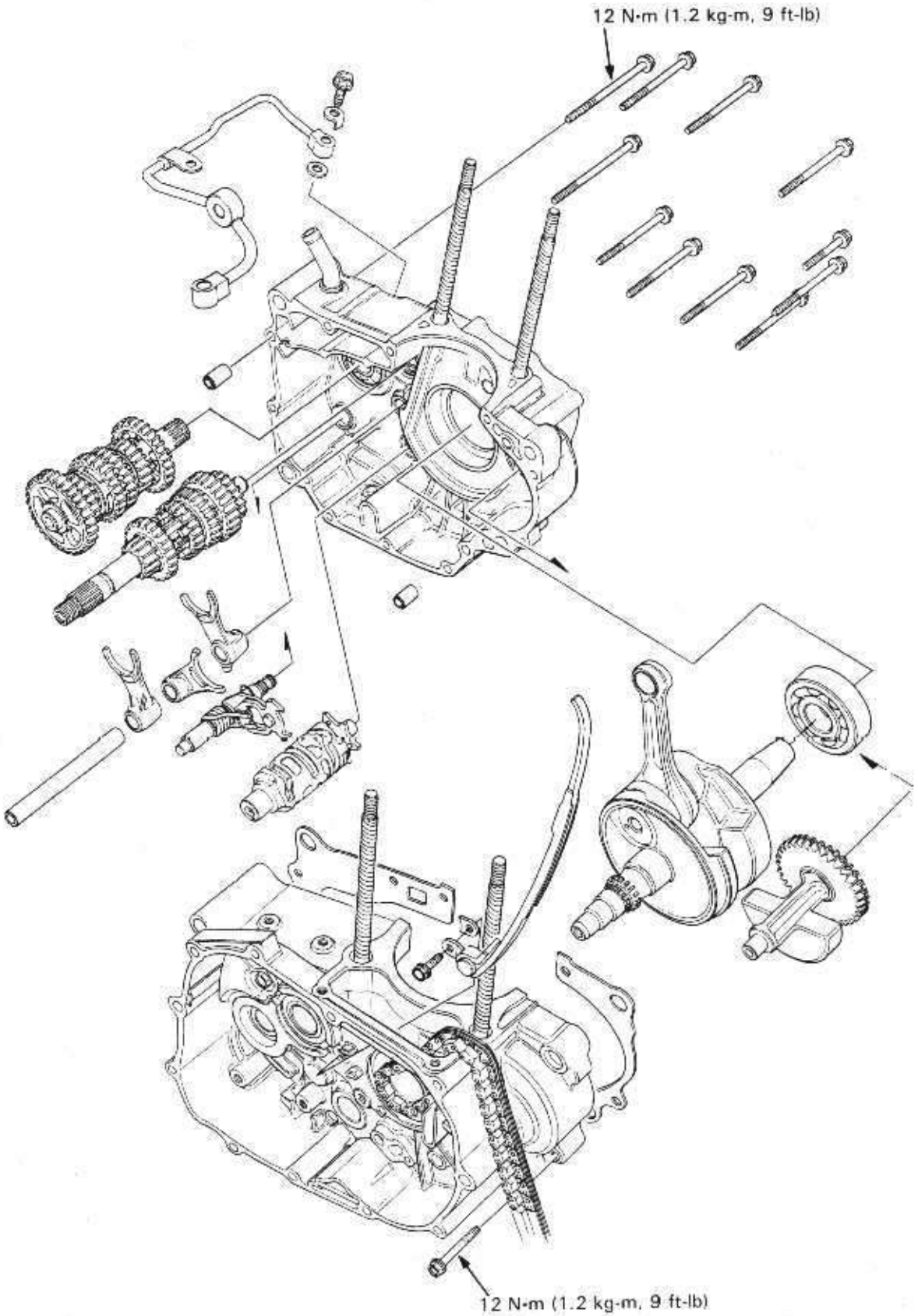
11

CRANKSHAFT/TRANSMISSION

VILEBREQUIN/BOITE DE VITESSES

KURBELWELLE/GETRIEBE



SERVICE INFORMATION

GENERAL

- The gearshift stopper arm, plate and primary drive gear can be serviced with the engine installed in the frame.
- The crankcase must be separated to repair the crankshaft, transmission, shift linkage and balancer. Remove the following parts before separating the crankcase.

Cylinder head	Section 9	Clutch	Section 7
Cylinder and piston	Section 10	Alternator	Section 8

SPECIFICATIONS

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT
Shift fork I.D.		13.000–13.021 (0.5118–0.5126)	13.05 (0.514)
Shift fork pawl thickness		4.90–5.00 (0.1929–0.1969)	4.50 (0.177)
Shift fork shaft O.D.		12.966–12.984 (0.510–0.511)	12.91 (0.508)
Gear I.D.	M5	20.020–20.041 (0.7882–0.7890)	20.08 (0.791)
	M6	23.020–23.041 (0.9061–0.9071)	23.09 (0.909)
	C1	23.00–23.021 (0.9055–0.9063)	23.07 (0.908)
	C2	25.020–25.041 (0.9850–0.9859)	25.09 (0.988)
	C3	25.000–25.021 (0.9843–0.9850)	25.07 (0.987)
	C4	22.020–22.041 (0.8669–0.8678)	22.08 (0.869)
Bushing I.D.	C1	18.000–18.018 (0.7087–0.7094)	18.08 (0.712)
	C2	22.020–22.041 (0.8669–0.8678)	22.12 (0.871)
Bushing O.D.	M6	22.959–22.980 (0.9039–0.9047)	22.90 (0.902)
	C1	22.959–22.980 (0.9039–0.9047)	22.90 (0.902)
	C2	24.972–24.993 (0.9831–0.9840)	24.92 (0.981)
	C3	24.959–24.980 (0.9826–0.9835)	24.90 (0.980)
Mainshaft O.D.	M5	19.959–19.980 (0.7858–0.7866)	19.91 (0.984)

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT
Countershaft O.D.	C1	17.966–17.984 (0.7073–0.7080)	17.93 (0.706)
	C2	21.959–21.980 (0.8645–0.8654)	21.91 (0.863)
	C4	21.959–21.980 (0.8645–0.8654)	21.91 (0.863)
Gear-to-bushing clearance	M6	0.040–0.082 (0.0016–0.0032)	0.10 (0.004)
	C1, C3	0.020–0.062 (0.0008–0.0024)	0.10 (0.004)
	C2	0.027–0.069 (0.0011–0.0027)	0.10 (0.004)
Gear-to-shaft clearance	M5	0.040–0.082 (0.0016–0.0032)	0.15 (0.006)
	C4	0.040–0.082 (0.0016–0.0032)	0.15 (0.006)
Bushing-to-shaft clearance	C1	0.016–0.052 (0.0006–0.0020)	0.07 (0.003)
	C2	0.040–0.082 (0.0016–0.0032)	0.15 (0.006)
Connecting rod big end side clearance		0.05–0.45 (0.002–0.0177)	0.60 (0.024)
Connecting rod big end radial clearance		0.006–0.012 (0.0002–0.0005)	0.04 (0.002)
Crankshaft journal runout		—	0.05 (0.002)

TORQUE VALUE

Crankcase bolt	12 N·m (1.2 kg-m, 9ft-lb)

TOOLS

Special

Universal bearing puller	07631–0010000
Bearing remover 15 mm	07936–KC10000
— remover assembly, 15 mm	07936–KC10500
— remover head, 15 mm	07936–KC10200
— remover shaft, 15 mm	07936–KC10100
— remover weight	07741–0010201
Crankcase assembly tool	07965–VM00000
— collar assembly	07965–VM00100
— threaded shaft	07965–VM00200
— threaded adaptor	07965–VM00300

Common

Driver	07749–0010000
Attachment, 32 x 35 mm	07746–0010100
Attachment, 37 x 40 mm	07746–0010200
Attachment, 42 x 47 mm	07746–0010300
Attachment, 52 x 55 mm	07746–0010400
Attachment, 62 x 68 mm	07746–0010500
Pilot, 15 mm	07746–0040300
Pilot, 17 mm	07746–0040400
Pilot, 20 mm	07746–0040500
Pilot, 22 mm	07746–0041000
Pilot, 28 mm	07746–0041100

TROUBLESHOOTING

Engine vibration
- Excessive crankshaft runout

Engine noise
- Worn crank pin bearing
- Worn crankshaft bearing(s)
- Worn transmission bearing(s)

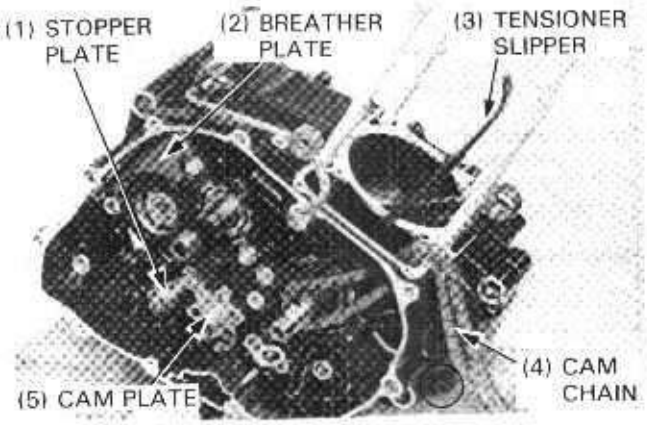
Transmission jumps out of gear
- Gear dogs and holes worn
- Shift fork bent or damaged
- Shift fork shaft bent
- Shift drum stopper damaged

Hard to shift
- Clutch not adjusted properly
- Shift fork bent
- Shift fork shaft bent
- Shift spindle pawl bent or damaged
- Worn or damaged shift drum cam grooves

CRANKCASE SEPARATION

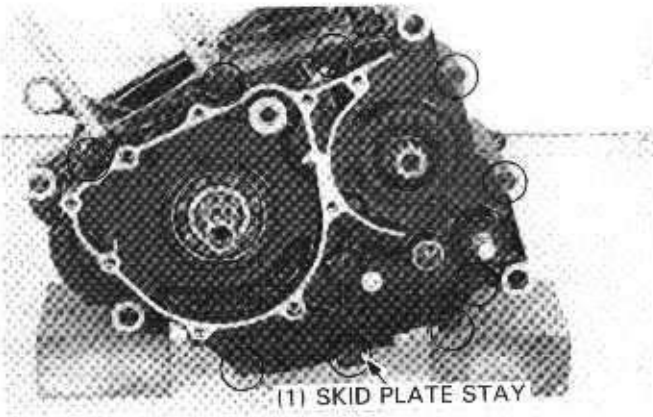
Remove the following:
- cam chain.
- tensioner slipper.
- stopper plate.
- cam plate.
- breather plate.

Remove the right crankcase mounting bolts.



Remove the skid plate stay if it was not removed.

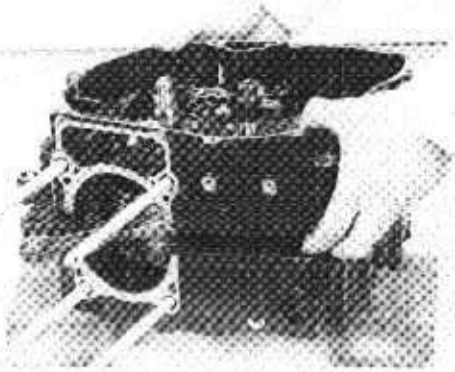
Remove the left crankcase mounting bolts.



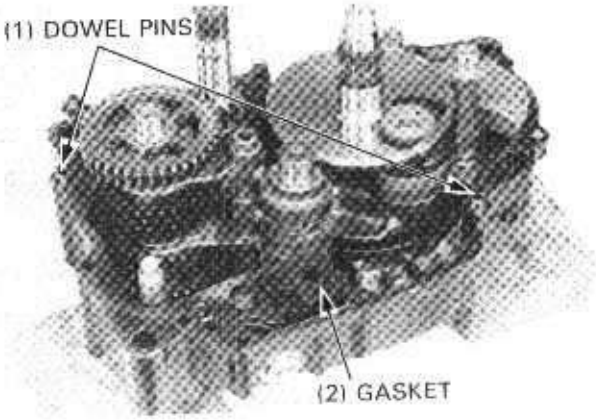
Place the left crankcase side down and separate the right crankcase from the left crankcase while tapping the cases at several locations with a soft hammer.

CAUTION

- *Do not pry between the left and right crankcases.*



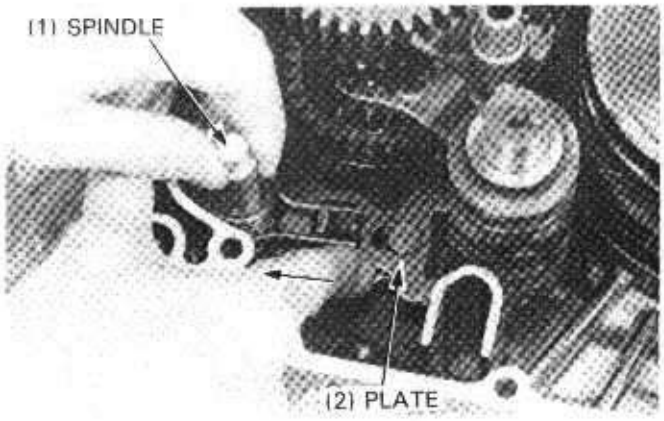
Remove the gasket and dowel pins.



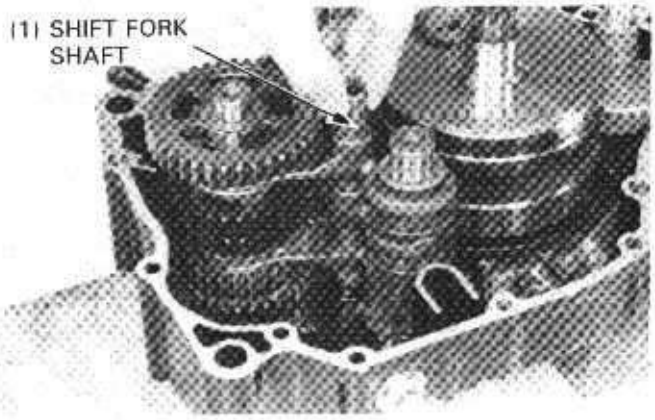
TRANSMISSION

REMOVAL

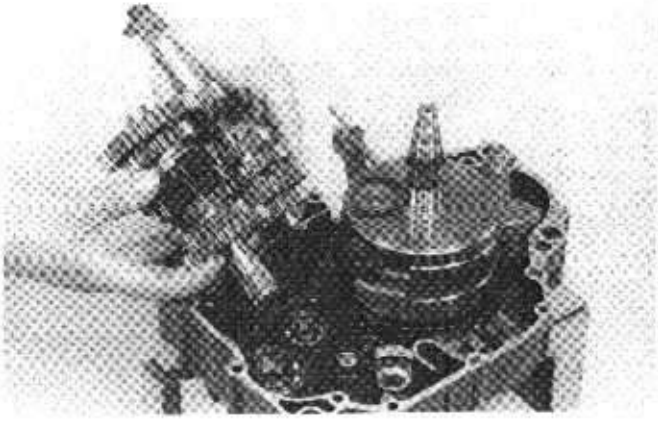
Pull the gearshift plate and remove the gearshift spindle.



Remove the shift fork shaft, then remove the shift forks and shift drum.

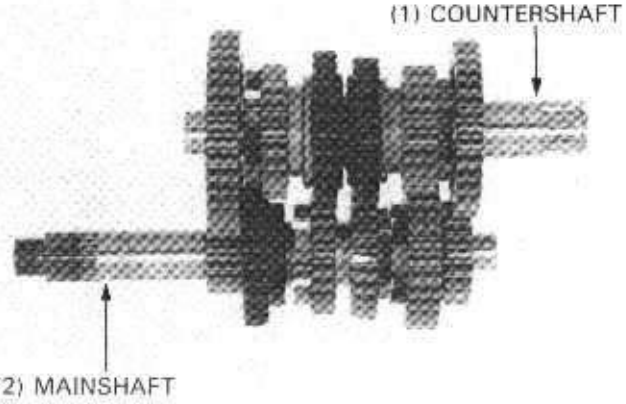


Remove the mainshaft and countershaft together.



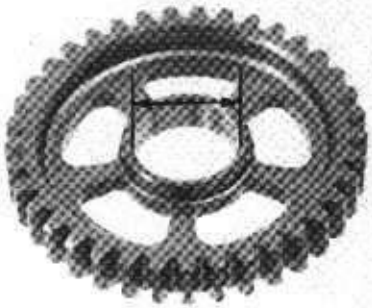
TRANSMISSION DISASSEMBLY

Disassemble the mainshaft and countershaft.



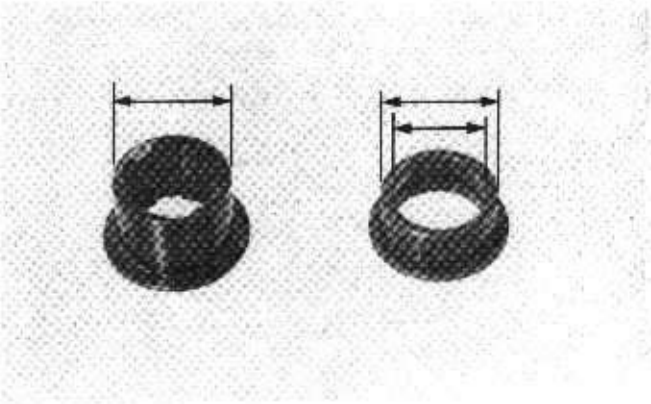
INSPECTION

Check each gear dog for excessive or abnormal wear. Inspect the I.D. each gear.



SERVICE LIMITS: M5 20.08 mm (0.791 in)
M6 23.09 mm (0.909 in)
C1 23.07 mm (0.908 in)
C2 25.09 mm (0.988 in)
C3 25.07 mm (0.987 in)
C4 22.08 mm (0.869 in)

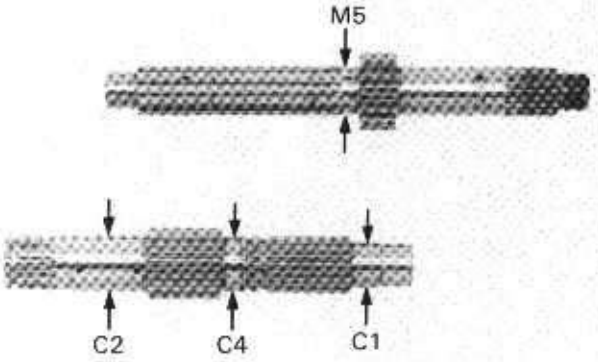
Measure the I.D. and O.D. of each gear bushing.



SERVICE LIMITS:
I.D. C1 18.08 mm (0.712 in)
C2 22.12 mm (0.871 in)
O.D. M6 22.90 mm (0.902 in)
C1 22.90 mm (0.902 in)
C2 24.92 mm (0.981 in)
C3 24.90 mm (0.980 in)

Calculate the clearance between the gear and bushing (refer to page 11-2).

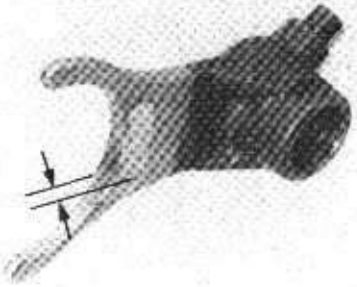
Measure the mainshaft and countershaft O.D.



SERVICE LIMITS: M5 19.91 mm (0.984 in)
C1 17.93 mm (0.706 in)
C2 21.91 mm (0.863 in)
C4 21.91 mm (0.863 in)

Calculate the clearance between the shaft and gear or bushing (refer to page 11-2).

Measure the thickness of the shift fork.



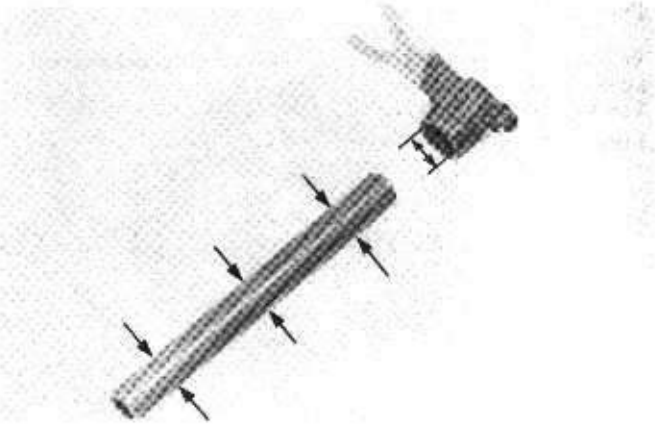
SERVICE LIMIT: 4.50 mm (0.177 in)

Measure the I.D. of the shift fork.

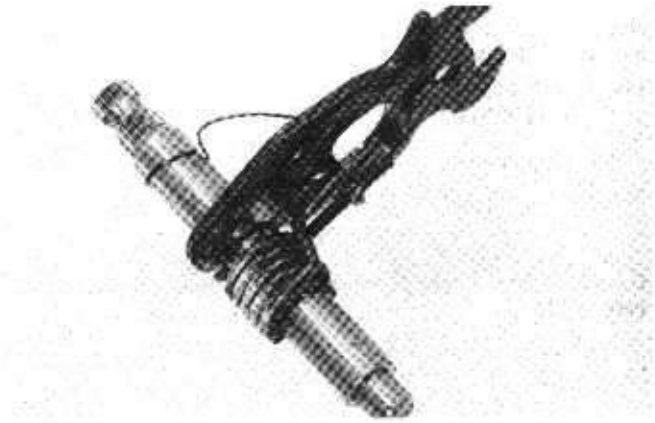
SERVICE LIMIT: 13.05 mm (0.514 in)

Measure the O.D. of the shift fork shaft.

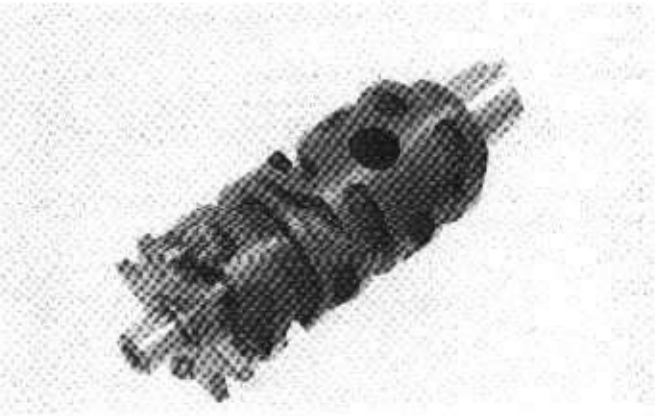
SERVICE LIMIT: 12.91 mm (0.508 in)



Inspect the shift shaft and springs for wear or damage.

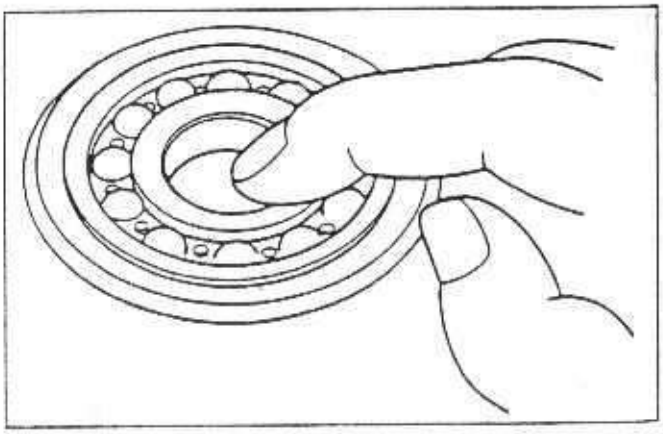


Inspect the shift drum grooves.
Replace the drum if the grooves are damaged or show excessive wear.



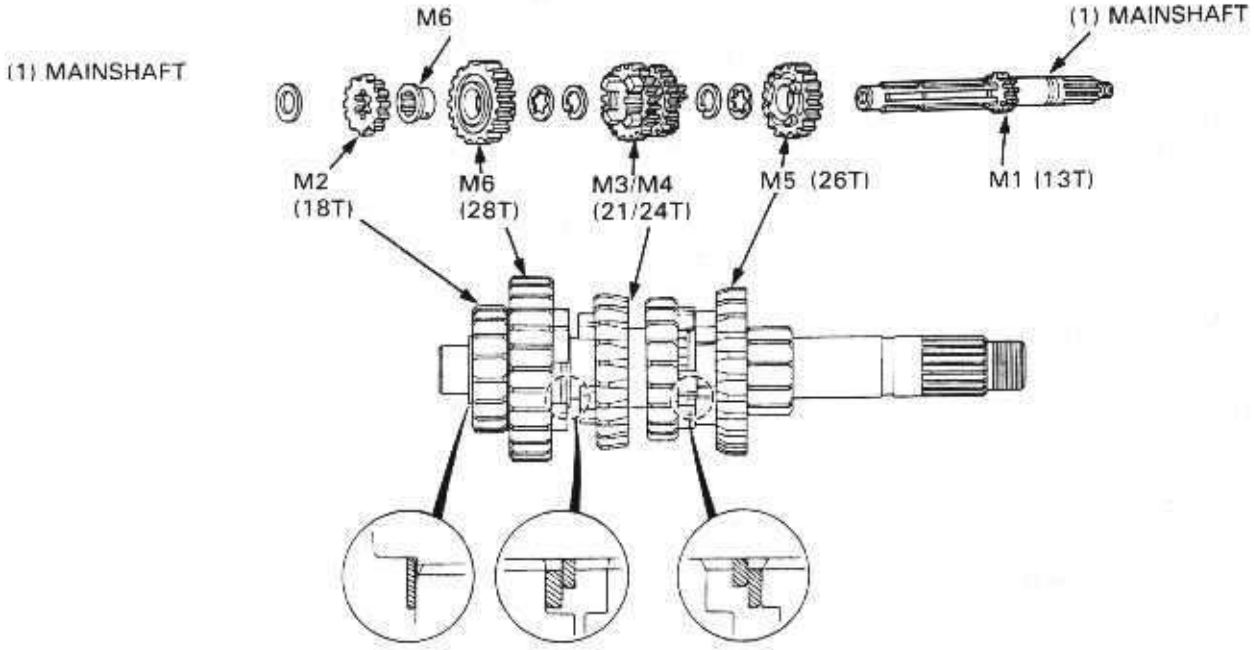
Turn the inner race of each bearing with your finger. The bearings should turn smoothly and quietly. Also check that the bearing outer race fits tightly in the crankcase.
Remove and discard the bearings if the races do not turn smoothly quietly, or if they fit loosely in the crankcase.

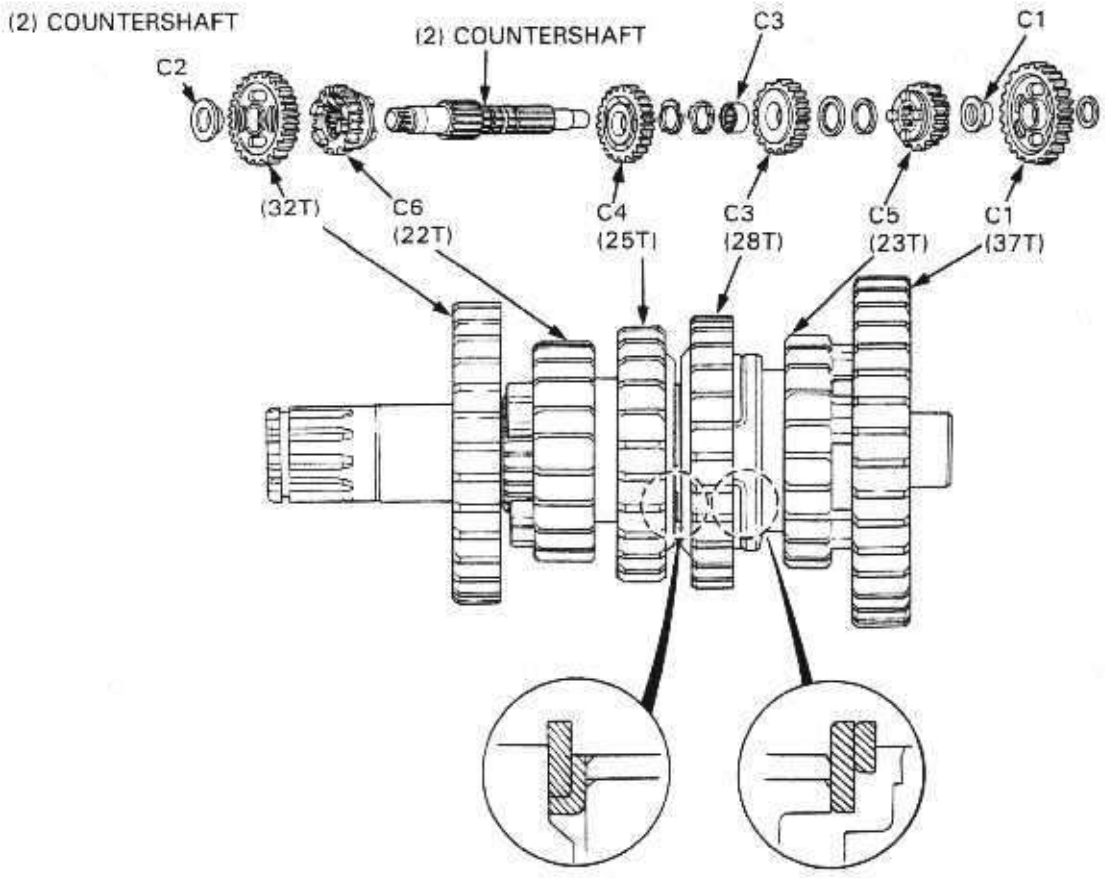
See page 11-11 for bearing replacement.



TRANSMISSION ASSEMBLY

Check the gears for freedom of movement or rotation on the shaft.
Check that the snap rings are seated in the grooves.





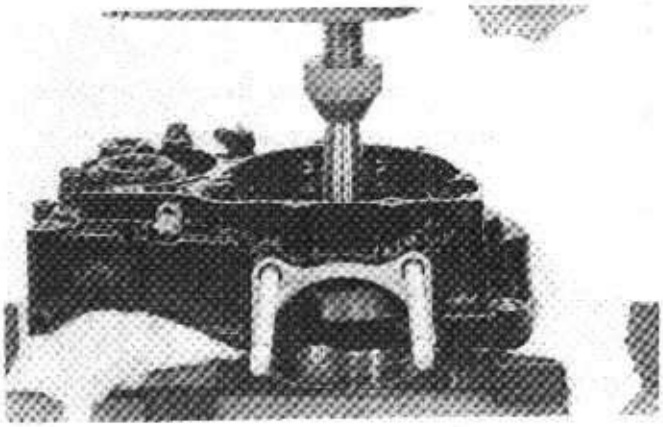
CRANKSHAFT/BALANCER

REMOVAL

Separate the crankcase (page 11-4).

Remove the transmission (page 11-5).

Press the crankshaft and balancer out of the left crankcase.

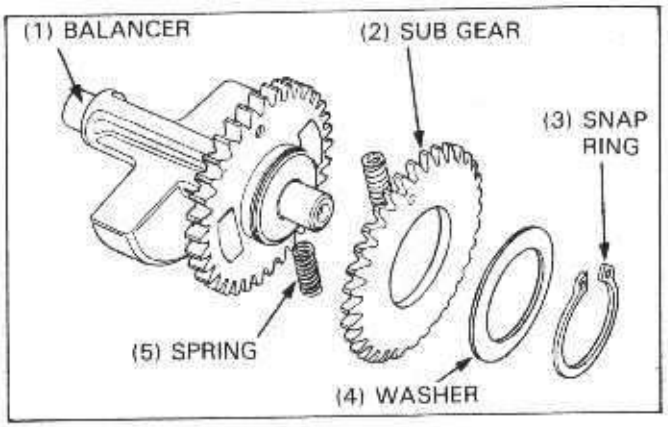


CAUTION

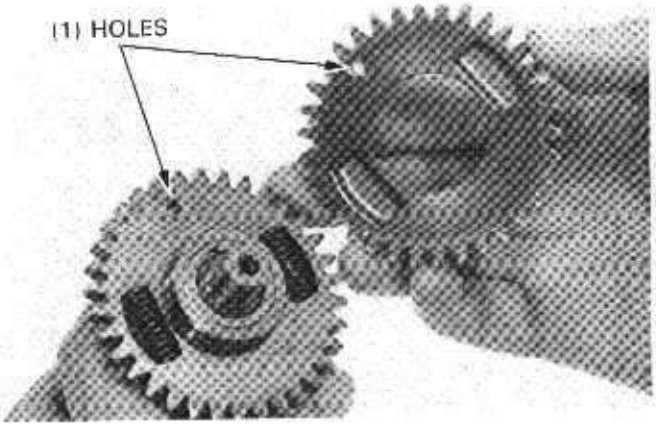
- *Be careful not to damage the crankcase gasket surface.*

BALANCER DISASSEMBLY/ASSEMBLY

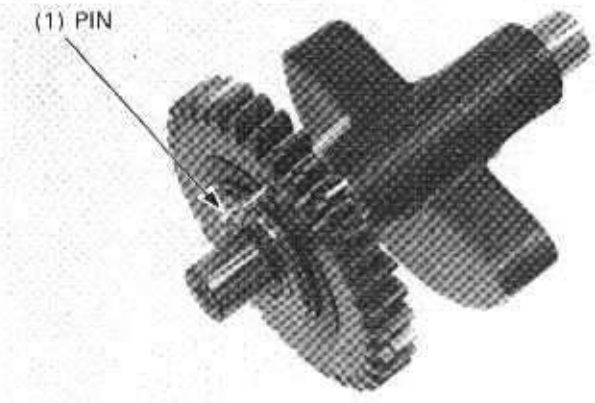
Remove the snap ring, and washer and sub gear.



Install the springs, then install the sub-gear on the balancer gear, aligning the holes as shown.



Install the washer and snap ring, then temporarily install a suitable pin as shown.

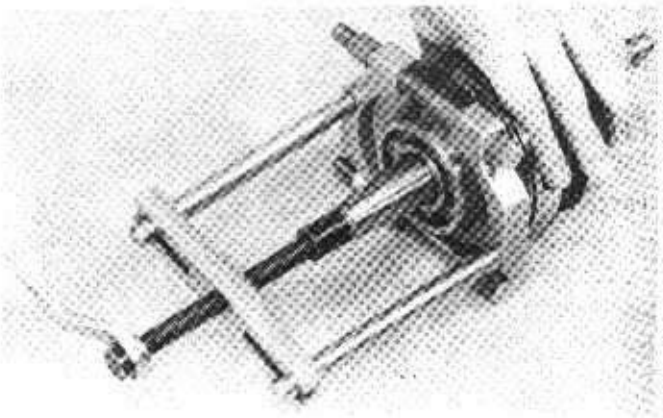


Remove the left crankshaft bearing with a bearing puller if it is removed with the crankshaft. Discard the bearing.

CAUTION

- *Always replace the left bearing with a new one if it is removed with the crankshaft.*

TOOL:
Universal bearing puller **07631–0010000**

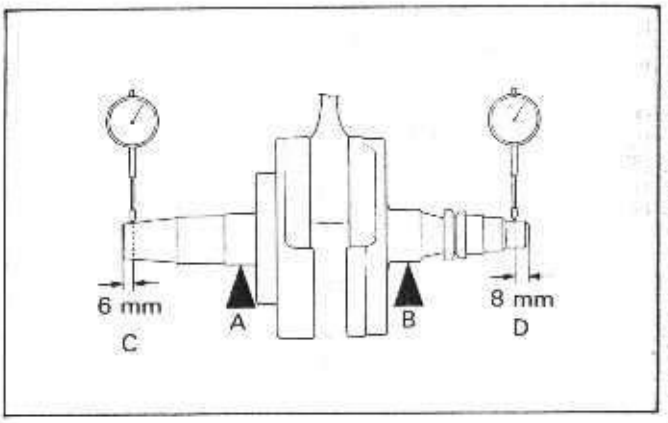


CRANKSHAFT INSPECTION

Measure the crankshaft runout.
Support the crankshaft at points A and B, and then measure the points C and D.

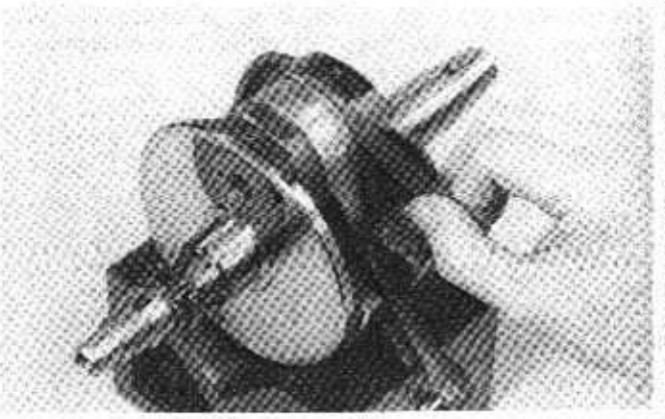
SERVICE LIMIT: 0.05 mm (0.002 in)

If runout exceeds the service limit, replace the crankshaft.



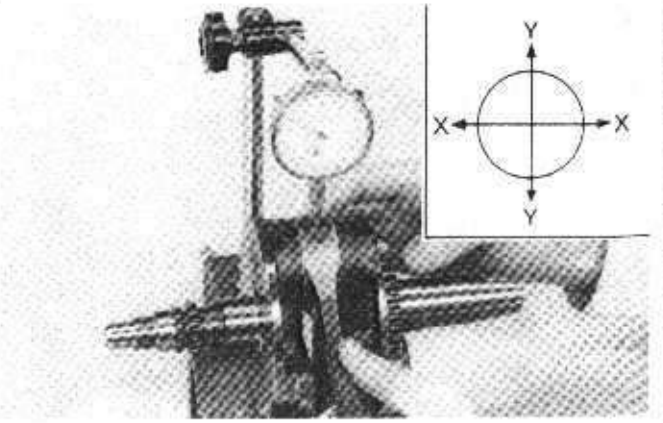
Measure the connecting rod big end side clearance with a feeler gauge.

SERVICE LIMIT: 0.60 mm (0.024 in)

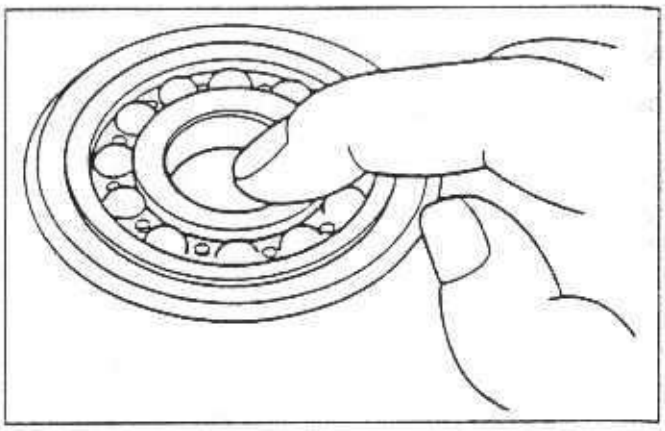


Measure the radial clearance at the connecting rod big end, at two points in the directions indicated by the arrows.

SERVICE LIMIT: 0.04 mm (0.002 in)



CRANKCASE BEARINGS REPLACEMENT

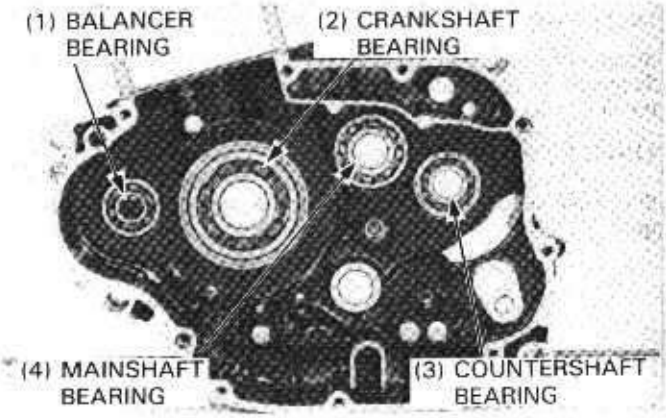


INSPECTION

Turn the inner race of each bearing with your finger. The bearings should turn smoothly and quietly. Also check that the bearing outer race fits tightly in the crankcase.
Remove and discard the bearings if the races do not turn smoothly, quietly, or if they fit loosely in the crankcase.

REMOVAL

When no special tools are listed, use commercially available bearing remove tools.

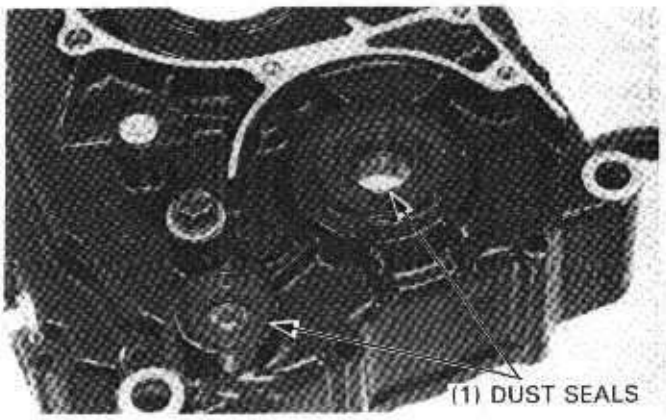


- Right crankshaft bearing

Drive the right crankshaft bearing out of the crankcase.

- Countershaft bearing

Remove the dust seals.
Drive the countershaft bearing out of the right and left crankcases using commercially available tools.



- Mainshaft bearing

TOOLS:

Bearing remover, 15 mm	**07936–KC10000**
– remover assembly, 15 mm	**07936–KC10500**
– remover shaft, 15 mm	**07936–KC10100**
– remover head, 15 mm	**07936–KC10200**
– remover weight	**07741–0010201**

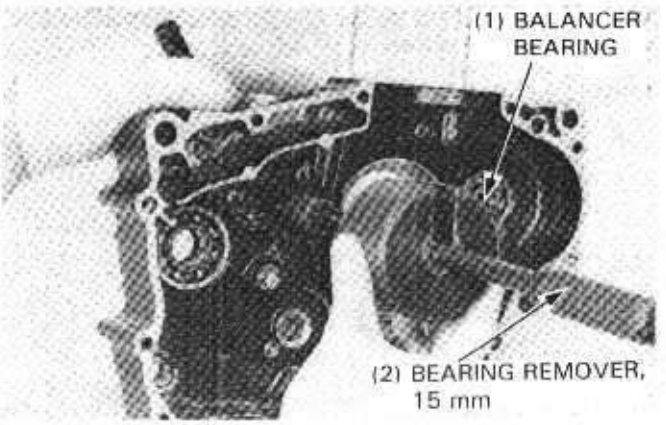
- Balancer bearing

Heat the crankcase around the balancer bearing to 176°F (80°C).

⚠WARNING

- *Always wear gloves when handling a heated crankcase.*

Tap around the bearing with soft hummer, then remove it from the case.



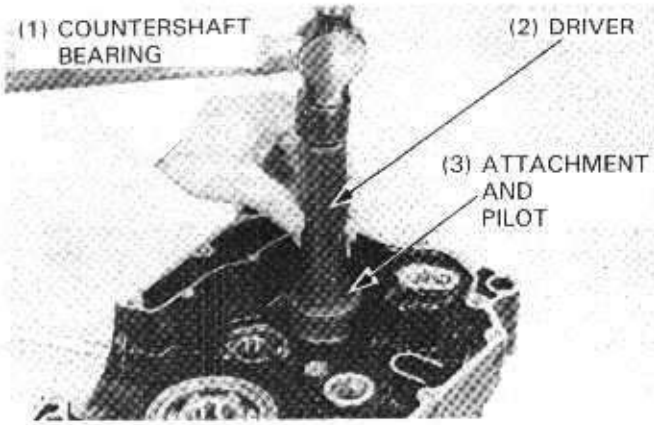
INSTALLATION

Drive-in new bearings with the following tools:

Left crankcase

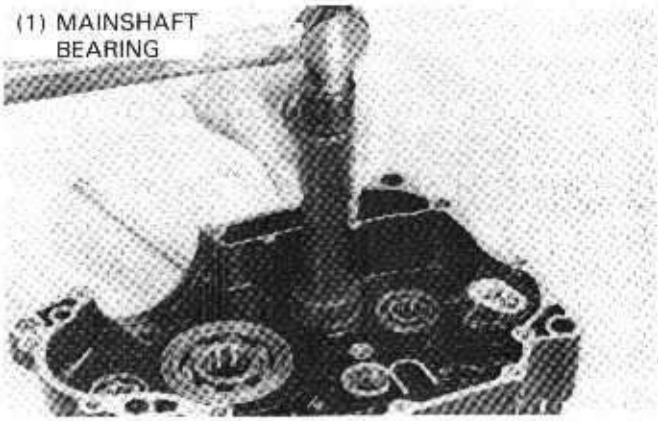
- Countershaft bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 52 x 55 mm	07746–0010400
Pilot, 22 mm	07746–0041000



- Mainshaft bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 32 x 35 mm	07746–0010100
Pilot, 15 mm	07746–0040300



- Balancer bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 37 x 40 mm	07746–0010200

- Crankshaft bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 62 x 68 mm	07746–0010500
Pilot, 28 mm	07746–0041100

Right crankcase

- Countershaft bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 42 x 47 mm	07746–0010300
Pilot, 17 mm	07746 0040400

- Mainshaft bearing:

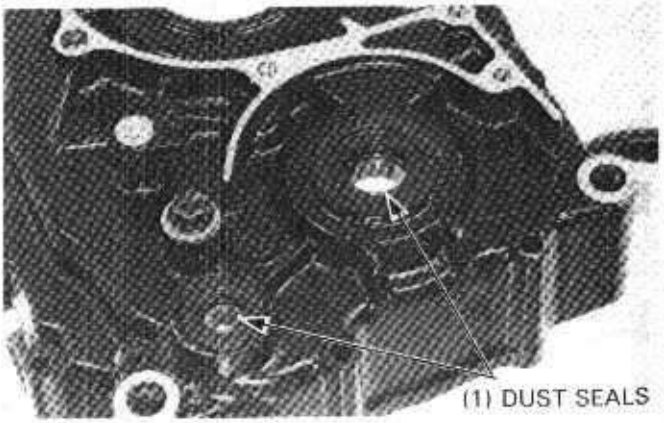
TOOLS:	
Driver	07749–0010000
Attachment, 42 x 47 mm	07746–0010300
Pilot, 20 mm	07746–0040500

- Balancer bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 37 x 40 mm	07746–0010200

- Crankshaft bearing:

TOOLS:	
Driver	07749–0010000
Attachment, 62 x 68 mm	07746–0010500
Pilot, 28 mm	07746–0041100

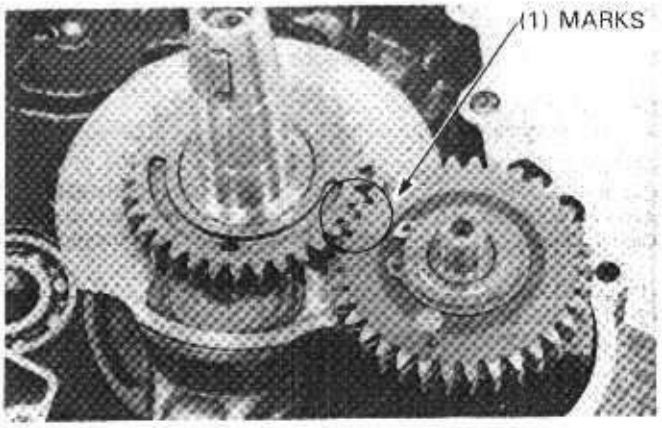


Apply grease to the dust seal lips and install new dust seals.

CRANKCASE ASSEMBLY

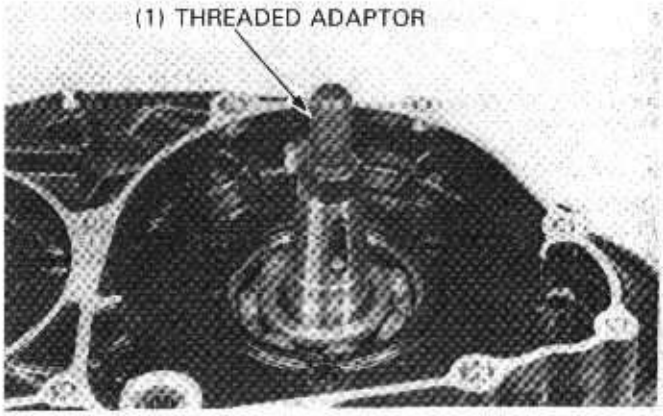
Install the crankshaft and balancer into the right crankcase, aligning the marks on the crankshaft gear and the balancer sub gear.

Remove the temporary holding pin from the balancer gear.



Position the left case cover the right case being careful to align the shaft.

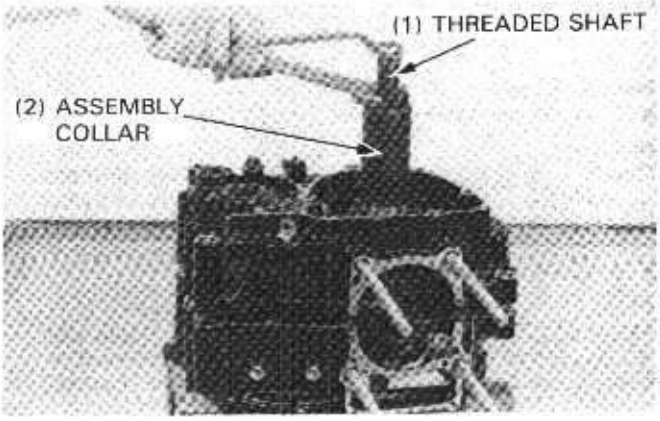
Install the threaded adaptor into the crankshaft.



Draw the crankshaft into the left crankcase with the crankshaft assembly tool, noting the connecting rod location. Remove the tool and the threaded adaptor.

TOOLS:

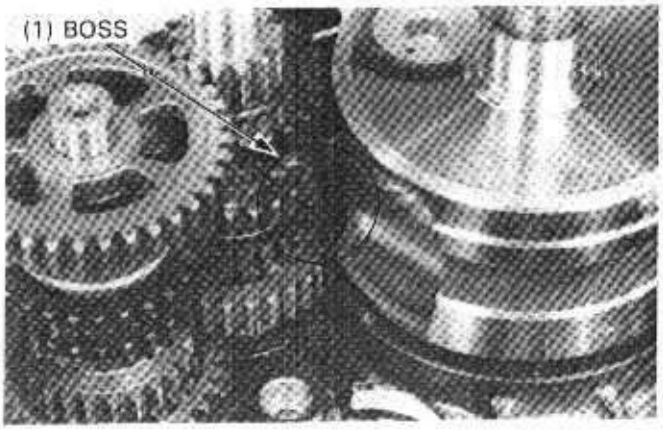
Crankcase assembly tool	**07965–VM00000**
— collar assembly	**07965–VM00100**
— threaded shaft	**07965–VM00200**
— threaded adaptor	**07965–VM00300**



Remove the right crankcase.

Remove the right crankcase.

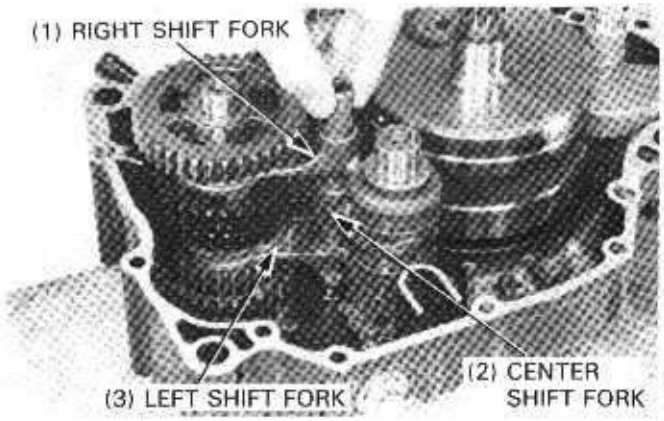
Install the mainshaft and countershaft assemblies, together aligning the bosses on the crankshaft and mainshaft gears.



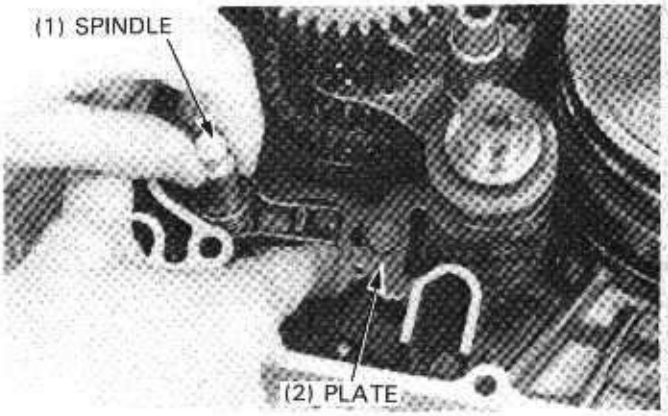
Install the left shift fork into the C6 gear groove with the "L" mark facing down.
Install the center shift fork into the M3/M4 gear groove with "C" mark facing up.

Install the right shift fork into the C5 gear groove with "R" mark facing up.

Insert the shift fork shaft through the shift forks into the left crankcase.



Align the return spring with the pin bolt and install the shift spindle while pulling the shift plate.

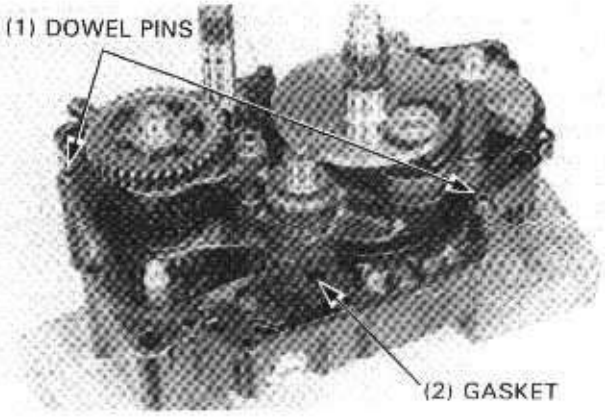


Clean the crankcase mating surfaces before assembling and check for wear or damage.

NOTE

- If there is minor roughness or irregularities on the crankcase mating surfaces, dress them with an oil stone.

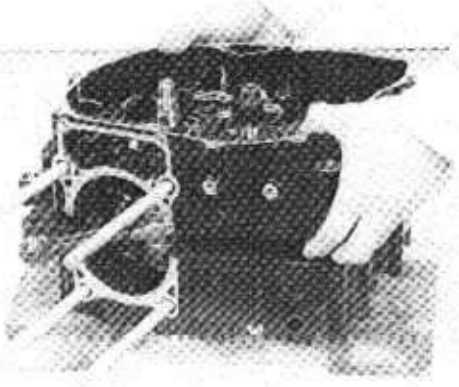
Install a new gasket and dowel pins.



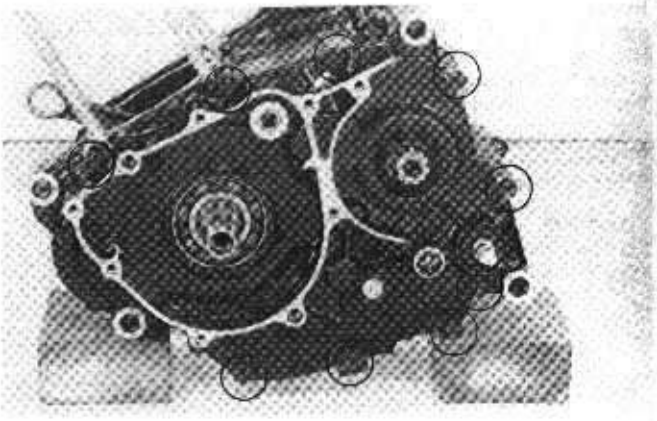
Assembly the right and left crankcases being careful to align the dowel pins and shafts.

CAUTION

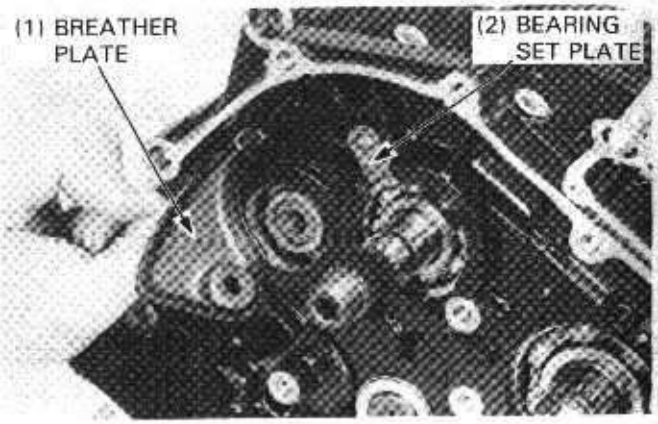
- *Don't force the crankcase halves together; if there is excessive force is required, something is wrong. Remove the right crankcase and check for misaligned parts.*



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



Install the mainshaft bearing set plate and the crankcase breather plate.



Make sure that the oil pipe and its oil bolt are not clogged, and that the sealing washers are in good condition.

NOTE

- When the installing the oil pipe on the engine, do not interchange the 7 mm and 8 mm oil bolts.

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

Install the removed parts in the reverse order of removal.