

ENGINE

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ENGINE COMPONENTS REMOVABLE WITH ENGINE IN PLACE

The parts listed below can be removed and installed without removing the engine from the frame. Refer to the page listed in each section for removal and installation instructions.

ENGINE LEFT SIDE

PARTS	REMOVAL	INSTALLATION
Engine sprocket	3-6	3-9
Starter drive/driven gear	3-14, -15	3-71
Generator rotor	3-21	3-63
Starter clutch	3-21	3-62
Gear position switch	3-11	3-79
Oil pump No.2	3-21	3-62
Balancer crank	3-22	—
Cam chain tensioner	3-21	3-62

ENGINE RIGHT SIDE

PARTS	REMOVAL	INSTALLATION
Exhaust pipe/muffler	3-4	3-10
Oil filter	3-15	3-70
Clutch pressure plate, drive plates, and driven plates	3-16, -17	3-68, -69
Clutch sleeve hub	3-17	3-67
Primary driven gear assembly	3-17	3-67
Primary drive gear	3-20	3-63
Oil pump idle gear and driven gear	3-18	3-66, -67
Oil pump No.1	3-18	3-66
Gearshift shaft	3-18	3-65
Gearshift cam driven gear	3-19	3-65
Gearshift cam stopper plate	3-19	3-64
Gearshift cam stopper	3-19	3-64
Balancer drive/driven gear	3-20	3-63, -64

ENGINE CENTER

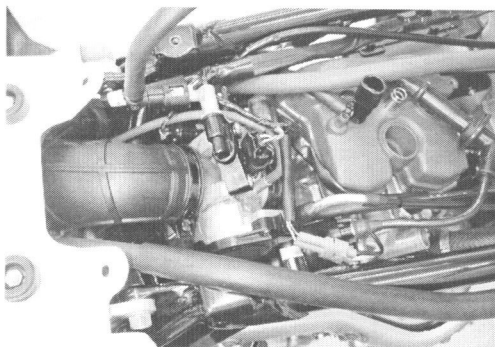
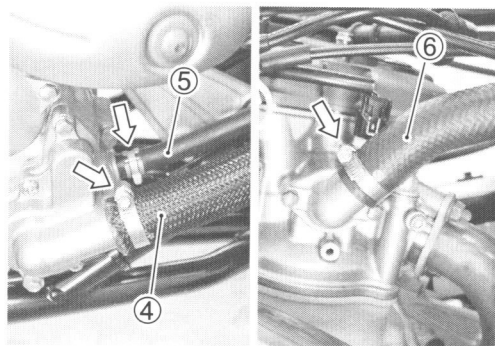
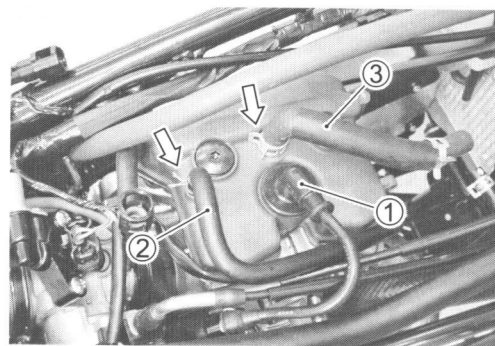
PARTS	REMOVAL	INSTALLATION
Throttle body	5-14	5-18
Starter motor	3-11	3-79
Cam chain tension adjuster	3-12	3-78
Cylinder head cover	3-11	3-79
Camshaft/automatic decompression assembly	3-13	3-76
Cylinder head	3-13	3-75
Cylinder	3-13	3-74
Piston	3-14	3-73
Cam chain	3-21	3-62
Cam chain guide	3-13	3-74

ENGINE REMOVAL AND REMOUNTING

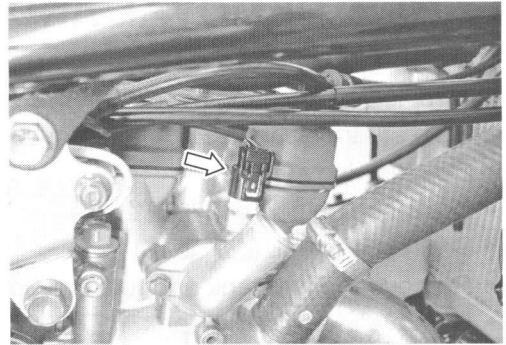
ENGINE REMOVAL

Before taking the engine out of the frame, wash the engine using a steam cleaner. Engine removal is sequentially explained in the following steps.

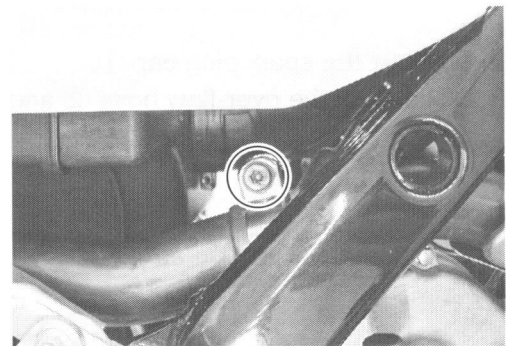
- Drain engine coolant. (☞ 2-15)
- Drain engine oil. (☞ 2-13)
- Remove the fuel tank and fuel tank lower cover. (☞ 5-4)
- Remove the oil return tank. (☞ 6-23)
- Remove the oil tank. (☞ 6-22)
- Remove the spark plug cap ①.
- Disconnect the over-flow hose ② and breather hose ③.
- Disconnect the engine coolant inlet hose ④, brather hose ⑤ and engine coolant outlet hose ⑥.
- Remove the throttle body assembly. (☞ 5-14)



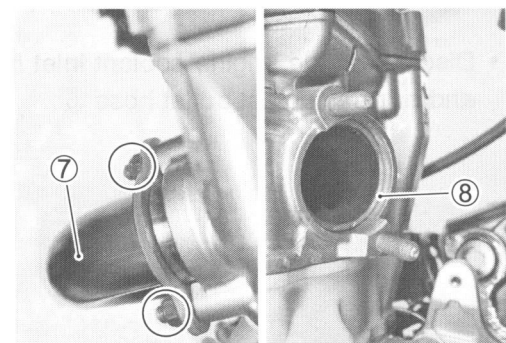
- Disconnect the ECT sensor coupler



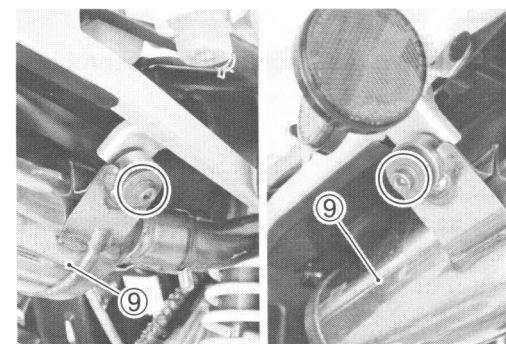
- Loosen the muffler clamp bolt.



- Remove the exhaust pipe ⑦.
- Remove the gasket ⑧.



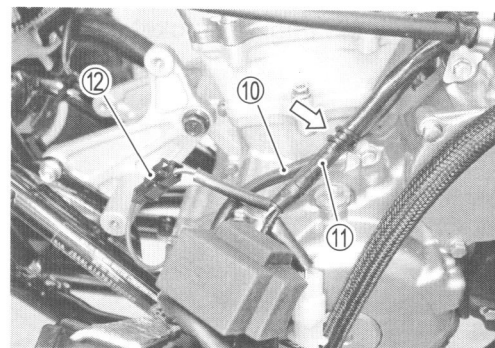
- Remove the muffler ⑨.



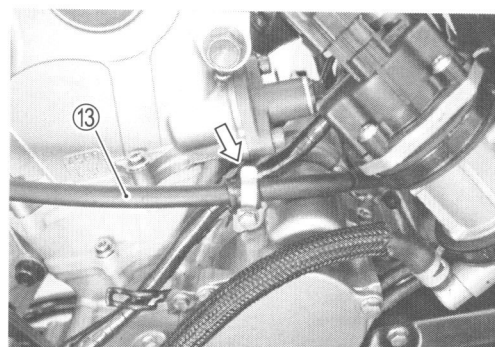
- Disconnect the motor lead wire.



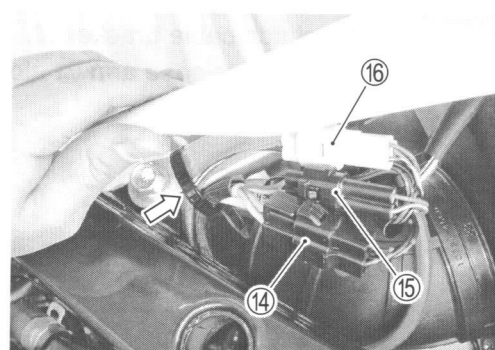
- Remove the starter motor lead wire ⑩ and wiring harness ⑪ from the clamp.
- Disconnect the ground lead wire coupler ⑫.



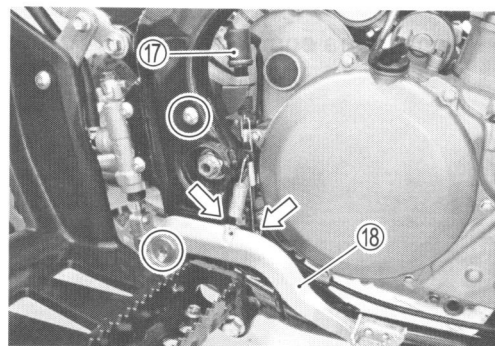
- Remove the parking brake cable ⑬ from the bracket.



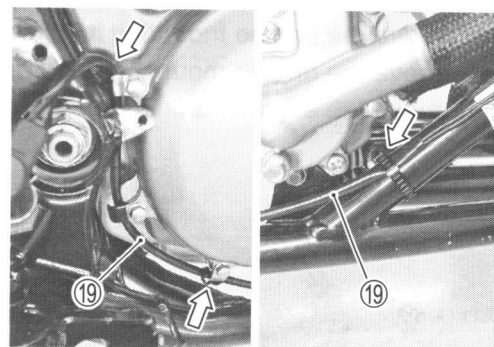
- Disconnect the generator starter coupler ⑭, CKP sensor ⑮ and gear position switch coupler ⑯.
- Remove the generator lead wire and gear position switch lead wire from the clamp.



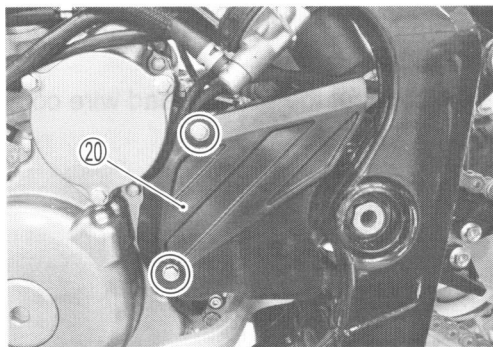
- Remove the rear brake switch ⑰ and brake pedal ⑱.
(☞ 7-67)



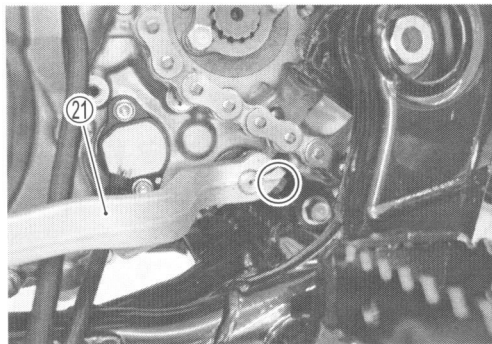
- Remove the rear brake switch wire ⑲ from the clamp.



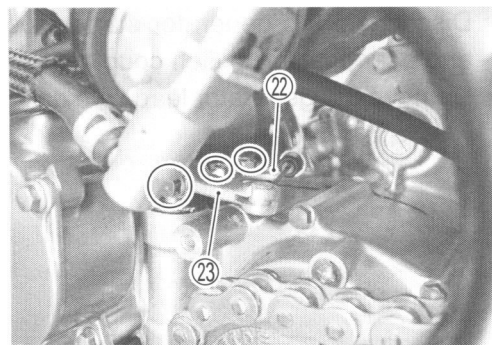
- Remove the engine sprocket cover ⑳.



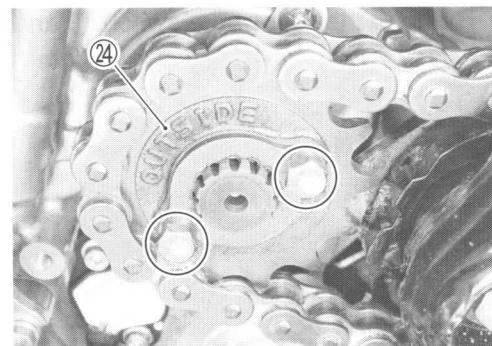
- Remove the gearshift lever ㉑.



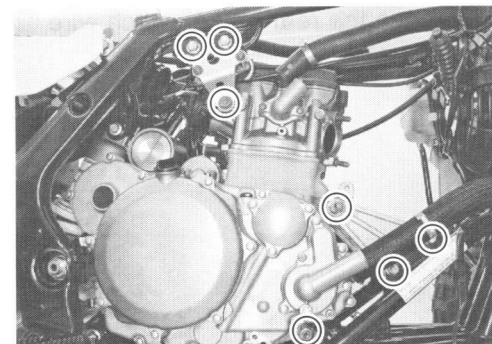
- Remove the clutch cable bracket ㉒.
- Remove the clutch release arm ㉓ along with the clutch cable.



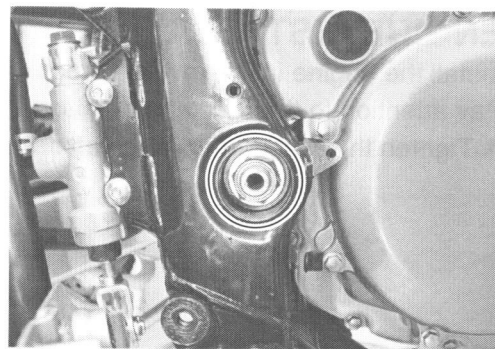
- Remove the engine sprocket ㉔ with drive chain.



- Remove the engine mounting lower brackets.
- Remove the engine mounting upper brackets.
- Remove the engine mounting bolts and nuts.



- Remove the swingarm pivot shaft nut and washer.

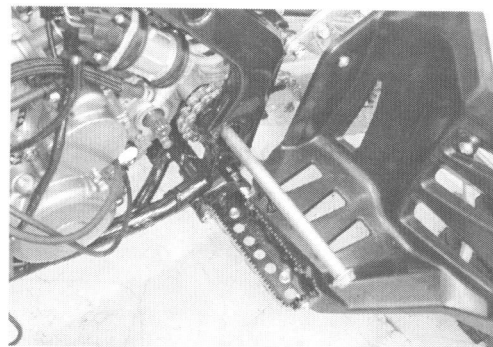


- Extract three quarters of the swingarm pivot shaft so as to keep the swingarm in position.

NOTE:

The swingarm will come off when the swingarm pivot shaft is completely removed.

- Remove the engine from the right side.

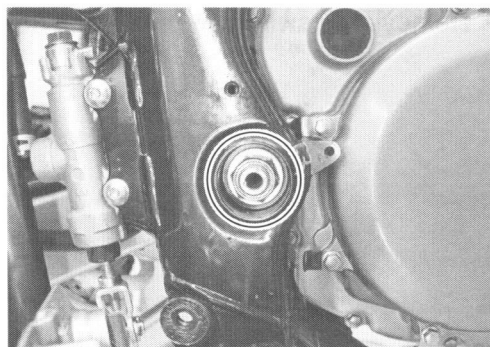


ENGINE INSTALLATION

Install the engine in the reverse order of engine removal.

Pay attention to the following points:

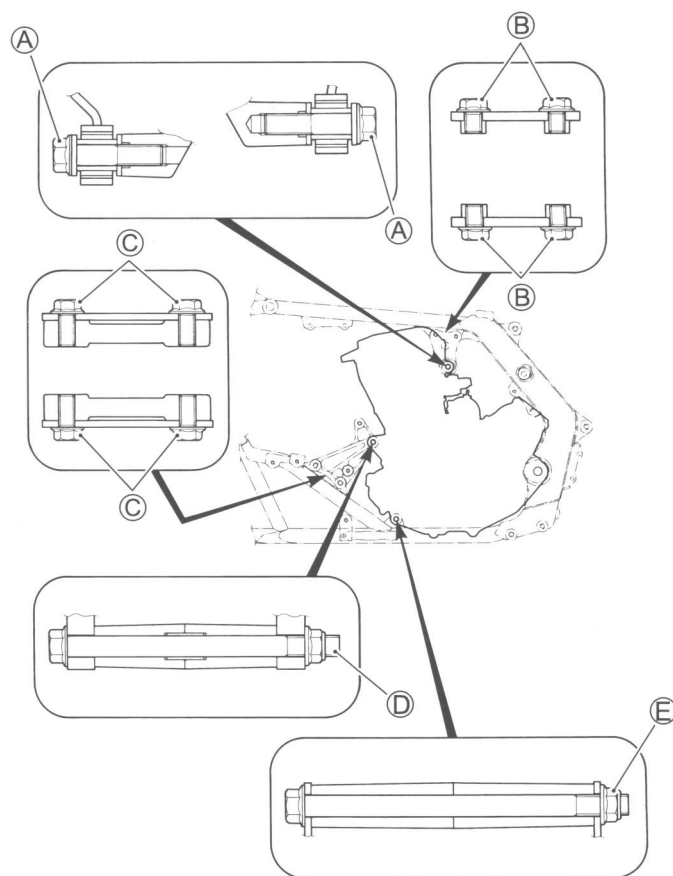
- Tighten the swingarm pivot shaft nut to the specified torque.



NOTE:

* The engine mounting nuts are self-locking.

* Once the nut has been removed, it is no longer of any use. Be sure to use new nuts, and then tighten them to the specified torque.

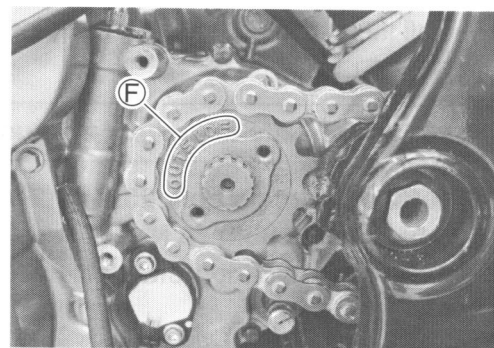


ITEM	N·m	kgf-m	lb-ft
(A)	55	5.5	40.0
(B)	26	2.6	19.0
(C)	26	2.6	19.0
(D)	55	5.5	40.0
(E)	55	5.5	40.0

- Install the engine sprocket with drive chain.

NOTE:

The letter **F** on the engine sprocket should face to the outside.

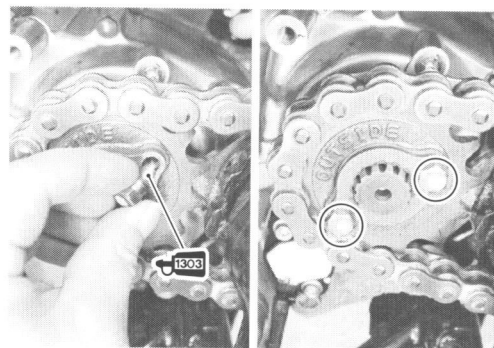


- Apply THREAD LOCK SUPER "1303" to the sprocket bolts.

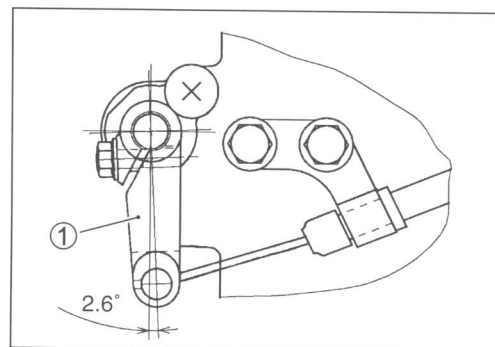
1303 99000-32030: THREAD LOCK SUPER "1303"

- Tighten the engine sprocket bolts to the specified torque.

Engine sprocket bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)



- Install the clutch release arm ① as shown in the illustration.

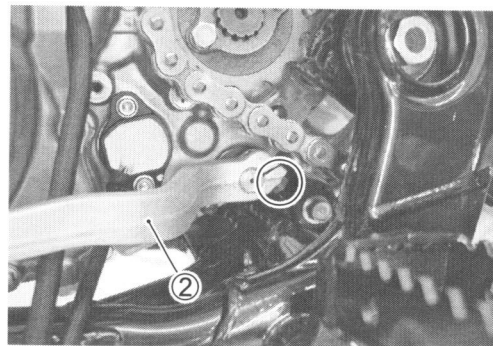
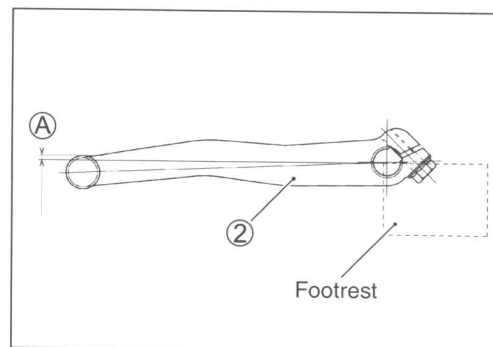


- Install the gearshift lever ② in the correct position.

DATA Gearshift lever height **A**: 5 – 10 mm (0.2 – 0.4 in)

Gearshift lever bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

Install the brake pedal and rear brake switch. (7-67)

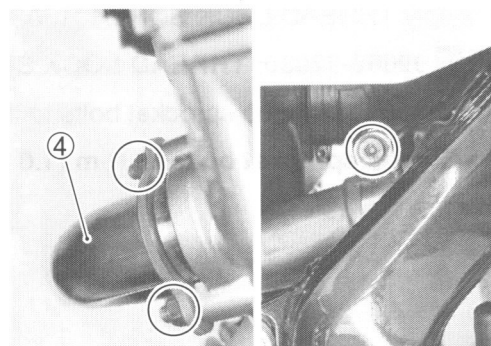
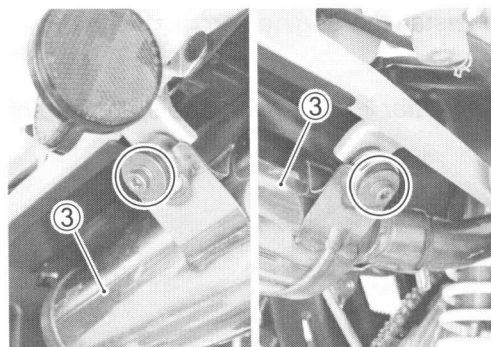


- Install the muffler ③ and exhaust pipe ④.

CAUTION

Use new gaskets to prevent exhaust gas leakage.

-  **Muffler mounting bolt: 23 N·m (2.3 kgf-m, 16.5 lb-ft)**
Exhaust pipe bolt: 23 N·m (2.3 kgf-m, 16.5 lb-ft)
Muffler connecting bolt: 23 N·m (2.3 kgf-m, 16.5 lb-ft)

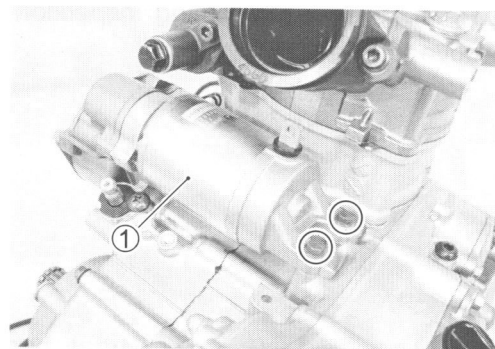


- Install the throttle body assembly. (☞ 5-18)
- Install the oil tank. (☞ 6-23)
- Install the oil return tank. (☞ 6-23)
- Install the fuel tank. (☞ 5-4)
- After installing the engine, route the wiring harness, cables and hoses properly. (☞ 9-15)
- Adjust the following items.
 - * Engine oil ☞ 2-13
 - * Engine coolant ☞ 2-15
 - * Throttle cable play ☞ 2-11
 - * Engine idle speed ☞ 2-12
 - * Clutch cable play ☞ 2-18
 - * Drive chain slack ☞ 2-26
 - * Brake pedal height ☞ 2-19
 - * Rear brake switch ☞ 2-19

ENGINE DISASSEMBLY

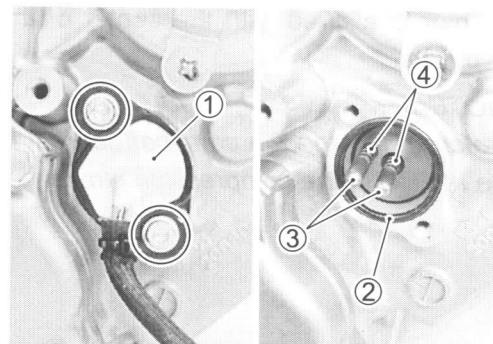
STARTER MOTOR

- Remove the starter motor ①.



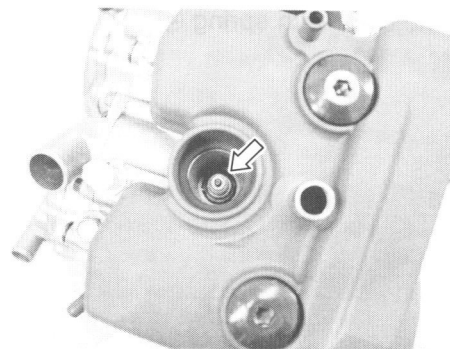
GEAR POSITION SWITCH

- Remove the gear position switch ①.
- Remove the O-ring ②, switch contacts ③ and springs ④.



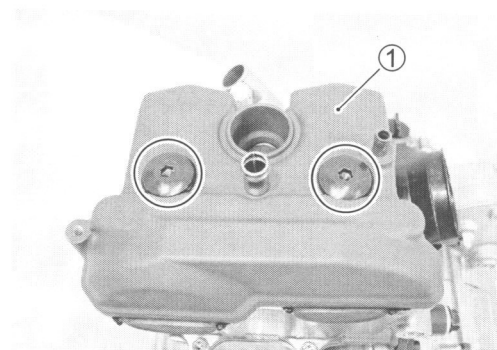
- Remove the spark plug.

 09930-10121: Spark plug wrench set



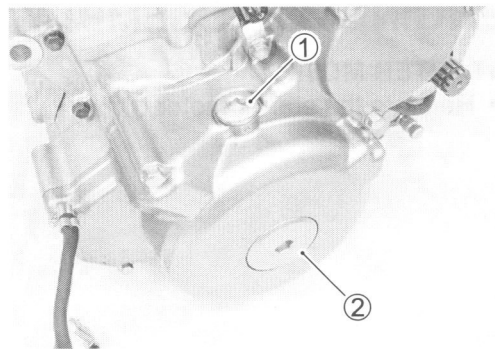
CYLINDER HEAD COVER

- Remove the cylinder head cover bolts, and then remove the cylinder head cover ①.



CAMSHAFT

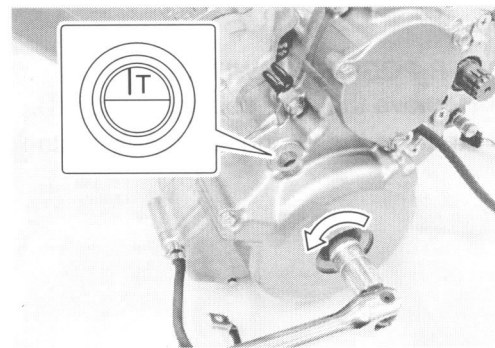
- Remove the valve timing inspection plug ① and generator cover cap ②.



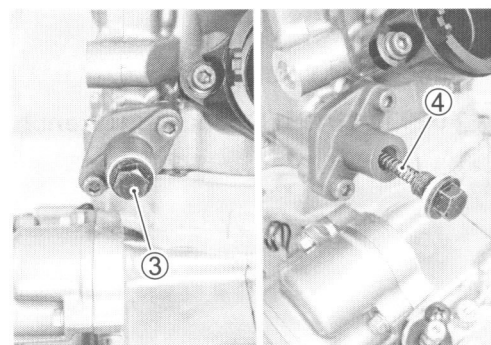
- Turn the generator rotor until the “T” line on the generator rotor is aligned with the center of the hole in the generator cover.

NOTE:

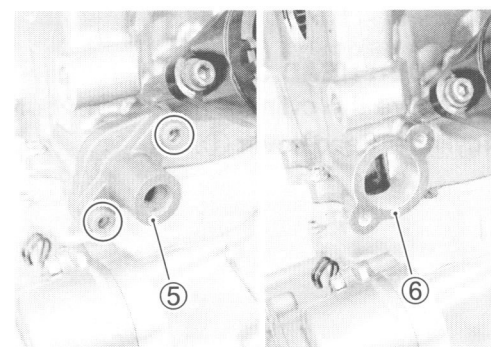
Before removing the camshaft journal holders, the piston must be at TDC of the compression stroke.



- Remove the spring holder bolt ③ of the cam chain tension adjuster with spring ④.



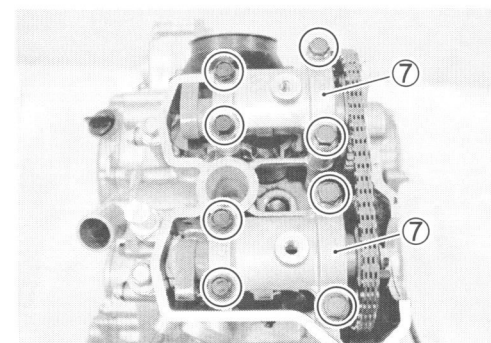
- Remove the cam chain tension adjuster ⑤ and gasket ⑥.



- Remove camshaft journal holders ⑦.

NOTE:

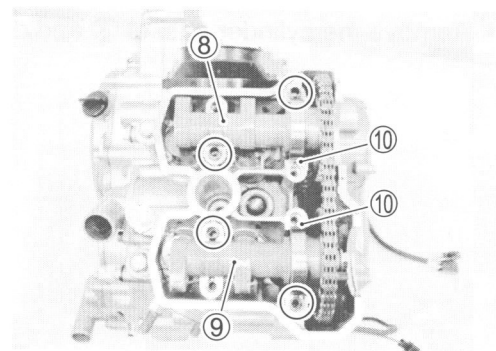
Loosen the camshaft journal holder bolts diagonally.



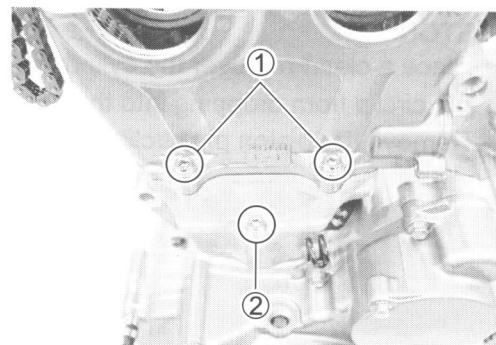
- Remove the dowel pins, intake camshaft ⑧, exhaust camshaft ⑨ and C-rings ⑩.

CAUTION

Do not drop the dowel pins, cam chain and C-rings into the crankcase.

**CYLINDER HEAD**

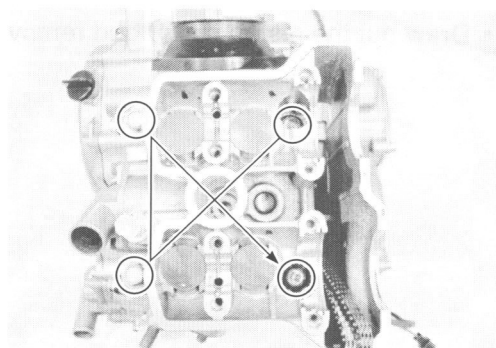
- Remove the cylinder head bolts ①.
- Loosen the cylinder base bolt ②.



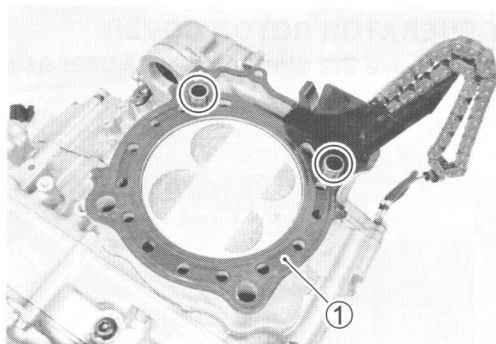
- Remove the four cylinder head bolts in diagonal stages, and then remove the cylinder head.

NOTE:

If the cylinder head does not come off easily, lightly tap it using a plastic mallet.

**CYLINDER**

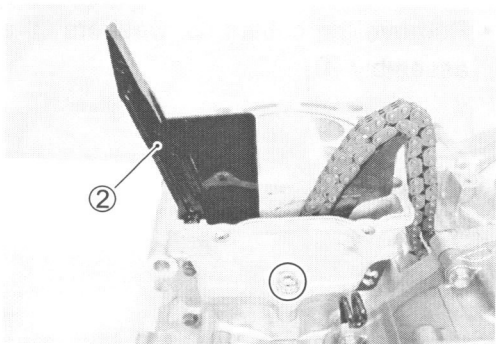
- Remove the cylinder head gasket ① and dowel pins.



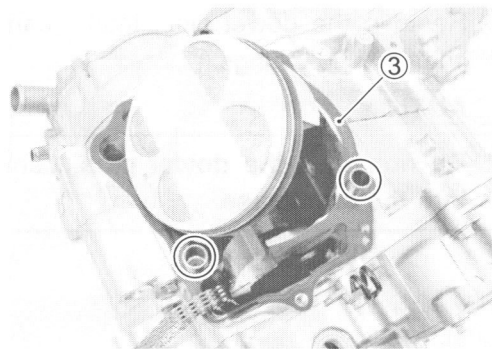
- Remove the cam chain guide ②.
- Remove the cylinder base bolt, and then remove the cylinder.

NOTE:

If the cylinder does not come off easily, lightly tap it using a plastic mallet.

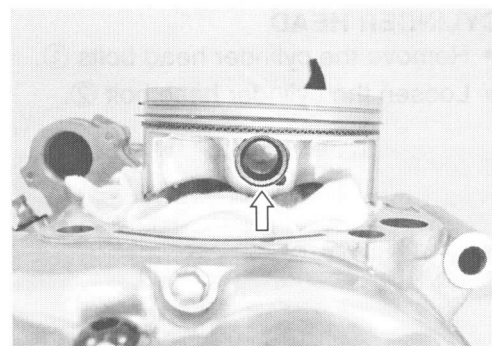


- Remove the cylinder gasket ③ and dowel pins.

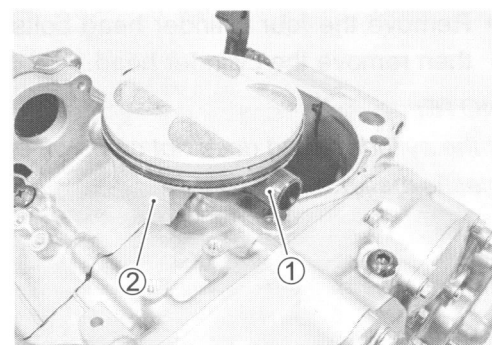


PISTON

- Place a clean rag over the cylinder base to prevent the piston pin circlip from dropping into the crankcase.
- Remove the piston pin circlip.

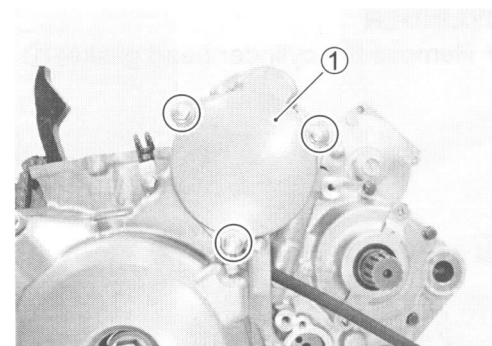


- Draw out the piston pin ① and remove the piston ②.

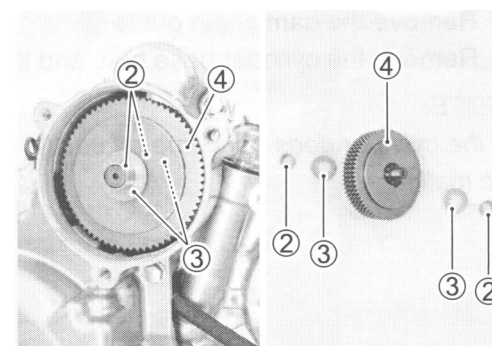


GENERATOR ROTOR COVER

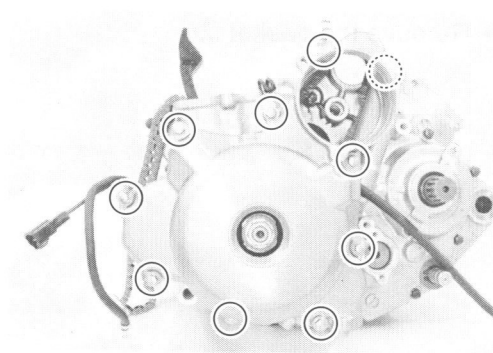
- Remove the starter torque limiter assembly cover ①.



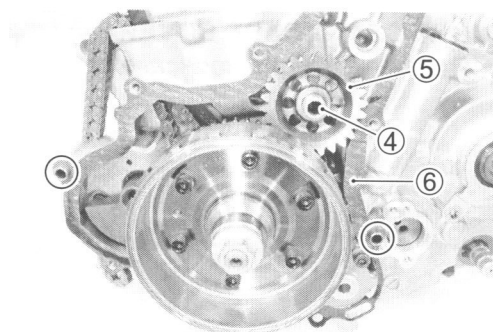
- Remove the collars ②, washers ③ and starter torque limiter assembly ④.



- Remove the generator rotor cover.

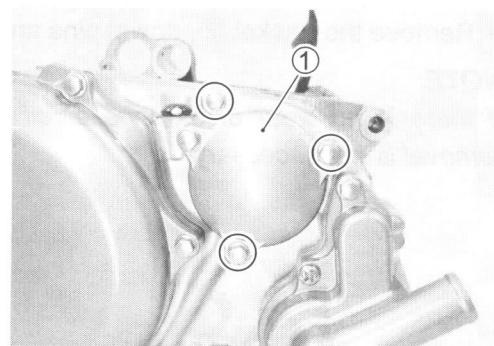


- Remove the shaft ④, starter idle gear ⑤, gasket ⑥ and dowel pins.

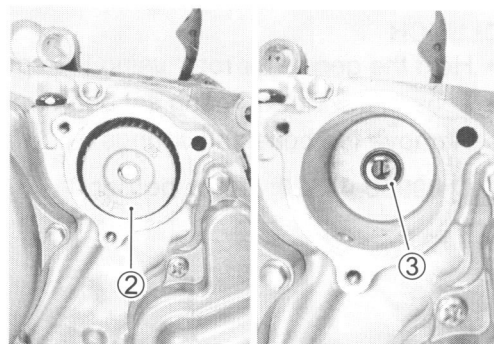


OIL FILTER

- Remove the oil filter cap ①.

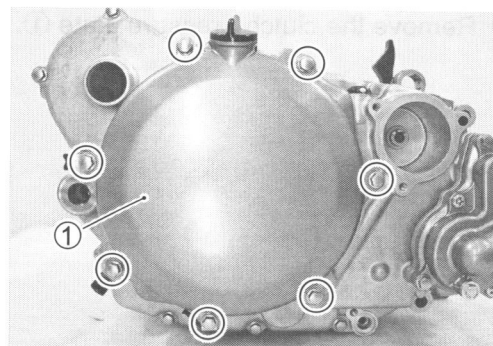


- Remove the oil filter ② and O-ring ③.

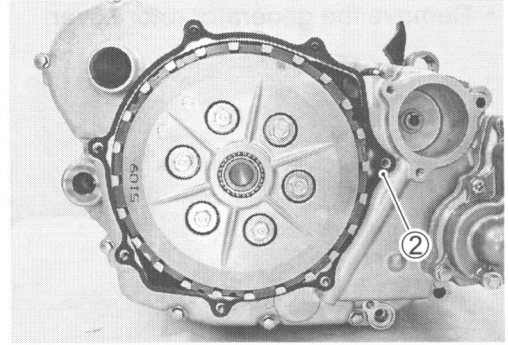


CLUTCH COVER

- Remove the clutch cover ①.

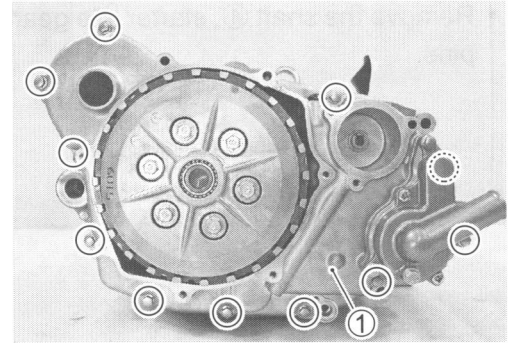


- Remove the gasket ②.



RIGHT CRANKCASE COVER

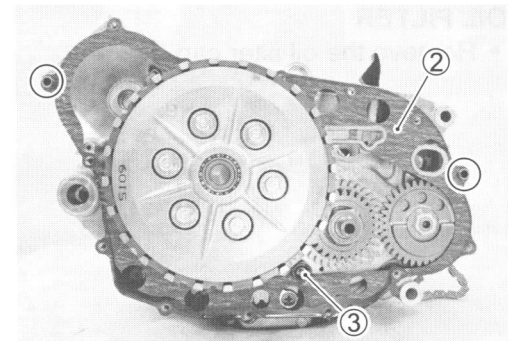
- Remove the right crankcase cover ①.



- Remove the gasket ②, dowel pins and oil seal ③.

NOTE:

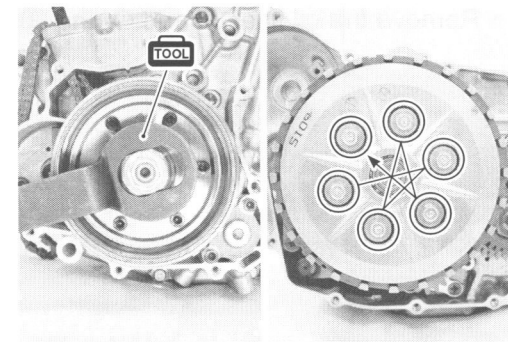
If there is no wear or damage at oil seal lip, the oil seal ③ removal is not necessary.



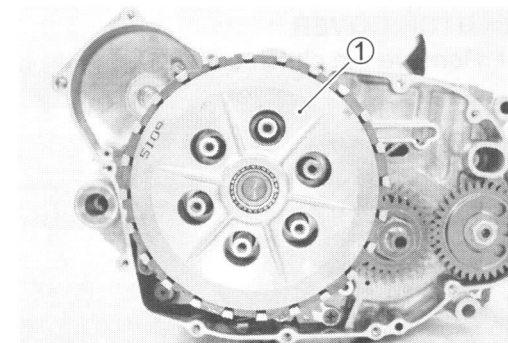
CLUTCH

- Hold the generator rotor using the special tool.
- Loosen the clutch spring set bolts working in diagonal stages.
- Remove the bolts and springs.

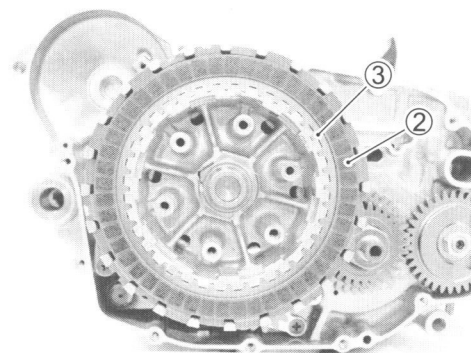
 09930-44520: Rotor holder



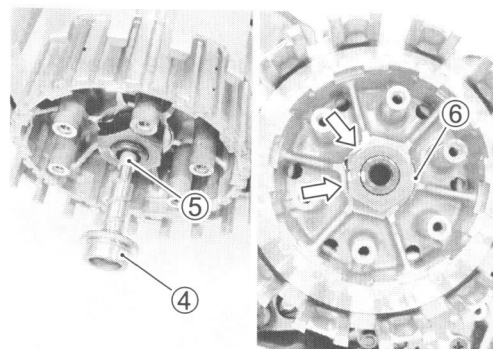
- Remove the clutch pressure plate ①.



- Remove the drive plates ② and driven plates ③.
- Remove the spring washer and spring washer seat.

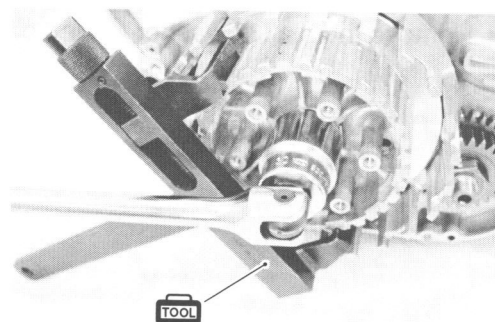


- Remove the push piece ④ and push rod ⑤.
- Flatten the lock washer ⑥.

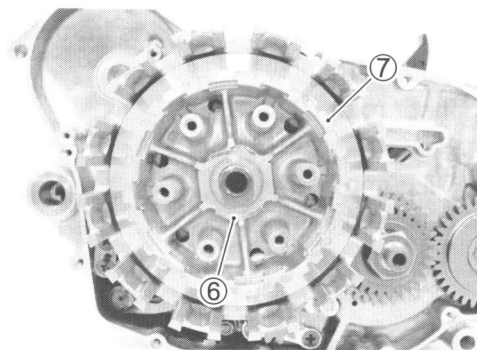


- Hold the clutch sleeve hub using the special tool, and then remove the clutch sleeve hub nut.

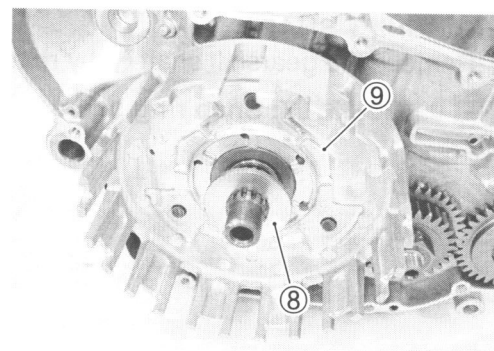
TOOL 09920-53740: Clutch sleeve hub holder



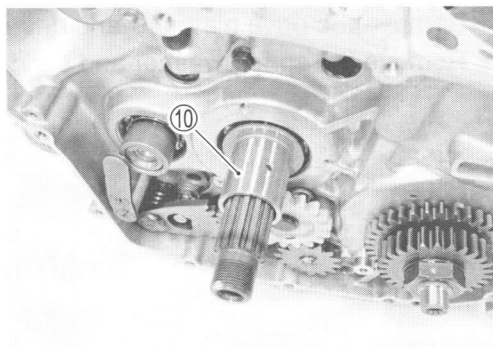
- Remove the lock washer ⑥ and clutch sleeve hub ⑦.



- Remove the washer ⑧ and primary driven gear assembly ⑨.



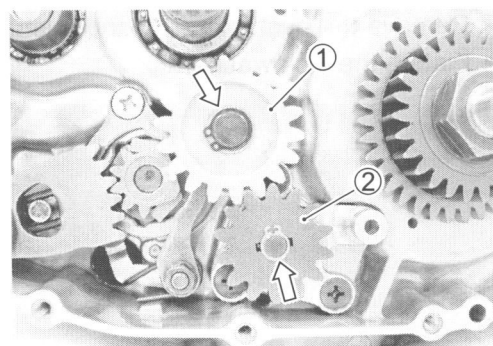
- Remove the spacer ⑩.



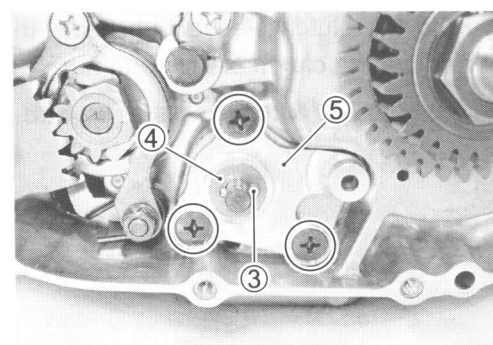
OIL PUMP (No.1)

- Remove the oil pump idle gear ① and oil pump driven gear ②.

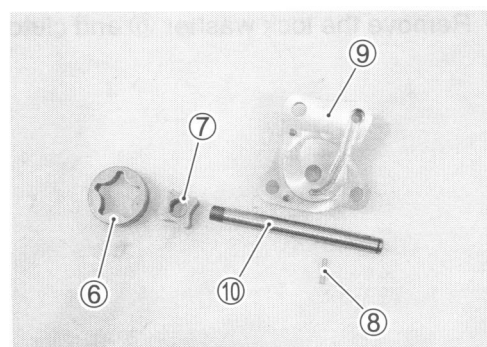
 09900-06107: Snap ring pliers



- Remove the pin ③, washer ④ and oil pump assembly ⑤.



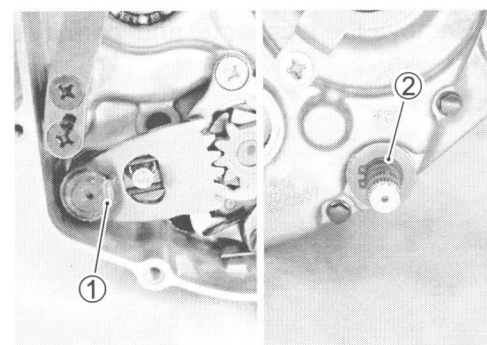
- Remove the following parts from the oil pump assembly.
Outer rotor ⑥
Inner rotor ⑦
Pin ⑧
Oil pump body ⑨
Oil pump shaft ⑩



GEARSHIFT SHAFT

- Remove the gearshift shaft ① by removing the snap ring ②.

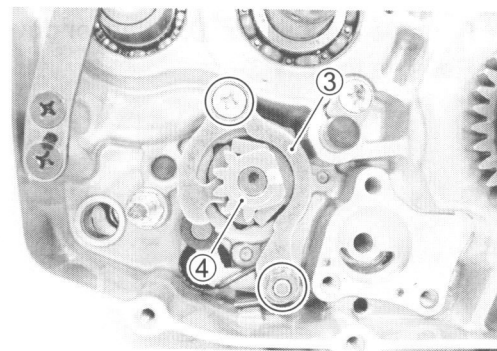
 09900-06107: Snap ring pliers



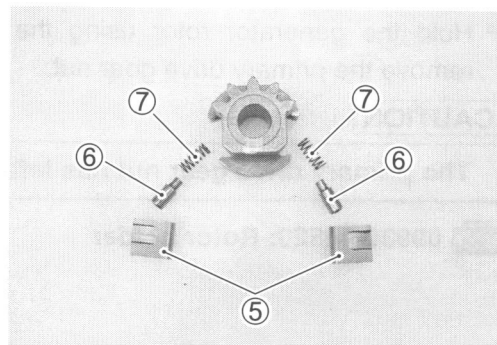
- Remove the gearshift pawl lifter ③ and gearshift cam driven gear ④.

NOTE:

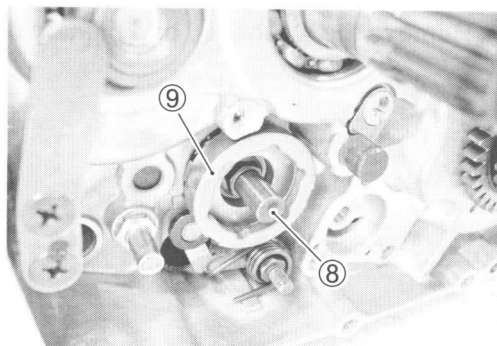
Be careful not to drop the pins and springs when removing the gearshift cam driven gear.



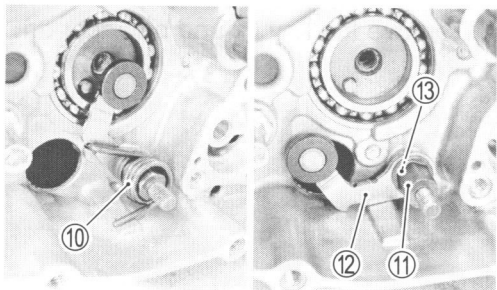
- Remove the gearshift pawls ⑤, pins ⑥ and springs ⑦.



- Remove the gearshift cam driven gear pin ⑧ and gearshift cam stopper plate ⑨.



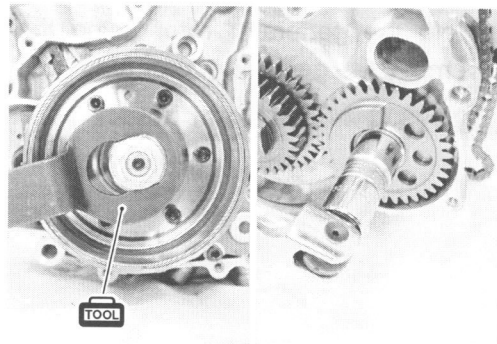
- Remove the spring ⑩.
- Remove the gearshift cam stopper bolt ⑪, gearshift cam stopper ⑫ and washer ⑬.



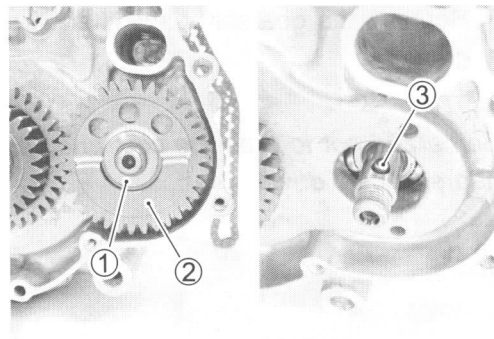
GENERATOR ROTOR

- Hold the generator rotor using the special tool, and then remove the balancer driven gear nut.

TOOL 09930-44520: Rotor holder



- Remove the washer ①, balancer driven gear ②.
- Remove the pin ③.

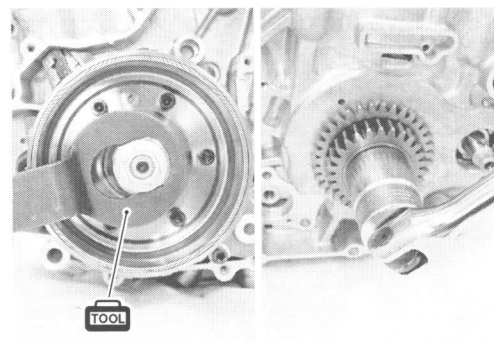


- Hold the generator rotor using the special tool, and then remove the primary drive gear nut.

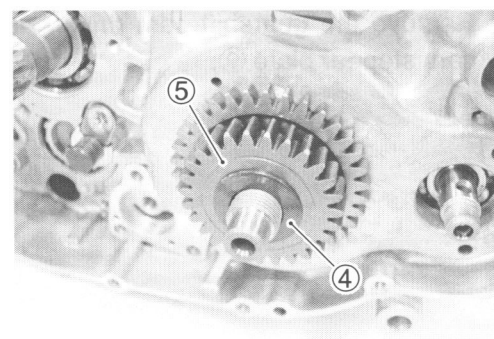
CAUTION

The primary drive gear nut has left-hand threads.

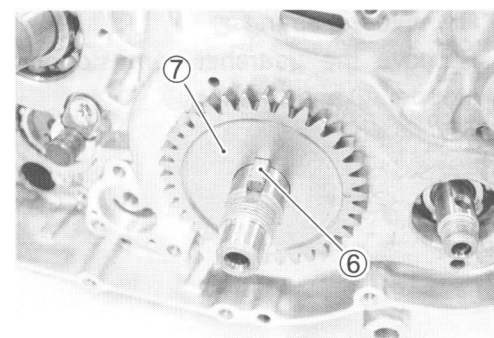
 09930-44520: Rotor holder



- Remove the washer ④ and primary drive gear ⑤.

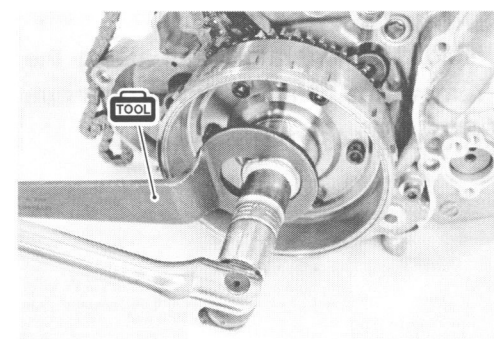


- Remove the key ⑥ and balancer drive gear ⑦.



- Hold the generator rotor using the special tool, and then remove the generator rotor nut.

 09930-44520: Rotor holder



- Remove the generator rotor using the special tool.

TOOL 09930-31921: Rotor remover

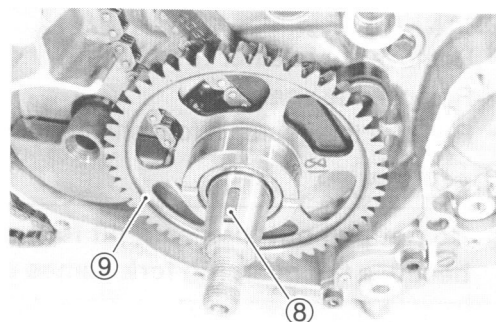
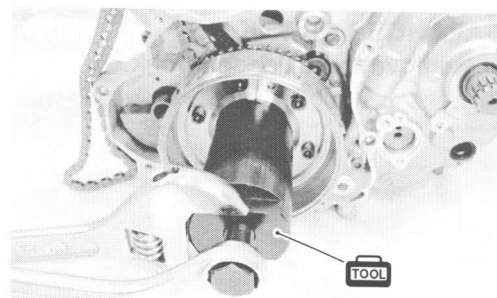
NOTE:

Temporarily install the generator rotor nut to the crankshaft, and then remove the generator rotor using the special tool.

CAUTION

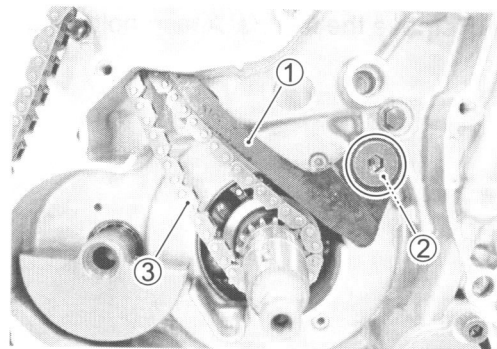
Do not hit the generator rotor with a hammer, otherwise the rotor may be damaged.

- Remove the generator rotor key ⑧.
- Remove the starter driven gear ⑨.



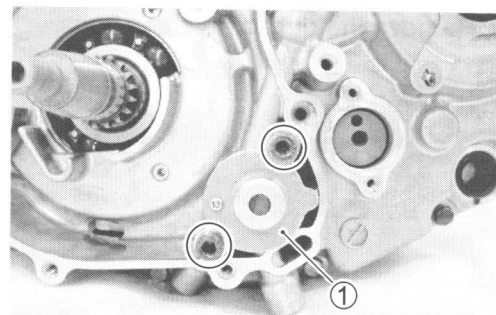
CAM CHAIN

- Remove the cam chain tensioner ①, washer ② and cam chain ③.

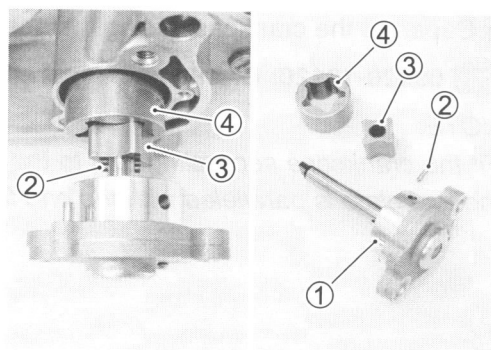


OIL PUMP (No.2)

- Remove the oil pump assembly ①.

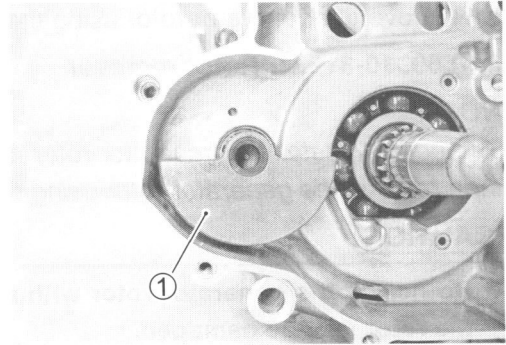


- Remove the pin ②, inner rotor ③ and outer rotor ④.



BALANCER CRANK

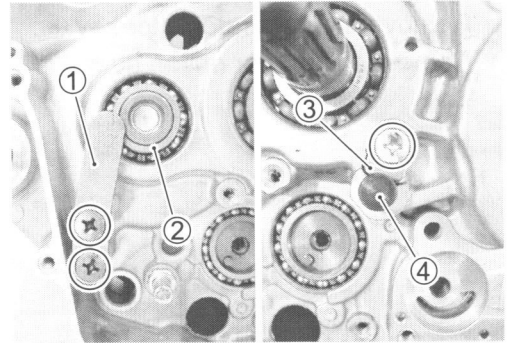
- Remove the balancer crank ①.

**CRANKCASE**

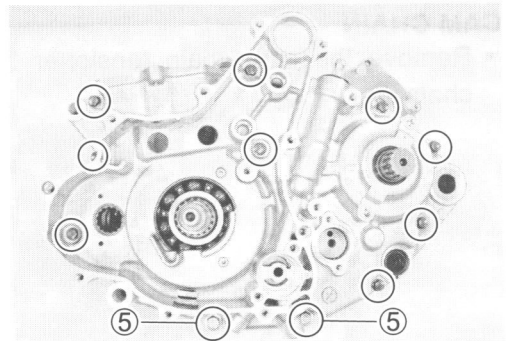
- Remove the retainer ①.
- Remove the spacer ②.
- Remove the gearshift fork shaft retainer ③.

CAUTION

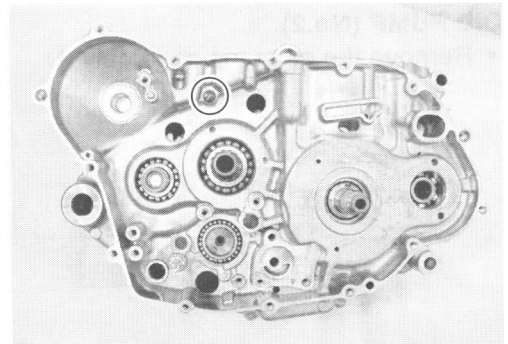
Do not pull out the gearshift fork shaft ④ at this point because the gearshift fork comes off in the crankcase.



- Remove the left crankcase bolts and engine oil drain plugs ⑤.



- Remove the right crankcase bolts.

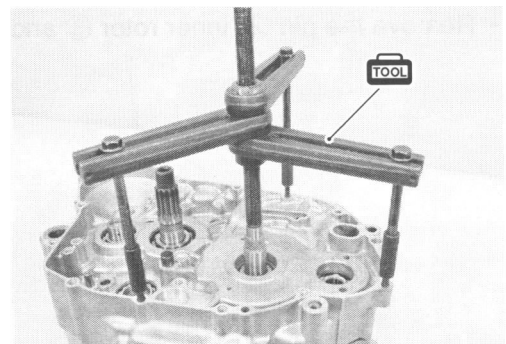


- Separate the crankcase using the special tool.

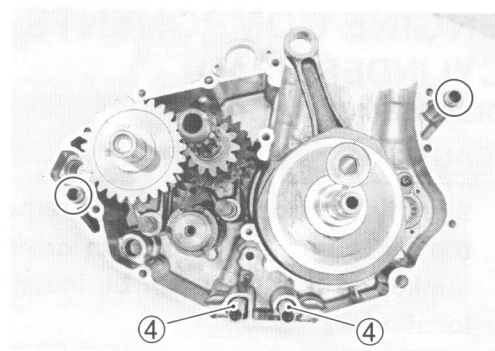
TOOL 09920-13120: Crankcase separating tool

NOTE:

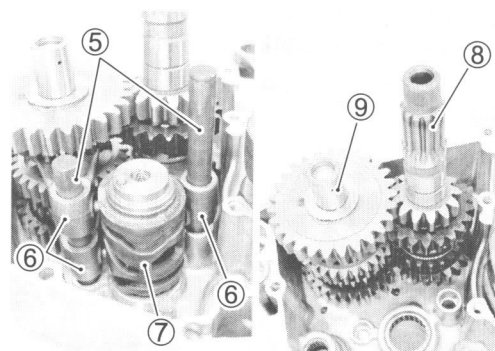
Fit the crankcase separating tool to the right crankcase, so that the tool plate is paralleled with the end face of the crankcase.



- Remove the dowel pins.
- Remove the oil strainers ④.

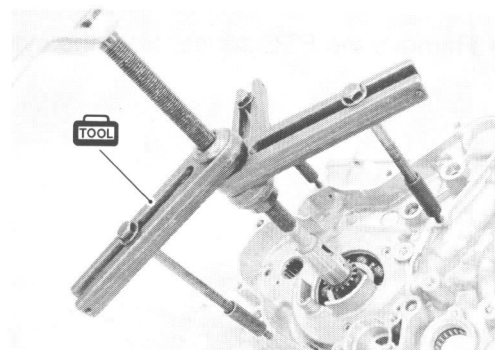


- Remove the gearshift fork shafts ⑤, gearshift forks ⑥ and gearshift cam ⑦.
- Remove the countershaft assembly ⑧ and driveshaft assembly ⑨.



- Remove the crankshaft from the crankcase using the special tool.

 **09920-13120: Crankcase separating tool**



ENGINE COMPONENTS INSPECTION AND SERVICE

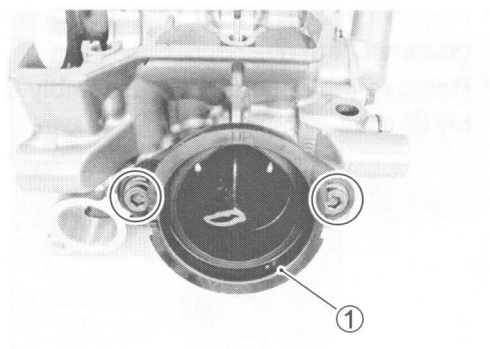
CYLINDER HEAD

DISASSEMBLY

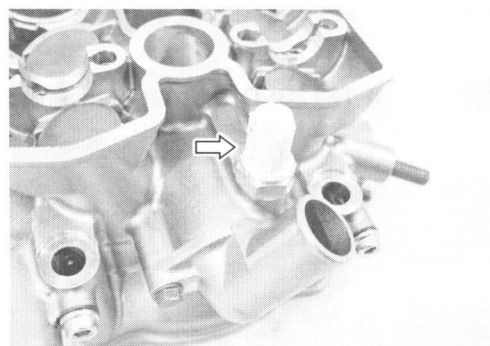
CAUTION

Identify the position of each removed part. Organize the parts in their respective groups (i.e., exhaust or intake) so that they can be installed in their original locations.

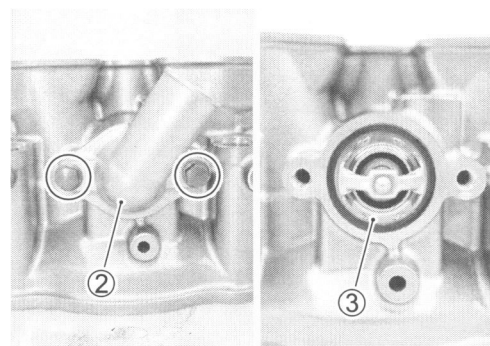
- Remove the intake pipe ①.



- Remove the ETC sensor from the cylinder head.



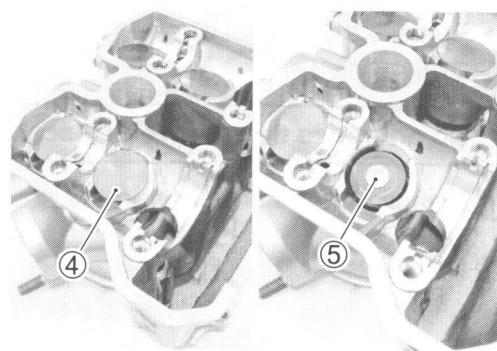
- Remove the thermostat cover ② and thermostat ③.



- Remove the tappets ④ and shims ⑤ by fingers or magnetic hand.

CAUTION

Identify the position of each removed part.



- Using the special tools, compress the valve spring and remove the two cotter halves ⑥ from the valve stem.

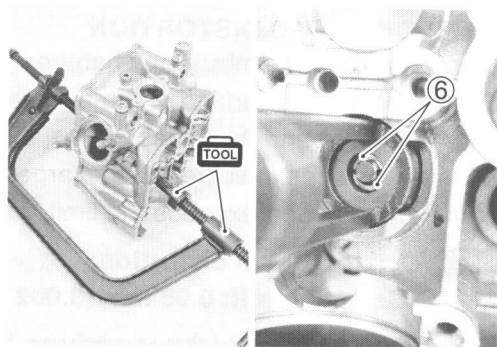


09916-14510: Valve lifter

09916-14521: Valve lifter attachment (Exhaust side)

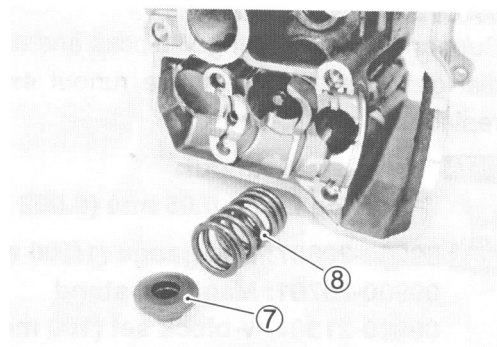
09916-14910: Valve lifter attachment (Intake side)

09916-84511: Tweezers

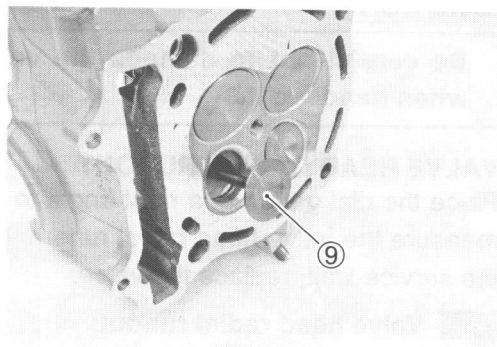
**CAUTION**

Be careful not to damage the tappet sliding surface with the special tool.

- Remove the valve spring retainer ⑦ and valve spring ⑧.



- Pull out the valve ⑨ from the combustion chamber side.

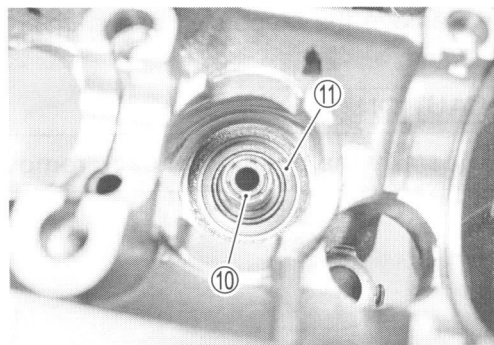


- Remove the oil seal ⑩ and spring seat ⑪.

CAUTION

Do not reuse the removed oil seal.

- Remove the other valves in the same manner as described previously.

**CYLINDER HEAD DISTORTION**

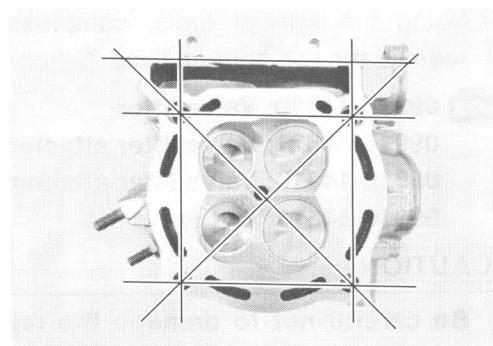
Decarbonize the combustion chambers.

Check the gasket surface of the cylinder head for distortion with a straightedge and thickness gauge, taking a clearance reading at several places indicated. If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder head.

DATA Cylinder head distortion:

Service Limit: 0.05 mm (0.002 in)

TOOL 09900-20803: Thickness gauge

**VALVE STEM RUNOUT**

Support the valve using V-blocks and check its runout using the dial gauge as shown. If the runout exceeds the service limit, replace the valve.

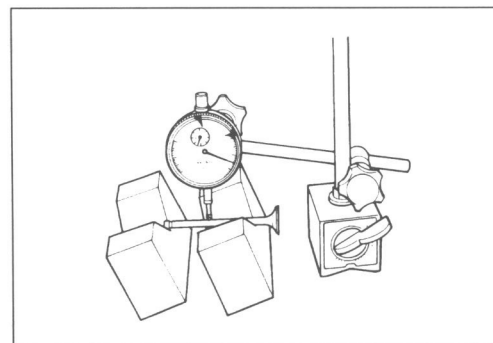
DATA Valve stem runout:

Service Limit: 0.05 mm (0.002 in)

TOOL 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

09900-21304: V-block set (100 mm)

**CAUTION**

Be careful not to damage the valve and valve stem when handling it.

VALVE HEAD RADIAL RUNOUT

Place the dial gauge at a right angle to the valve head face and measure the valve head radial runout. If it measures more than the service limit, replace the valve.

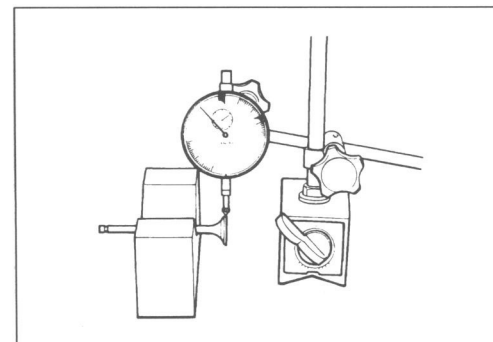
DATA Valve head radial runout:

Service Limit: 0.03 mm (0.001 in)

TOOL 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

09900-21304: V-block set (100 mm)

**CAUTION**

Be careful not to damage the valve and valve stem when handling it.

VALVE STEM AND VALVE FACE WEAR CONDITION

Visually inspect each valve stem and valve face for wear and pitting. If it is worn or damaged, replace the valve with a new one.



VALVE STEM DEFLECTION

Lift the valve about 10 mm (0.39 in) from the valve seat.

Measure the valve stem deflection in two directions, perpendicular to each other, by positioning the dial gauge as shown.

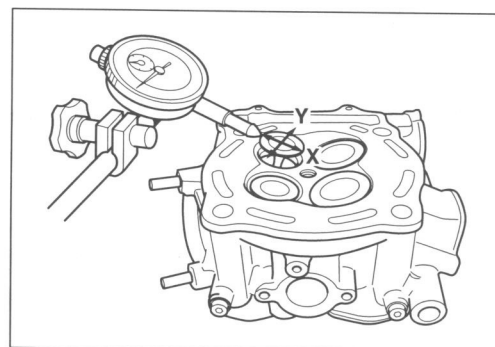
If the deflection measured exceeds the limit, then determine whether the valve or the guide should be replaced with a new one.

DATA Valve stem deflection (IN & EX):

Service Limit: 0.25 mm (0.010 in)

TOOL 09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand



VALVE STEM WEAR

If the valve stem is worn down to the limit, as measured with a micrometer, replace the valve.

If the stem is within the limit, then replace the guide.

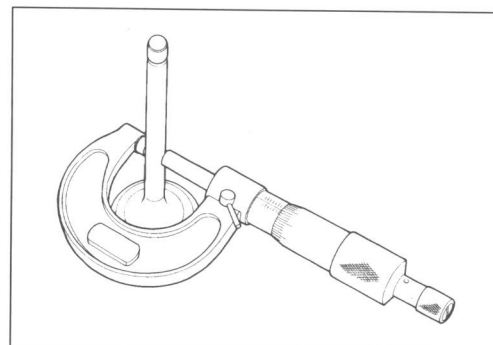
After replacing valve or guide, be sure to recheck the deflection.

DATA Valve stem O.D.:

Standard (IN) : 5.475 – 5.490 mm (0.2156 – 0.2161 in)

(EX) : 5.455 – 5.470 mm (0.2148 – 0.2154 in)

TOOL 09900-20205: Micrometer (0 – 25 mm)



NOTE:

If valve guides have to be removed for replacement after inspecting related parts, carry out the steps shown in valve guide servicing. (3-28)

VALVE GUIDE SERVICING

- Using the valve guide remover, drive the valve guide out toward the intake or exhaust camshaft side.

 **09916-44910: Valve guide remover/installer**

NOTE:

- * Discard the removed valve guide subassemblies.
- * Only oversized valve guides are available as replacement parts. (Part No. 11115-45G70)

- Re-finish the valve guide holes in cylinder head with the reamer and handle.

 **09916-34580: Valve guide reamer (10.8 mm)**
09916-34542: Reamer handle

CAUTION

When refinishing or removing the reamer from the valve guide hole, always turn it clockwise.

- Cool down the new valve guides in a freezer for about one hour and heat the cylinder head to 100 – 150 °C (212 – 302 °F) with a hot plate.

CAUTION

Do not use a burner to heat the valve guide hole to prevent cylinder head distortion.

- Apply engine oil to the valve guide hole.
- Drive the valve guide into the hole using the valve guide installer ① and attachment ②.

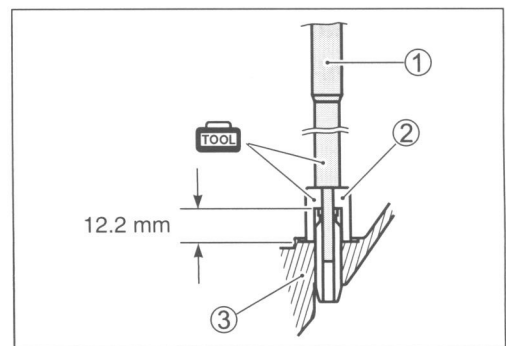
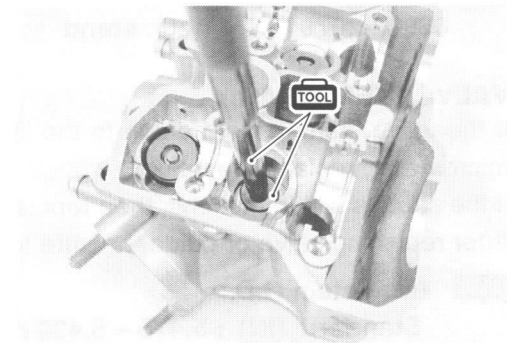
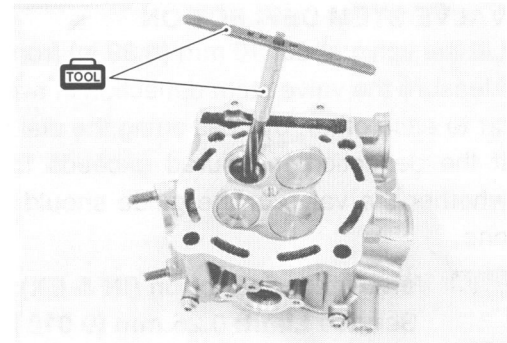
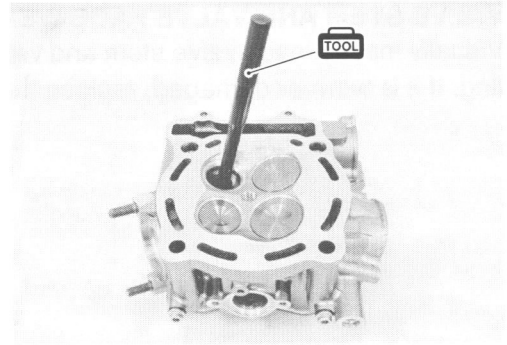
 **09916-44310: Valve guide remover/installer ①**
09916-53360: Attachment ②

NOTE:

Install the valve guide until the attachment contacts with the cylinder head ③.

CAUTION

Failure to oil the valve guide hole before driving the new guide into place may result in a damaged guide or head.

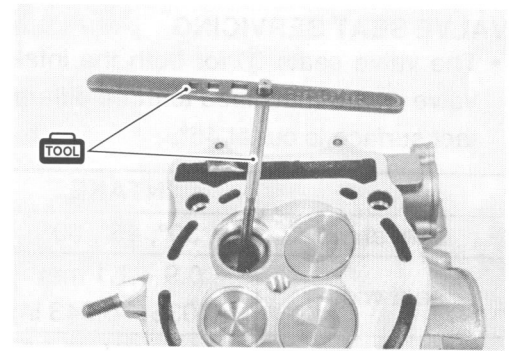


- After installing the valve guides, re-finish their guiding bores using the reamer.
- Clean and engine oil the guides after reaming.

TOOL 09916-34550: Valve guide reamer (5.5 mm)
09916-34542: Reamer handle

NOTE:

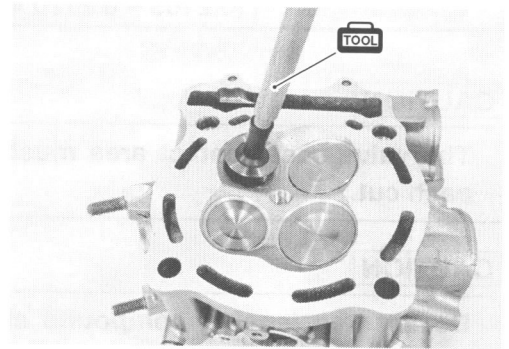
- * Be sure to cool down the cylinder head to ambient air temperature.
- * Insert the reamer from the combustion chamber and always turn the reamer handle clockwise.



VALVE SEAT WIDTH INSPECTION

- Visually check for valve seat width on each valve face.
- If the valve face has worn abnormally, replace the valve.
- Coat the valve seat with a red lead (Prussian Blue) and set the valve in place. Rotate the valve with light pressure.
- Check that the transferred red lead (blue) on the valve face is uniform all around and in center of the valve face.

TOOL 09916-10911: Valve lapper set

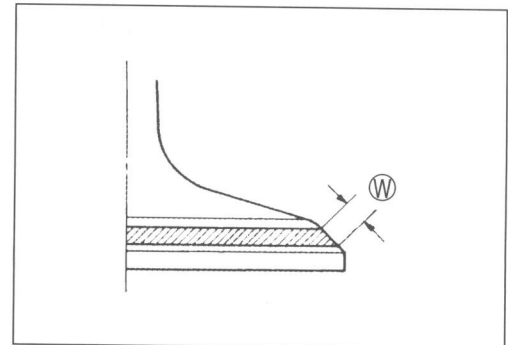


- If the seat width $\textcircled{W}$ measured exceeds the standard value or seat width is not uniform, refuse the seat using the seat cutter.

DATA Valve seat width $\textcircled{W}$:

Standard: 0.9 – 1.1 mm (0.035 – 0.043 in)

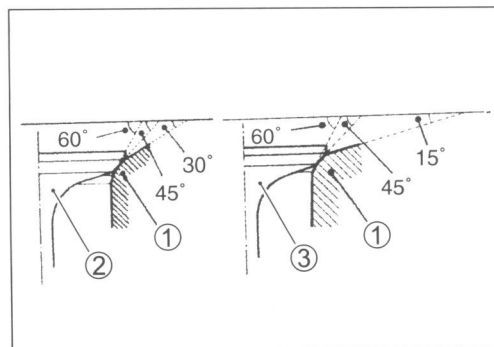
If the valve seat is out of specification, correct the seat by servicing it as follows:



VALVE SEAT SERVICING

- The valve seats ① for both the intake valve ② and exhaust valve ③ are machined to three different angles. The seat contact surface is cut at 45°.

	INTAKE	EXHAUST
seat angle	30°, 45°, 60°	15°, 45°, 60°
seat width	0.9 – 1.1 mm (0.035 – 0.043 in)	0.9 – 1.1 mm (0.035 – 0.043 in)
valve diameter	36 mm (1.42 in)	29 mm (1.14 in)
valve guide I.D.	5.500 – 5.512 mm (0.2165 – 0.2170 in)	5.500 – 5.512 mm (0.2165 – 0.2170 in)

**CAUTION**

The valve seat contact area must be inspected after each cut.

CAUTION

Do not use lapping compound after the final cut is made. The finished valve seat should have a velvety smooth finish but not a highly polished or shiny finish. This will provide a soft surface for the final seating of the valve which will occur during the first few seconds of engine operation.

CAUTION

The titanium valves are coated with an oxidized membrane treatment to resist wear but the membrane tend to be removed if lapped after valve seat servicing.

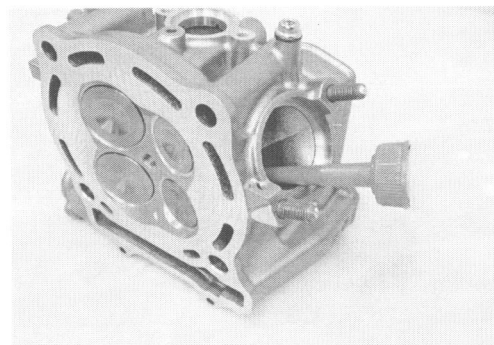
NOTE:

After servicing the valve seats, be sure to check the valve clearance after the cylinder head has been reinstalled. (P 2-5)

- Clean and assemble the head and valve components. Fill the intake and exhaust ports with gasoline to check for leaks.
- If any leaks occur, inspect the valve seat and face for burrs or other things that could prevent the valve from sealing.

⚠ WARNING

Always use extreme caution when handling gasoline.



VALVE SPRING

The force of the coil spring keeps the valve seat tight. Weakened spring results in reduced engine power output, and often accounts for the chattering noise coming from the valve mechanism.

Check the valve spring for proper strength by measuring its free length and also by the force required to compress it.

If the spring length is less than the service limit, or if the force required to compress the spring does not fall within the range specified, replace the spring.

DATA Valve spring free length:

Service limit: (IN.) 34.0 mm (1.34 in)
(EX.) 33.3 mm (1.31 in)

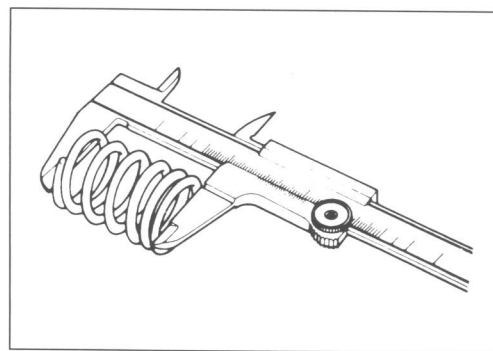
TOOL 09900-20102: Vernier calipers

DATA Valve spring tension:

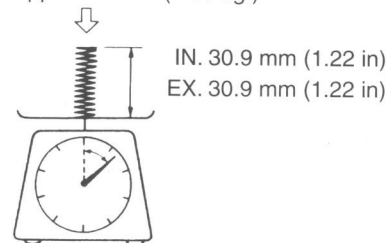
Standard:

(IN.) Approx. 119 – 137 N, 11.9 – 13.7 kgf/ 30.9 mm
(26.2 – 30.2lbs/ 1.22in)

(EX.) Approx. 78.5 N, 7.85 kgf/ 30.9 mm
(17.3 lbs/ 1.22in)



IN. Approx 119 – 137 N (11.9 – 13.7 kgf)
 EX. Approx 78.5 N (7.85 kgf)



IN. 30.9 mm (1.22 in)
 EX. 30.9 mm (1.22 in)

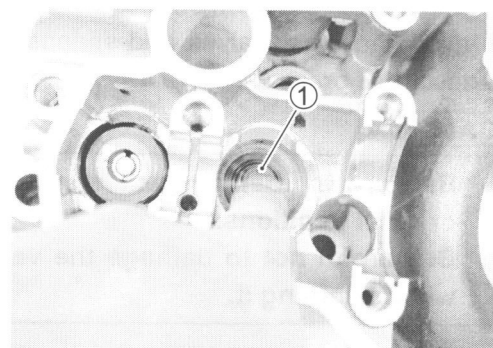
REASSEMBLY

- Install the valve spring seat.
- Apply MOLYBDENUM OIL SOLUTION to the oil seal ①, and press-fit it into position.

MOLYBDENUM OIL SOLUTION

CAUTION

Do not reuse the removed oil seal.

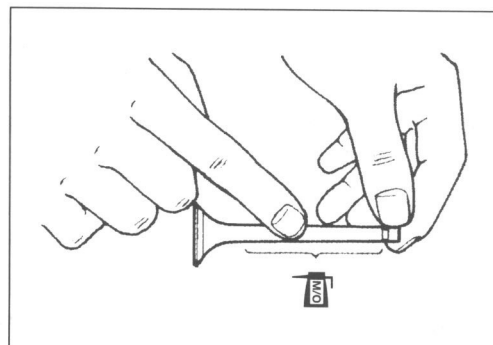


- Insert the valve, with its stem coated with MOLYBDENUM OIL SOLUTION all around and along the full stem length without any break.

CAUTION

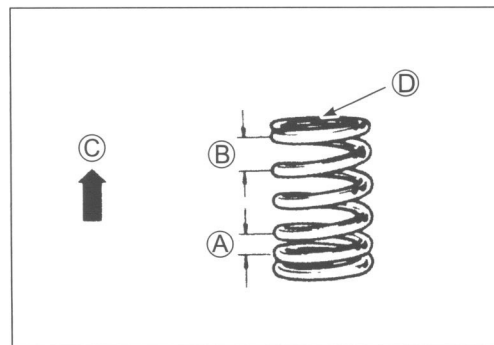
When inserting the valve, take care not to damage the lip of the oil seal.

MOLYBDENUM OIL SOLUTION



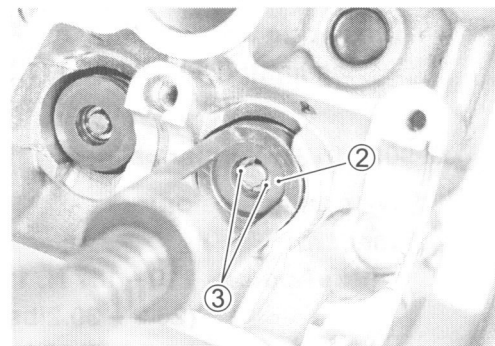
- Install the valve spring with the small-pitch portion (A) facing cylinder head.

- ⓑ Large-pitch portion
- ⓒ UPWARD
- ⓓ Paint



- Put on the valve spring retainer (2), and using the valve lifter, press down the spring, fit the valve cotter halves to the stem end, and release the lifter to allow the valve cotter (3) to wedge in between retainer and stem.

TOOL 09916-14510: Valve lifter
 09916-14521: Valve lifter attachment (Exhaust side)
 09916-14910: Valve lifter attachment (Intake side)
 09916-84511: Tweezers

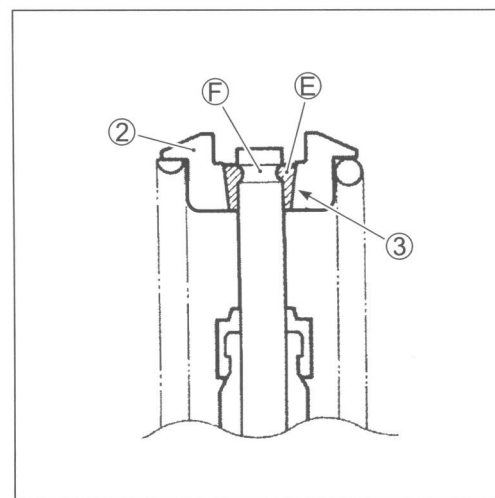


- Be sure that the rounded lip (E) of the cotter fits snugly into the groove (F) in the stem end.
- Install the other valves and springs in the same manner as described previously.

CAUTION

- * Be sure to restore each spring and valve to their original positions.
- * Be careful not to damage the valve and valve stem when handling it.

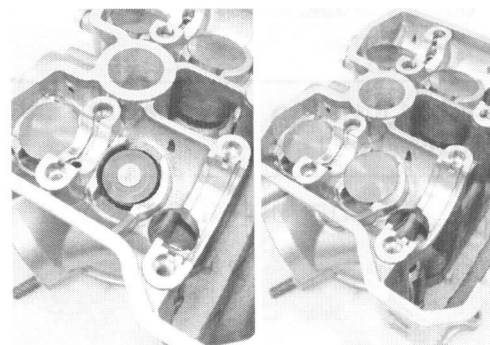
- ② Valve spring retainer
- ③ Valve cotter



- Install the tappet shims and the tappets to their original positions.

NOTE:

- * Apply engine oil to the stem end, shim and tappet before fitting them.
- * When seating the tappet shim, be sure the figure printed surface faces the tappet.



- Install the ETC sensor. (6-11)
- Apply SUZUKI SUPER GREASE to the O-ring.

 99000-25010: SUZUKI SUPER GREASE "A"
(or equivalent grease)

CAUTION

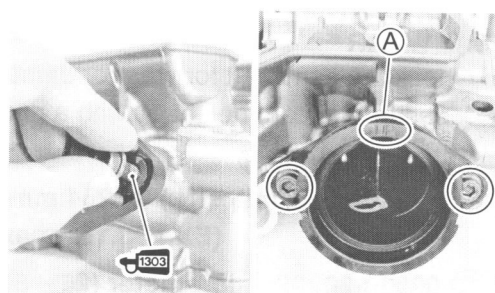
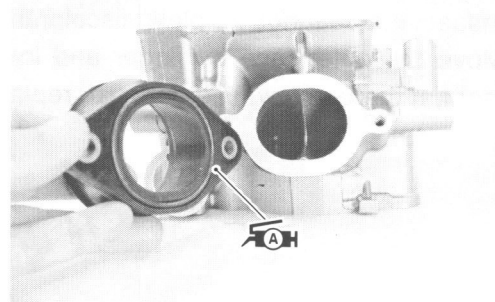
The removed O-ring must be replaced with a new one.

- Apply THREAD LOCK SUPER "1303" to the intake pipe bolts.
- Install the intake pipe.

NOTE:

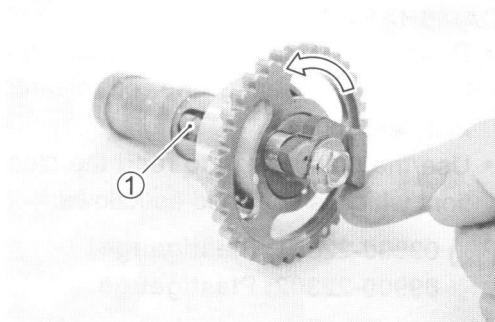
Make sure that the "up mark" Ⓐ comes to the upper side.

 99000-32030: THREAD LOCK SUPER "1303"



AUTOMATIC DECOMP.

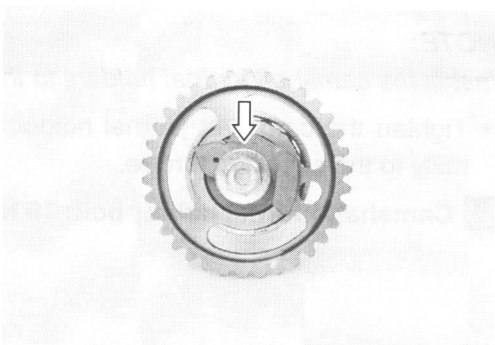
Check the decomp. cam moves smoothly and shaft ① rotates together. If any abnormal condition are found, replace the cam-shaft assembly.



CAMSHAFT

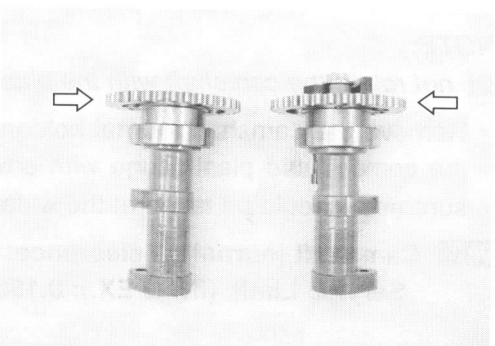
CAUTION

Do not attempt to disassemble the camshaft/automatic decomp. assembly. It is not serviceable.



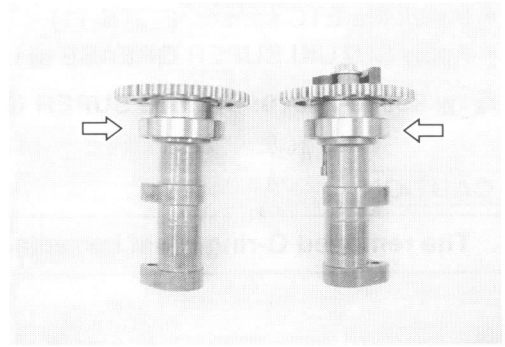
CAM SPROCKET

Inspect the sprocket teeth for wear. If they are worn, replace the camshafts, crankshaft and cam chain as a set.



CAMSHAFT BEARING

Inspect the bearings for play, discoloration, wear and seizure. Move the outer race by finger and inspect for smooth movement. If there is anything unusual, replace the camshaft assembly.

**CAM WEAR**

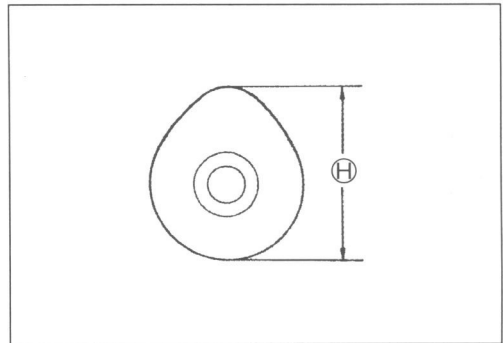
- Check the camshaft for wear or damage.
- Measure the cam height $\textcircled{H}$ with a micrometer.

**Cam height $\textcircled{H}$**

Service Limit (IN.) 32.264 mm (1.2702 in)
(EX.) 33.151 mm (1.3052 in)



09900-20202: Micrometer (25 – 50 mm)

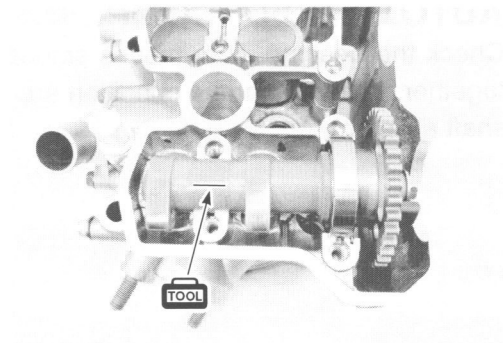
**CAMSHAFT JOURNAL WEAR**

- Determine whether or not each journal is worn down to the limit by measuring the oil clearance with the camshaft installed in place.
- Use the plastigauge to read the clearance at the widest portion, which is specified as follows:



09900-22301: Plastigauge

09900-22302: Plastigauge

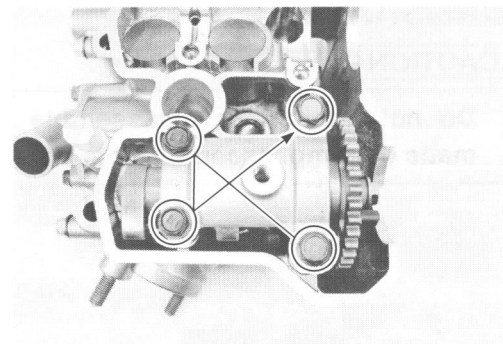
**NOTE:**

Install the camshaft journal holders to their original positions.

- Tighten the camshaft journal holder bolts evenly and diagonally to the specified torque.



Camshaft journal holder bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

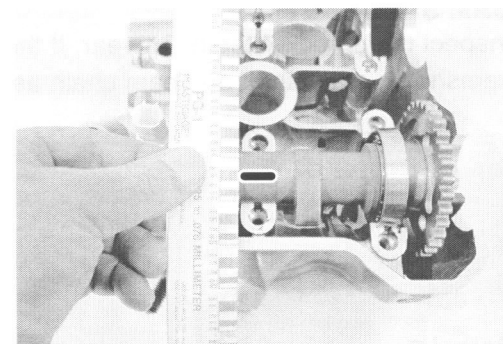
**NOTE:**

Do not rotate the camshaft with the plastigauge in place.

- Remove the camshaft journal holders, and read the width of the compressed plastigauge with envelope scale. This measurement should be taken at the widest part.

**Camshaft journal oil clearance:**

Service Limit (IN. & EX.): 0.150 mm (0.006 in)



- If the camshaft journal oil clearance measured exceeds the limit, measure the inside diameter of the camshaft journal holder and outside diameter of the camshaft journal.
- Replace the camshaft or the cylinder head depending upon which one exceeds the specification.

**Camshaft journal holder I.D.:**

Standard: (IN & EX): 22.012 – 22.025 mm
(0.8667 – 0.8671 in)



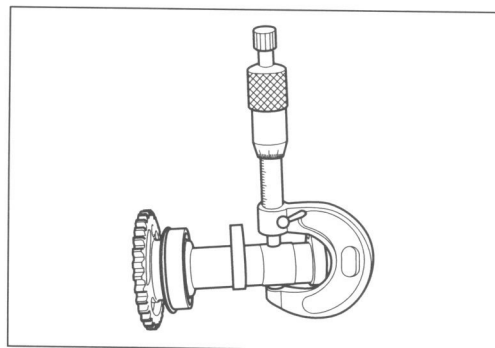
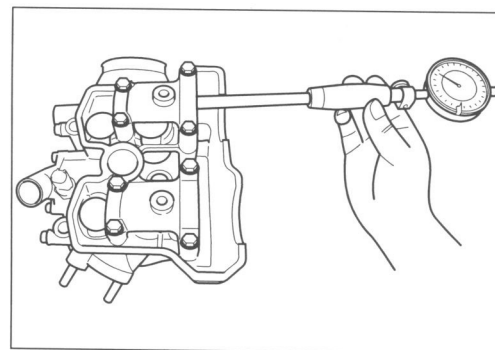
09900-20602: Dial gauge (1/1000, 1 mm)
09900-22403: Small bore gauge (18 – 35 mm)

**Camshaft journal O.D.:**

Standard (IN & EX): 21.959 – 21.980 mm
(0.8645 – 0.8653 in)



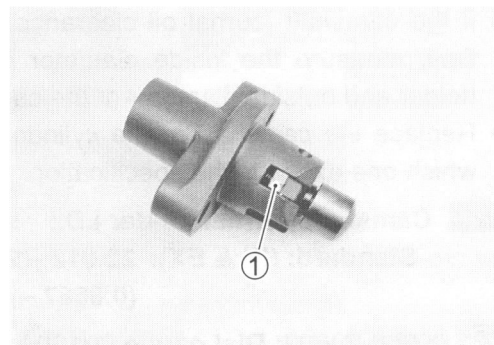
09900-20205: Micrometer (0 – 25 mm)



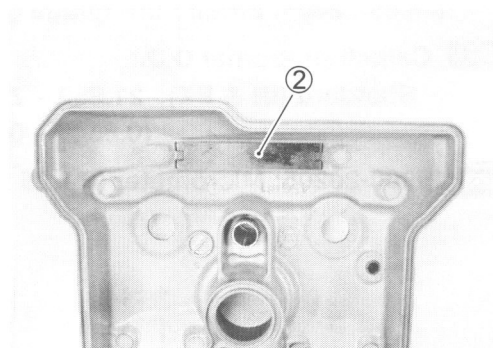
CAM CHAIN TENSION ADJUSTER AND TENSIONER

Check that the push rod slides smoothly when unlocking the ratchet mechanism ①.

If push rod does not slide smoothly, replace the cam chain tension adjuster with a new one.

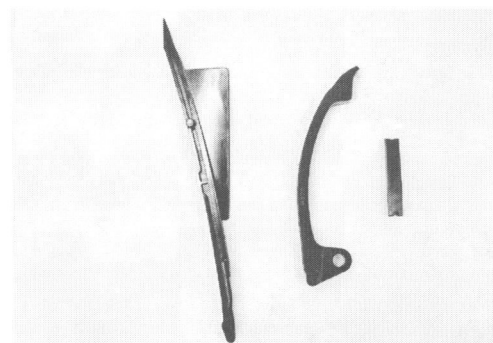


- Remove the cam chain guide ② from cylinder head cover.



Check the contacting surface of the cam chain tensioner and cam chain guides.

If any defects are found, replace it with a new one.



CYLINDER

CYLINDER DISTORTION

Check the gasket surface of the cylinder for distortion with a straightedge and thickness gauge, taking a clearance reading at several places indicated.

If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder head.

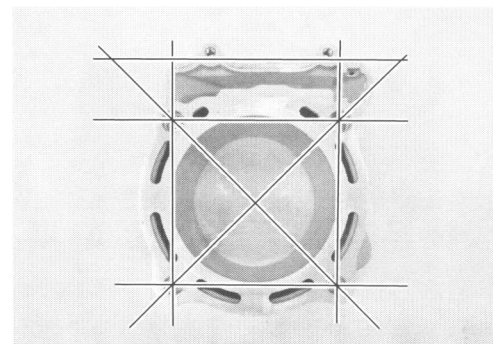


Cylinder distortion:

Service Limit: 0.05 mm (0.002 in)



09900-20803: Thickness gauge



CYLINDER BORE

Inspect the cylinder wall for any scratches, nicks or other damage. Measure the cylinder bore diameter at six places.

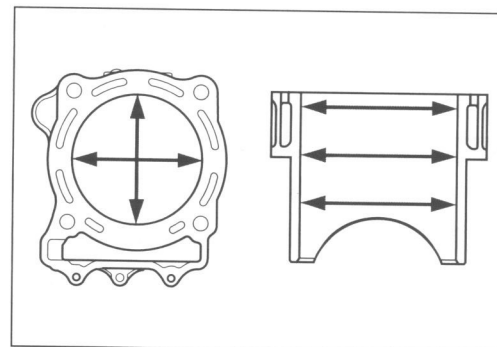
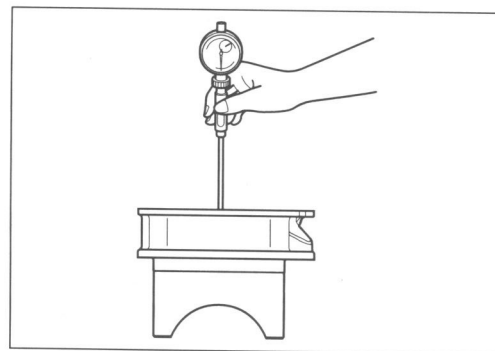
If any one of the measurements exceed the limit, replace the cylinder.

DATA Cylinder bore

Standard: 95.500 – 95.515 mm (3.7598 – 3.7604 in)

TOOL 09900-20530: Cylinder gauge set

09900-20513: Rod (94 mm)

**PISTON AND PISTON RING****PISTON DIAMETER**

Using a micrometer, measure the piston outside diameter at 10 mm (0.4 in) **A** from the piston skirt end.

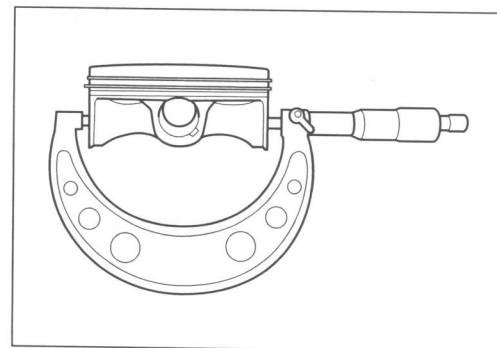
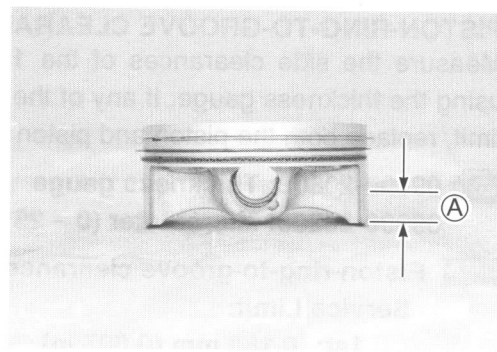
If the measurement is less than the limit, replace the piston.

DATA Piston diameter:

Service Limit: 95.380 mm (3.7551 in)

at 15 mm (0.6 in) from the skirt end

TOOL 09900-20204: Micrometer (75 – 100 mm)

**PISTON-TO-CYLINDER CLEARANCE**

Subtract the piston diameter from the cylinder bore diameter.
( above)

If the piston-to-cylinder clearance exceeds the service limit, replace the cylinder or the piston, or both.

DATA Piston-to-cylinder clearance:

Service Limit: 0.120 mm (0.0047 in)

PISTON PIN AND PIN BORE

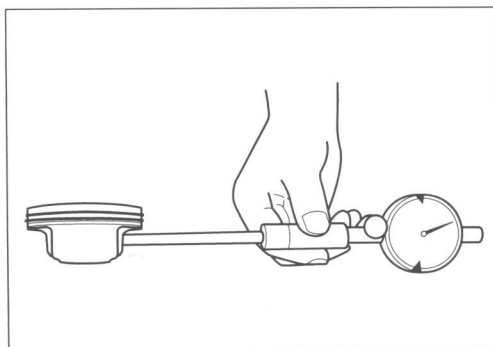
Measure the piston pin bore diameter using the small bore gauge. If the measurement is out of specifications replace the piston.

DATA Piston pin bore I.D.:

Service Limit: 19.030 mm (0.7492 in)

TOOL 09900-20602: Dial gauge (1/1000 mm)

09900-22403: Small bore gauge (18 – 35 mm)

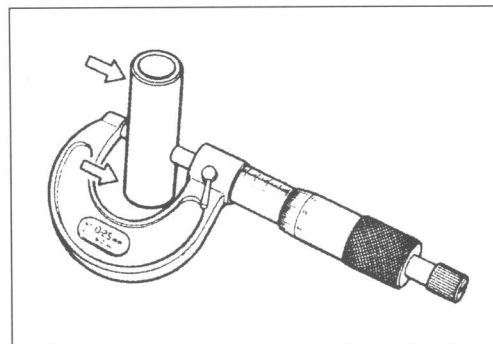


Measure the piston pin outside diameter at three positions using the micrometer. If any of the measurements are out of specification, replace the piston pin.

DATA Piston pin O.D.:

Service Limit: 18.980 mm (0.7472 in)

TOOL 09900-20205: Micrometer (0 – 25 mm)

**PISTON-RING-TO-GROOVE CLEARANCE**

Measure the side clearances of the 1st and 2nd piston rings using the thickness gauge. If any of the clearances exceeds the limit, replace both the piston and piston rings.

TOOL 09900-20803: Thickness gauge

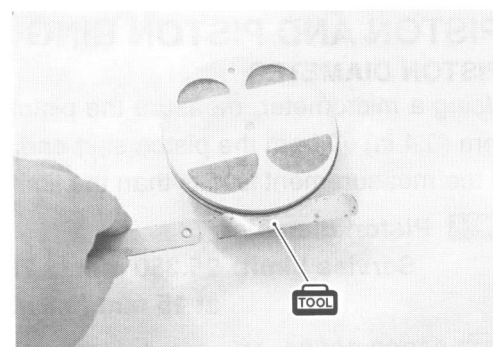
09900-20205: Micrometer (0 – 25 mm)

DATA Piston-ring-to-groove clearance

Service Limit:

1st: 0.180 mm (0.007 in)

2nd: 0.150 mm (0.006 in)

**DATA** Piston ring groove width

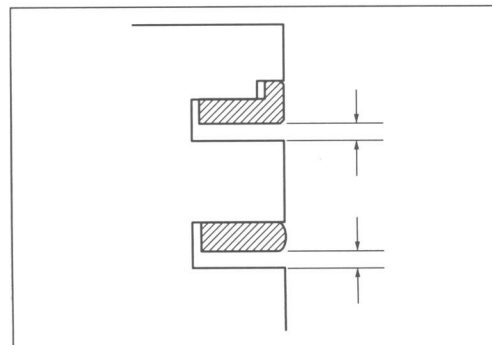
Standard:

1st: 0.78 – 0.80 mm (0.0307 – 0.0315 in)

1.30 – 1.32 mm (0.0512 – 0.0520 in)

2nd: 0.81 – 0.83 mm (0.0319 – 0.0327 in)

Oil: 2.01 – 2.03 mm (0.0791 – 0.0799 in)



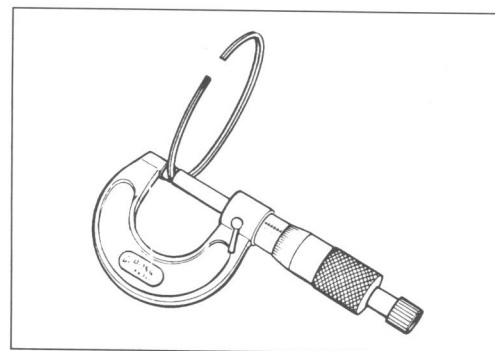
DATA Piston ring thickness

Standard:

1st: 0.71 – 0.76 mm (0.0280 – 0.0299 in)

1.08 – 1.10 mm (0.0425 – 0.0433 in)

2nd: 0.77 – 0.79 mm (0.0303 – 0.0311 in)

**PISTON RING END GAP**

Fit the piston ring squarely into the cylinder and measure the piston ring end gap using the thickness gauge.

If any of the measurements exceeds the service limit, replace the piston ring with a new one.

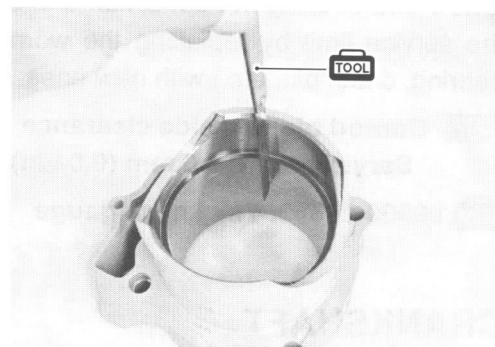
DATA Piston ring end gap:

Service Limit:

1st: 0.50 mm (0.020 in)

2nd: 0.50 mm (0.020 in)

TOOL 09900-20803: Thickness gauge

**CONROD****CONROD SMALL END I.D.**

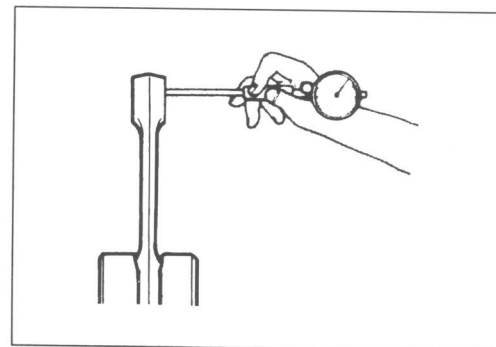
Using a small bore gauge, measure the inside diameter of the conrod small end. If the inside diameter of the conrod small end exceeds the limit, replace the conrod.

DATA Conrod small end I.D.:

Service Limit: 19.040 mm (0.7496 in)

TOOL 09900-20602: Dial gauge (1/1 000 mm, 1 mm)

09900-22403: Small bore gauge (18 – 35 mm)



CONROD DEFLECTION AND BIG END SIDE CLEARANCE

Wear on the big end of the conrod can be estimated by checking the movement of the small end of the rod. This method can also be used to check the extent of wear on the parts of the conrod big end.

**Conrod deflection**

Service Limit: 3.0 mm (0.12 in)



09900-20701: Magnetic stand

09900-20607: Dial gauge (1/100 mm)

09900-21304: V-block set (100 mm)

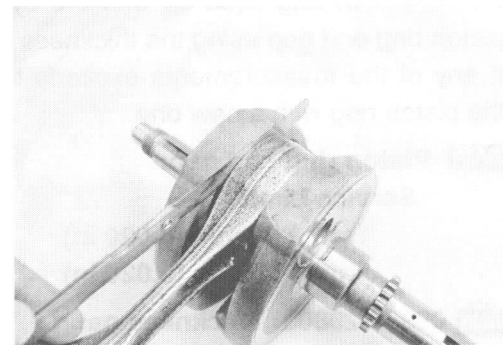
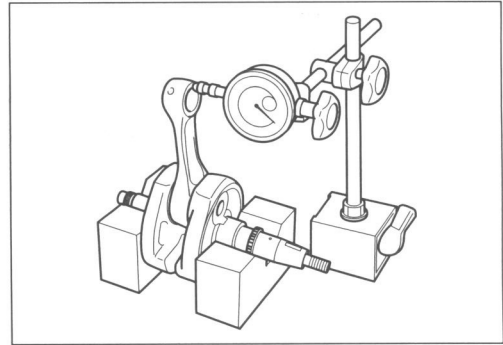
Push the big end of the conrod to one side and measure the side clearance using a thickness gauge. If the clearance exceeds the service limit, replace the crankshaft assembly with a new one or bring the deflection and the side clearance within the service limit by replacing the worn parts (conrod, big end bearing, crank pin, etc.) with new ones.

**Conrod big end side clearance**

Service Limit: 1.0 mm (0.04 in)



09900-20803: Thickness gauge

**CRANKSHAFT****CRANKSHAFT RUNOUT**

Support the crankshaft using V-blocks and measure the crankshaft runout using the dial gauge, as shown. If the runout exceeds the service limit, replace the crankshaft with a new one.

NOTE:

* Place the crankshaft onto the V-blocks so that it becomes horizontally.

* Measure the runout from the tips of the crankshaft.

**Crankshaft runout**

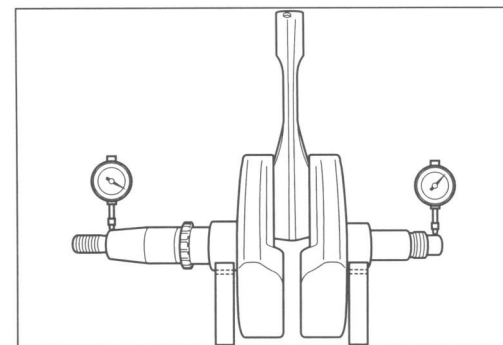
Service Limit: 0.080 mm (0.003 in)



09900-20607: Dial gauge (1/100 mm)

09900-20701: Magnetic stand

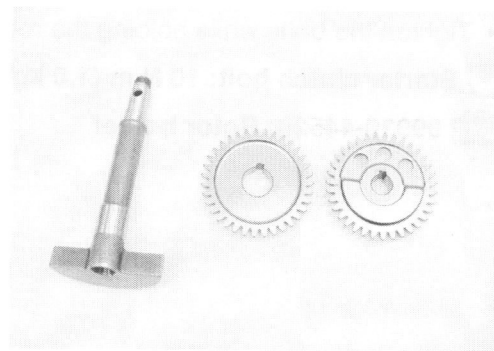
09910-21304: V-block set (100 mm)



BALANCER SHAFT AND BALANCER DRIVEN AND DRIVE GEAR

INSPECTION

Inspect the balancer shaft and balancer driven and drive gear for wear or damage. If any defects are found, replace the defective part.

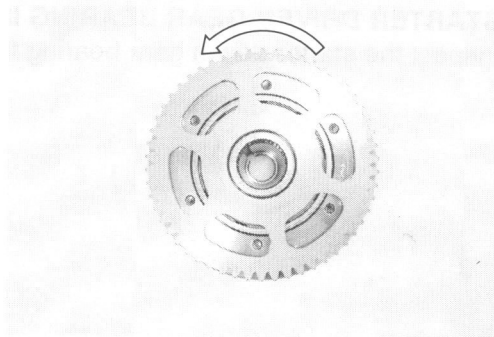


STARTER CLUTCH

INSPECTION

Install the starter driven gear onto the starter clutch and turn the starter driven gear by hand to inspect the starter clutch for a smooth movement. The gear turns one direction only. If a large resistance is felt to rotation, inspect the starter clutch for damage or inspect the starter clutch contacting surface of the starter driven gear for wear or damage.

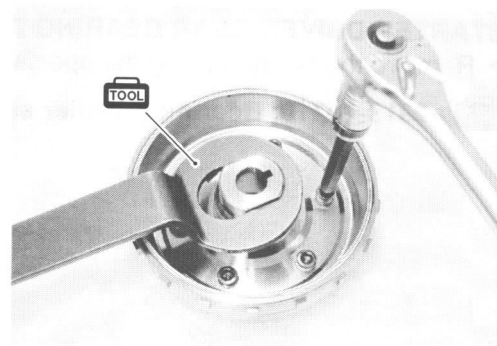
If they are found to be damaged, replace them with new ones.



DISASSEMBLY

- Hold the rotor using the special tool and remove the bolts.

 **09930-44520: Rotor holder**



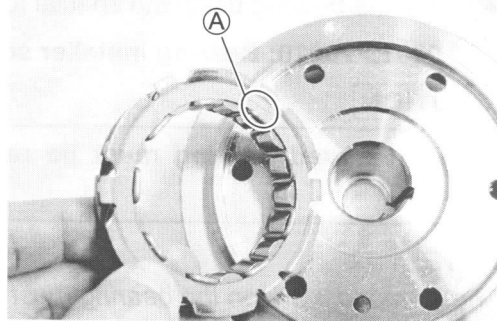
REASSEMBLY

- Install the starter clutch in the proper direction as shown.

NOTE:

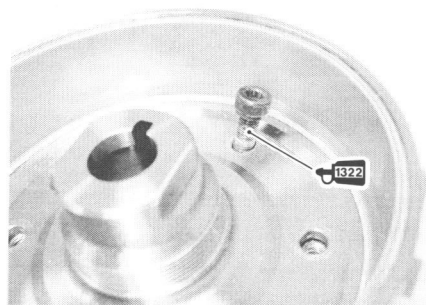
When installing the starter clutch onto the rotor, make sure that the arrow mark Ⓐ in the bearing faces to the rotor.

- Apply engine oil to the starter clutch.



- Apply a small quantity of THREAD LOCK SUPER "1322" to the starter clutch bolt.

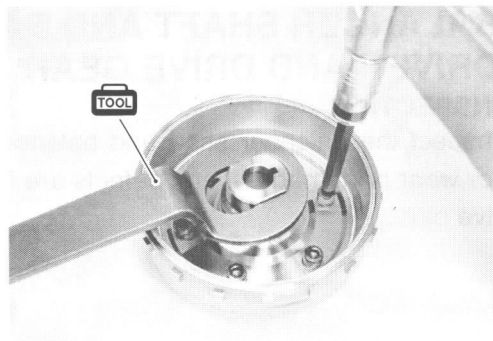
 **99000-32110: THREAD LOCK SUPER "1322"**
(or equivalent thread lock)



- Tighten the bolts while holding the rotor using the special tool.

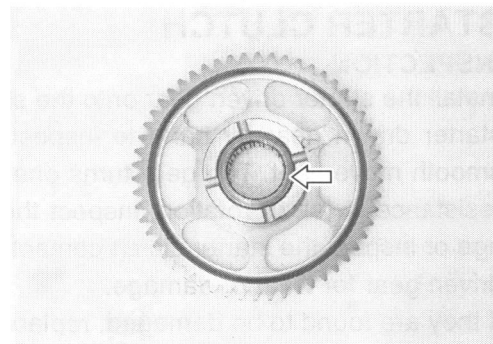
 **Starter clutch bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)**

 **09930-44520: Rotor holder**



STARTER DRIVEN GEAR BEARING INSPECTION

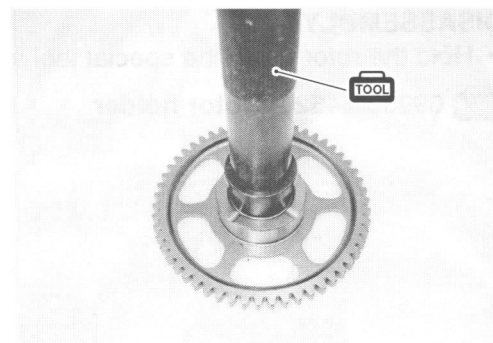
Inspect the starter driven gear bearing for any damages.



STARTER DRIVEN GEAR BEARING REPLACEMENT

- Remove the bearing using the special tool.

 **09913-70210: Bearing installer set**



- Install the bearing using the special tool.

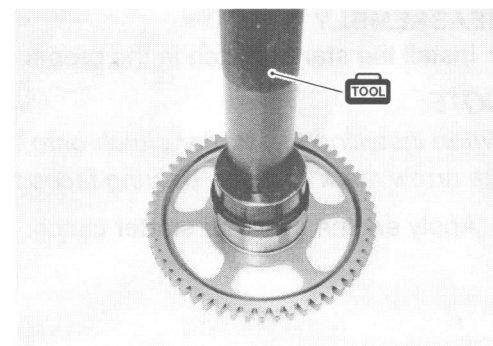
 **09913-70210: Bearing installer set**

CAUTION

The removed bearing must be replaced with a new one.

NOTE:

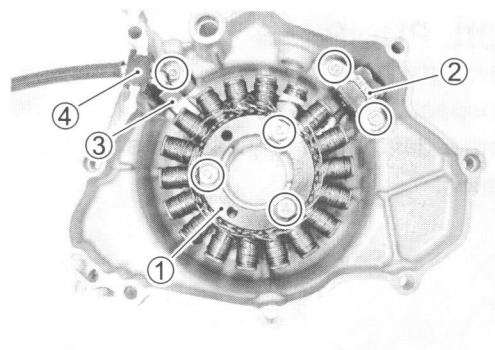
The stamped mark on the bearing must face crankcase side.



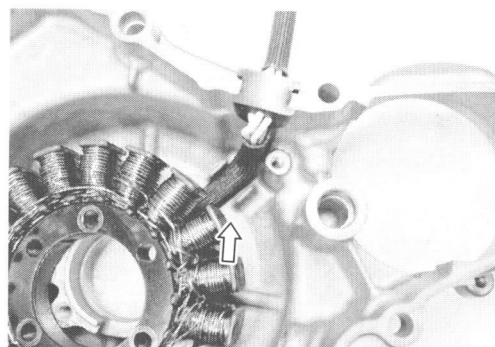
GENERATOR

INSPECTION (8-9, -21)

- Remove the generator stator ①, CKP sensor ②, bracket ③ and grommet ④.

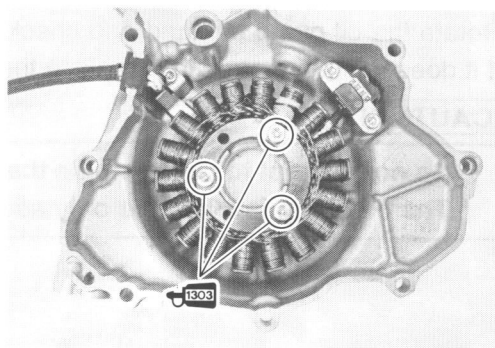


- When replacing the generator stator or CKP sensor, route the wire properly.



- Apply a small quantity of THREAD LOCK SUPER "1303" to the generator stator mounting bolts, and tighten them securely.

 99000-32030: THREAD LOCK SUPER "1303"



STARTER TORQUE LIMITER

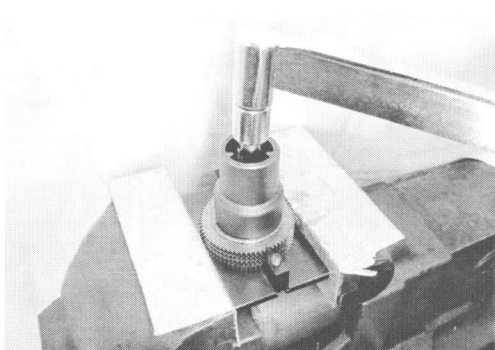
CAUTION

Do not attempt to disassemble the starter torque limiter. It is unserviceable.

Check the slip torque of the starter torque limiter using the special tools and vise as shown, if the slip torque is not within the specified torque, replace the starter torque limiter with a new one.

 **09930-73170: Starter torque limiter holder**
09930-73120: Starter torque limiter socket

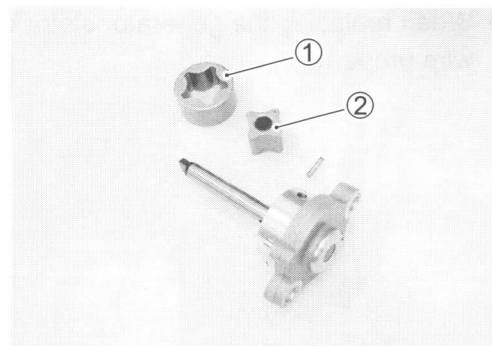
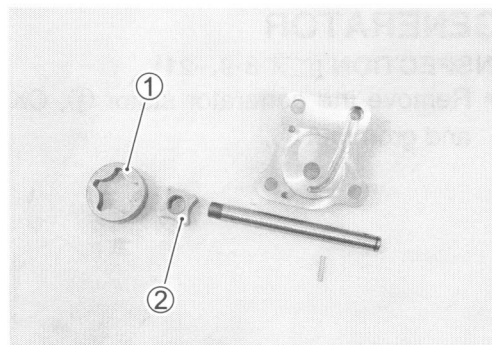
 **Slip torque:**
 20.5 – 36.0 N·m (2.05 – 3.6 kgf-m, 14.8 – 26.0 lb-ft)



OIL PUMP

INSPECTION

Inspect the outer rotor ① and inner rotor ② for any scratches or other damage. If any damages are found, replace them with new ones.



Rotate the oil pump by hand and check that it moves smoothly. If it does not move smoothly, replace the oil pump assembly.

CAUTION

- * Do not attempt to disassemble the oil pump assembly.
- * The oil pump is available only as an assembly.



CLUTCH

CLUTCH DRIVE PLATE

NOTE:

Wipe off engine oil from the clutch drive plates with a clean rag.

Measure the thickness of drive plates using the vernier calipers. If the drive plate thickness is found to have reached the limit, replace it with a new one.

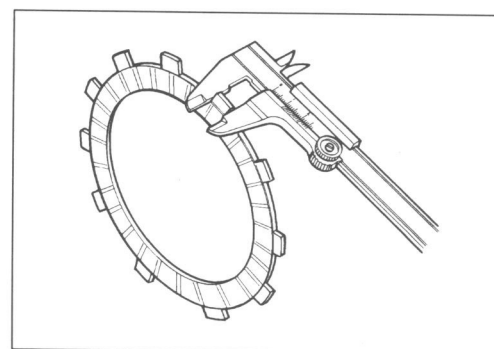
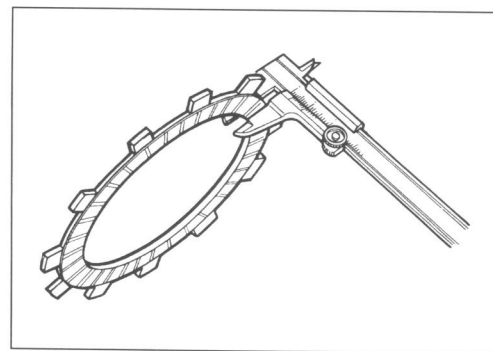
DATA Drive plate thickness (No.1 & No.2):
Service Limit: 2.77 mm (0.109 in)

TOOL 09900-20101: Vernier calipers

Measure the claw width of drive plates using the vernier calipers. Replace the drive plates found to have worn down to the limit.

DATA Drive plate claw width (No.1 & No.2):
Service Limit: 13.35 mm (0.528 in)

TOOL 09900-20101: Vernier calipers



CLUTCH DRIVEN PLATE

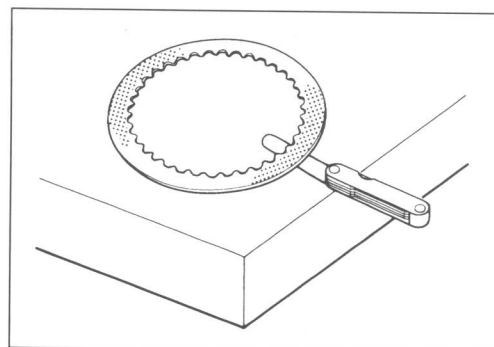
NOTE:

Wipe off engine oil from the clutch driven plates with a clean rag.

Measure each driven plate for distortion with a thickness gauge and surface plate. Replace driven plates which exceed the limit.

DATA Driven plate distortion:
Service Limit: 0.10 mm (0.004 in)

TOOL 09900-20803: Thickness gauge

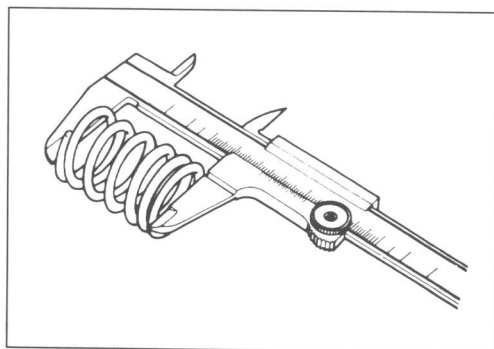


CLUTCH SPRING

Measure the free length of each coil spring with a vernier caliper, and compare the length with the specified limit. Replace all the springs if any spring is not within the limit.

DATA Clutch spring free length:
Service Limit: 50.4 mm (1.98 in)

TOOL 09900-20101: Vernier calipers



PUSH ROD

Inspect the push rod for wear and damage.

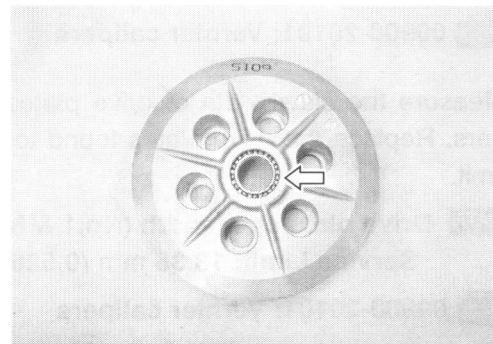
If any defects are found, replace the push rod with a new one.

**RELEASE BEARING**

Inspect the release bearing for play, wear and damage.

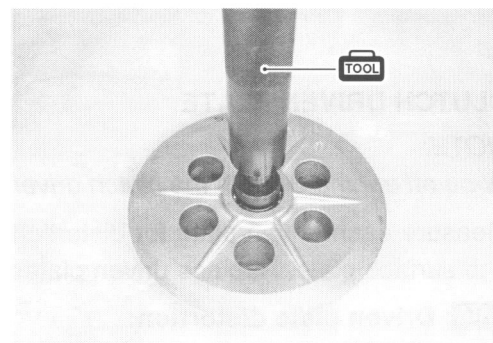
Move the inner race by finger and inspect for smooth movement.

If any defects are found, replace the release bearing with a new one.

**RELEASE BEARING REPLACEMENT**

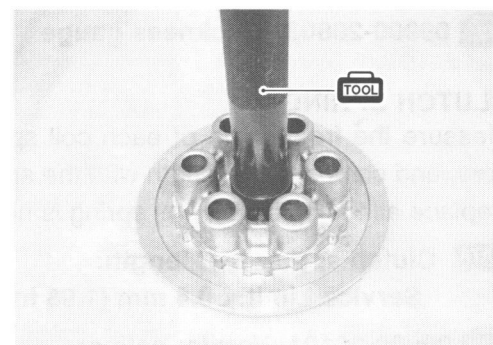
- Remove the release bearing using the special tool.

 **09913-70210: Bearing installer set**

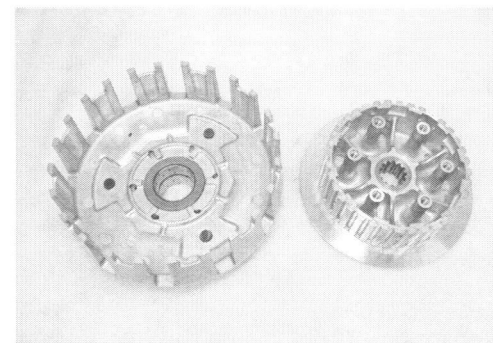


- Press the bearings using the special tool.

 **09913-70210: Bearing installer set**

**CLUTCH SLEEVE HUB/PRIMARY DRIVEN GEAR ASSEMBLY**

Inspect the slot of the clutch sleeve hub and primary driven gear assembly for damage or wear caused by the clutch plates. If necessary, replace it with a new one.



GEARSHIFT FORK AND GEAR

GEARSHIFT FORK-TO-GROOVE CLEARANCE

Using a thickness gauge, check the gearshift fork clearance in the groove of its gear.

The clearance for each gearshift fork plays an important role in the smoothness and positiveness of the shifting action.

DATA Shift fork-to-groove clearance:
Service Limit: 0.5 mm (0.020 in)

TOOL 09900-20101: Vernier calipers
09900-20803: Thickness gauge

If the clearance checked is noted to exceed the limit specified, replace the fork or its gear, or both.

GEARSHIFT FORK GROOVE WIDTH

Measure the gearshift fork groove width using the vernier calipers.

DATA Shift fork groove width:
Standard: 4.8 – 4.9 mm (0.189 – 0.193 in)

TOOL 09900-20101: Vernier calipers

GEARSHIFT FORK THICKNESS

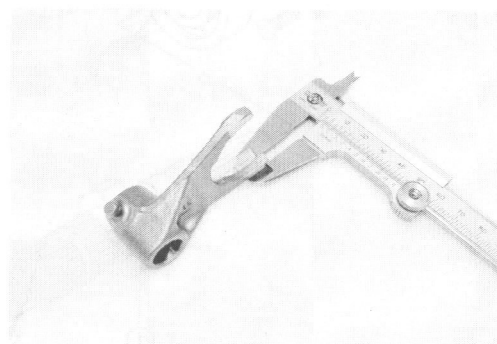
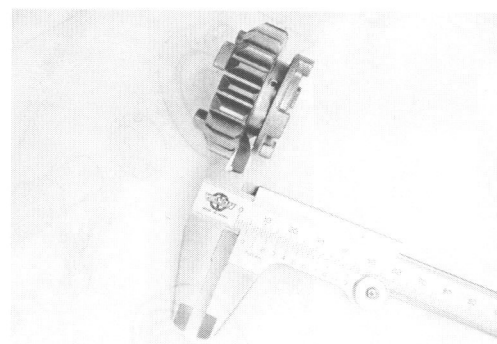
Measure the gearshift fork thickness using the vernier calipers.

DATA Shift fork thickness:
Standard: 4.6 – 4.7 mm (0.181 – 0.185 in)

TOOL 09900-20101: Vernier calipers

GEARSHIFT CAM

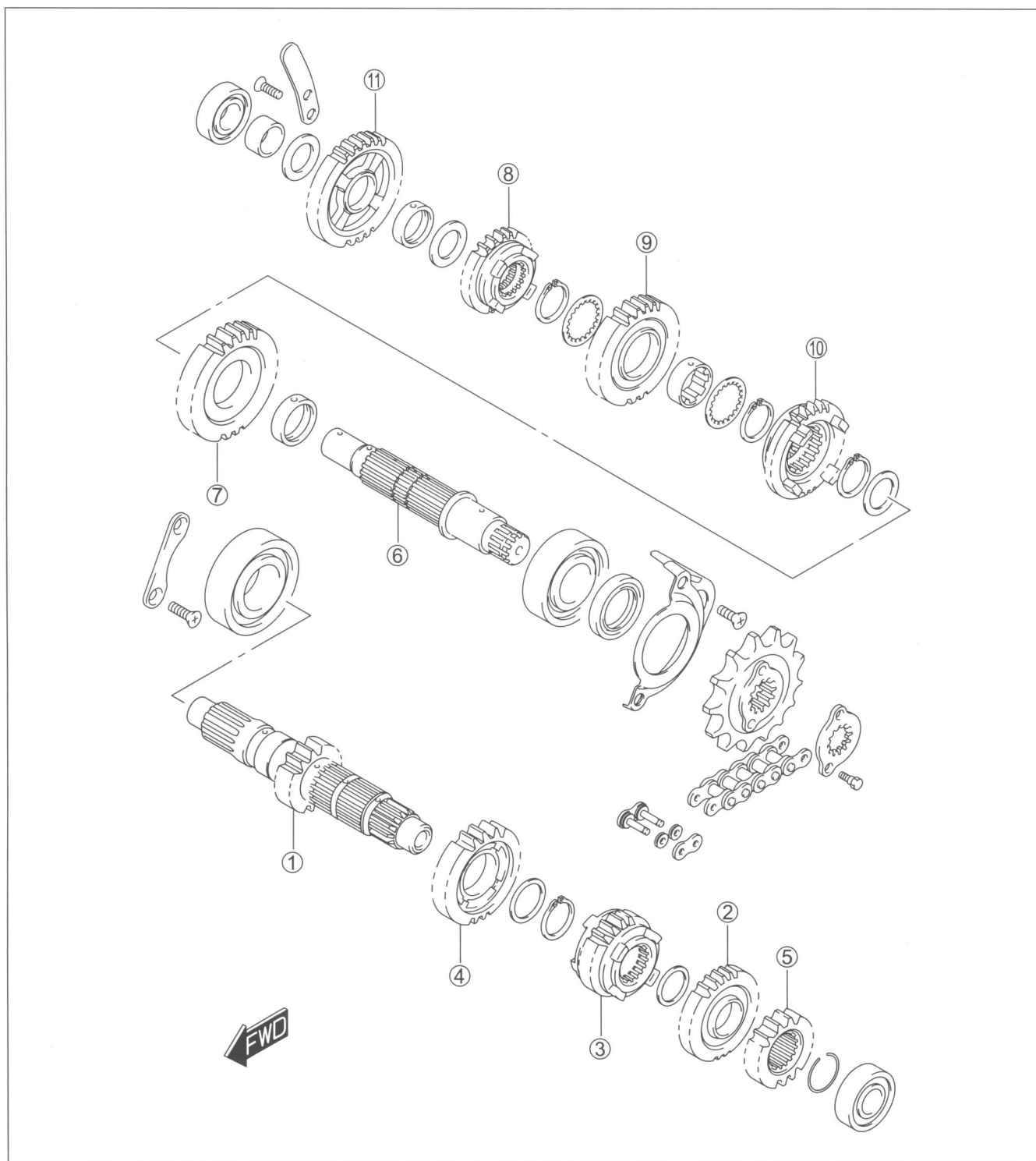
Inspect the gearshift cam groove for abnormal wear and damage. If any defects are found, replace the gearshift cam with a new one.



TRANSMISSION

DISASSEMBLY

Disassemble the transmission gears as shown in the illustration.



① Countershaft	⑤ 2nd drive gear	⑨ 3rd driven gear
② 5th drive gear	⑥ Driveshaft	⑩ 5th driven gear
③ 3rd drive gear	⑦ 2nd driven gear	⑪ 1st driven gear
④ 4th drive gear	⑧ 4th driven gear	

REASSEMBLY

Reassemble the countershaft and driveshaft in the reverse order of disassembly. Pay attention to the following points:

NOTE:

- * Before installing the gears, apply engine oil to the inner surface of each gear and bushing.
- * Apply molybdenum oil solution to the surface of countershaft and inner surface of 5th drive gear ①.

**MOLYBDENUM OIL SOLUTION****CAUTION**

- * Never reuse a snap ring. After a snap ring has been removed from a shaft, it should be discarded and a new snap ring must be installed.
- * When installing a new snap ring, do not expand the end gap larger than required to slip the snap ring over the shaft.
- * After installing a new snap ring, make sure that it is completely seated in its groove and securely fitted.

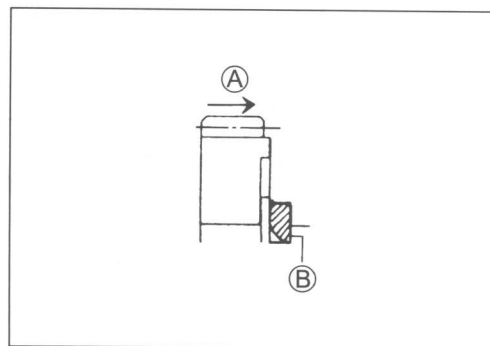
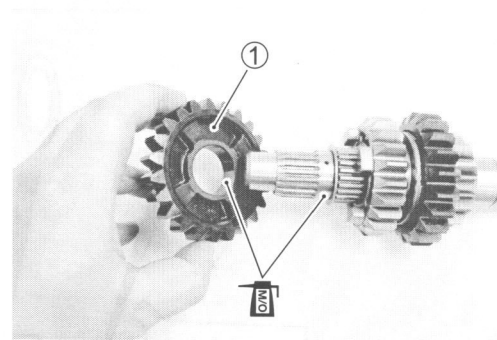
NOTE:

When reassembling the transmission, attention must be given to the locations and positions of the washers and snap rings. The cross sectional view shows the correct position of the gears, bushings, washers, and snap rings. (☞ 3-50)

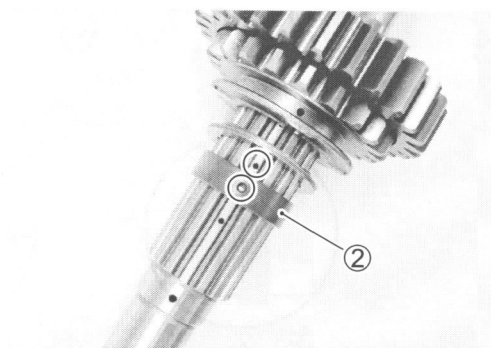
- When installing a new snap ring, pay attention to the direction. Fit it to the side where the thrust is as shown in the illustration.

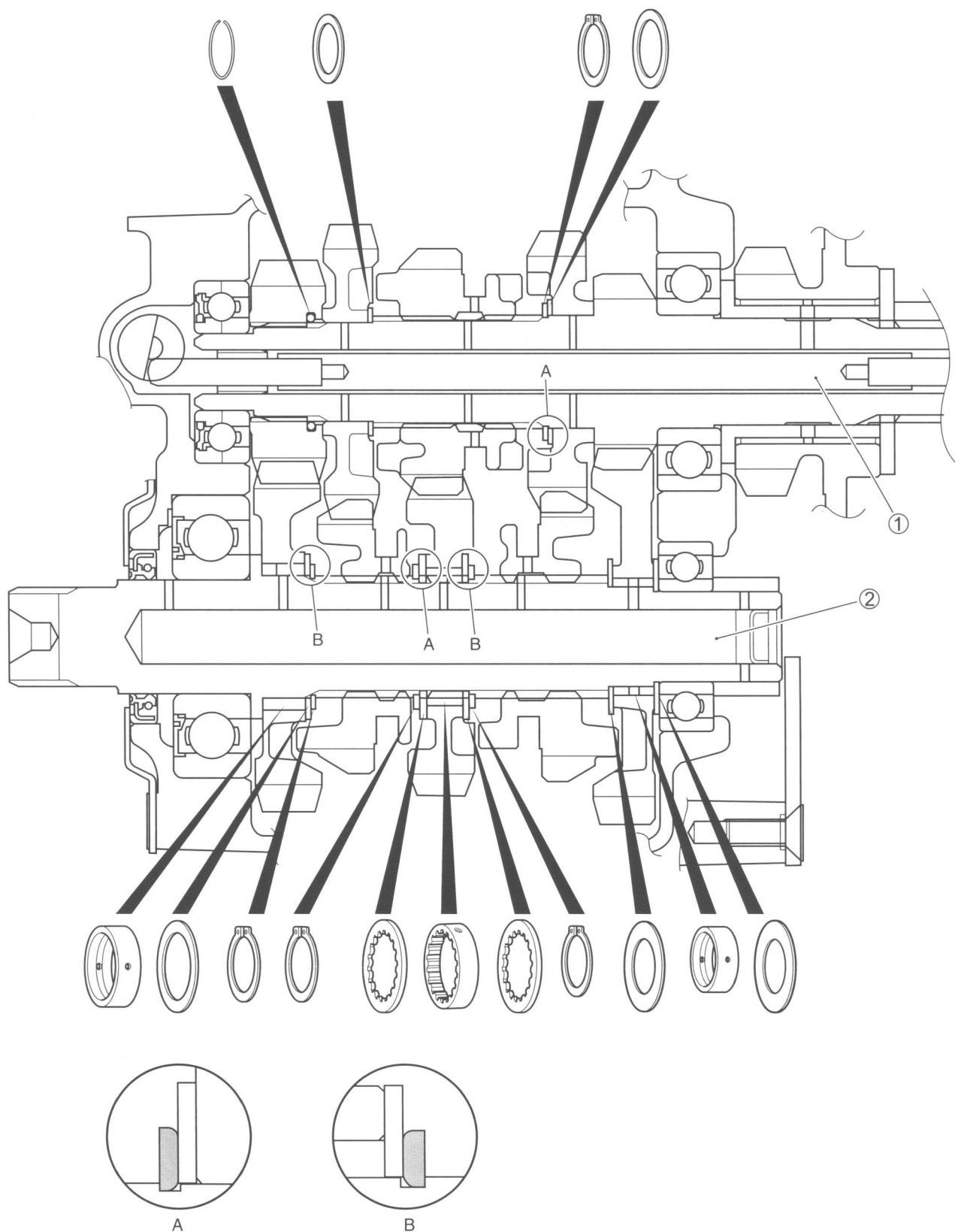
Ⓐ Thrust

Ⓑ Sharp edge



- When installing the 3rd driven gear bushing ②, align the its oil hole with the driveshaft oil hole.



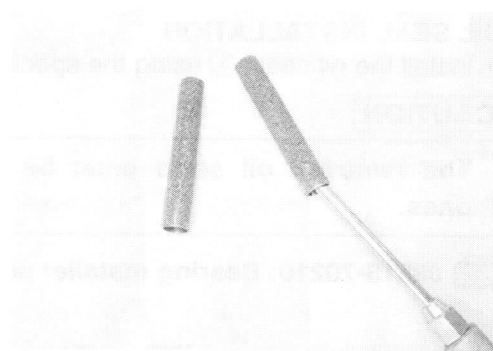


① Countershaft

② Driveshaft

OIL STRAINER

- Clean the oil strainers using the compressed air.



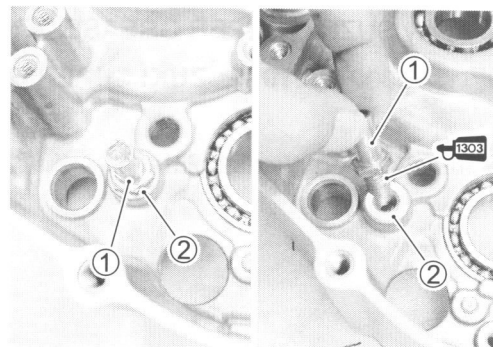
CRANKCASE

GEARSHIFT ARM STOPPER

- Remove the gearshift arm stopper ① and washer ②.
- Apply a small quantity of THREAD LOCK SUPER "1303" to the gearshift arm stopper.
- Install the washer ② and tightening the gearshift arm stopper ① to the specified torque.

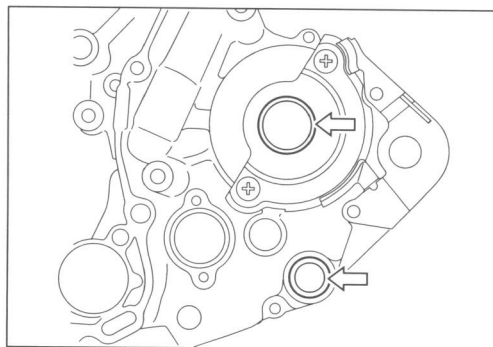
 **99000-32030: THREAD LOCK SUPER "1303"**

 **Gearshift arm stopper: 32 N·m (3.2 kgf-m, 23.0 lb-ft)**



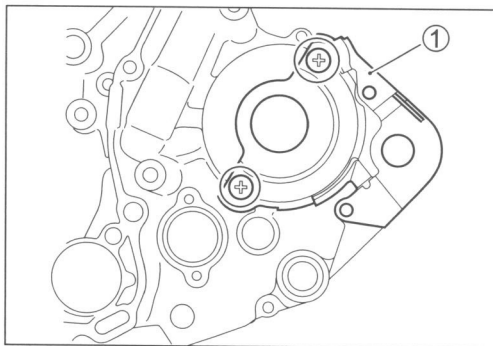
OIL SEAL INSPECTION

Inspect the oil seal lips for wear or damage. If any defects are found, replace the oil seal with new ones.

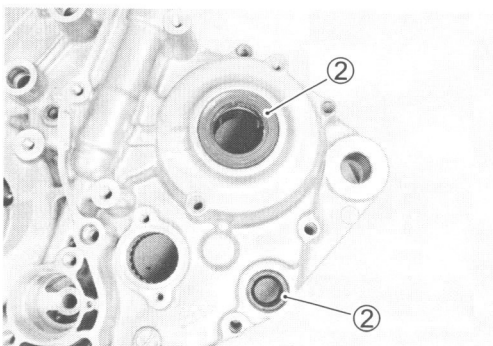


OIL SEAL REMOVAL

- Remove the crankcase plate ①.



- Remove the oil seals ②.



OIL SEAL INSTALLATION

- Install the oil seals ① using the special tool.

CAUTION

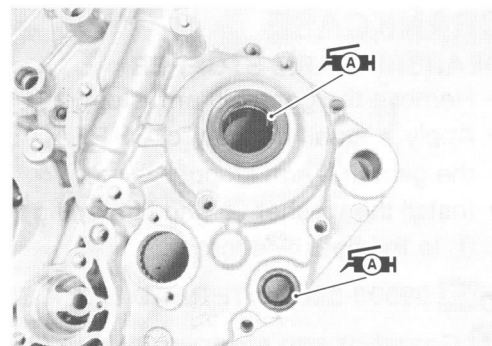
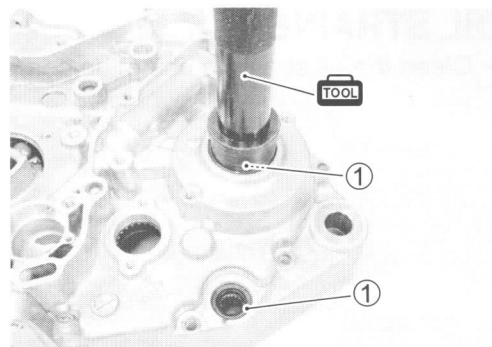
The removed oil seals must be replaced with new ones.

 09913-70210: Bearing installer set

- Apply SUZUKI SUPER GREASE “A” to the lip of the oil seals.

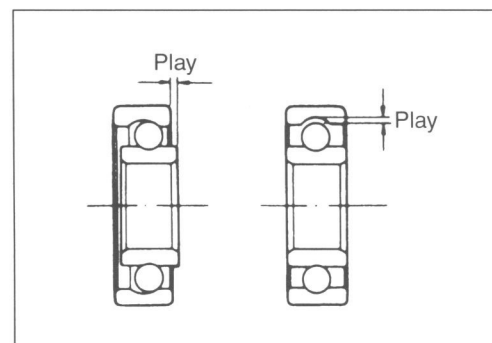
 99000-25010: SUZUKI SUPER GREASE “A”
(or equivalent grease)

- Install the crankcase plate.

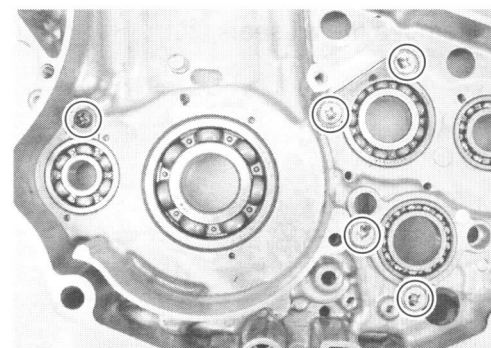
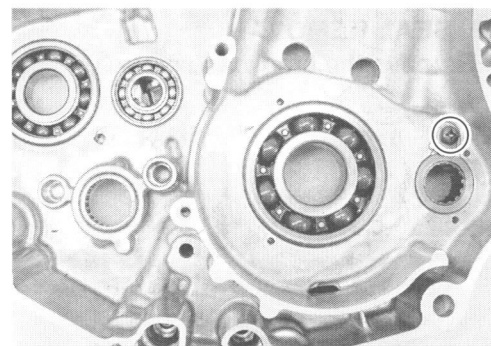
**BEARING INSPECTION**

Rotate the bearing inner race by finger to inspect for abnormal play, noise and smooth rotation while the bearings are in the crankcase.

Replace the bearing in the following procedure if there is anything unusual.

**BEARING REMOVAL**

- Remove the oil seals. (3-51)
- Remove the bearing retainers.



Remove the bearings using the special tool.

TOOL 09913-70210: Bearing installer set

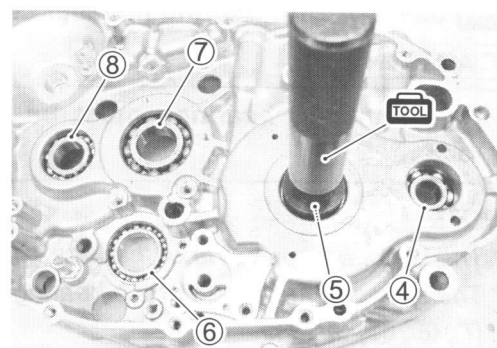
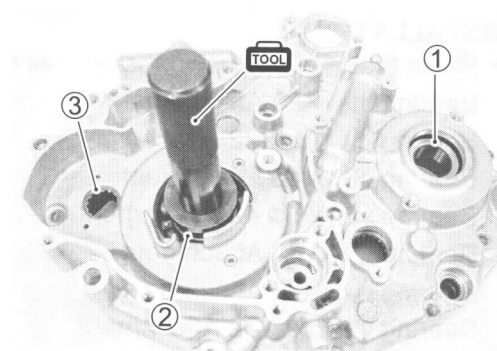
Bearing ④: ϕ 22 Attachment

Bearing ③: ϕ 25 Attachment

Bearing ⑥, ⑧: ϕ 30 Attachment

Bearing ①, ⑤, ⑦: ϕ 35 Attachment

Bearing ②: ϕ 42 Attachment

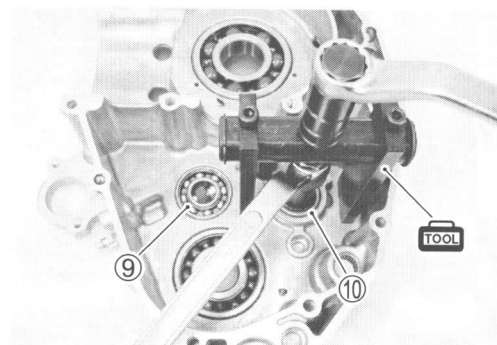


• Remove the bearings using the special tool.

TOOL 09921-20240: Bearing remover set

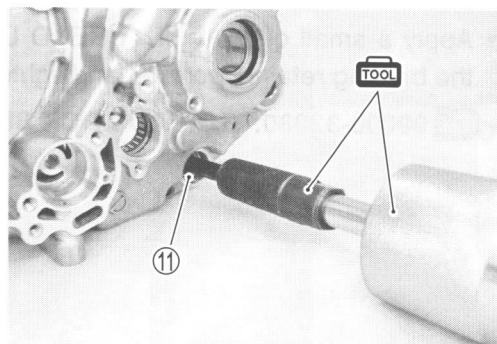
Bearing ⑨: Remover ϕ 17 mm

Bearing ⑩: Remover ϕ 25 mm



• Remove the bearing ⑪.

TOOL 09921-20210: Bearing remover
09930-30104: Sliding shaft



INSTALLATION

- Press the bearings using the special tool.

Bearing ⑪: ϕ 20 Attachment

Bearing ③, ⑩: ϕ 32 Attachment

Bearing ⑨: ϕ 40 Attachment

Bearing ⑥, ⑧: ϕ 42 Attachment

Bearing ⑦: ϕ 52 Attachment

Bearing ①: ϕ 62 Attachment

Bearing ②, ⑤: ϕ 72 Attachment

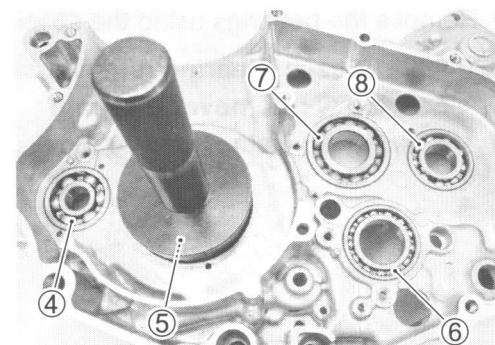
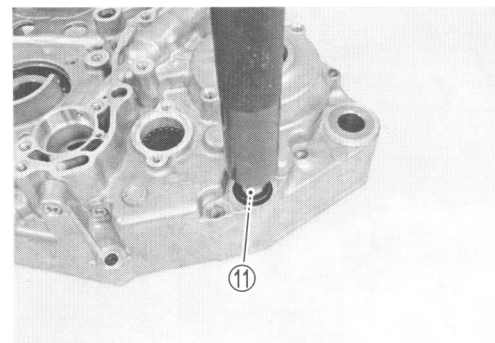
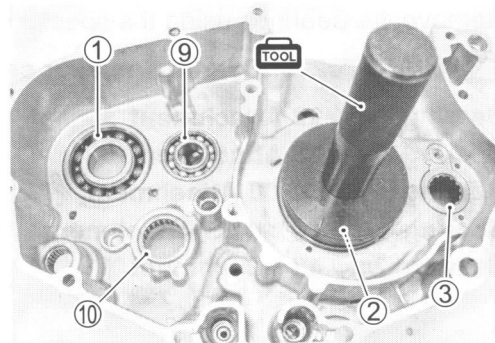
 **09913-70210: Bearing installer set**

CAUTION

The removed bearings must be replaced with new ones.

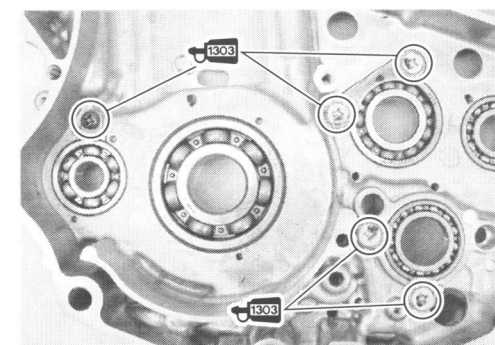
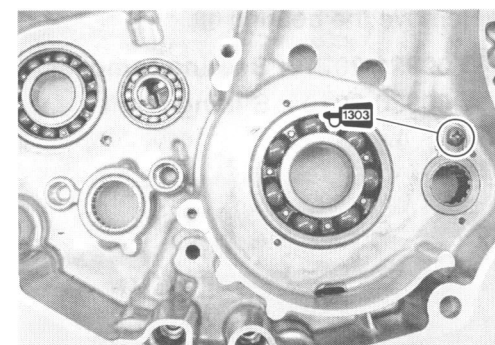
NOTE:

- * The stamped mark side of the bearing faces ⑪ outside.
- * The stamped mark side of the bearing faces (②, ③, ④, ⑤, ⑥, ⑦, ⑧, ⑩) inside.
- * The sealed side of the bearing faces (①, ⑨) outside.



- Apply a small quantity of THREAD LOCK SUPER "1303" to the bearing retainer screws, and tighten them securely.

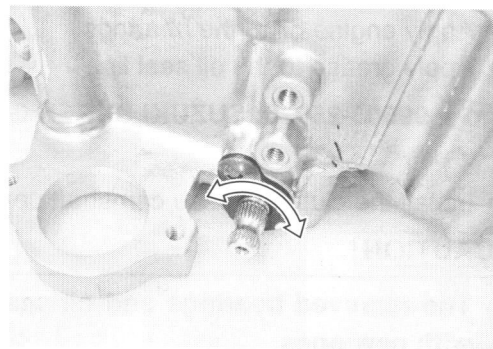
 **99000-32030: THREAD LOCK SUPER "1303"**



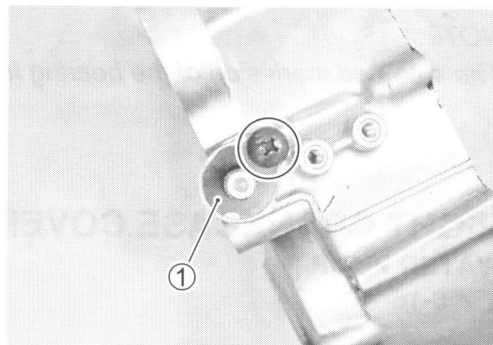
CLUTCH RELEASE CAMSHAFT INSPECTION

Rotate the clutch release camshaft by finger to inspect for abnormal noise or smooth movement.

If any defects are found, replace the clutch release camshaft or bearings with new ones.

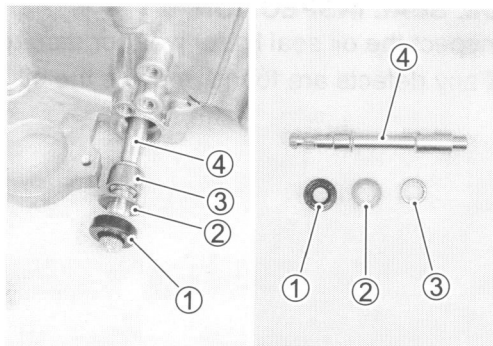
**CLUTCH RELEASE CAMSHAFT AND BEARING REPLACEMENT**

- Remove the oil seal retainer ①.

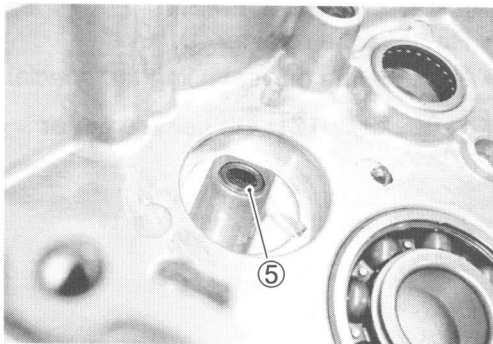


- Remove the following parts.

- ① Oil seal
- ② Washer
- ③ Upper bearing
- ④ Clutch release camshaft



- Remove the lower bearing ⑤.



- Apply engine oil to the bearings.
- Apply grease to the oil seal lip.

 **99000-25010: SUZUKI SUPER GREASE "A"**
(or equivalent grease)

- Install the clutch release camshaft correctly.

CAUTION

The removed bearings and oil seal must be replaced with new ones.

NOTE:

The stamped mark side of the bearing faces upside.



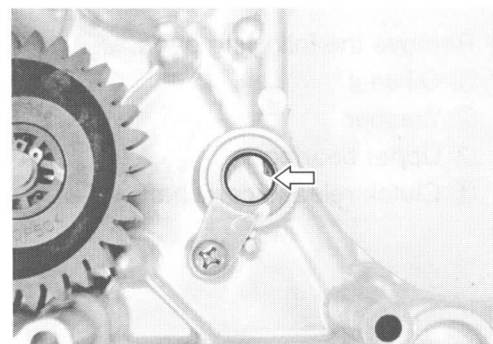
RIGHT CRANKCASE COVER WATER PUMP

 6-16

OIL SEAL INSPECTION

Inspect the oil seal lip for wear or damage.

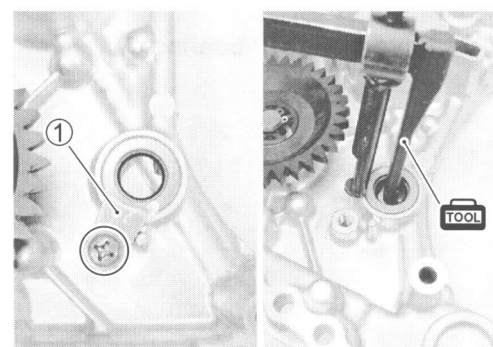
If any defects are found, replace the oil seal with a new one.



OIL SEAL REPLACEMENT

- Remove the retainer ①.
- Remove the oil seal using the special tool.

 **09913-50121: Oil seal remover**



- Install the oil seal using the special tool.

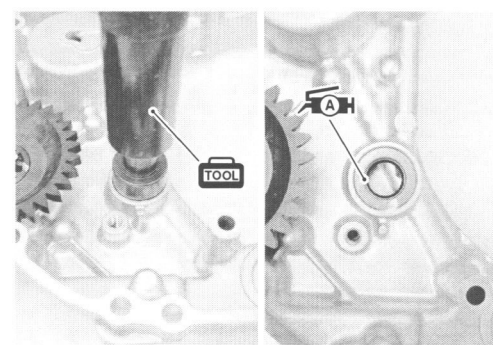
 **09913-70210: Bearing installer set**

CAUTION

The removed oil seal must be replaced with a new one.

- Apply grease to the oil seal lip.

 **99000-25010: SUZUKI SUPER GREASE "A"**
(or equivalent grease)



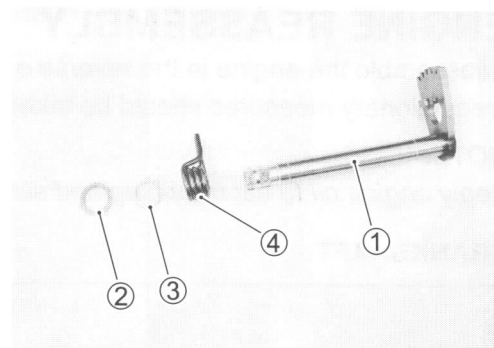
GEARSHIFT SHAFT

DISASSEMBLY

- Remove the following parts from the gearshift shaft ①.

- ② Shim
- ③ Snap ring
- ④ Return spring

 **09900-06107: Snap ring pliers**

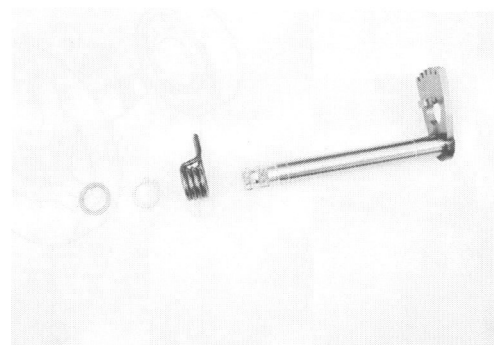


INSPECTION

Inspect the gearshift shaft for bend or damage.

Inspect the return spring for damage or fatigue.

Replace the defective parts with a new one if necessary.

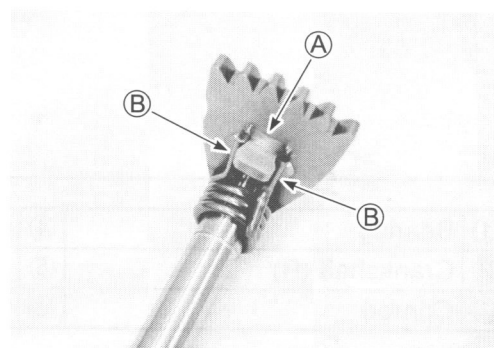


REASSEMBLY

Reassemble the gearshift shaft in the reverse order of disassembly. Pay attention to the following points:

NOTE:

When installing the gearshift shaft return spring, position the stopper ① of gearshift arm between the shaft return spring ends ②.



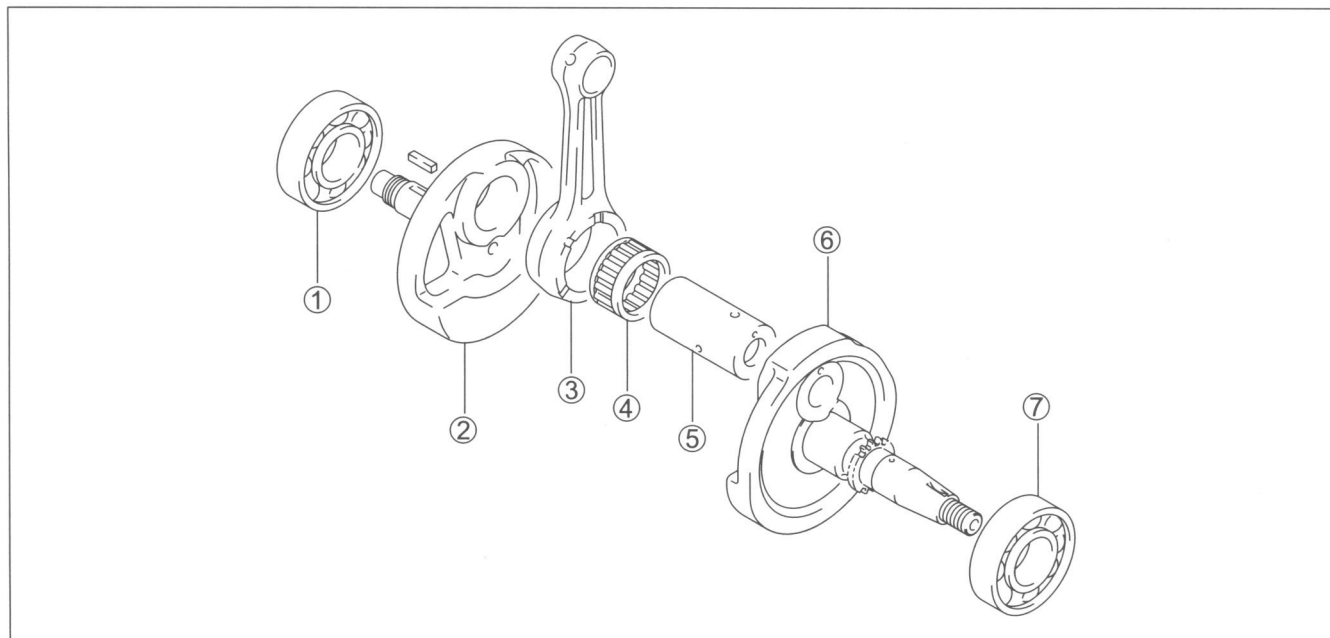
ENGINE REASSEMBLY

Reassemble the engine in the reverse order of disassembly. The following steps require special attention or precautionary measures should be taken.

NOTE:

Apply engine oil to each running and sliding part before reassembling.

CRANKSHAFT



① Bearing	④ Bearing	⑦ Bearing
② Crankshaft (R)	⑤ Crank pin	
③ Conrod	⑥ Crankshaft (L)	

- Determine the width between the webs referring to the figure when rebuilding the crankshaft.



DATA Crank-web-to-web-width

Standard: 62.0 ± 0.1 mm (2.441 ± 0.004 in)

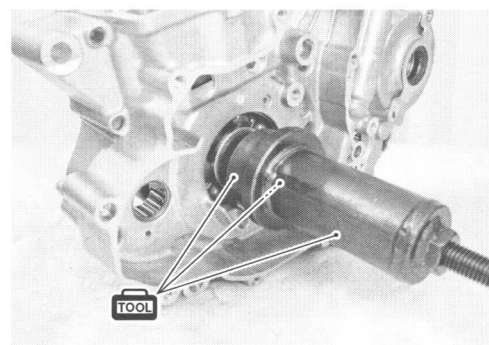
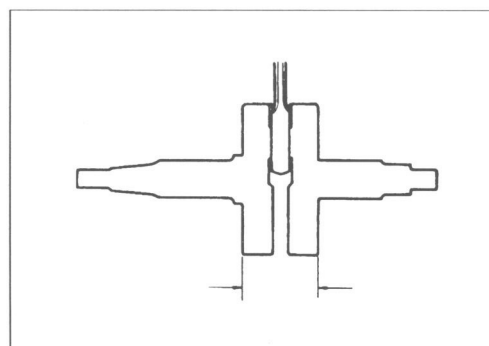
- When mounting the crankshaft in the crankcase, it is necessary to pull its left end into the crankcase by using the special tools.



09910-32812: Crankshaft installer ①

09911-11310: Attachment ②

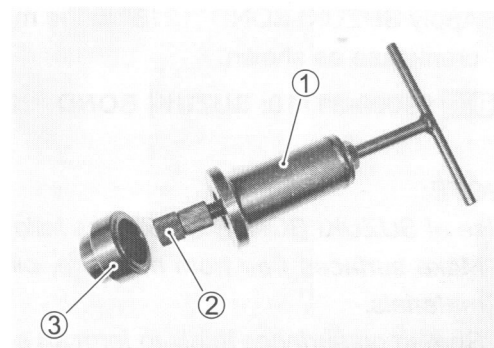
09913-70210: Bearing installer set ③
(inner driver attachment ϕ 35)



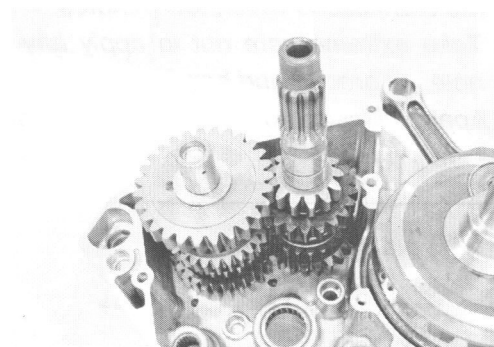
CAUTION

Never fit the crankshaft into the crankcase by striking it with a plastic hammer.

Always use the special tool, otherwise the accuracy of the crankshaft alignment will be affected.

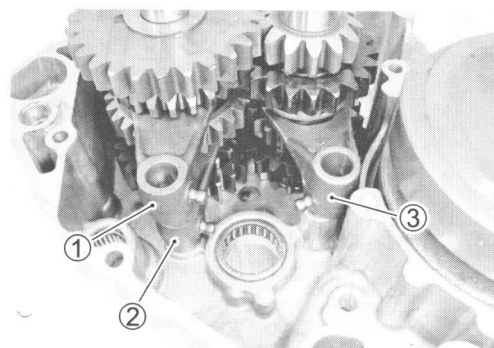
**COUNTERSHAFT/DRIVESHAFT**

- Install the countershaft assembly and driveshaft assembly.

**GEARSHIFT CAM, FORK AND SHAFT**

- Install the gearshift forks into the gearshifting grooves in the correct position and direction.

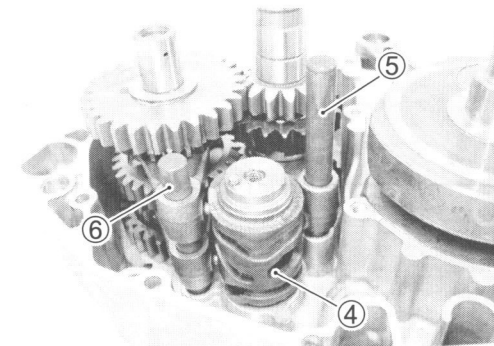
- ① Gearshift fork No.1
- ② Gearshift fork No.2
- ③ Gearshift fork No.3



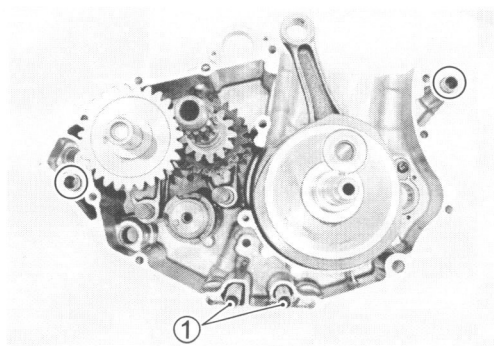
- Install the gearshift cam ④.
- Install the gearshift fork shaft ⑤, ⑥.

NOTE:

- * After the gearshift fork shaft and gearshift forks have been fitted, make sure that the gears engage normally.
- * Set the transmission gears to the neutral position.

**CRANKCASE**

- Thoroughly remove the sealant material and oil stains on the mating surface of the right and left crankcases.
- Install the dowel pins to the left crankcase.
- Install the oil strainers ①.
- Apply engine oil to the conrod big end and to the transmission gears.



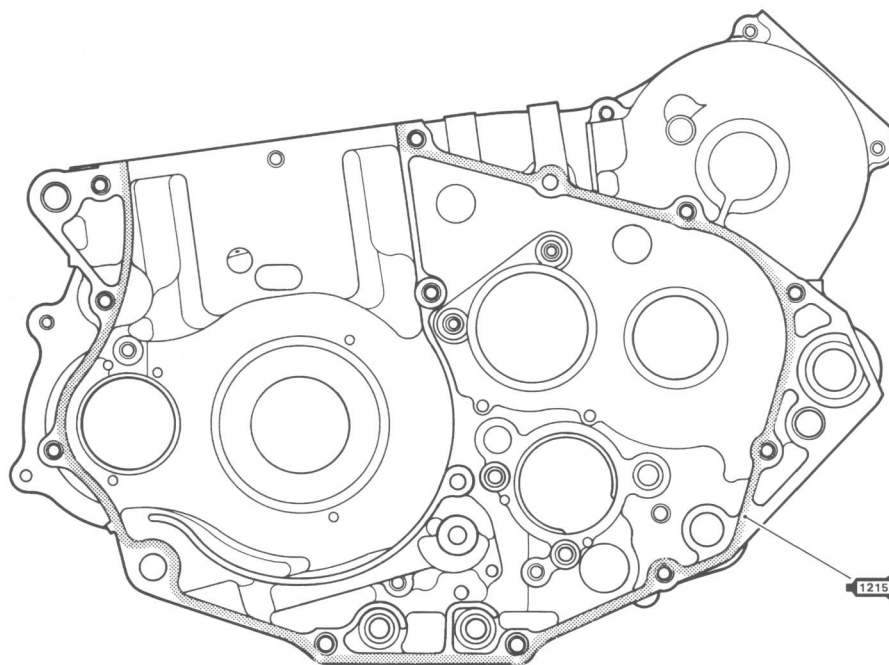
- Apply SUZUKI BOND “1215” to the mating surface of the right crankcase as shown.

 **99000-31110: SUZUKI BOND “1215”**
(or equivalent bond)

NOTE:

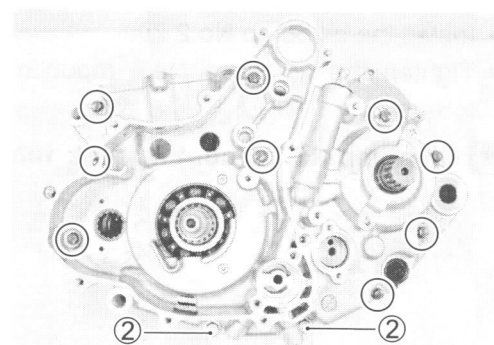
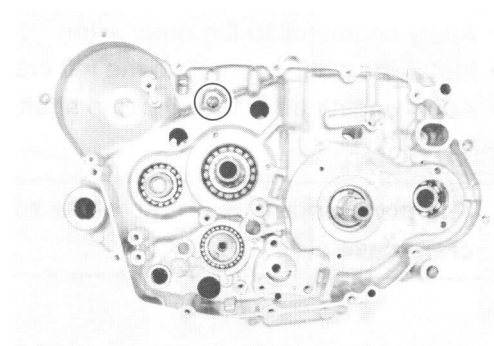
Use of SUZUKI BOND “1215” is as follows:

- * *Make surfaces free from moisture, oil, dust and other foreign materials.*
- * *Spread on surfaces thinly to form an even layer, and assemble the crankcases within few minutes.*
- * *Take extreme care not to apply any BOND “1215” to the oil hole, oil groove and bearing.*
- * *Apply to distorted surfaces as it forms a comparatively thick film.*

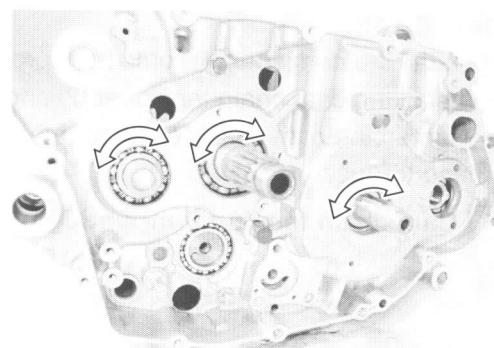


- Tighten the crankcase bolts and engine oil drain plug ② to the specified torque.

 **Crankcase bolt: 11 N·m (1.1 kgf-m, 8.0 lb-ft)**
Engine oil drain plug: 18 N·m (1.8 kgf-m, 13.0 lb-ft)



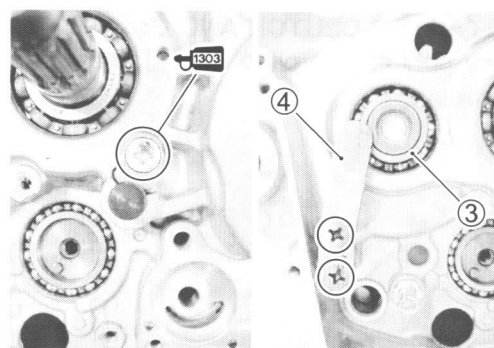
- After the crankcase bolts have been tightened, check if the crankshaft, countershaft, and driveshaft rotate smoothly.



- Apply a small quantity of THREAD LOCK SUPER “1303” to the gearshift fork shaft retainer screw, and tighten it securely.

 **99000-32030: THREAD LOCK SUPER “1303”**

- Install the spacer ③ and retainer ④.
- Install the balancer crank.

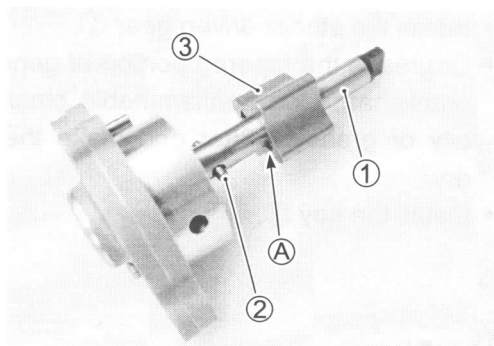


OIL PUMP No.2

- Install the pin ② to oil pump No.2 shaft ①.
- Install the inner rotor ③ to oil pump No.2 shaft ①.

NOTE:

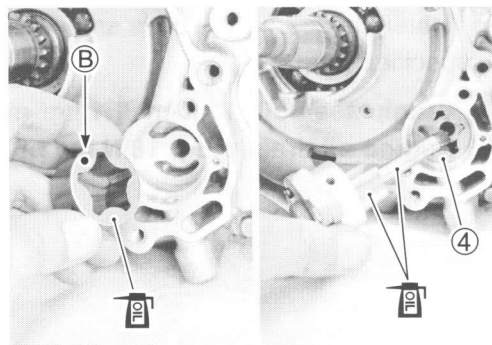
Fit the slot ① of the inner rotor on the pin ②.



- Apply engine oil to the outer rotor.
- Install the outer rotor ④ to the left crankcase.
- Apply engine oil to the oil pump shaft and inner rotor.

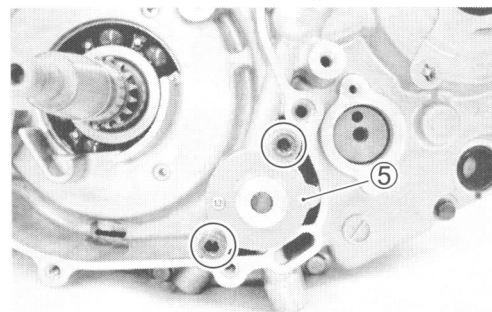
CAUTION

The punch mark ⑧ on the outer rotor must face to the crankcase side.



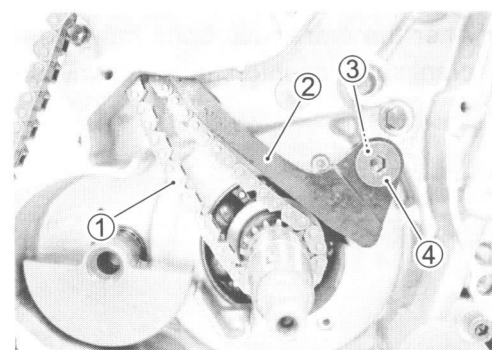
- Install the oil pump No.2 ⑤.
- Tighten the oil pump No.2 mounting bolts to the specified torque.

 Oil pump No.2 mounting bolt: 10N·m (1.0 kgf-m, 7.0lb-ft)

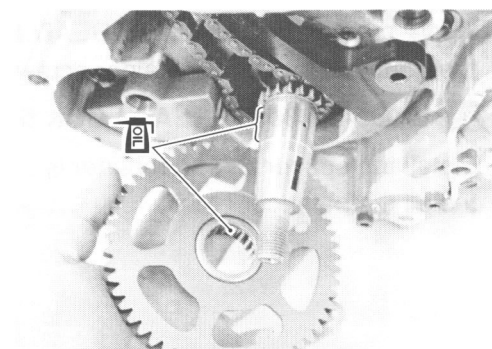
**CAM CHAIN**

- Install the cam chain ① onto the sprocket.
- Install the cam chain tensioner ② and washer ③.
- Tighten the cam chain tensioner mounting bolt ④ to the specified torque.

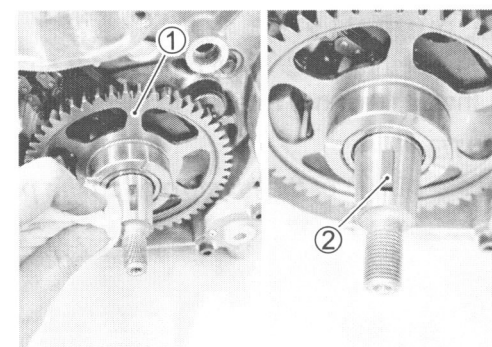
 Cam chain tensioner mounting bolt:
10 N·m (1.0 kgf-m, 7.0 lb-ft)

**STARTER CLUTCH AND GENERATOR ROTOR**

- Apply engine oil to the starter driven gear bearing and crankshaft.



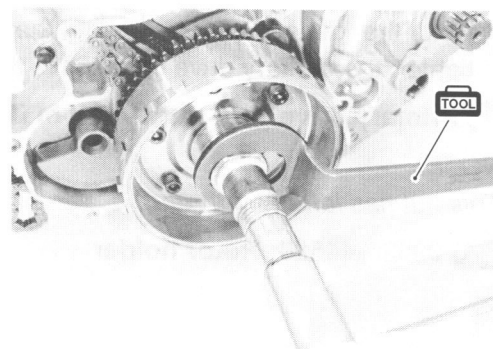
- Install the starter driven gear ①.
- Degrease the tapered portion of generator rotor and also the crankshaft. Use nonflammable cleaning solvent to wipe off oily or greasy matter and make these surfaces completely dry.
- Install the key ②.



- Install the generator rotor.
- Tighten the generator rotor nut to the specified torque using the special tool.

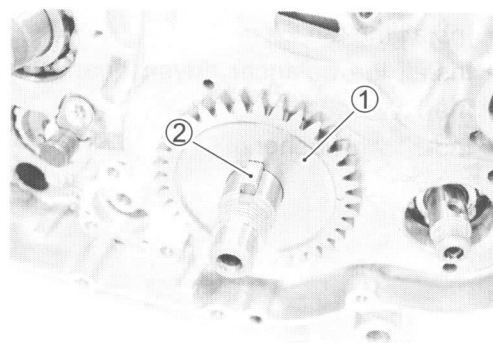
 **Generator rotor nut: 120 N·m (12.0 kgf-m, 87.0 lb-ft)**

 **09930-44520: Rotor holder**

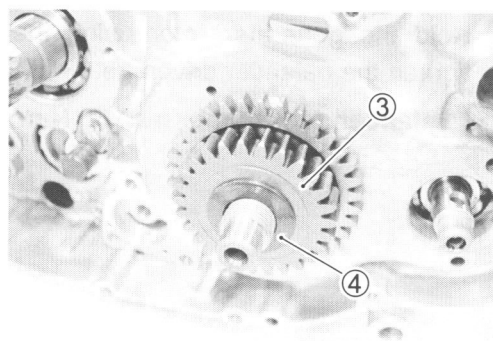


PRIMARY DRIVE GEAR AND BALANCER GEAR

- Install the balancer drive gear ①.
- Install the key ②.

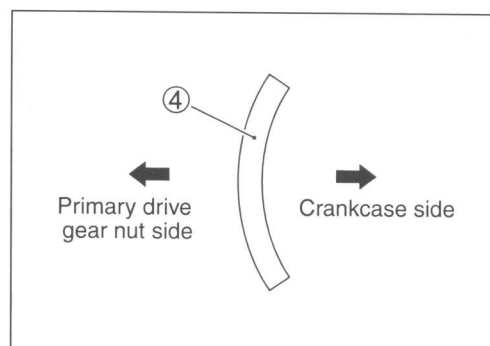


- Install the primary drive gear ③ and washer ④.

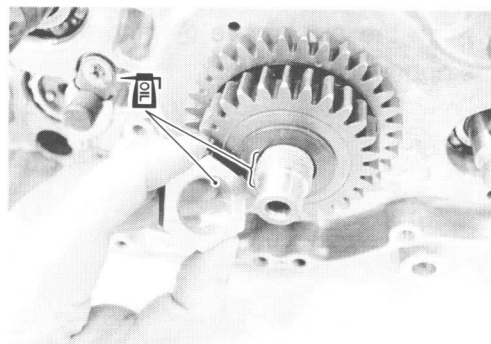


NOTE:

Install the washer ④ as shown in the illustration.



- Apply engine oil to the thread and inside surface of the nut.



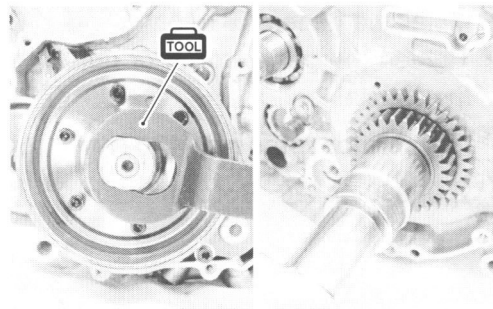
- Hold the generator rotor using the special tool, and then tighten the primary drive gear nut to the specified torque.

 **Primary drive gear nut: 140 N·m (14.0 kgf-m, 101.5 lb-ft)**

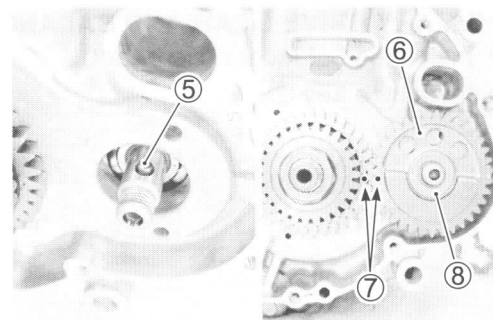
NOTE:

This nut has left-hand thread.

 **09930-44520: Rotor holder**

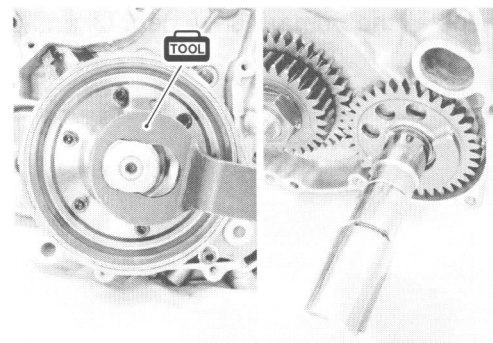


- Install the pin ⑤.
- Install the balancer driven gear ⑥ by aligning the matching marks ⑦.
- Install the washer ⑧.



- Hold the generator rotor using the special tool, and then tighten the balancer driven gear nut to the specified torque.

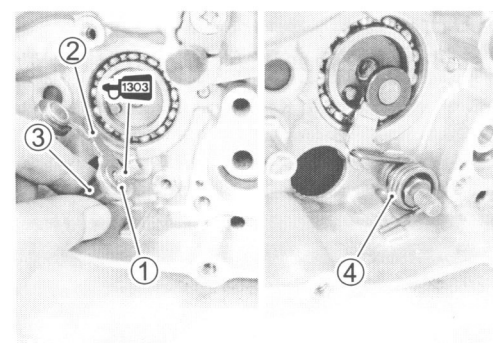
 **Balancer driven gear nut: 50 N·m (5.0 kgf-m, 36.0 lb-ft)**



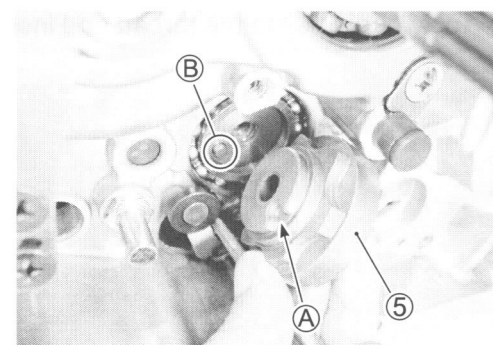
GEARSHIFT CAM DRIVEN GEAR

- Install the washer ① and gearshift cam stopper ② to the gearshift cam stopper bolt ③.
- Apply a small quantity of THREAD LOCK SUPER "1303" to the gearshift cam stopper bolt.
- Tighten the gearshift cam stopper bolt.
- Install the spring ④.

 **99000-32030: THREAD LOCK SUPER "1303"**



- Align the pin groove A with the pin B when installing the stopper plate ⑤.

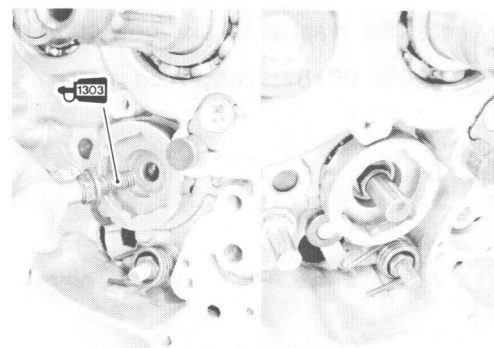


- Apply a small quantity of THREAD LOCK SUPER “1303” to the gearshift cam driven gear bolt.
- Tighten the gearshift cam driven gear bolt to the specified torque.

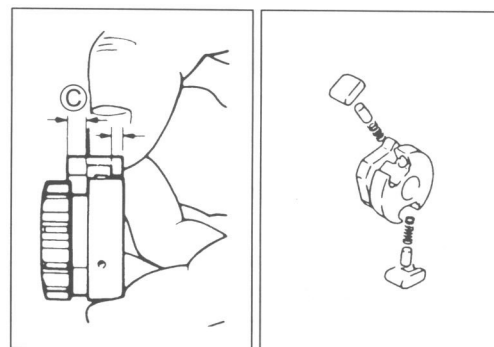
 Gearshift cam driven gear bolt:

31 N·m (3.1 kgf-m, 22.5 lb-ft)

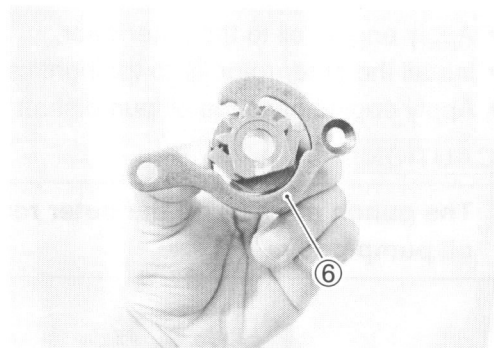
 **99000-32030: THREAD LOCK SUPER “1303”**



- Install each pawl lifter into the gearshift cam driven gear. The large shoulder © must face to the outside.

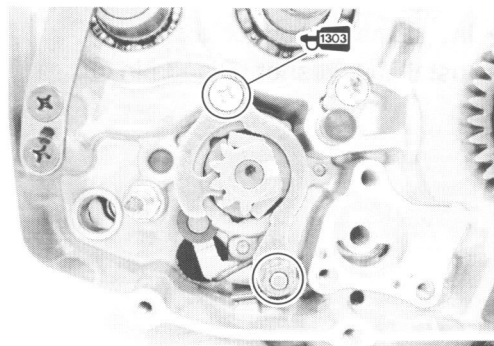


- With the pawls held in pushed position, install the pawl lifter ⑥.



- Apply a small quantity of THREAD LOCK SUPER “1303” to the pawl lifter screw, and then tighten the screw and nut securely.

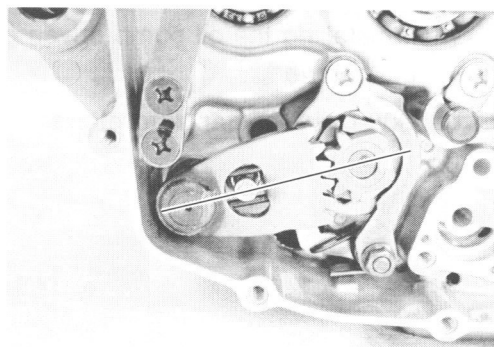
 **99000-32030: THREAD LOCK SUPER “1303”**



- Install the gearshift shaft.

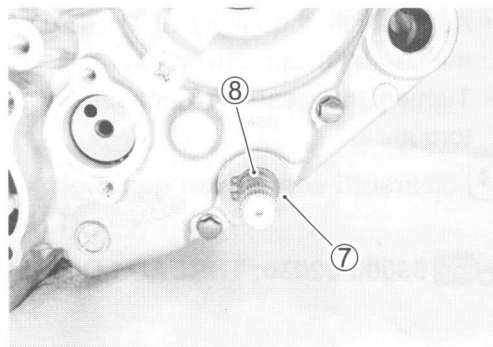
NOTE:

Align the center teeth on the gearshift shaft with the center teeth on the gearshift cam driven gear.



- Install the washer ⑦ and new snap ring ⑧.

TOOL 09900-06107: Snap ring pliers



OIL PUMP No.1

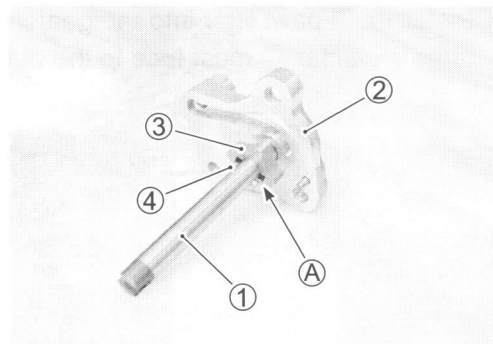
- Install the oil pump body ②, inner rotor ③ and pin ④ to oil pump shaft ①.

NOTE:

Fit the slot ① of the inner rotor on the pin ④.

CAUTION

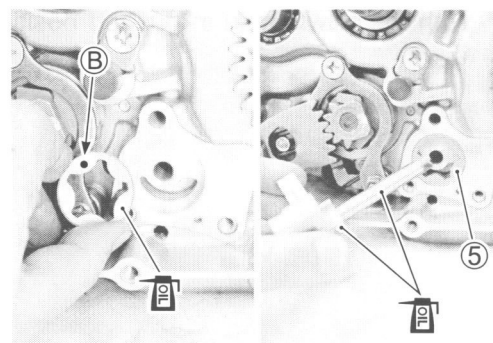
The slit must face to the crankcase side.



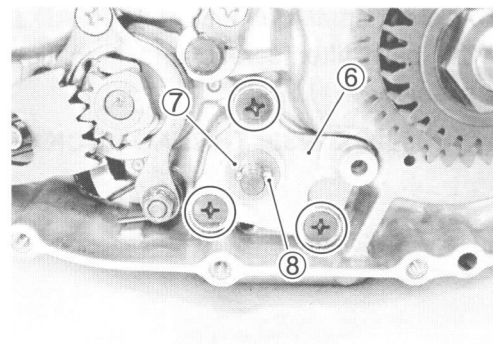
- Apply engine oil to the outer rotor.
- Install the outer rotor ⑤ to the right crankcase.
- Apply engine oil to the oil pump shaft and inner rotor.

CAUTION

The punch mark ① on the outer rotor must face to the oil pump body.

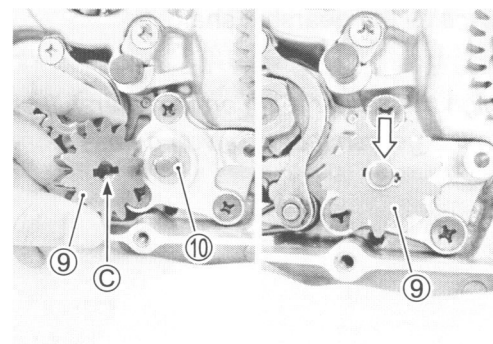


- Install the oil pump No.1 ⑥.
- Install the washer ⑦ and pin ⑧.



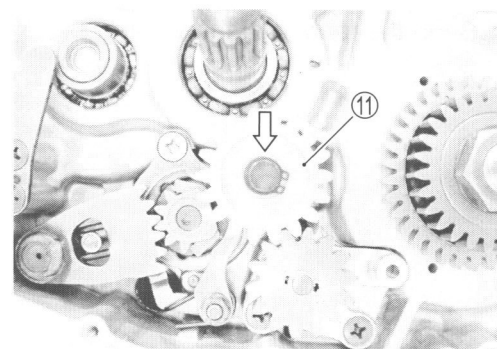
- When installing the oil pump driven gear ⑨, align the pin ⑩ with the groove ①.

TOOL 09900-06107: Snap ring pliers



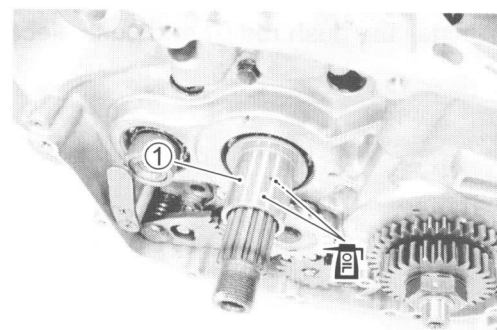
- Install the oil pump idle gear ⑪.

 **09900-06107: Snap ring pliers**

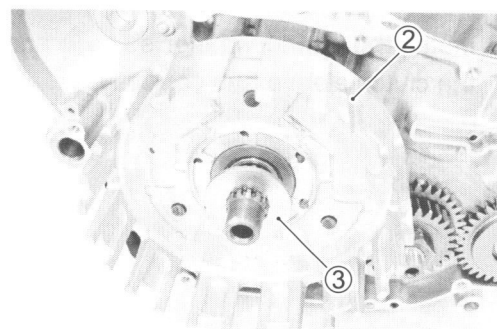


CLUTCH

- Apply engine oil to the spacer.
- Install the spacer ①.



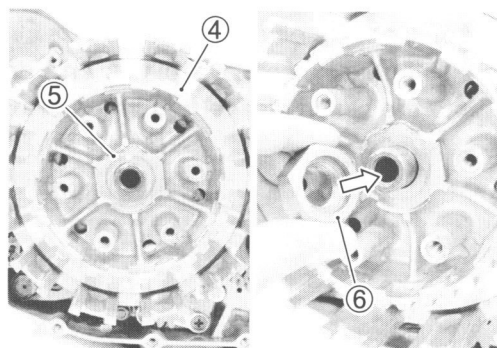
- Install the primary driven gear assembly ②.
- Install the washer ③.



- Install the clutch sleeve hub ④, new lock washer ⑤ and clutch sleeve hub nut ⑥.

NOTE:

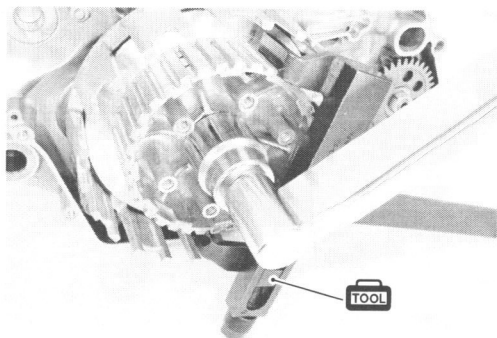
The concave side of clutch sleeve hub nut faces inside.



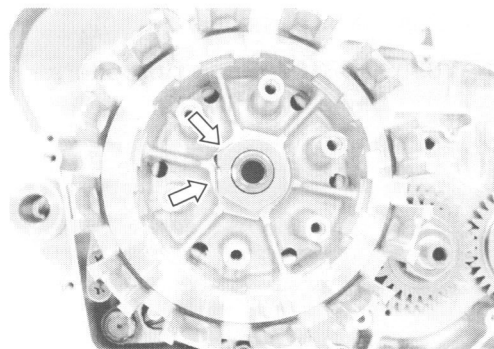
- Hold the clutch sleeve hub using the special tool, and then tighten the clutch sleeve hub nut to the specified torque.

 **Clutch sleeve hub nut: 90 N·m (9.0 kgf-m, 65.0 lb-ft)**

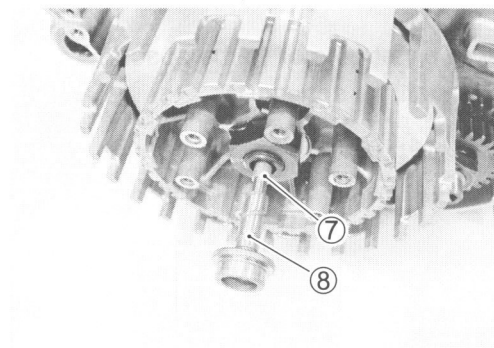
 **09920-53740: Clutch sleeve hub holder**



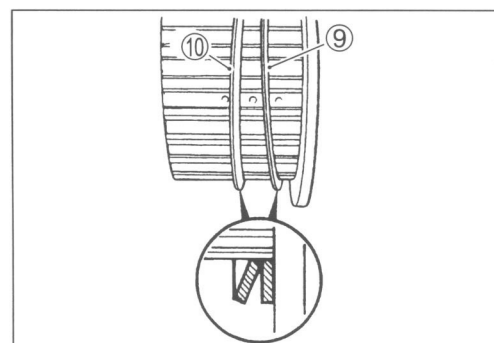
- Bend the tongue of the washer securely.



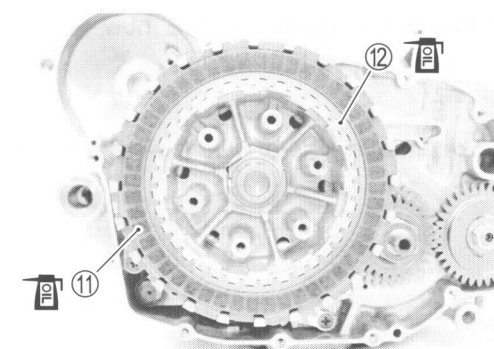
- Install the push rod ⑦ and push piece ⑧.

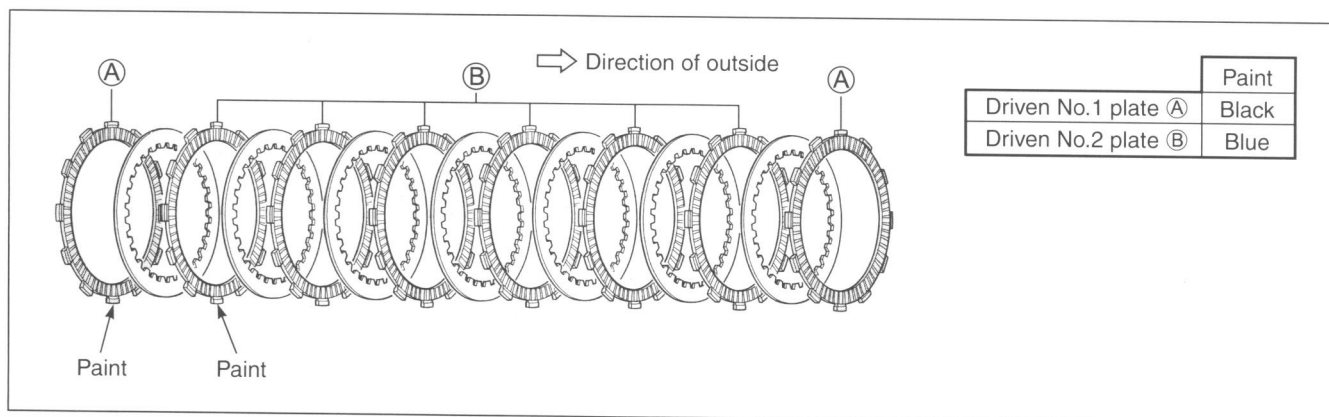


- Install the spring washer seat ⑨ and spring washer ⑩ onto the clutch sleeve hub correctly.

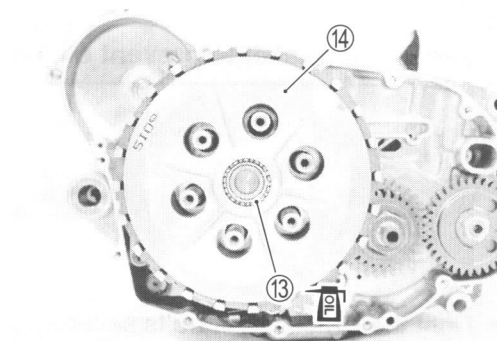


- Apply engine oil to the drive plates ⑪ and driven plates ⑫.
- Install the clutch drive plates and driven plates one by one into the clutch sleeve hub in the prescribed order as show in illustration.



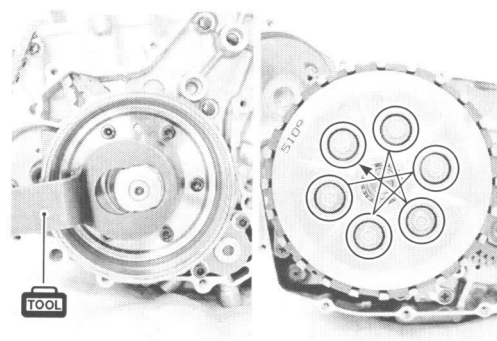


- Apply engine oil to the release bearing (13).
- Install the clutch pressure plate (14).



- Hold the generator rotor using the special tool.
- Tighten the clutch spring set bolts securely in diagonal stages.

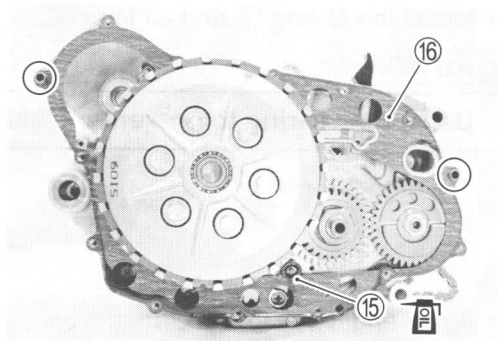
TOOL 09930-44520: Rotor holder



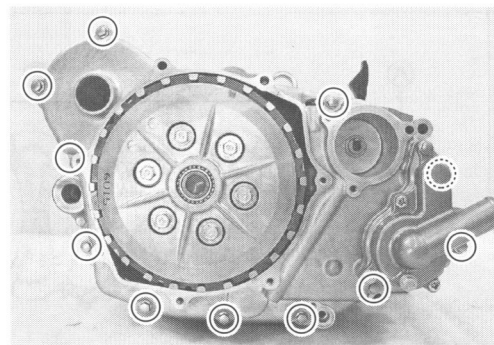
- Apply engine oil to the lip of the oil seal.
- Install the oil seal (15) dowel pins and gasket (16).

CAUTION

Use a new oil seal and gasket to prevent oil leakage.



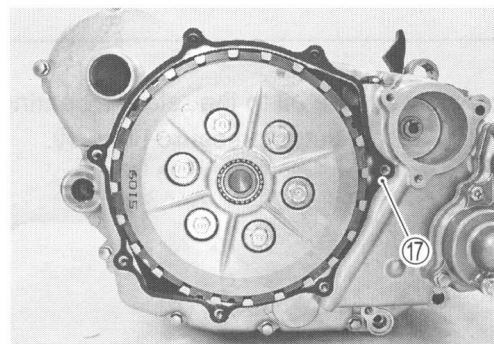
- Tighten the right crankcase cover bolts securely.



- Install the gasket ⑰.

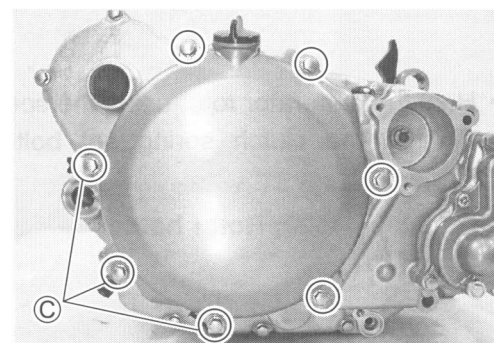
CAUTION

Use a new gasket to prevent oil leakage.



- Tight the clutch cover bolts securely.

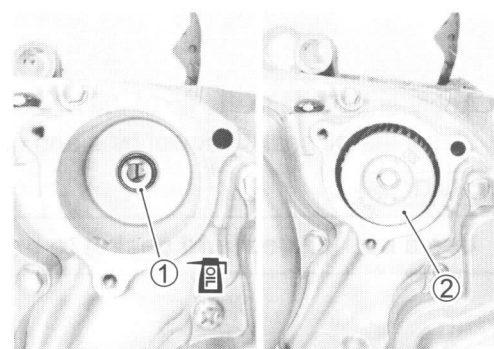
Ⓒ: Bolt with clamp


OIL FILTER

- Apply engine oil to the O-ring.
- Install the O-ring ① and oil filter ②.

CAUTION

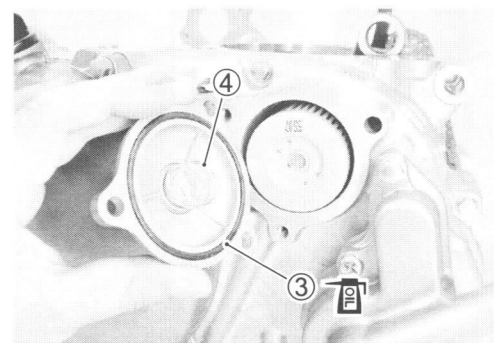
Use a new O-ring to prevent oil leakage.



- Apply engine oil to the O-ring.
- Install the O-ring ③ and spring ④.

CAUTION

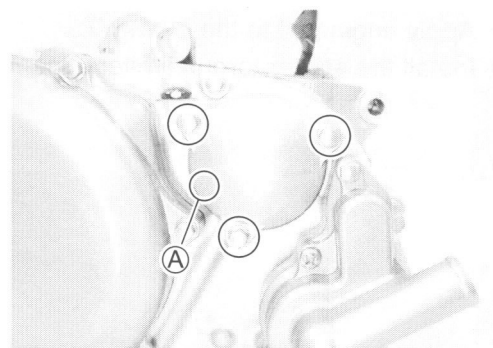
Use a new O-ring to prevent oil leakage.



- Replace the oil filter cap and tighten the bolts securely.

NOTE:

Face the triangle mark **A** on the cap rearward.

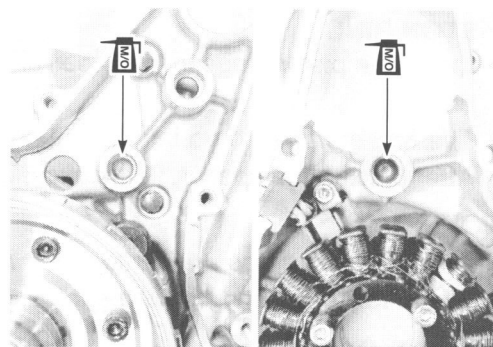


GENERATOR ROTOR COVER

- Before installing the starter idle gear, apply molybdenum oil solution to the hole of starter idle gear shaft.



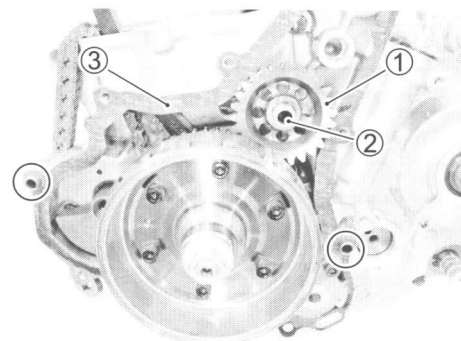
MOLYBDENUM OIL SOLUTION



- Install the starter idle gear ①, shaft ②, dowel pins and gasket ③.

CAUTION

Use a new gasket to prevent oil leakage.

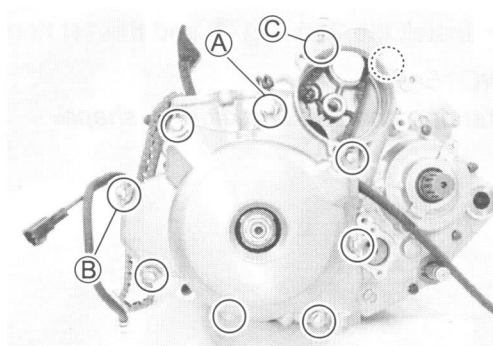


- Tighten the generator rotor cover bolts securely.

A: Bolt with clamp

B: Bolt with lead wire

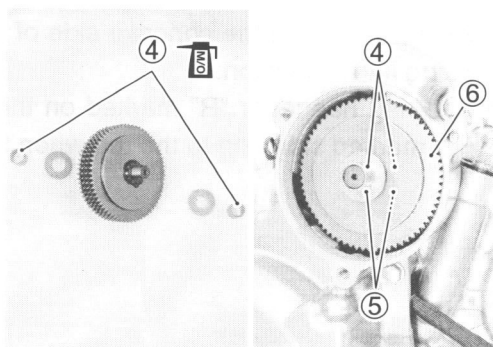
C: Bolt with bracket



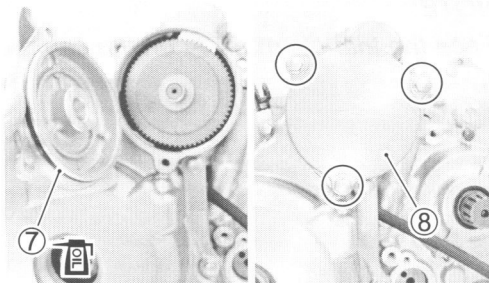
- Before installing the starter torque limiter assembly, apply molybdenum oil solution to the collars ④ of starter torque limiter assembly shaft.
- Install the collars ④, washers ⑤ and starter torque limiter assembly ⑥.



MOLYBDENUM OIL SOLUTION



- Apply engine oil to the O-ring ⑦.
- Install the starter torque limiter assembly cover ⑧.

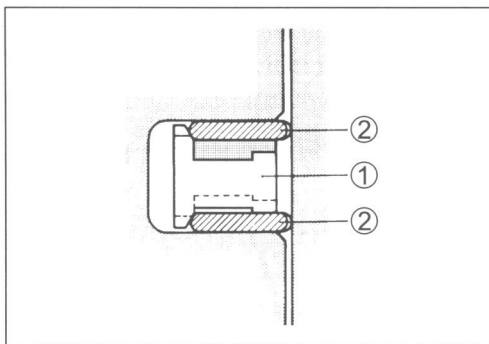


PISTON RING

- Install the piston rings in the order of oil ring, 2nd ring and 1st ring.
- The first member to go into the oil ring groove is a spacer ①. After placing the spacer, fit the two side rails ②.

NOTE:

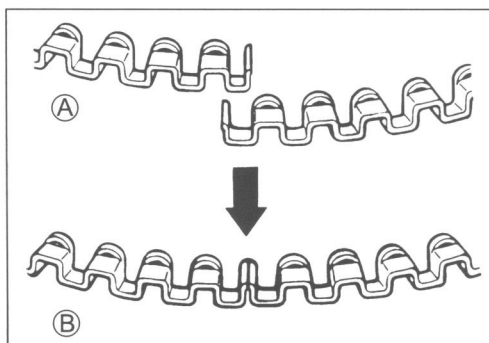
Side designations, top and bottom, are not applied to the spacer and side rails: you can position each either way.



CAUTION

When installing the spacer, be careful not to allow its two ends to overlap in the groove.

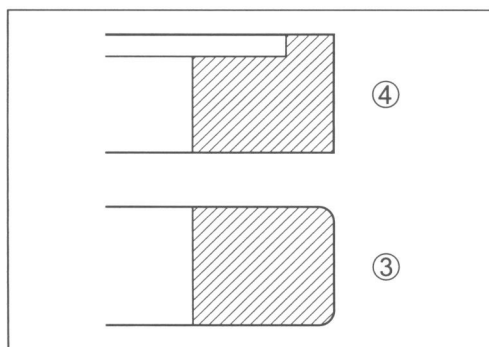
- Ⓐ INCORRECT
Ⓑ CORRECT



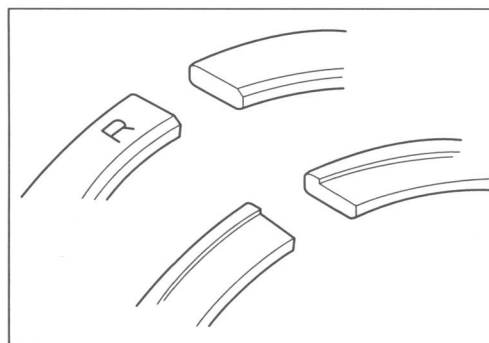
- Install the 2nd ring ③ and the 1st ring ④ to the piston.

NOTE:

1st ring and 2nd ring differ in shape.

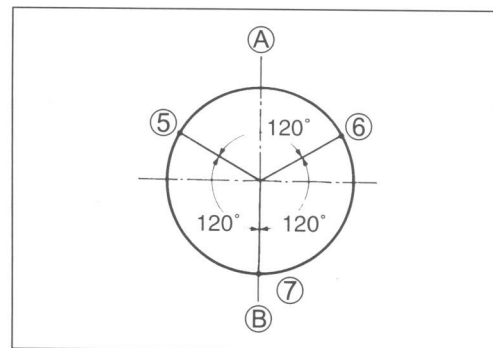


- Be sure to bring the concave side of 1st ring to the top when fitting it to the piston.
- 2nd ring has letter "R" marked on the side. Be sure to bring the marked side ring to the top when fitting it to the piston.



- Position the gaps of the three ring as shown. Before inserting each piston into the cylinder, check that the gaps are so located.

- Ⓐ Exhaust side
- Ⓑ Intake side
- ⑤ 2nd ring and lower side rail
- ⑥ Upper side rail
- ⑦ 1st ring and spacer



PISTON AND CYLINDER

- Apply molybdenum oil solution onto the piston pin and small end of the conrod.

NOTE:

Install the piston with the punch mark Ⓐ on the piston head facing toward the exhaust side.

MOLYBDENUM OIL SOLUTION

- Place a clean rag over the cylinder base to prevent the piston pin circlip from dropping into the crankcase, and then fit the piston pin circlip with long-nose pliers.

CAUTION

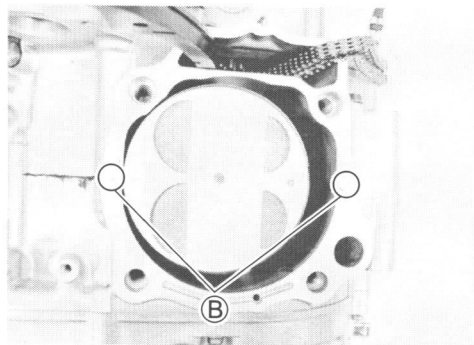
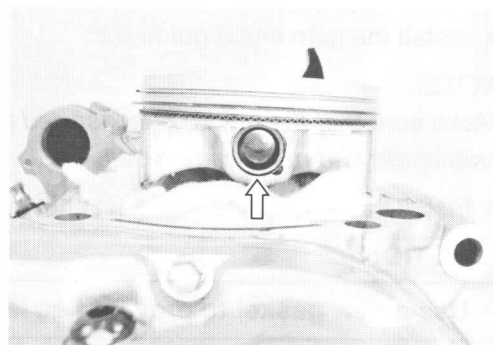
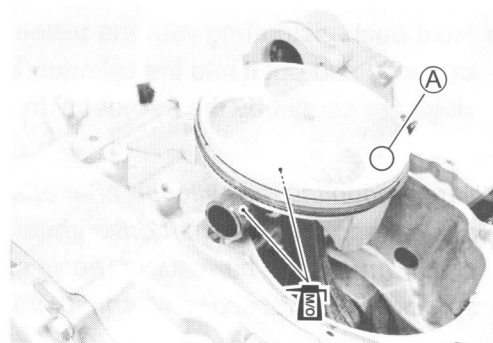
Use a new piston pin circlip to prevent circlip failure with a bent one.

NOTE:

End gap of the circlip should not be aligned with the cutaway in the piston pin bore.

- Thoroughly wipe off oil from the fitting surface of the crankcase.
- Apply SUZUKI BOND "1215" to the crankcase Ⓑ as shown.

 **99000-31110: SUZUKI BOND "1215"**
(or equivalent bond)



- Apply molybdenum oil solution to the sliding surface of the piston and piston rings.
- Install the dowel pins and gasket ① onto the crankcase.

CAUTION

Use a new gasket to prevent oil leakage.

**MOLYBDENUM OIL SOLUTION**

- Hold each piston ring with the piston ring sections positioned correctly and put it into the cylinder. Make sure that the piston rings are caught by the cylinder skirt.

NOTE:

* When mounting the cylinder, after attaching the camshaft drive chain, keep the camshaft drive chain taut. The camshaft drive chain must not be caught between the cam drive chain sprocket and crankcase when the crankshaft is rotated.

- Install the cam chain guide ②.

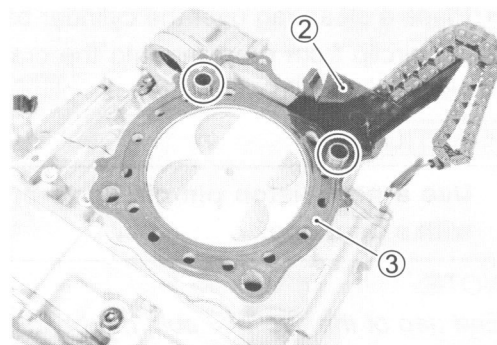
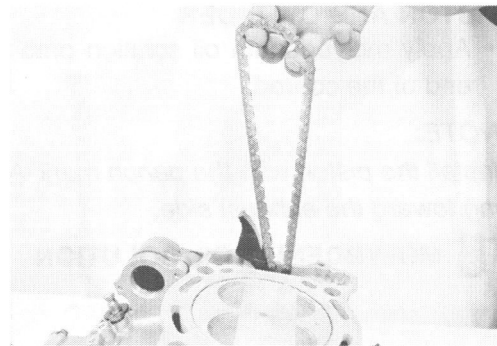
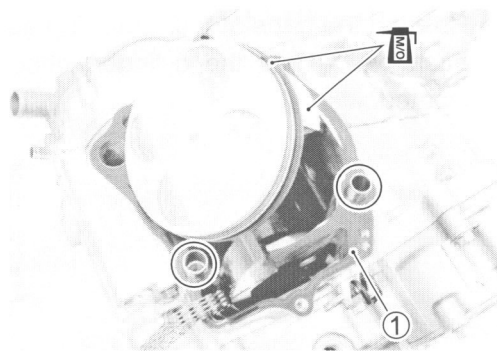
NOTE:

Make sure that the guide ② is inserted properly or binding of the cam chain and guide may result.

- Install the dowel pins and gasket ③.

CAUTION

Use a new gasket to prevent gas leakage.



CYLINDER HEAD

- With the head snugly seated on the cylinder, secure it by tightening the bolts in diagonal stages. Tighten the cylinder head bolts diagonally to the specified torque.

Cylinder head bolt

Initial: 25 N·m (2.5 kgf-m, 18.0 lb-ft)

Final: 47 N·m (4.7 kgf-m, 34.0 lb-ft)

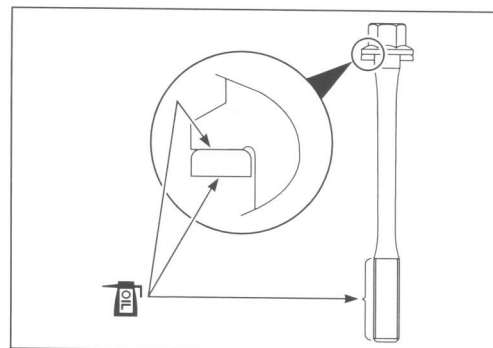
NOTE:

* Apply engine oil to the threaded parts of the cylinder head bolts and both sides of the its washers.

* Be sure to install the washer with rounded side facing up.

CAUTION

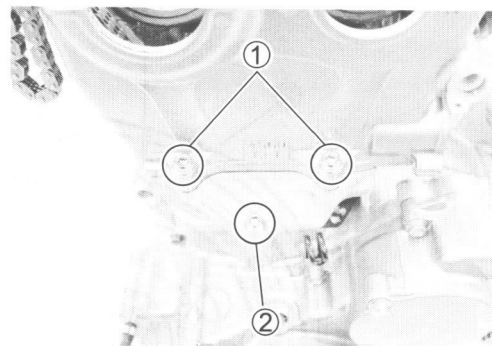
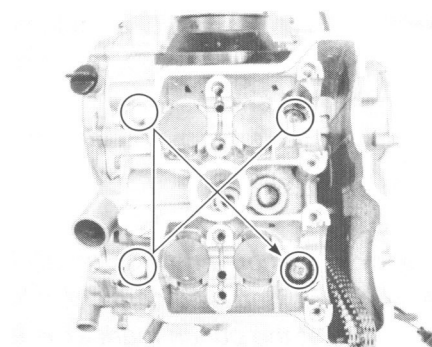
Use new copper washers to prevent oil leakage.



- After tightening the cylinder head bolts to specification, tighten the cylinder head bolts ① and cylinder bolts ② to the specified torque.

Cylinder head bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

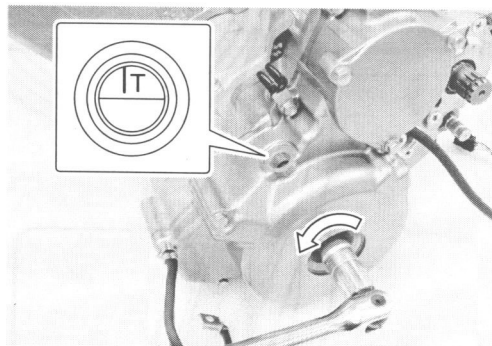
Cylinder bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

**CAMSHAFT/AUTOMATIC DECOMP. ASSEMBLY**

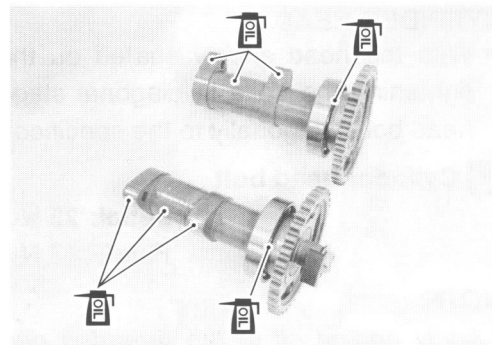
- Turn the generator rotor until the "T" line on the generator rotor is aligned with the center of the hole in the generator cover.

CAUTION

If the crankshaft is turned without drawing the cam chain upward, the cam chain will catch between crankcase and cam chain drive sprocket.



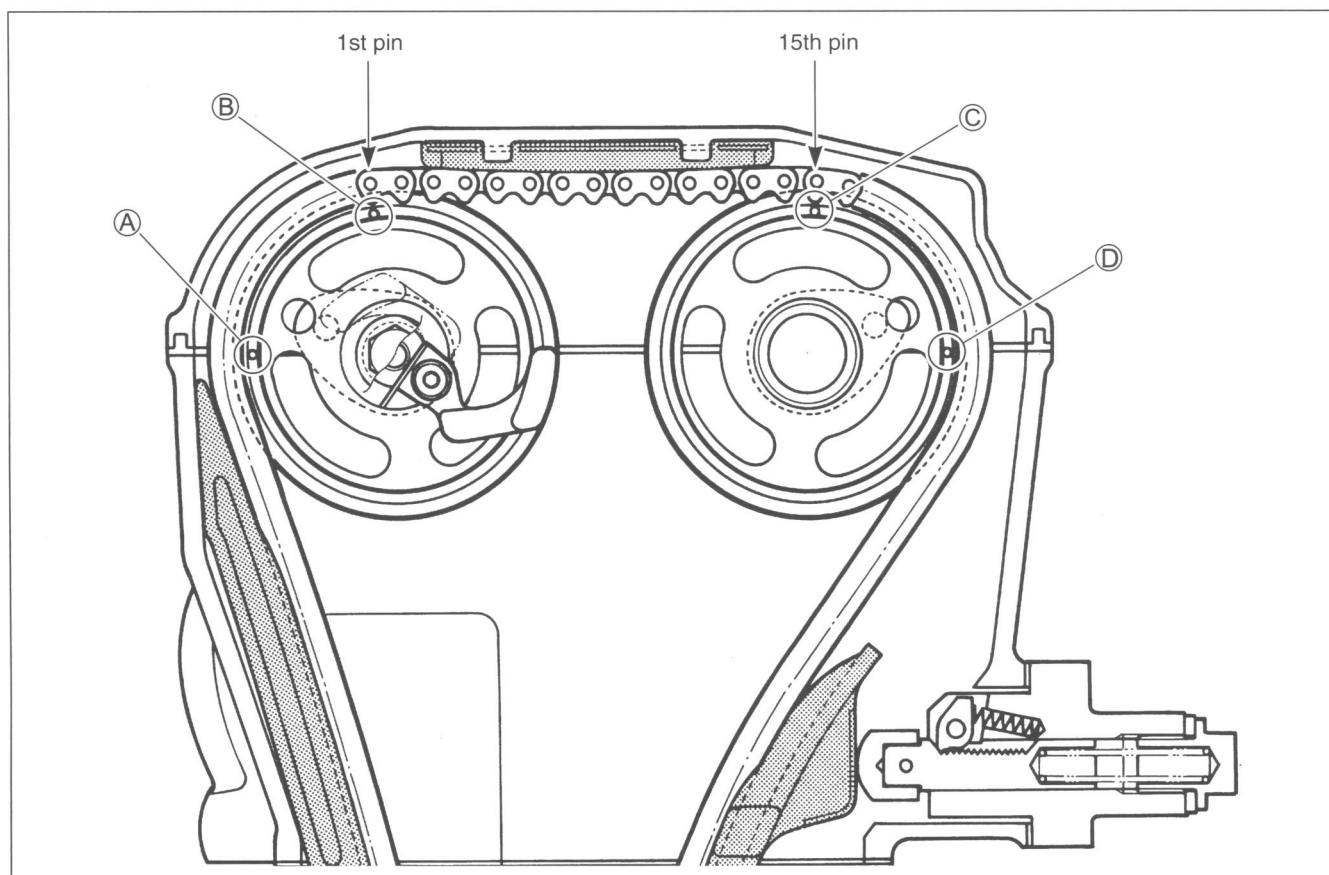
- Just before installing the camshaft into the cylinder head, apply engine oil to the camshaft journals, cam faces, camshaft journal holders and camshaft bearings.



- With the “T” line aligned with the center of the hole, hold the camshaft steady and lightly pull up the cam chain to remove any slack between the cam chain drive sprocket and exhaust camshaft sprocket.
 - The exhaust camshaft sprocket has a punch marked (A). Turn the exhaust camshaft so that the punch is aligned with the gasket surface of the cylinder head. Engage the cam chain with the exhaust camshaft sprocket.
 - The other punch marked (B) should now be pointing straight up. Starting from the roller pin that is directly above the punch marked (B), count out 15 roller pins (from the exhaust camshaft side going towards the intake camshaft side). Engage the 15th roller pin on the cam chain with the punch marked (C) on the intake sprocket. Refer to the following illustrations.
- Engage the 15th roller pin on the cam chain with the punch marked (D) on the intake sprocket. Refer to the following illustrations.

NOTE:

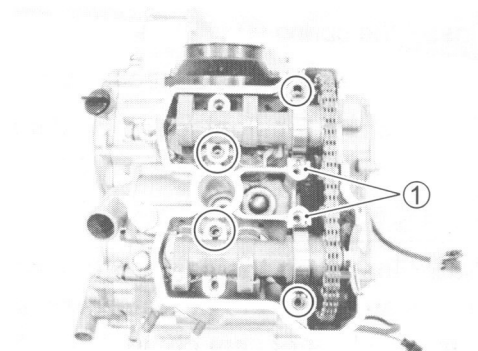
- * The cam chain should now be on all three sprockets. Be careful not to move the crankshaft until the camshaft journal holders and cam chain tensioner are secured.
- * Make sure that the punch mark (D) is aligned with the gasket surface of the cylinder head.



- Install the dowel pins and C-ring ①.
- Place each camshaft journal holders into the correct position.

NOTE:

Camshaft journal holders marked "EX" are for the exhaust side and those marked "IN" are for the intake side.



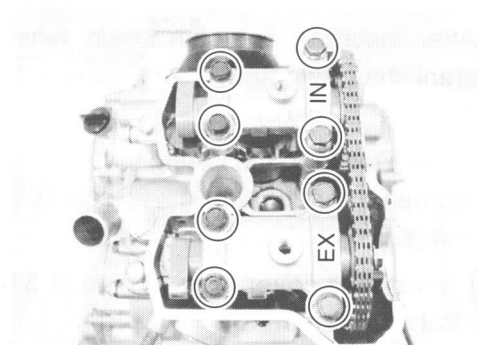
- Tighten the camshaft journal holder bolts to the specified torque.

Camshaft journal holder bolt: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

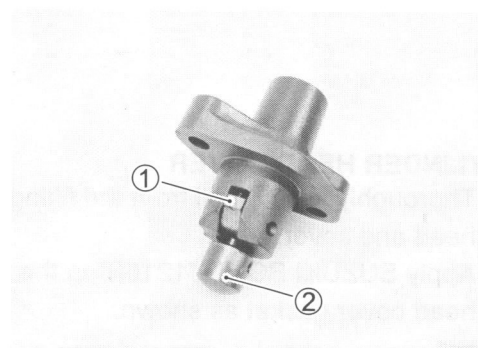
NOTE:

* When tightening the camshaft journal holder bolts, the piston position must be at TDC on the compression stroke.

* Tighten the camshaft journal holder bolts diagonally.

**CAM CHAIN TENSION ADJUSTER**

- Unlock the ratchet mechanism ① and push the push rod ② all the way.



- Install the gasket ③ and cam chain tension adjuster to the cylinder.

CAUTION

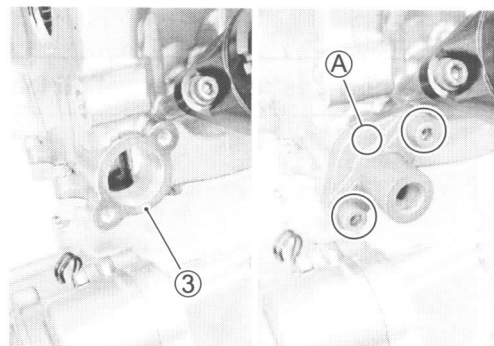
Use a new gasket to prevent oil leakage.

- Tighten the cam chain tension adjuster mounting bolts to the specified torque.

Cam chain tension adjuster mounting bolt:
10 N·m (1.0 kgf-m, 7.0 lb-ft)

NOTE:

Make sure that the "up mark" Ⓐ comes to the upper side.



- Install the spring ④.
- Tighten the spring holder bolt to the specified torque.

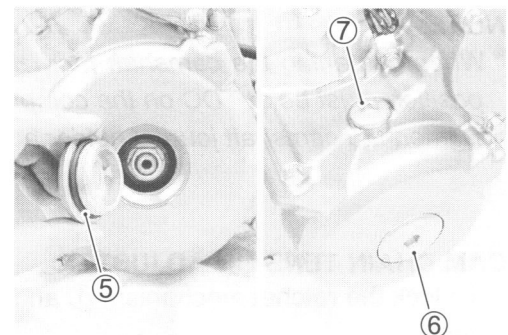
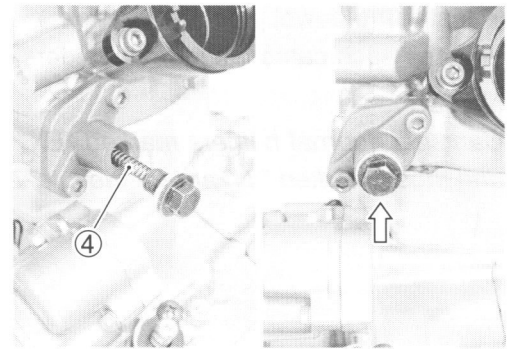
Cam chain tension spring holder bolt:
30 N·m (3.0 kgf-m, 21.5 lb-ft)

CAUTION

After installing the cam chain tension adjuster, check to be sure that the adjuster works properly by checking the slack of cam chain.

- After installing the cam chain tension adjuster, rotate the crankshaft (two turns), and recheck the positions of the camshafts. (➡ 3-76)
- Apply grease to the O-ring ⑤.
- Tighten the generator cover cap ⑥ and valve timing inspection plug ⑦.

Generator cover cap: 15 N·m (1.5 kgf-m, 11 lb-ft)
Valve timing inspection plug:
23 N·m (2.3 kgf-m, 16.5 lb-ft)



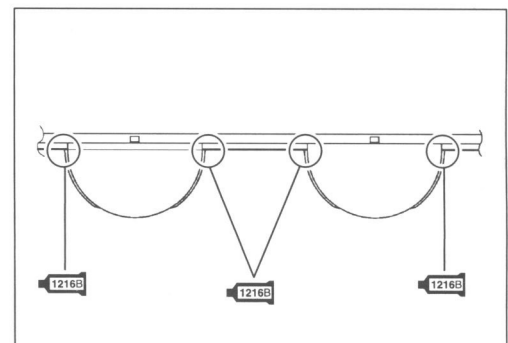
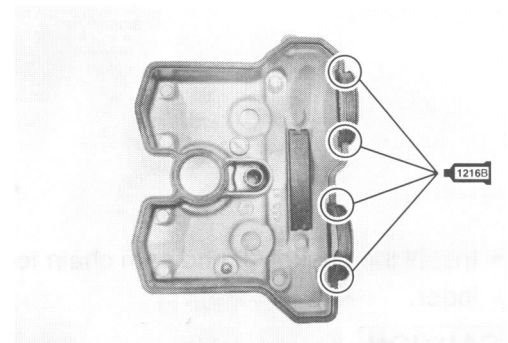
CYLINDER HEAD COVER

- Thoroughly wipe off oil from the fitting surfaces of the cylinder head and cover.
- Apply SUZUKI BOND “1216B” to the end caps of the cylinder head cover gasket as shown.

1216B 99000-31230: SUZUKI BOND “1216B”

CAUTION

Use a new gasket to prevent oil leakage.



- Apply engine oil to both sides of the washers ①.
- Lightly tighten the cylinder head cover bolts and then tighten them to the specified torque.

Cylinder head cover bolt

Initial: 10 N·m (1.0 kgf-m, 7.0 lb-ft)

Final: 14 N·m (1.4 kgf-m, 10.0 lb-ft)

CAUTION

Use new washers to prevent oil leakage.

- Tighten the spark plug. (➡ 2-10)

GEAR POSITION SWITCH

- Apply grease to the O-ring.
- Install the O-ring ①, springs ② and contacts ③.

CAUTION

Use a new O-ring to prevent oil leakage.

 99000-25010: SUZUKI SUPER GREASE "A"
(or equivalent grease)

- Install the gear position switch ④ and tighten the bolts to the specified torque.

 Gear position switch bolt: 6.5 N·m (0.65 kgf-m, 4.7 lb-ft)

STARTER MOTOR

- Apply grease to the O-ring.
- Install the starter motor ①.

 99000-25010: SUZUKI SUPER GREASE "A"
(or equivalent grease)

