ENGINE

CONTENTS

COMPRESSION CHECK

The compression of a cylinder is good indicator of its internal condition. The decision to overhaul the cylinders is often based on the results of a compression test. Periodic maintenance records kept at your dealership should include compression readings for each maintenance service.

COMPRESSION

Standard	Limit	Difference in cylinders
1300 – 1600 kPa (13 – 16 kg/cm^2) (184 – 227 psi)	1100 kPa (11 kg/cm^2) (156 psi)	200 kPa (2 kg/cm^2) (28 psi)

Low compression pressure can indicate any of the following conditions:

* Excessively worn cylinder wall
* Worn-down piston or piston rings
* Piston rings stuck in the grooves
* Poor seating of valves
* Ruptured or otherwise defective cylinder head gasket
* Valve clearance out of adjustment
* Starter motor cranks too slowly

Overhaul the engine in the following cases:

* Compression pressure in one of the cylinders is less than 1100 kPa (11 kg/cm^2, 156 psi).
* Difference in compression pressure between two cylinders is more than 200 kPa (2 kg/cm^2, 28 psi).
* All compression pressure are below 1300 kPa (13 kg/cm^2, 184 psi) even when they measure more than 1100 kPa (11 kg/cm^2, 156 psi).

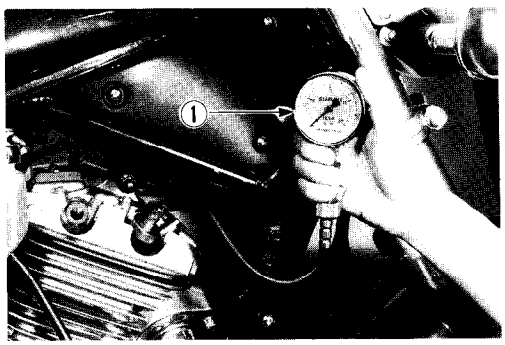
COMPRESSION TEST PROCEDURE

NOTE:

* *Before testing the compression of the engine, make sure that the cylinder head bolts and nuts are tightened to specified torque values.*
* *Warm up the engine before testing.*

- Remove all the spark plugs.
- Fit the compression gauge ① in one of the plug holes, while taking care that the connection is tight.
- Twist the throttle grip full open.
- Crank the engine a few seconds with the starter, and record the maximum gauge reading as the compression of the cylinder.
- Repeat this procedure with the other cylinder.

09915-64510 : Compression gauge
09918-03810 : Adaptor



ENGINE COMPONENTS REMOVABLE WITH THE ENGINE IN PLACE

The parts listed below can be removed and reinstalled without removing the engine from the frame. Refer to the page listed in this section for removal and reinstallation instructions.

ENGINE REMOVAL AND REINSTALLATION

ENGINE REMOVAL

Before taking the engine out of the frame, thoroughly clean the engine with a suitable cleaner. The procedure of engine removal is sequentially explained in the following steps.

1. Remove the oil drain plug to drain out engine oil.
2. Remove the frame head cover and radiator cap.
3. Remove the water drain plug to drain out coolant.
4. Remove the seat.
5. Disconnect the battery ⊖ and ⊕ lead wires from the battery terminals, remove the battery.

CAUTION: Be sure to disconnect the ⊖ lead wire first.

6. Remove all the frame covers.
7. Turn the fuel cock "OFF" position and remove the fuel tank mounting bolts, remove the fuel tank by disconnecting the fuel hose.
8. Remove the left and right mufflers.
9. Disconnect the following lead wires.
   - * Side stand switch
   - * Generator
   - * Pick-up coil
   - * Starter motor
   - * Starter relay
   - * Water temperature gauge
   - * Cooling fan motor lead
   - * Neutral indicator
   - * Ground lead
   - * Oil pressure indicator
10. Remove the secondary bevel gear case cover.
11. Remove the clutch release cam assembly.
12. Remove the radiator by removing the radiator protector, radiator hose clamps and radiator cooling fan.
13. Remove the left-footrest.
14. Remove the gearshift lever.
15. Remove the water pump case.
16. Loosen the shaft drive boot clamp.
17. Remove the coolant reservoir tank.
18. Disconnect the choke cables and throttle cables.
19. Disconnect the rear carburetor fuel hose.
20. Disconnect the breather hose from the rear cylinder head.
21. Disconnect the fuel pump vacuum hose from the front carburetor intake pipe.
22. Loosen the front and rear carburetor clamps.
23. Remove the rear carburetor air cleaner mounting bolts and slide the air cleaner backward.
24. Remove the front and rear carburetors.
25. Remove the rear brake pedal mounting bolts and rear brake master cylinder mounting bolts, remove the brake pedal and master cylinder.
26. Support the engine with a proper jack.
27. Remove the engine mounting bolts, nuts, spacer, brackets and right frame down tube securing bolts.

CAUTION: When holding the engine with a jack, place a wooden piece on a jack or oil pan may be damaged.

28. Dismount the engine by pulling slightly forward and to right-side.

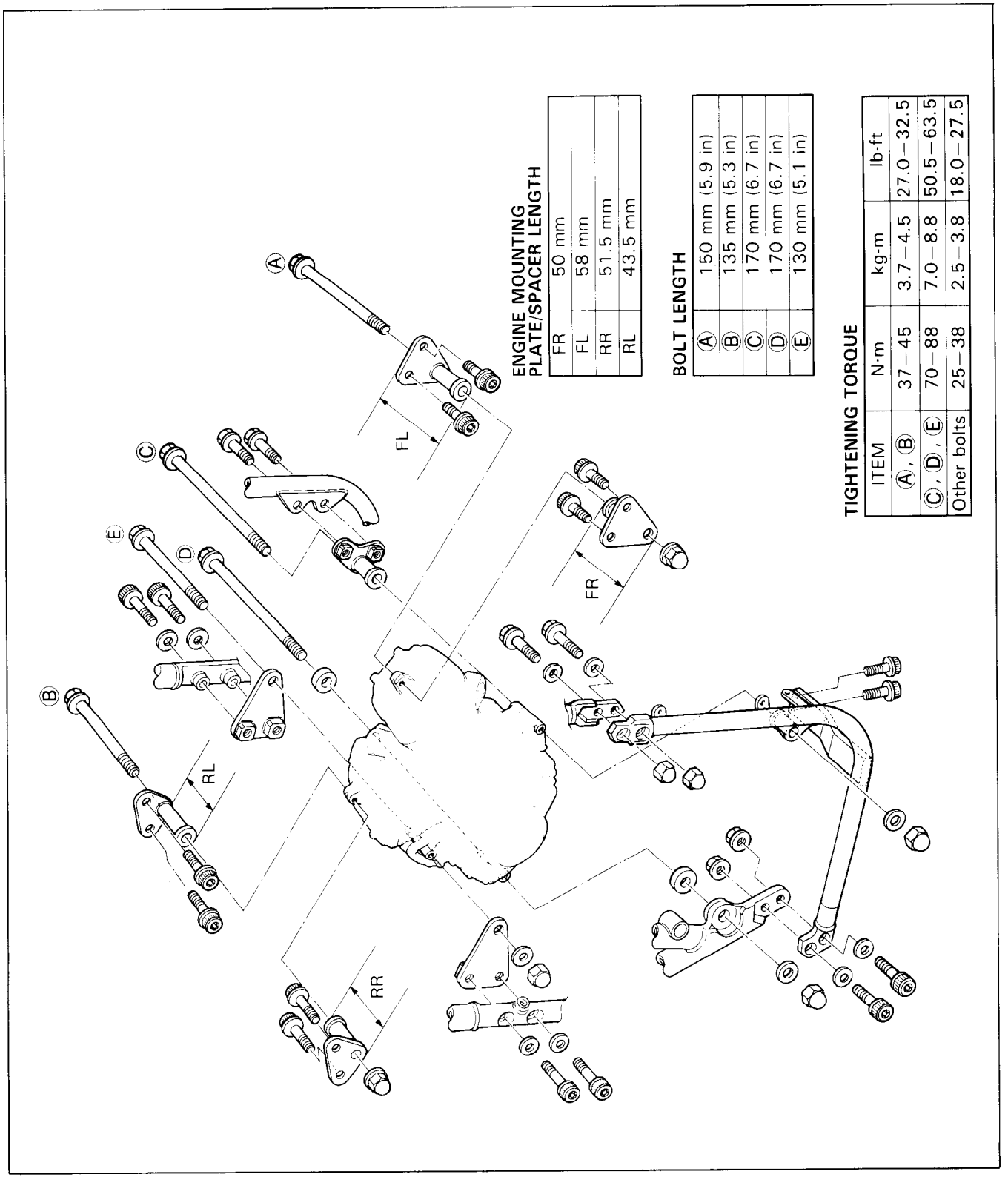
ENGINE REINSTALLATION

Reinstall the engine in the reverse order of engine removal.

- Install the brackets, spacer, bolts and nuts properly, as shown in the following illustration.

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 tighten them to the specified torque.



ENGINE MOUNTING PLATE/SPACER LENGTH

FR	50 mm
FL	58 mm
RR	51.5 mm
RL	43.5 mm

BOLT LENGTH

Ⓐ	150 mm (5.9 in)
Ⓑ	135 mm (5.3 in)
Ⓒ	170 mm (6.7 in)
Ⓓ	170 mm (6.7 in)
Ⓔ	130 mm (5.1 in)

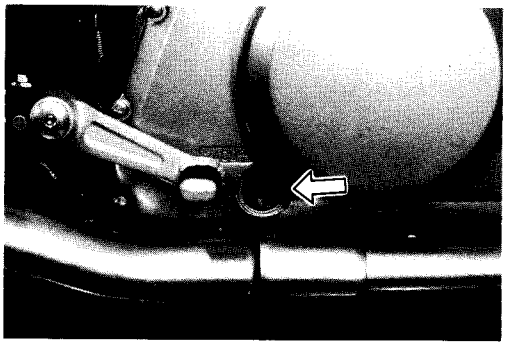
TIGHTENING TORQUE

ITEM	N·m	kg-m	lb-ft
Ⓐ, Ⓑ	37–45	3.7–4.5	27.0–32.5
Ⓒ, Ⓓ, Ⓔ	70–88	7.0–8.8	50.5–63.5
Other bolts	25–38	2.5–3.8	18.0–27.5

- After remounting the engine, route wiring harness, cables and hoses properly by referring to the sections, for wire routing, cable routing and hose routing. (See pages 9-12 through 23.)

- Adjust the following items to the specification.

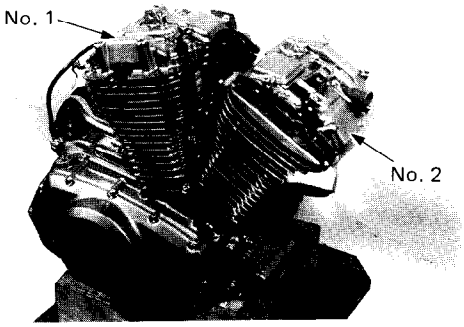
- Pour 3.3 L (3.5/2.9 US/Imp qt) of engine oil SAE 10W/40 graded SE or SF into the engine after overhauling engine.
- Start up the engine and allow it run for several minutes at idle speed. About several minutes after stopping engine, check that the oil level remains between the marks of oil level inspection window.



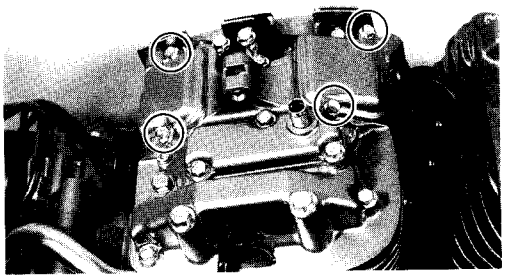
Change	2400 ml (2.5/2.1 US/Imp qt)
Filter change	2800 ml (3.0/2.5 US/Imp qt)
Overhaul	3300 ml (3.5/2.9 US/Imp qt)

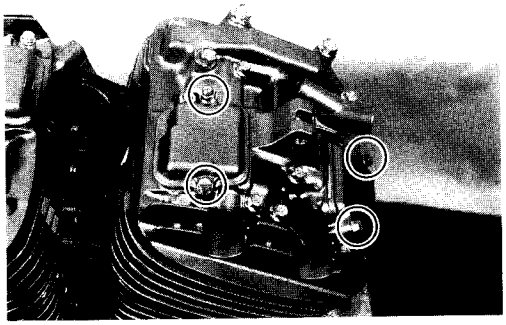
ENGINE DISASSEMBLY

CAUTION:
Be sure to identify each removed part such as intake pipe, camshaft, piston, conrod etc. as to its location and lay the parts out in groups so that each will be restored to the original location during assembly.



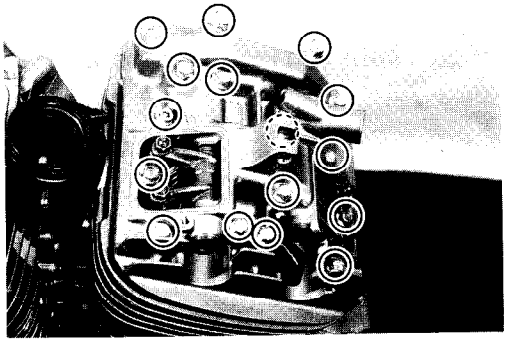
- Remove the valve inspection caps.



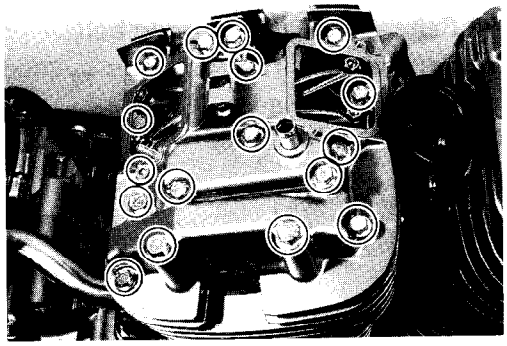


- Remove the cylinder head covers.

NOTE:
When removing the cylinder head covers, the piston must be at top dead center on the compression stroke.

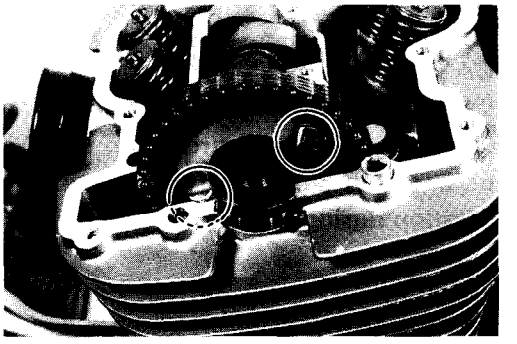


No. 2 (FRONT)

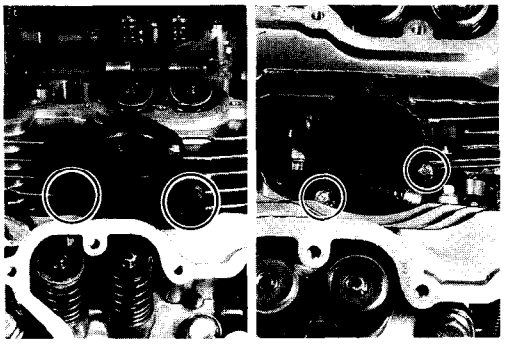


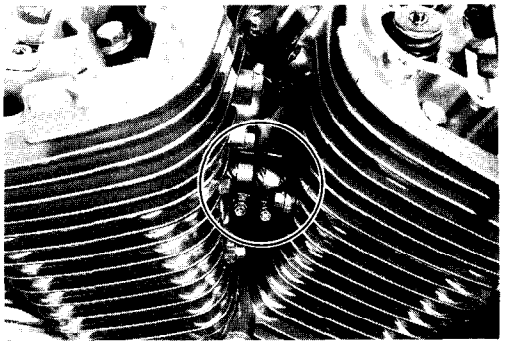
No. 1 (REAR)

- Flatten the lock washers and remove the camshaft sprocket bolts.
- Remove the camshafts and sprockets.

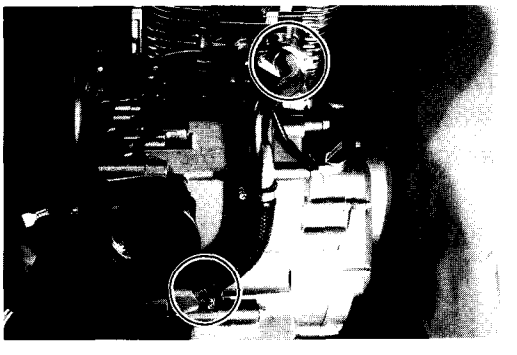


- Remove the front intake pipe.
- Loosen the water hose clamp screws.

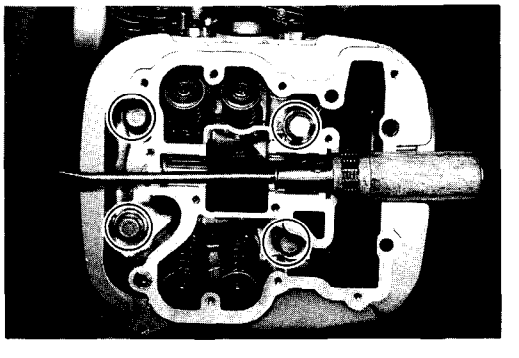




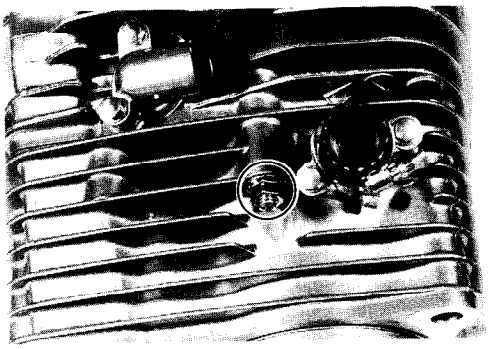
- Remove the water pipe/water hose by removing the water pipe bolts and loosening the water hose clamp screw.

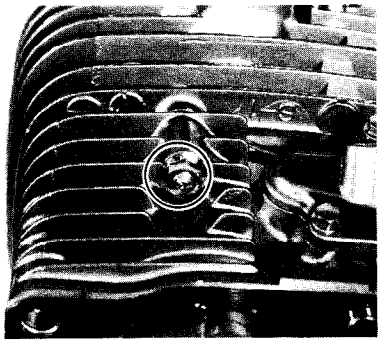


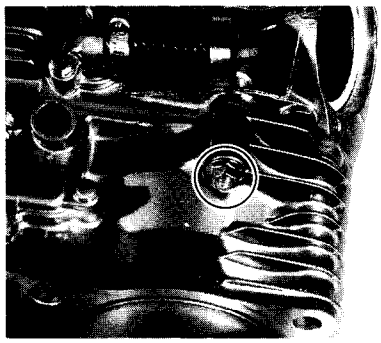
- Remove the cylinder head bolts.
- Remove the front and rear cylinder heads along with the respective cylinders.

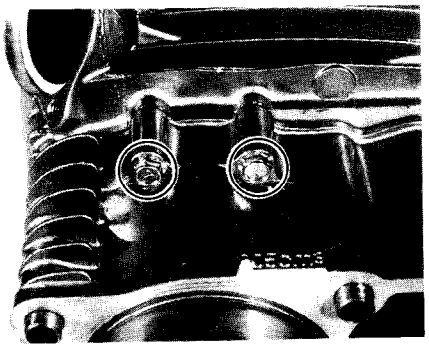


- Remove the cylinder head nuts and bolts.

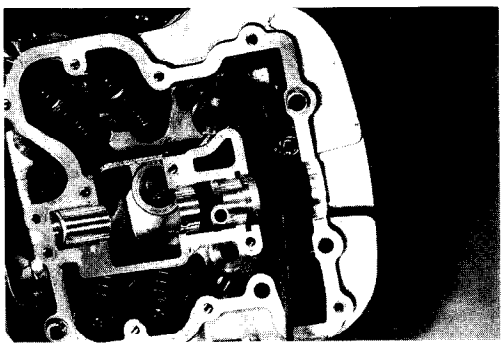




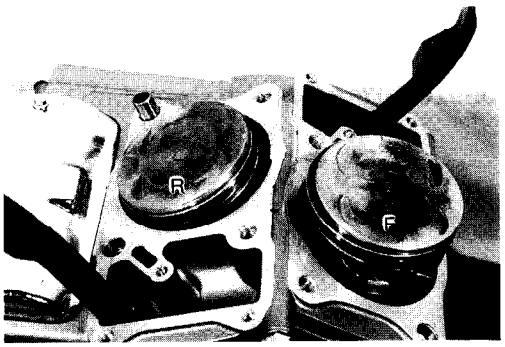




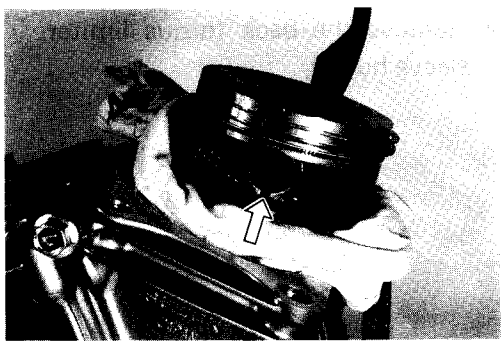
- After releasing the ratchet, push the chain tensioner rod and insert a screwdriver between ratchet and chain tensioner body.
- Separate the respective cylinder heads and cylinders.



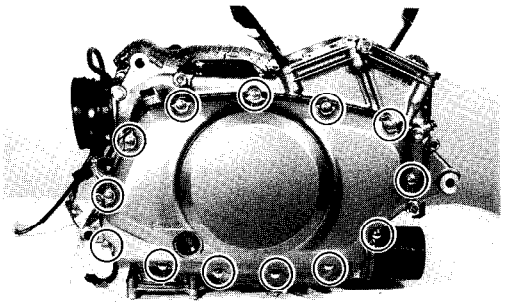
- Check the "F" and "R" piston marks.



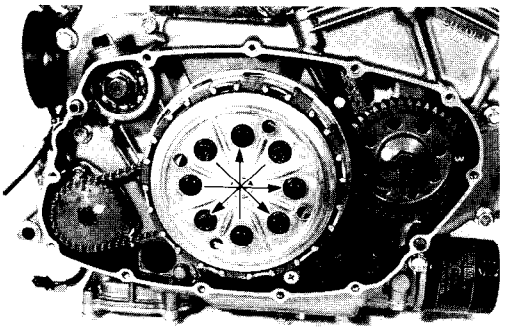
- Place a clean rag over the cylinder base to prevent piston pin circlips from dropping into crankcase. Remove the piston pin circlips with long-nose pliers.
- Drive out the piston pins by using proper drift.



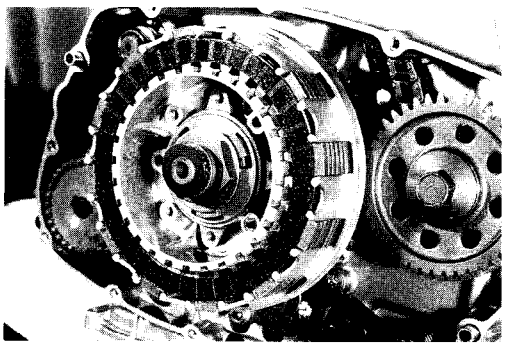
- After removing the clutch cover bolts, remove the clutch cover by tapping with a plastic hammer.



- Remove the clutch spring mounting bolts diagonally.
- Remove the pressure plate.

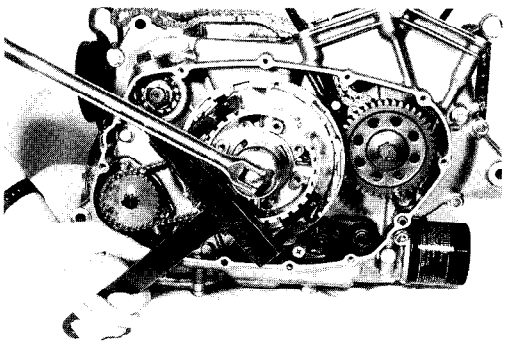


- Remove the clutch push piece, thrust washer, bearing and push rod.
- Remove the clutch drive and driven plates.

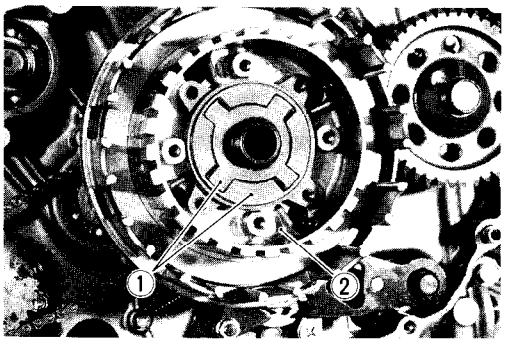


- Remove the clutch sleeve hub nut by using the special tool.

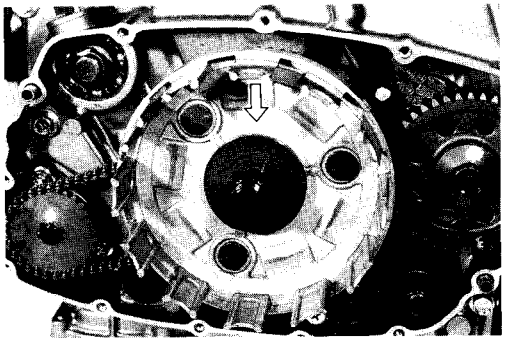
09920-50710 : Clutch sleeve hub holder



- Remove the back torque limiter ① along with the clutch sleeve hub ②.

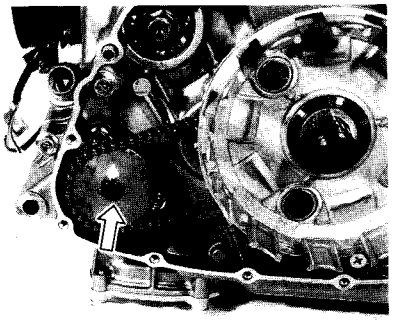


- Remove the thrust washer.

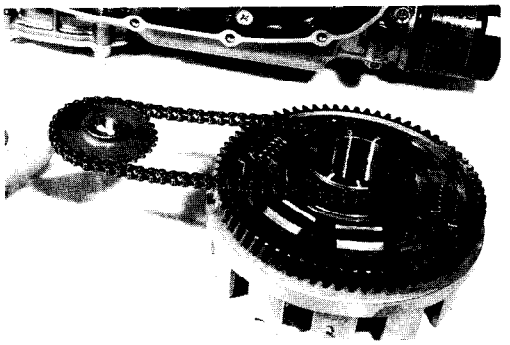


- Remove the oil pump driven gear circlip.

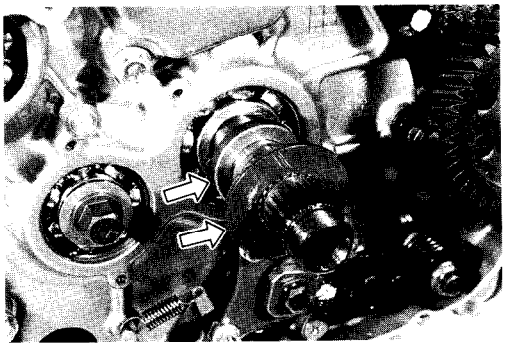
09900-06107 : Snap ring pliers



- Remove the primary driven gear assembly, oil pump drive chain and oil pump driven gear.



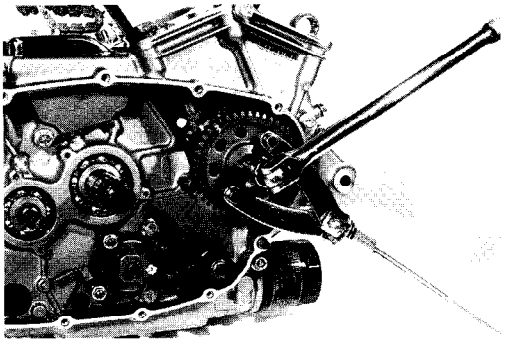
- Remove the thrust washer and spacer.



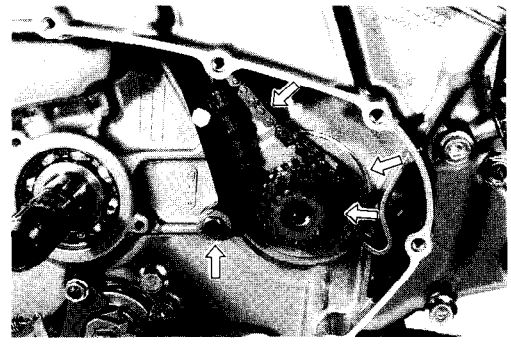
- Remove the primary drive gear bolt while holding the primary drive gear with the special tool and remove the primary drive gear.

09930-40113 : Rotor holder

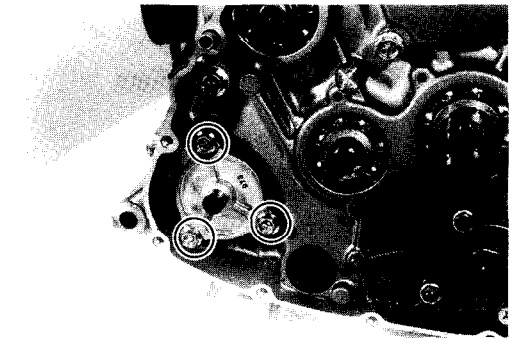
CAUTION:
This bolt has left-hand thread. Turning it counter-clockwise it may cause damage.



- Remove the cam chain guide and cam chain.
- Remove the camshaft drive sprocket and thrust washer.



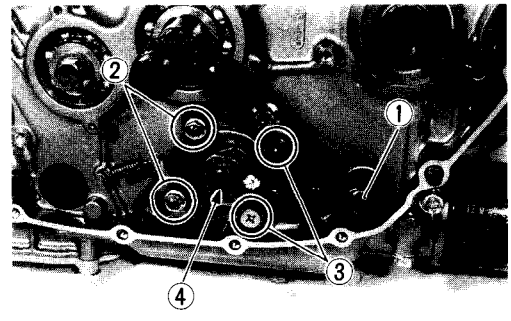
- Remove the oil pump by removing the bolts.



- Remove the gearshift shaft ①.
- Remove the pawl lifter and cam guide by removing the nuts ② and screws ③.

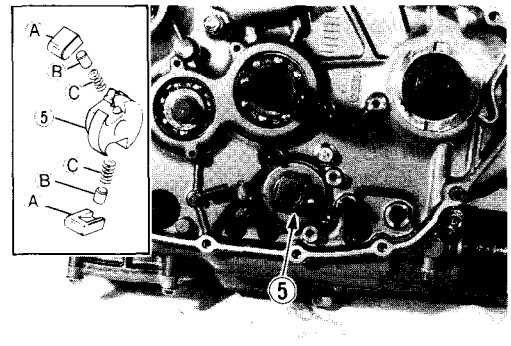
09900-09003 : Impact driver set

- Remove the gearshift cam driven gear retaining bolt ④.

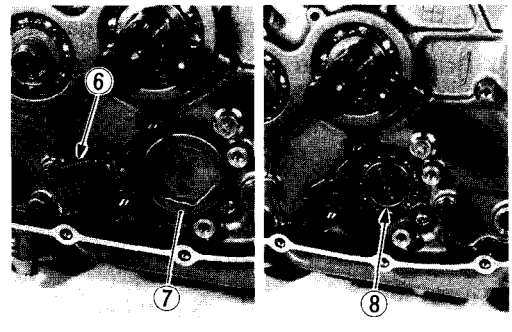


- Remove the gearshift cam driven gear ⑤.

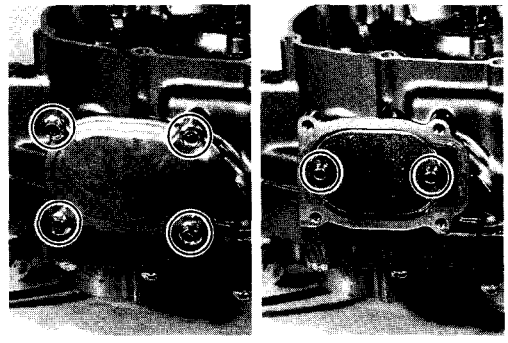
NOTE:
When removing the gearshift cam driven gear, do not lose gearshift pawl Ⓐ, pin Ⓑ and spring Ⓒ.



- Unhook the gearshift cam stopper spring ⑥, gearshift cam stopper plate ⑦ and washer ⑧.

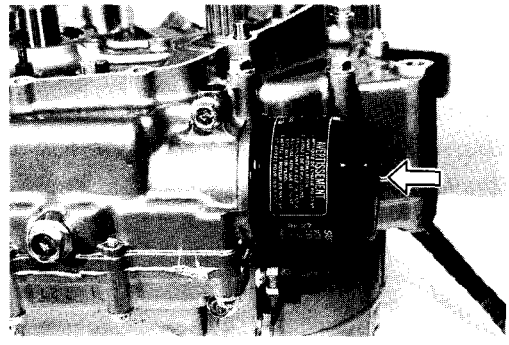


- Remove the oil sump filter cap and oil sump filter.

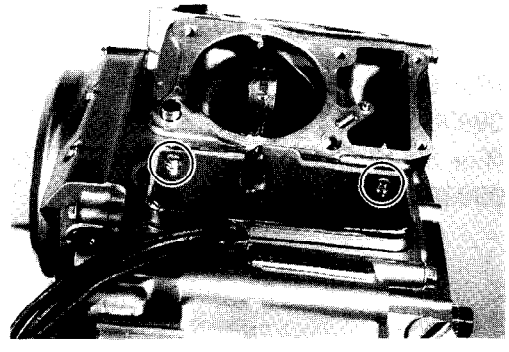


- Remove the oil filter by using the special tool.

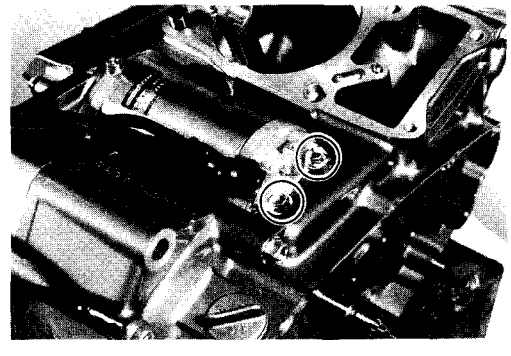
09915-40611 : Oil filter wrench



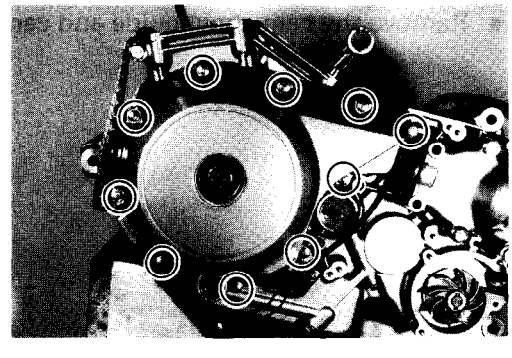
- Remove the starter motor cover.



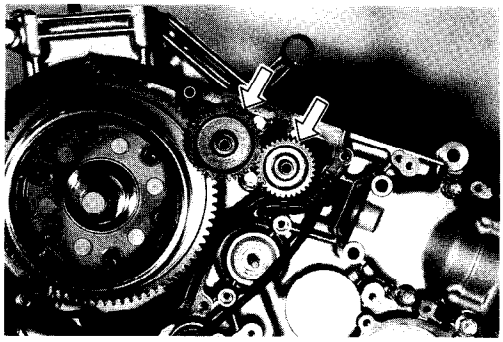
- Remove the starter motor.



- Remove the generator cover.

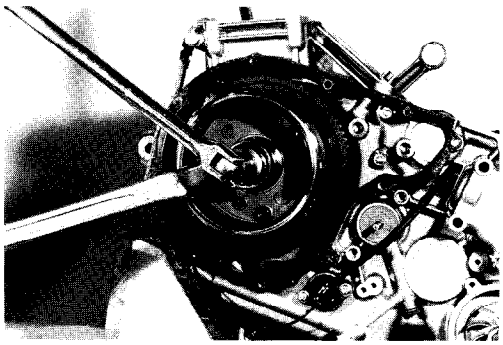


- Remove the starter driven gear and its idle gear.



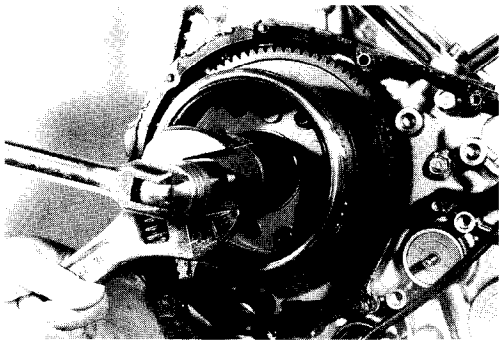
- Loosen the rotor bolt.

NOTE:
When removing the rotor, do not remove the rotor bolt after loosening the bolt. The rotor bolt is used in conjunction with the rotor remover.

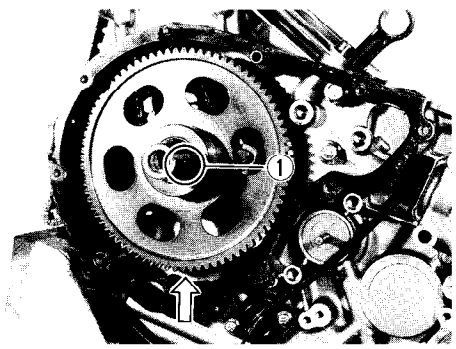


- Remove the rotor by using the special tool.

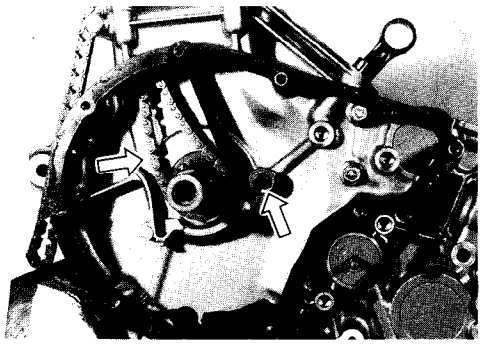
(For U.S.A. models)
09930-30720 : Rotor remover
(For the other models)
09930-34970 : Rotor remover



- Remove the key ①.
- Remove the starter driven gear.

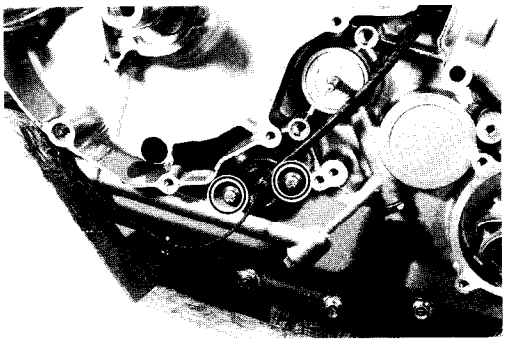


- Remove the cam chain guide and cam chain.

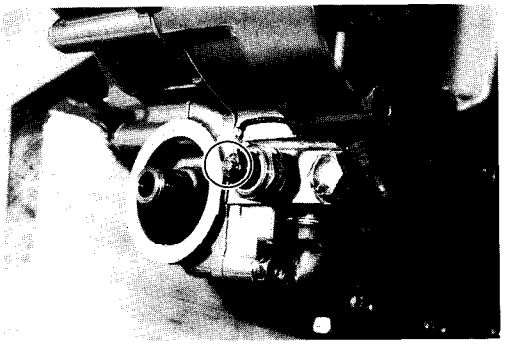


- Remove the neutral switch assembly.

NOTE:
Do not lose the neutral switch contact and its spring.

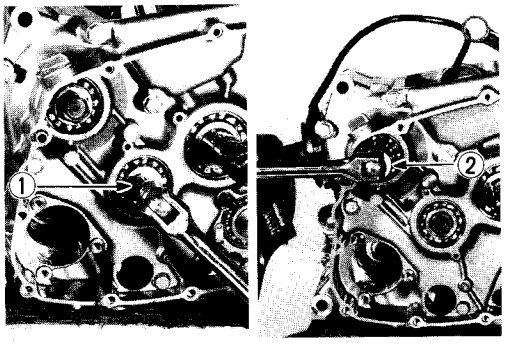


- Disconnect the oil pressure switch lead wire.

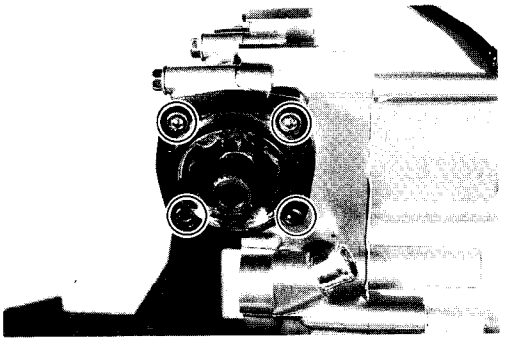


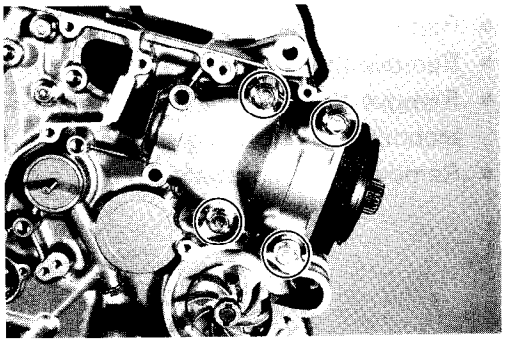
- Install the universal joint into the secondary driven bevel gear.
- Remove the driveshaft bolt ① and secondary drive bevel gear shaft nut ② while holding the universal joint.

CAUTION:
Driveshaft bolt ① has left-hand thread.

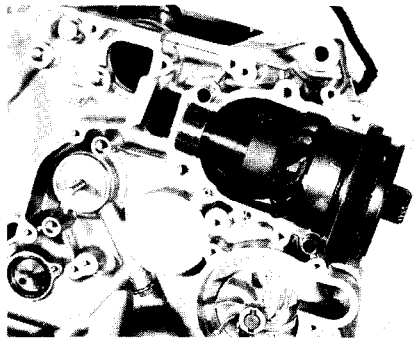


- Remove the secondary driven bevel gear housing bolts and secondary bevel gear case bolts.

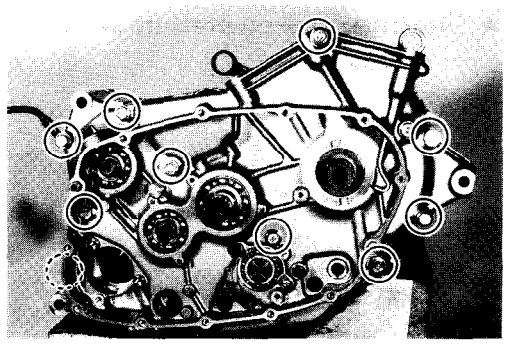


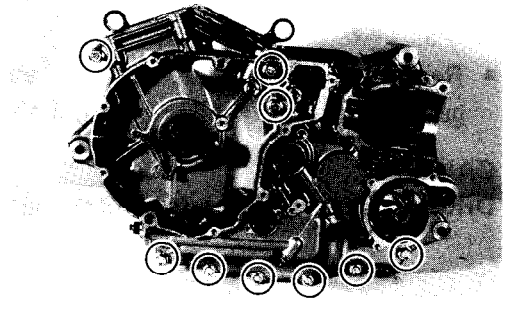


- Remove the secondary driven bevel gear assembly and bearing.



- Remove the crankcase securing bolts.

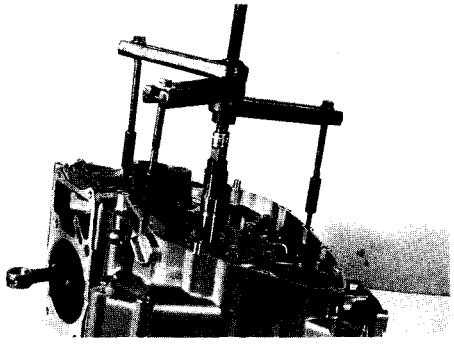




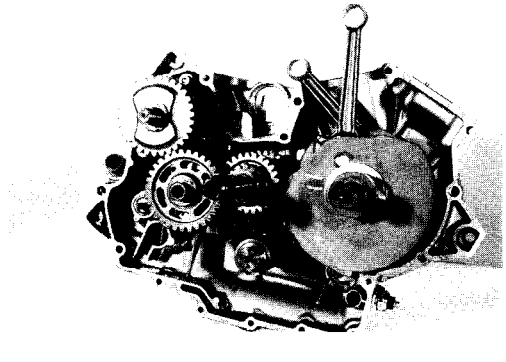
- Separate the crankcase into 2 parts, right and left with a crankcase separating tool.

09920-13120 : Crankcase separating tool

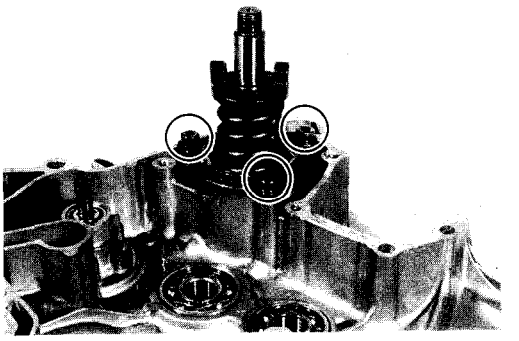
NOTE:
Fit the crankcase separating tool, so that the tool plate is parallel with the end face of the crankcase. The crankshaft and transmission components must remain in the left crankcase half.



- Remove the gearshift fork shafts and gearshift forks.
- Remove the gearshift cam.
- Remove the driveshaft assembly, countershaft assembly and secondary reduction gear.
- Remove the crankshaft.



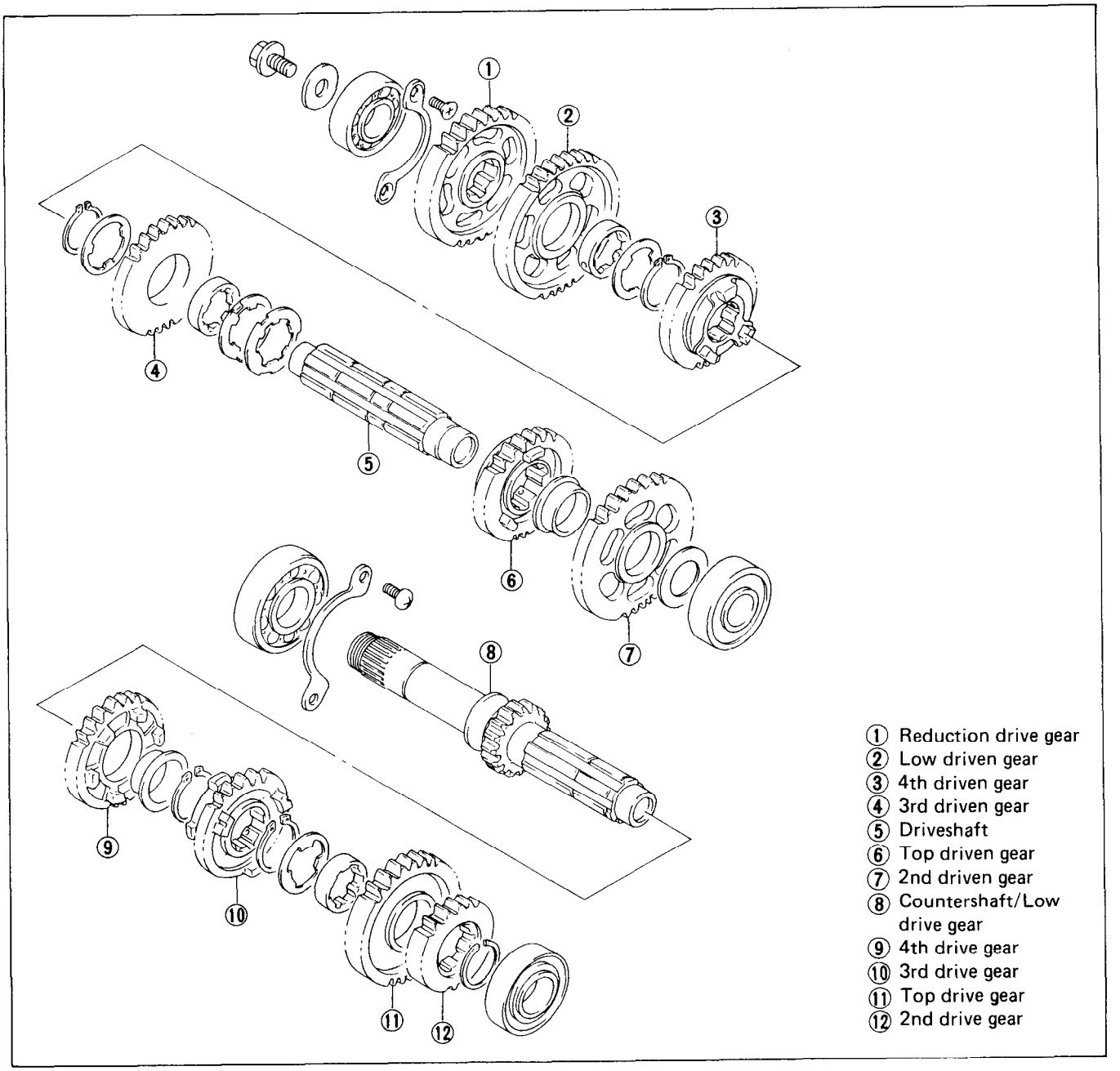
- Loosen the secondary drive bevel gear housing bolts and remove the secondary drive bevel gear assembly.



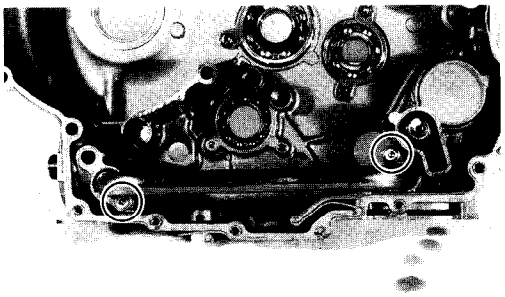
TRANSMISSION

DISASSEMBLY

- Disassemble the transmission gears as shown in the illustration.

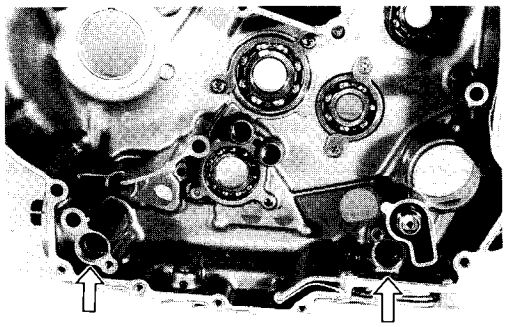


LUBRICATION RELATED PARTS

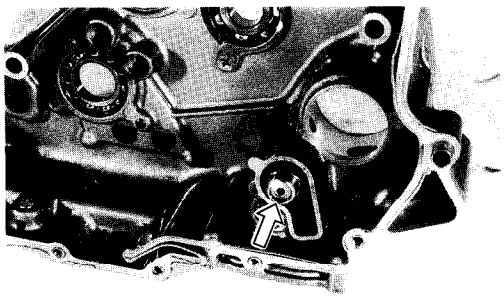


- Remove the oil pipe and O-rings.

CAUTION:
The removed O-ring should be replaced with a new one.



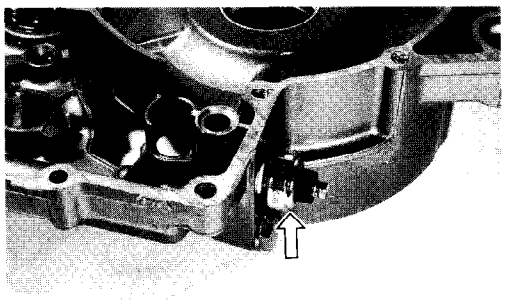
- Remove the oil pressure regulator.



- Remove the oil pressure switch.

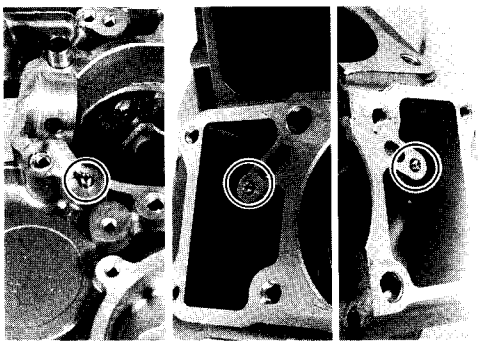
NOTE:
When reinstalling the oil pressure switch, apply the SUZUKI BOND NO. 1207B/NO. 1215 to thread part.

(For U.S.A. model)
99104-31140 : SUZUKI BOND NO. 1207B
(For the other models)
99000-31110 : SUZUKI BOND NO. 1215



- Check the oil jet fitted on the crankcase for clogging.

NOTE:
When installing the oil jet, apply the motor oil to the oil jet O-ring.



CRANKCASE BEARING OIL AND SEAL

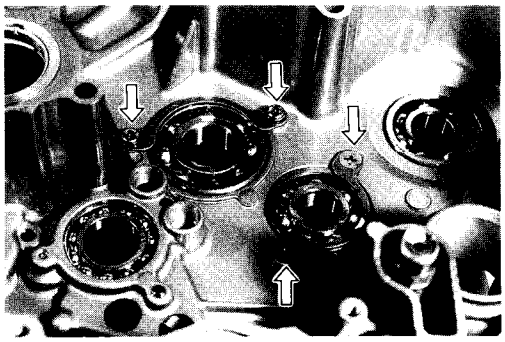
- Remove the bearing retainer screws.

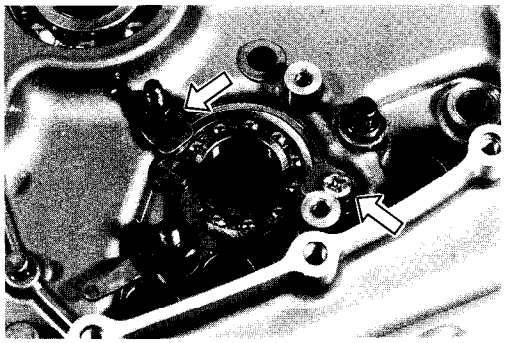
NOTE:
When reinstalling the bearing retainers, apply THREAD LOCK SUPER "1303"/"1324" to bearing retainer bolts or screws.

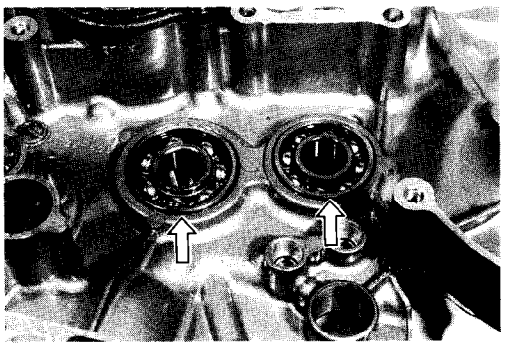
(For U.S.A. model)
99000-32030 : THREAD LOCK SUPER "1303"
(For the other models)
99000-32120 : THREAD LOCK SUPER "1324"

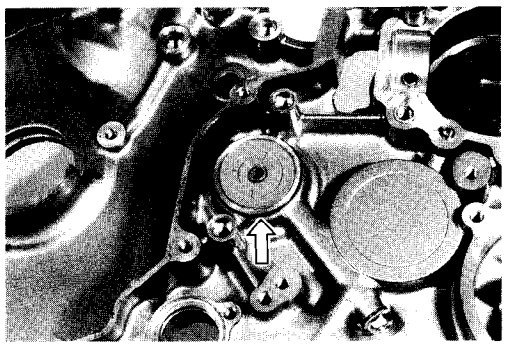
- Remove the bearings and oil seal by using the special tools.

09914-79610 : Bearing remover
09923-73210 : Bearing remover
09930-30102 : Sliding shaft



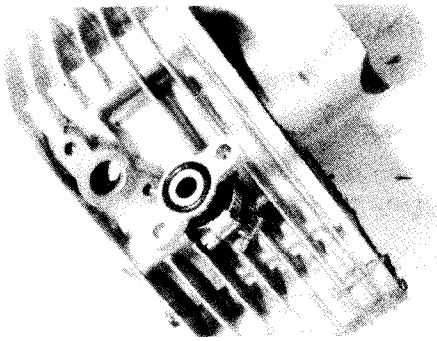


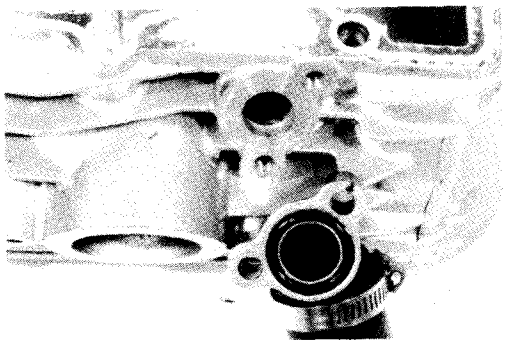


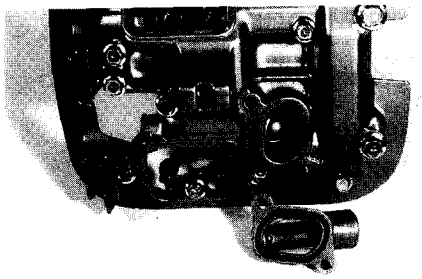


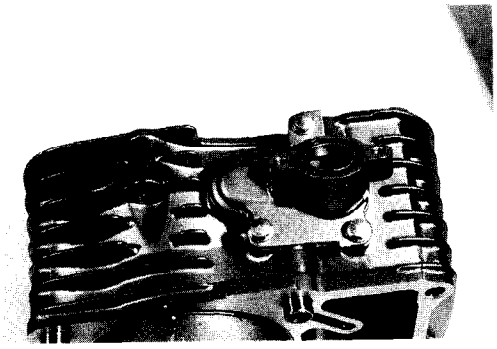
COOLING SYSTEM RELATED PARTS

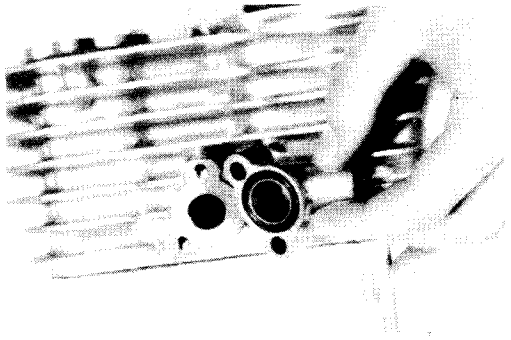
NOTE:
When reinstalling each cover, check that the O-ring is installed.

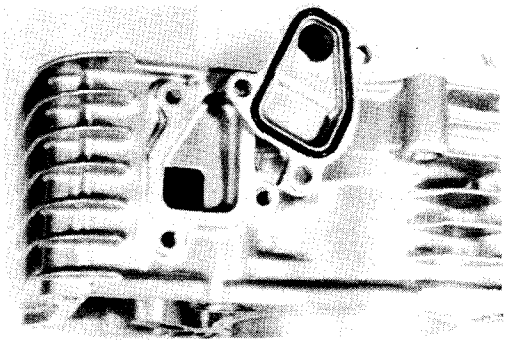


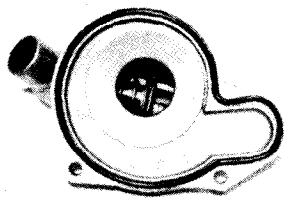








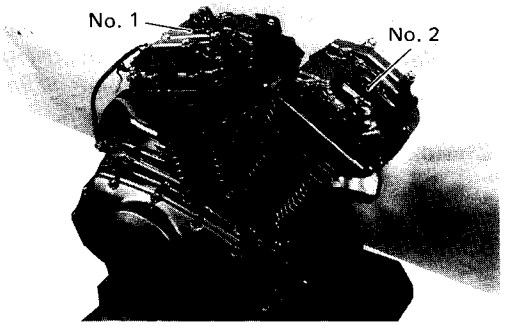




ENGINE COMPONENTS INSPECTION AND SERVICING

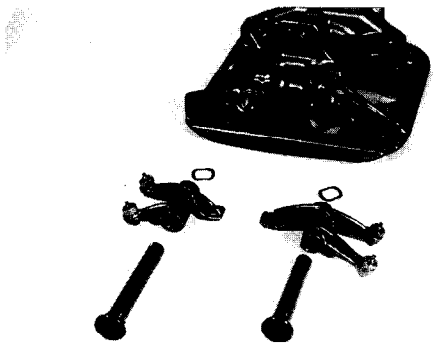
CYLINDER HEAD COVER

DISASSEMBLY



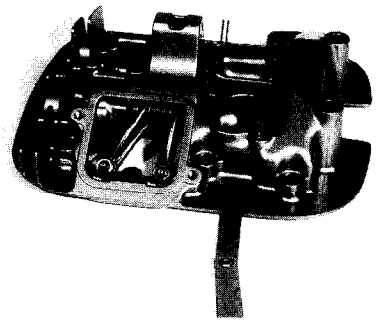
CAUTION:
Be sure to identify each removed part as to its location, and lay the parts out in groups designated as "No. 1 cylinder", "No. 2 cylinder", "Exhaust", "Inlet", so that each will be restored to the original location during assembly.

- Loosen the rocker arm shafts and pull out the rocker arm shafts.
  (Refer to page 3-60 for reassembly)



CYLINDER HEAD COVER DISTORTION

After removing sealant (SUZUKI BOND NO. 1216) from the fitting surface of the cylinder head cover, place the cylinder head cover on a surface plate and check for distortion with a thickness gauge. Check points are shown in Fig.



Service Limit : 0.05 mm (0.002 in)

09900-20803 : Thickness gauge

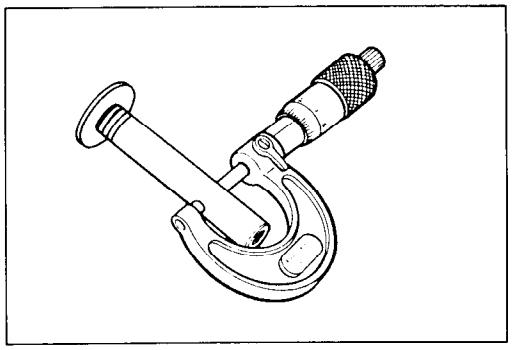
If the distortion exceeds the limit, replace the cylinder head cover.

ROCKER ARM SHAFT O.D.

Measure diameter of rocker arm shaft.

Standard : 11.966 – 11.984 mm
(0.4711 – 0.4718 in)

09900-20205 : Micrometer (0 – 25 mm)

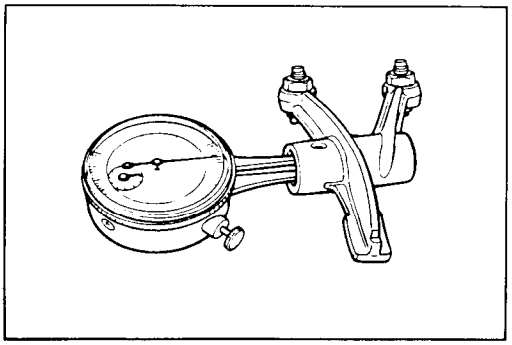


ROCKER ARM I.D.

When checking the valve rocker arm, the inside diameter of the valve rocker arm and wear of the camshaft contacting surface should be checked.

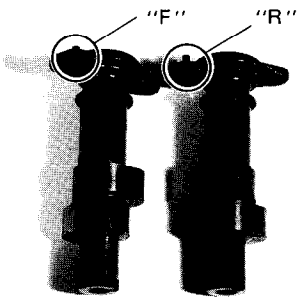
Standard : 12.000 – 12.018 mm
(0.4725 – 0.4731 in)

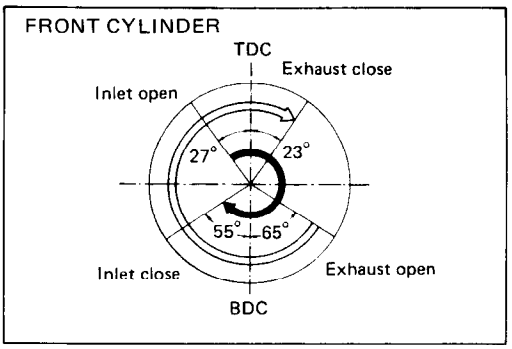
09900-20605 : Dial calipers

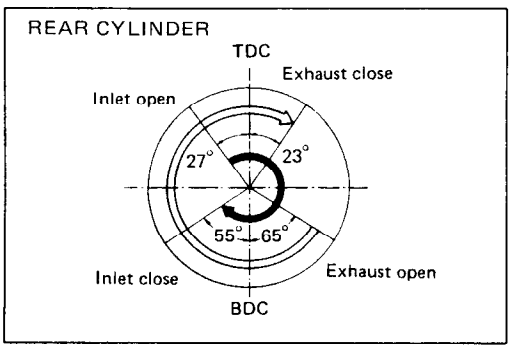


CAMSHAFT

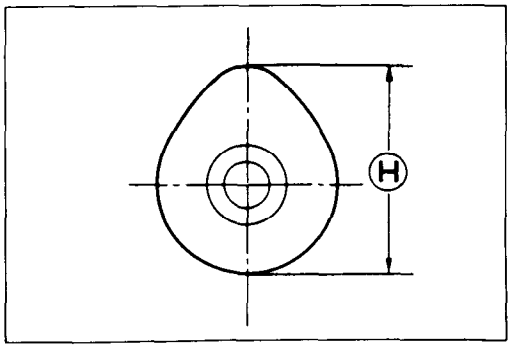
The camshafts should be checked for wear and also for runout of cams and journals if the engine has been noted to produce abnormal noise or vibration or to lack output power. Any of these malconditions could be caused by a worn camshafts.
The camshaft can be distinguished by the embossed-letters, "F" and "R", on the camshaft.
"F" : Front (No. 2) camshaft
"R" : Rear (No. 1) camshaft







CAMSHAFT CAM WEAR



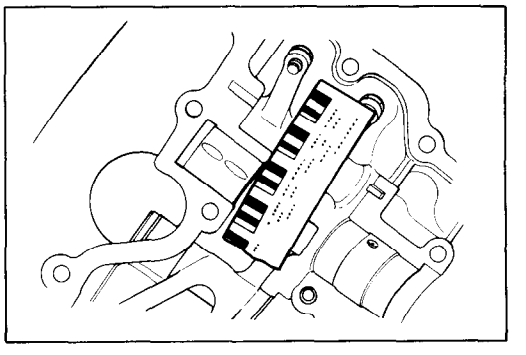
Worn-down cams are often the cause of mistimed valve operation resulting in reduced output power. The limit of cam wear is specified for both intake and exhaust cams in terms of cam height Ⓗ, which is to be measured with a micrometer. Replace camshafts if found worn down to the limit.

Cam height Ⓗ

Service Limit Intake cam : 35.660 mm (1.4039 in)
Exhaust cam : 36.620 mm (1.4417 in)

09900-20202 : Micrometer (25 – 50 mm)

CAMSHAFT JOURNAL WEAR



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

Camshaft journal oil clearance
Service Limit : 0.15 mm (0.006 in)

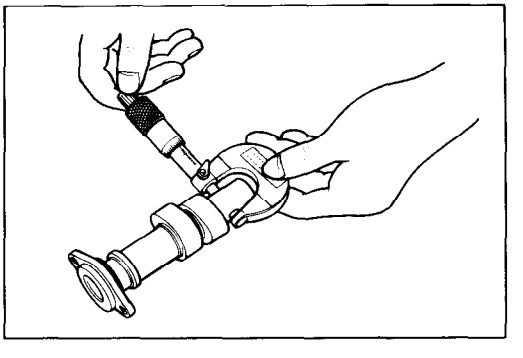
- Tighten the cylinder head cover bolts evenly and diagonally to the specified torque.

Cylinder head cover tightening torque

Length	N·m	kg-m	lb-ft
140 mm 235 mm	21 – 25	2.1 – 2.5	15.0 – 18.0
The others	9 – 11	0.9 – 1.1	6.5 – 8.0

09900-22301 : Plastigauge

NOTE:
To properly measure the oil clearance with plastigauge, all gasket material must be removed from fitting surfaces of cylinder head and cover. Do not apply SUZUKI BOND NO. 1216 until after the oil clearance has been determined.



If the camshaft journal oil clearance measured exceeds the limit, measure the outside diameter of camshaft.
Replace either the cylinder head set or the cam shaft if the clearance is incorrect.

09900-20205 : Micrometer (0 – 25 mm)

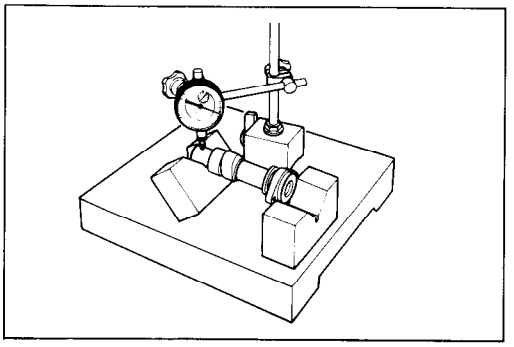
Camshaft journal O.D.	24.959 – 24.980 mm (0.9826 – 0.9835 in)
	19.959 – 19.980 mm (0.7858 – 0.7866 in)

CAMSHAFT RUNOUT

Measure the runout with a dial gauge. Replace the camshaft if the runout exceeds the limit.

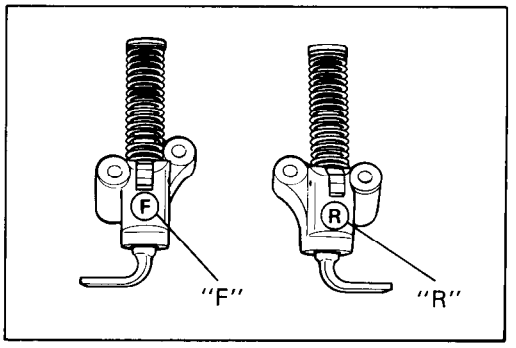
09900-20701 : Magnetic stand
09900-20606 : Dial gauge (1/100 mm)
09900-21304 : V-block (100 mm)

Service Limit : 0.1 mm (0.004 in)



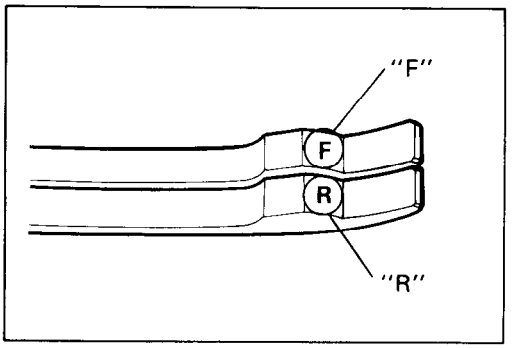
CAM CHAIN TENSIONER

For driving the camshafts, two cam chain tensioners are used on the respective cam drive chains. Unlock the ratchet mechanism, and move the push rod in place to see if it slides smoothly. If any stickiness is noted or ratchet mechanism is faulty, replace the chain tensioner assembly with a new one.
The cam chain tensioner can be distinguished by the embossed-letters, "F" and "R", on the cam chain tensioners.
"F" : Front (No. 2) cam chain tensioner
"R" : Rear (No. 1) cam chain tensioner



CAM CHAIN GUIDE

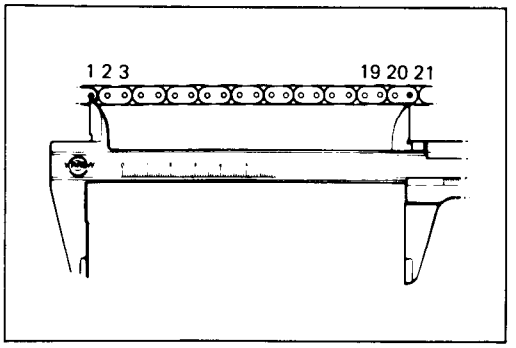
Two kinds of cam chain guide are used on the respective cam drive chains.
"F" : Front (No. 2) cam chain guide
"R" : Rear (No. 1) cam chain guide



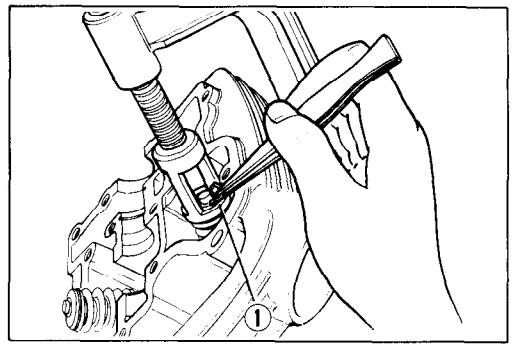
CAM CHAIN 20-PITCH LENGTH

Pull the chain tight to remove any slack, then using vernier calipers, measure the 20-pitch length of cam chain. If it measures more than limit, replace the cam chain.

Service Limit : 128.9 mm (5.07 in)

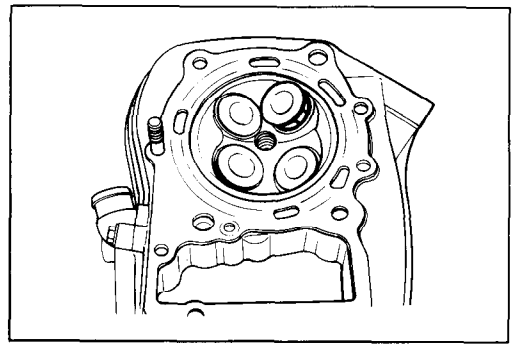


VALVE AND VALVE SPRING DISASSEMBLY



- Using special tools, compress the valve springs and remove the two cotter halves ① from valve stem.

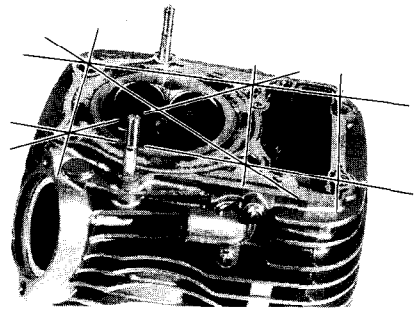
09916-14510 : Valve spring compressor
09916-14910 : Valve spring compressor attachment
09916-84510 : Tweezers



- Remove the valve spring retainer, inner spring and outer spring.
- Pull out the valve from the other side.

NOTE:
Removal of valves completes ordinary disassembling work. If valve guides have to be removed for replacement after inspecting related parts, carry out the steps shown in valve guide servicing.
(Refer to page 3-30 for reassembly.)

CYLINDER HEAD DISTORTION



- Decarbonize the combustion chambers.

Check the gasketed 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.

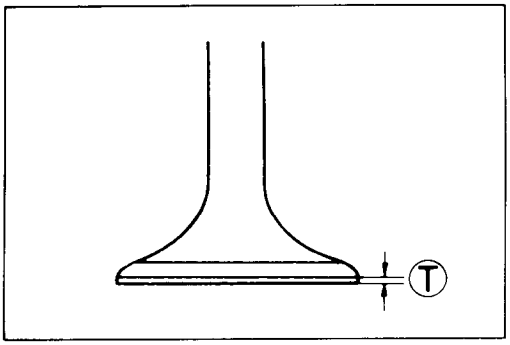
09900-20803 : Thickness gauge

Service Limit : 0.05 mm (0.002 in)

VALVE FACE WEAR

Visually inspect each valve for wear of its seating face. Replace any valve with an abnormally worn face.
The thickness Ⓣ decreases as the wear of the face advances. Measure the thickness and, if the thickness is found to have been reduced to the limit, replace it.

Service Limit : 0.5 mm (0.02 in)

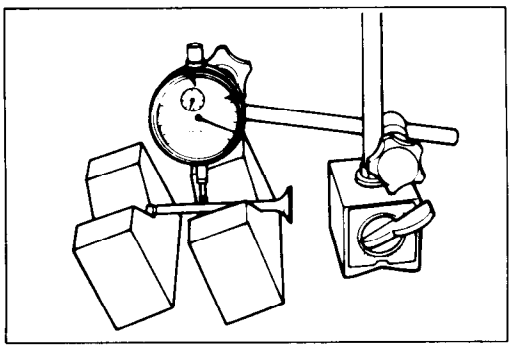


VALVE STEM RUNOUT

Support the valve with "V" blocks, as shown, and check its runout with a dial gauge.
The valve must be replaced if the runout exceeds the limit.

Service Limit : 0.05 mm (0.002 in)

09900-20701 : Magnetic stand
09900-20606 : Dial gauge (1/100 mm)
09900-21304 : V-block

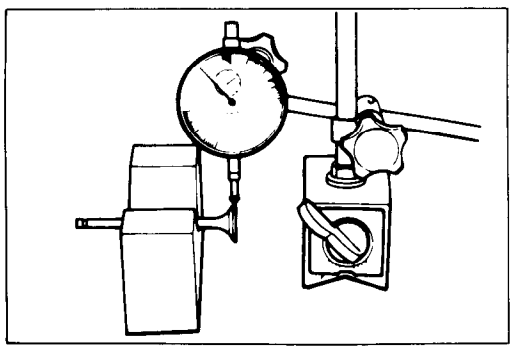


VALVE HEAD RADIAL RUNOUT

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

Service Limit : 0.03 mm (0.001 in)

09900-20701 : Magnetic stand
09900-20606 : Dial gauge (1/100 mm)
09900-21304 : V-block

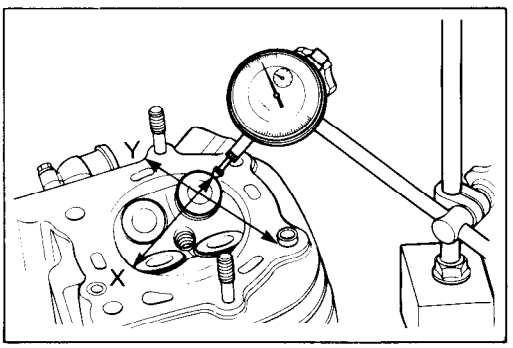


VALVE GUIDE TO VALVE STEM CLEARANCE

Measure the clearance in two directions "X" and "Y", perpendicular to each other, by rigging up the dial gauge as shown. If the clearance measured exceeds the limit, specified below, then determine whether the valve or the guide should be replaced to reduce the clearance to within the standard range:

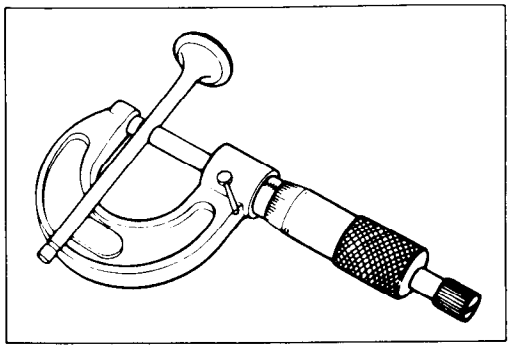
Service Limit **IN. : 0.35 mm (0.014 in)**
EX. : 0.35 mm (0.014 in)

09900-20701 : Magnetic stand
09900-20606 : Dial gauge (1/100 mm)



VALVE STEM WEAR

If the valve stem is worn down to the limit, as measured with a micrometer, where the clearance is found to be in excess of the limit indicated replace the valve, if the stem is within the limit, then replace the guide. After replacing valve or guide, be sure to re-check the clearance.



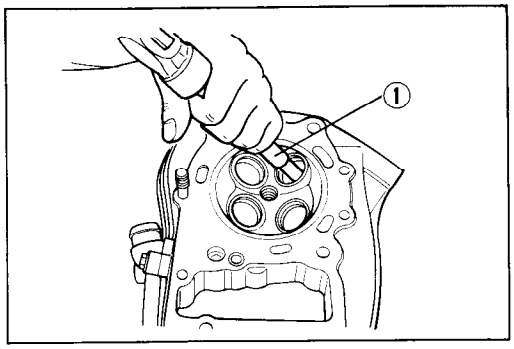
09900-20205 : Micrometer (0 – 25 mm)

Valve stem O.D.

Standard **IN. : 5.465 – 5.480 mm (0.2152 – 0.2157 in)**
EX. : 5.450 – 5.465 mm (0.2146 – 0.2152 in)

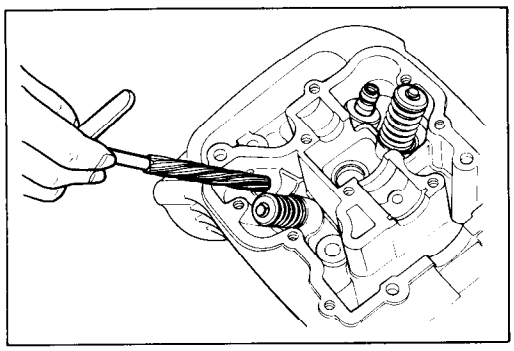
VALVE GUIDE SERVICING

- Using the valve guide remover ①, drive the valve guide out toward intake or exhaust rocker arm side.



09916-44910 : Valve guide remover/installer

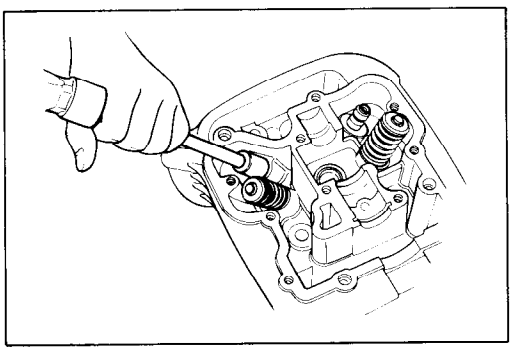
- Re-finish the valve guide holes in cylinder head with a 10.8 mm reamer and handle.



09916-34580 : Valve guide hole reamer
09916-34541 : Reamer handle

NOTE:
* *Discard the removed valve guide subassemblies.*
* *Only oversized valve guide is available.*

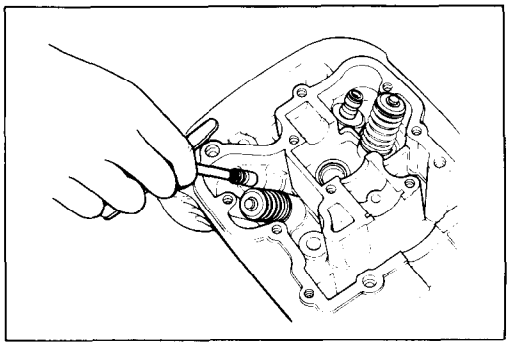
- Lubricate each valve guide with engine oil and drive the guide into the guide hole using the valve guide installer and attachment.



09916-44910 : Valve guide remover/installer
09916-44920 : Valve guide installer attachment

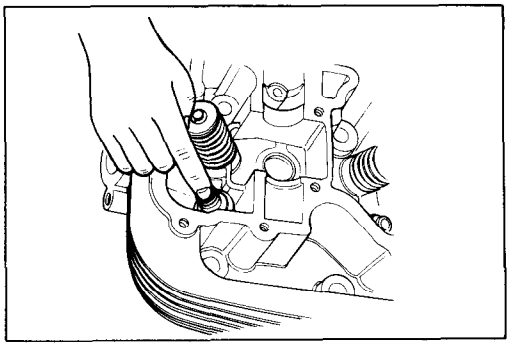
- After fitting all valve guides, re-finish their guiding bores with a 5.5 mm reamer. Be sure to clean and oil the guide after reaming.

09916-34550 : Valve guide reamer
09916-34541 : Reamer handle



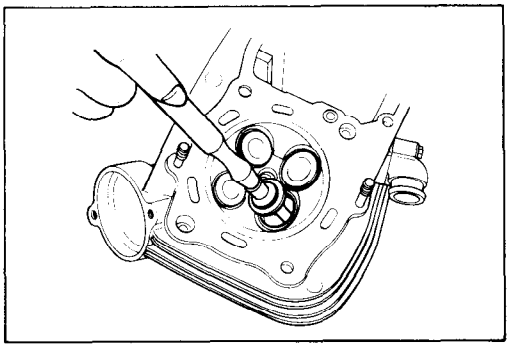
- Fit the valve spring lower seats.
- Lubricate each oil seal with engine oil, and press-fit the oil seal into position with the finger tip.

CAUTION:
Do not reuse the oil seal.



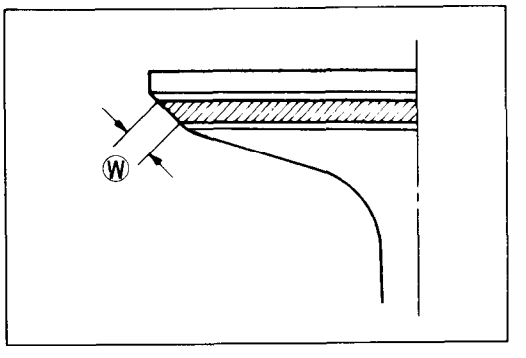
VALVE SEAT WIDTH

Coat the valve seat with prussian blue uniformly. Fit the valve and tap the coated seat with the valve face in a rotating manner, in order to obtain a clear impression of the seating contact. In this operation, use the valve lapper to hold the valve head.
The ring-like dye impression left on the valve face must be continuous – without any break. In addition, the width of the dye ring, which is the visualized seat "width", must be within the following specification:



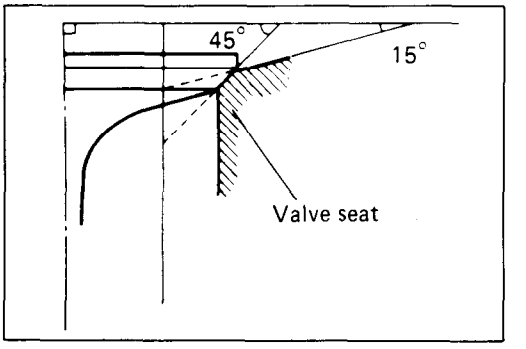
Valve seat width
STD. Ⓦ : 0.9 – 1.1 mm (0.035 – 0.043 in)

If either requirement is not met, correct the seat by servicing it as follows:



VALVE SEAT SERVICING

The valve seats for both intake and exhaust valves are machined to two different angles. The seat contact surface is cut 45° and the area above the contact surface (closest to the combustion chamber) is cut to 15°.

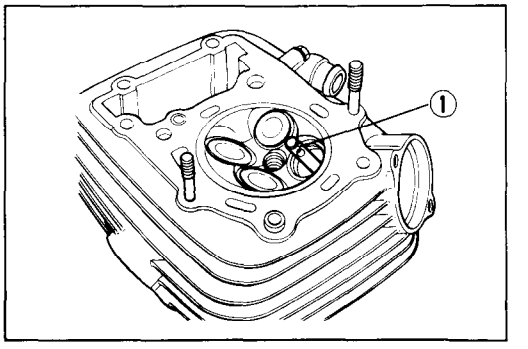


Parts list of valve seat servicing tools (For U.S.A. model)

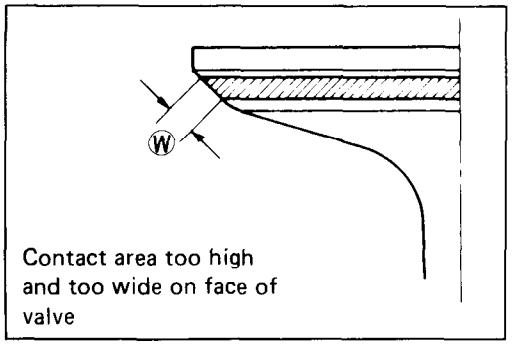
Valve seat cutter head	N-116 (15° x 45° cutter) for both IN. and EX. (45°) and for EX. (15°)
	N-212 and Blade (N-635) for IN. 15°
Solid pilot	N-140-5.5
Adapter	N-503-1
T-handle	N-503

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

- Insert the solid pilot ① with a slight rotation. Seat the pilot snugly. Install the 45° cutter, attachment and T-handle.
- Using the 45° cutter, descale and cleanup the seat with one or two turns.
- Inspect the seat by the previous seat width measurement procedure. If the seat is pitted or burned, additional seat conditioning with the 45° cutter is required.



CAUTION:
Cut only the minimum amount necessary from the seat to prevent the possibility of the valve stem becoming too close to the cam for correct valve clearance adjustment.

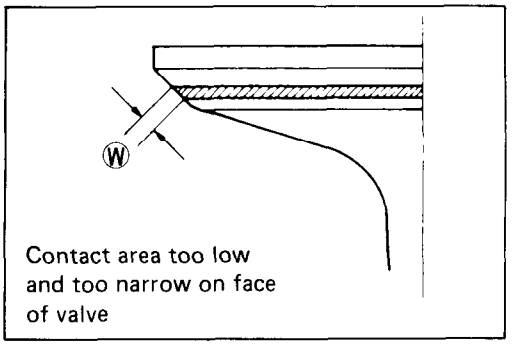


If the contact area is too high on the valve, or if it is too wide, use a 15° cutter to lower and narrow the contact area.

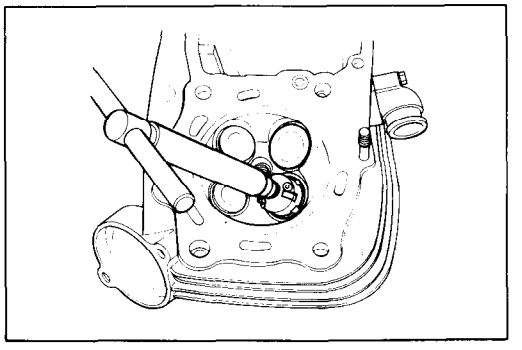
Parts list of valve seat servicing tools (For the other models)
09916-24420 : Valve seat cutter (N-116)
09916-24910 : Valve seat cutter (N-212)
09916-24480 : Solid pilot (N-140-5.5)
09916-21110 : Valve seat cutter set

- After the desired seat position and width is achieved, use the 45° cutter very lightly to clean up any burrs caused by the previous cutting operations. DO NOT use lapping compound after the final cut is made. The finished valve seat should have a velvety smooth finish and 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.
- 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.

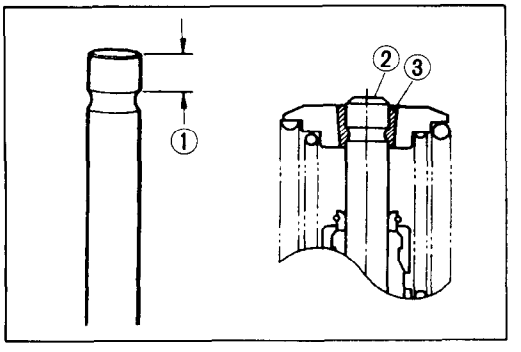


If the contact area is too low or too narrow, use the 45° cutter to raise and widen the contact area.



VALVE STEM END CONDITION

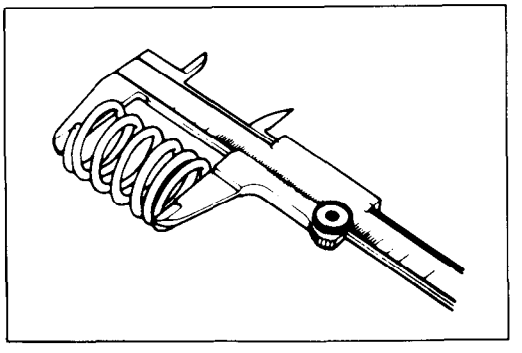
Inspect the valve stem end face for pitting and wear. If pitting or wear of the stem end face are present, the valve stem end may be resurfaced, providing that the length ① will not be reduced to less than 4.0 mm (0.15 in). If this length becomes less than 4.0 mm (0.15 in), the valve must be replaced. After installing a valve whose stem end has been ground off as above, check to ensure that the face ② of the valve stem end is above the cotters ③.



VALVE SPRING

The force of the two coil springs keeps the valve seat tight. Weakened springs result in reduced engine power output, and often account for the chattering noise coming from the valve mechanism.

Check the springs for strength by measuring their free lengths and also the force required to compress them. If the limit indicated is exceeded by the free length reading or if the measured force does not fall within the range specified, replace both inner and outer springs as a set.

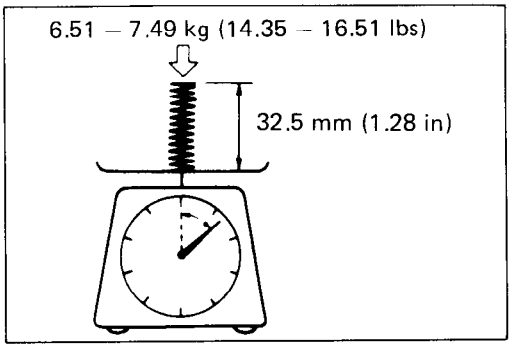


Valve spring free length limit **Unit: mm (in)**

INNER	OUTER
38.3 (1.51)	40.1 (1.58)

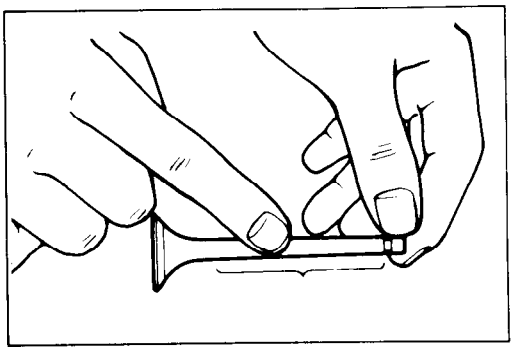
Valve spring tension

Spring	Standard
INNER	6.51 – 7.49 kg/32.5 mm (14.35 – 16.51 lbs/1.28 in)
OUTER	12.09 – 13.91 kg/36.0 mm (26.65 – 30.67 lbs/1.42 in)



VALVE AND VALVE SPRING REASSEMBLY

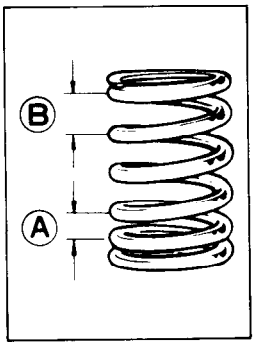
- Insert the valves, with their stems coated with high quality molybdenum disulfide lubricant (SUZUKI MOLY PASTE) all around and along the full stem length without any break.

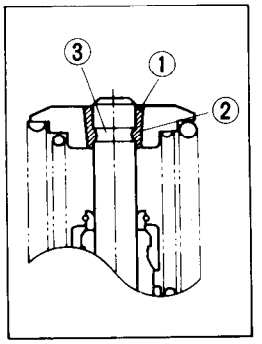


CAUTION:
When inserting each valve, take care not to damage the lip of the stem seal.

99000-25140 : SUZUKI MOLY PASTE

- Install the valve springs with the small-pitch portion Ⓐ facing cylinder head.
  Ⓑ : Large-pitch portion.
- Put on the spring retainer and, using the valve spring compressor, press down the spring, fit the two cotter halves to the stem end, and release the compressor to allow the cotter ① to wedge in between seat and stem. Be sure that the rounded lip ② of the cotter fits snugly into the groove ③ in the stem end.



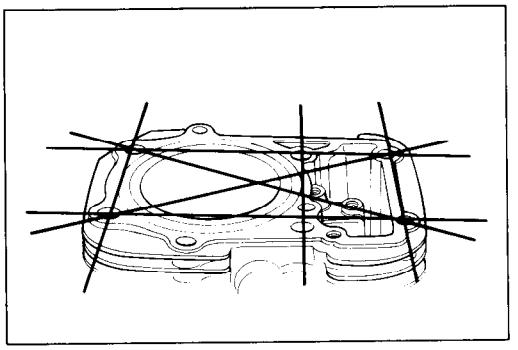


CAUTION:
Be sure to restore each spring, valve and spring retainer to their original positions.

CYLINDER DISTORTION

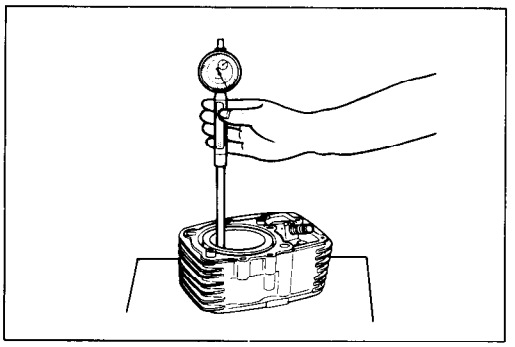
Check the gasketed surface of the cylinder for distortion with a straightedge and thickness gauge, taking a clearance reading at several places as indicated. If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder.

Cylinder distortion
Service Limit : 0.05 mm (0.002 in)



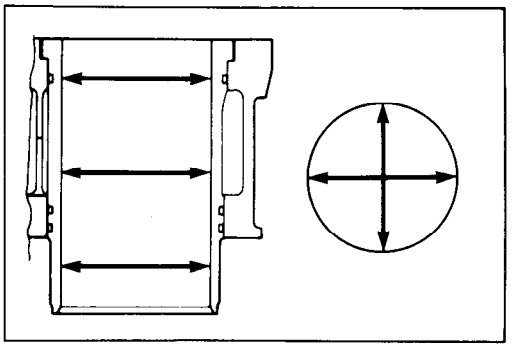
CYLINDER BORE

Measure the cylinder bore diameter at six places. If any one of the measurements exceeds the limit, overhaul the cylinder and replace the piston with an oversize, or replace the cylinder. Once the reboring is done on any one cylinder which measurements is beyond the limit, the remaining cylinders must be also rebored accordingly. Otherwise the imbalance might causes excess vibration.



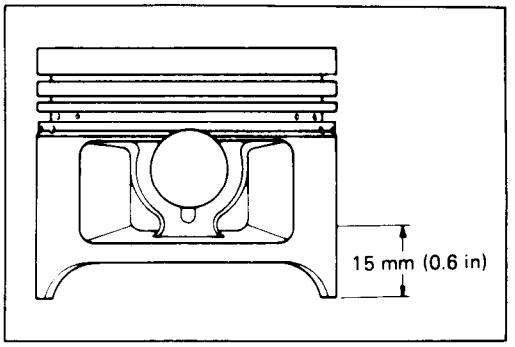
Cylinder bore
Service Limit : 83.085 mm (3.2711 in)

09900-20508 : Cylinder gauge set



PISTON DIAMETER

Using a micrometer, measure the piston outside diameter at the place shown in Fig. If the measurement is less than the limit, replace the piston.



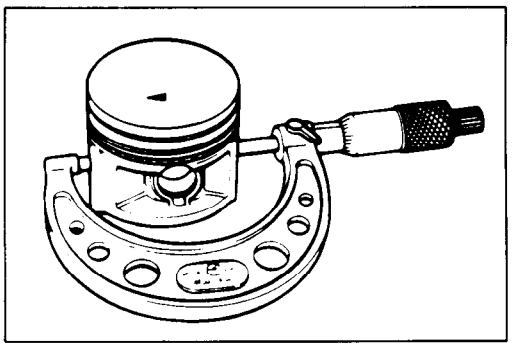
Piston oversize : 0.5, 1.0 mm

Service Limit : 82.880 mm (3.2630 in)

09900-20204 : Micrometer (75 – 100 mm)

PISTON TO CYLINDER CLEARANCE

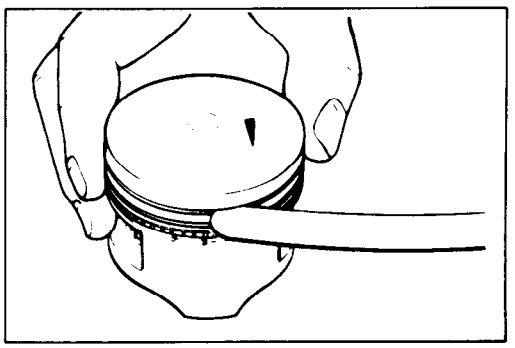
As a result of the above measurement, if the piston to cylinder clearance exceeds the following limit, overhaul the cylinder and use an oversize piston, or replace both cylinder and piston.



Service Limit : 0.120 mm (0.0047 in)

PISTON RING TO GROOVE CLEARANCE

Using a thickness gauge, measure the side clearances of the 1st and 2nd rings. If any one of the clearances exceeds the limit, replace both piston and piston rings.



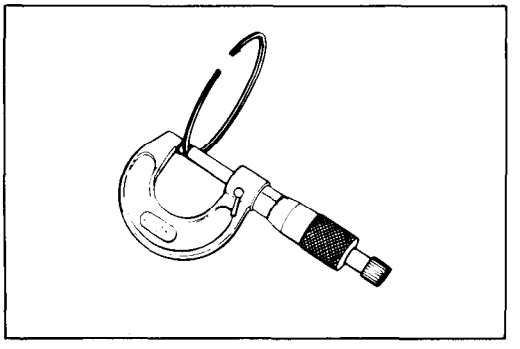
09900-20803 : Thickness gauge

Piston ring to groove clearance

Piston ring	Service Limit
1st	0.18 mm (0.007 in)
2nd	0.15 mm (0.006 in)

Piston ring groove width

Piston ring	Standard
1st	1.01 – 1.03 mm (0.0398 – 0.0406 in)
2nd	1.21 – 1.23 mm (0.0476 – 0.0484 in)
Oil	2.51 – 2.53 mm (0.0988 – 0.0996 in)

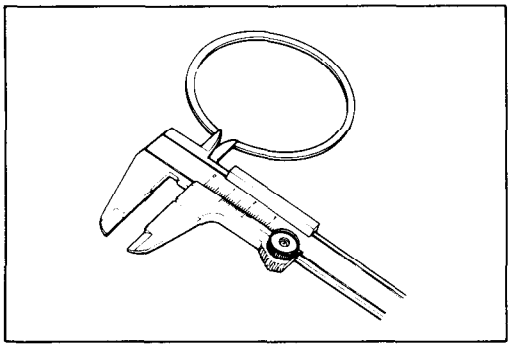


Piston ring thickness

Piston ring	Standard
1st	0.970 – 0.990 mm (0.0382 – 0.0390 in)
2nd	1.170 – 1.190 mm (0.0461 – 0.0469 in)

PISTON RING FREE END GAP AND END GAP

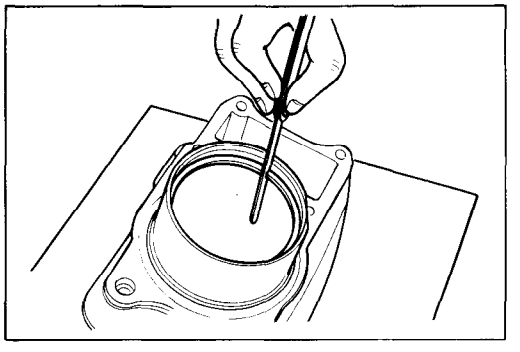
Before installing piston rings, measure the free end gap of each ring using vernier calipers. Next, fit the ring in the cylinder, and measure each ring end gap using a thickness gauge.
If any ring has an excess end gap, replace the ring.



Piston ring free end gap

Piston ring		Service Limit
1st	R	8.4 mm (0.33 in)
2nd	R	9.4 mm (0.37 in)

09900-20101 : Vernier calipers



Piston ring end gap

Piston ring	Service Limit
1st & 2nd	0.70 mm (0.028 in)

09900-20803 : Thickness gauge

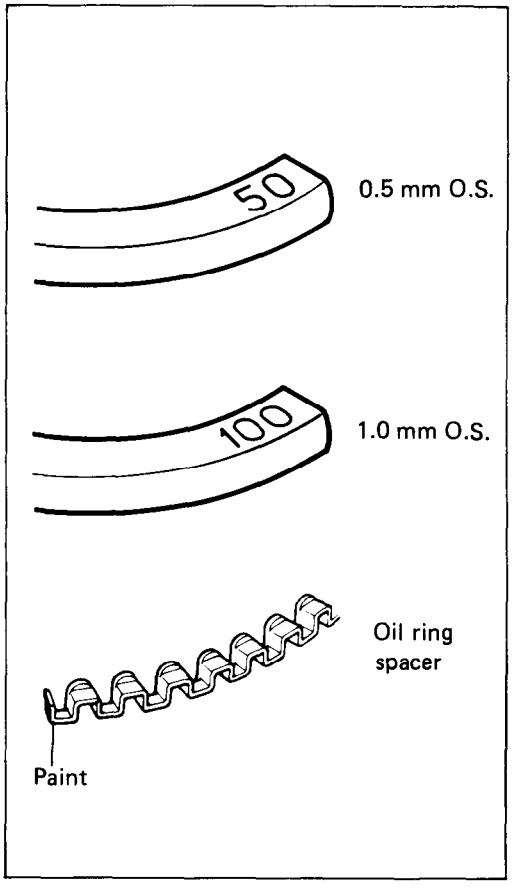
- **Oversize piston ring**
  The following two types of oversize piston rings are used. They bear the following identification numbers.

SIZE	1st	2nd
0.5 mm O.S.	50	50
1.0 mm O.S.	100	100

- **Oversize oil ring**
  The following two types of oversize oil rings are available as optional parts. They bear the following identification marks.

SIZE	COLOR
STD	NIL
0.5 mm O.S.	Painted Red
1.0 mm O.S.	Painted Yellow

- **Oversize side rail**
  Just measure outside diameter to identify the side rail as there is no mark or numbers on it.

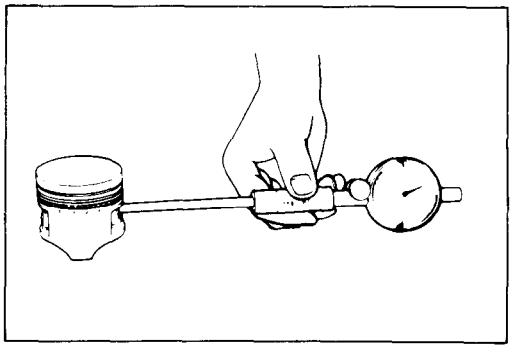


PISTON PIN AND PIN BORE

Using a small bore gauge, measure the piston pin bore inside diameter, and using a micrometer, measure the piston pin outside diameter. If the reading exceeds the following limit, replace both piston and piston pin.

Piston pin bore I.D.
Service Limit : 20.030 mm (0.7886 in)

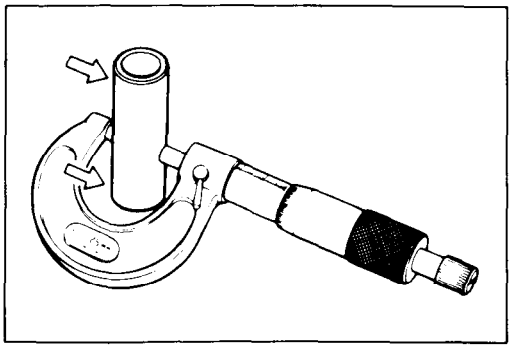
09900-20602 : Dial gauge (1/1000 mm, 1 mm)
09900-22403 : Small bore gauge (18 – 35 mm)



Using a micrometer, measure the piston pin outside diameter at three positions.

Piston pin O.D.
Service Limit : 19.980 mm (0.7866 in)

09900-20205 : Micrometer (0 – 25 mm)

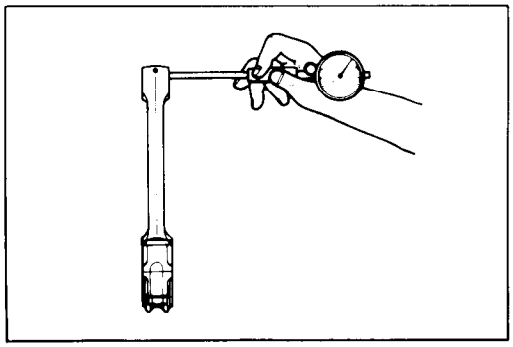


CONROD SMALL END I.D.

Using a small bore gauge, measure the conrod small end inside diameter.

Conrod small end I.D.
Service Limit : 20.040 mm (0.7890 in)

If the conrod small end inside diameter exceeds the above mentioned limit, replace conrod.

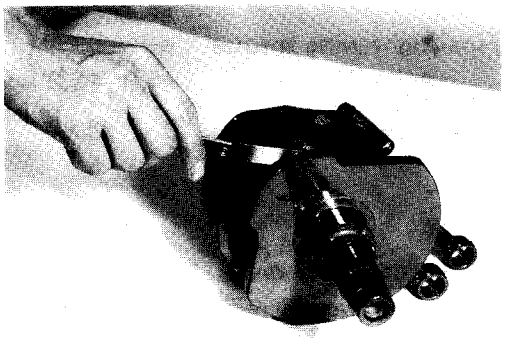


CONROD BIG END THRUST CLEARANCE

Check the conrod thrust clearance by using a thickness gauge. If the clearance exceeds the limit, replace the conrod or crankshaft.

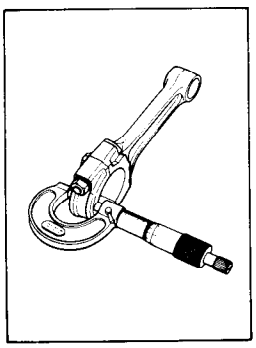
Service Limit : 0.30 mm (0.012 in)

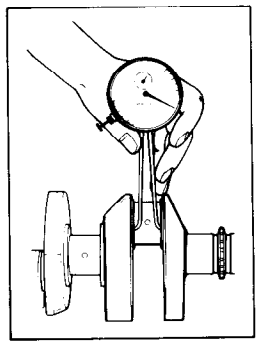
09900-20803 : Thickness gauge



	Standard
Big end width	21.95 – 22.00 mm (0.864 – 0.866 in)
Crank pin width	22.10 – 22.15 mm (0.870 – 0.872 in)

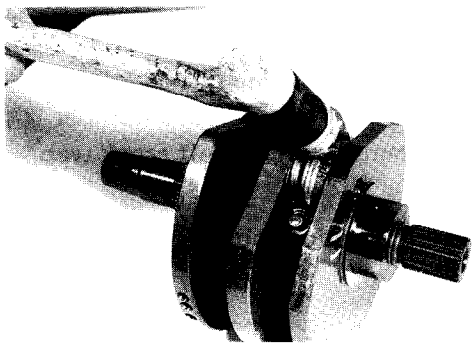
09900-20205 : Micrometer (0 – 25 mm)
09900-20605 : Dial calipers (10 – 34 mm)





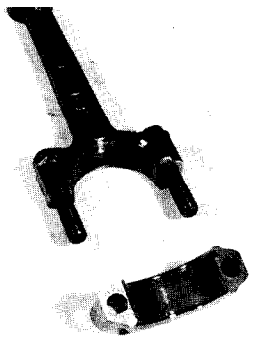
CONROD-CRANK PIN BEARING SELECTION

- Loosen the bearing cap nuts and tap the bolt end lightly with plastic hammer to remove the bearing cap.

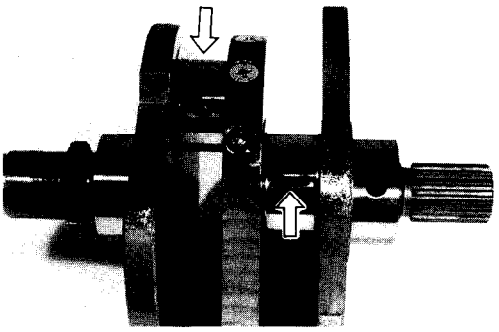


- Remove the rods and mark them to identify the cylinder position.
- Inspect the bearing surfaces for any sign of fusion, pitting, burn or flaws. If any, replace them with a specified set of bearings.

NOTE:
Never try to remove or loosen the conrod cap bolts due to their possible loosening in the rod. Once displaced, the bearing cap will not be fitted properly.



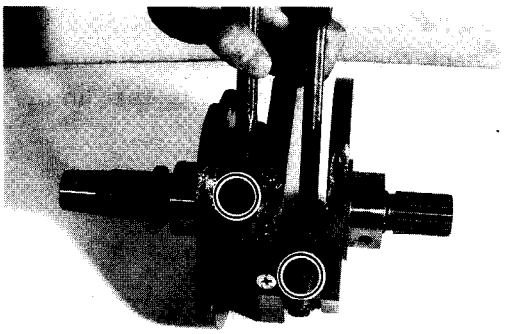
- Place plastigauge axially on the crank pin avoiding the oil hole, at TDC or BDC side as shown.
- Tighten the bearing cap with two-step torque values.



NOTE:
When fitting the bearing cap to crank pin, be sure to discriminate between its two ends, I.D. code side and the other.
I.D. code always faces intake valve side.

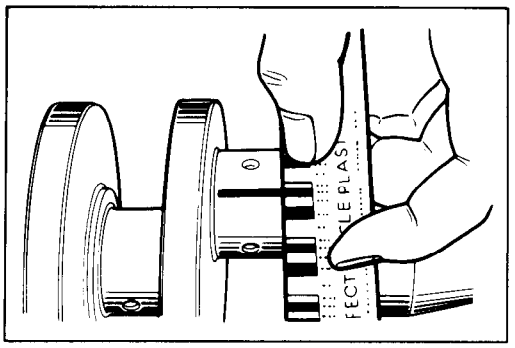
Initial tightening torque : 22 – 28 N·m
(2.2 – 2.8 kg-m, 16.0 – 20.0 lb-ft)
Final tightening torque : 49 – 53 N·m
(4.9 – 5.3 kg-m, 35.5 – 38.5 lb-ft)

09900-22301 : Plastigauge



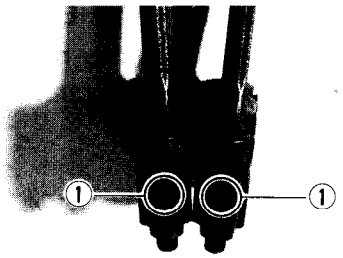
NOTE:
Never rotate the crankshaft or conrod when a piece of plastigauge is in the clearance.

- Remove the caps and measure the width of compressed plastigauge with envelope scale. This measurement should be taken at the widest part.



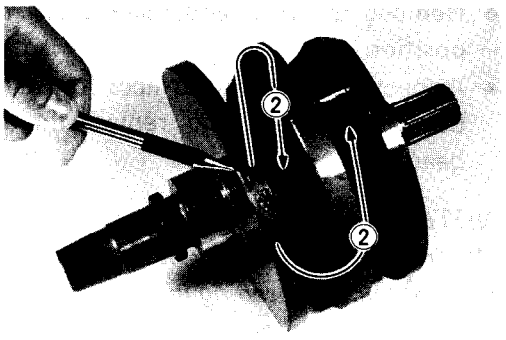
Crank pin bearing oil clearance
Service Limit : 0.080 mm (0.0031 in)

- If oil clearance exceeds the service limit, select the specified bearings from the following table.
- Check the corresponding conrod I.D. code number ①, "1", "2" or "3".
- Check the corresponding crank pin O.D. code number ②, "1", "2" or "3".
- The crank pin O.D. code number ②, "1", "2" or "3" which are stamped on the left crank web.



Bearing selection table

		Crank pin O.D. code ②		
	Code	1	2	3
Conrod I.D. code ①	1	Green	Black	Brown
	2	Black	Brown	Yellow
	3	Brown	Yellow	Blue



Oil clearance
Standard : 0.024 – 0.042 mm (0.0009 – 0.0017 in)

Conrod I.D. specification

Code ①	I.D. specification
1	44.000 – 44.006 mm (1.7323 – 1.7325 in)
2	44.006 – 44.012 mm (1.7325 – 1.7328 in)
3	44.012 – 44.018 mm (1.7328 – 1.7330 in)

Crank pin O.D. specification

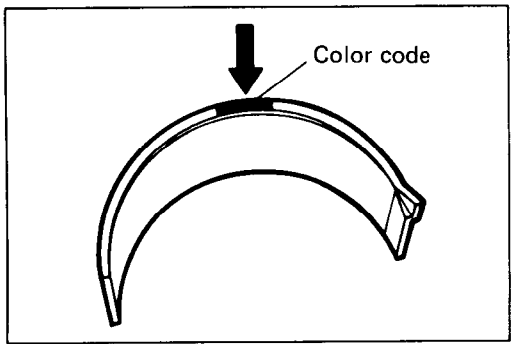
Code ②	O.D. specification
1	40.994 – 41.000 mm (1.6139 – 1.6142 in)
2	40.988 – 40.994 mm (1.6137 – 1.6139 in)
3	40.982 – 40.988 mm (1.6135 – 1.6137 in)

09900-20202 : Micrometer (25 – 50 mm)

CAUTION:
Bearing should be replaced as a set.

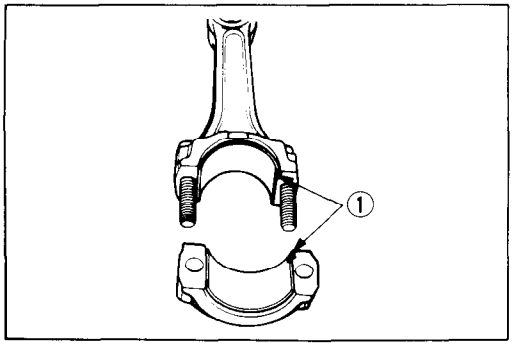
Bearing thickness

Color (Part No.)	Thickness
Green (12164-45C00-0A0)	1.485 – 1.488 mm (0.0585 – 0.0586 in)
Black (12164-45C00-0B0)	1.488 – 1.491 mm (0.0586 – 0.0587 in)
Brown (12164-45C00-0C0)	1.491 – 1.494 mm (0.0587 – 0.0588 in)
Yellow (12164-45C00-0D0)	1.494 – 1.497 mm (0.0588 – 0.0589 in)
Blue (12164-45C00-0E0)	1.497 – 1.500 mm (0.0589 – 0.0590 in)



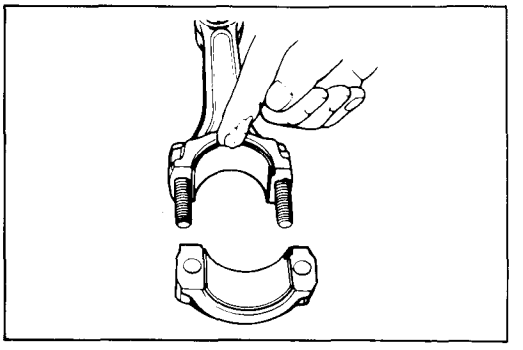
CONROD-CRANK PIN BEARING ASSEMBLY

- When fitting the bearing to the bearing cap and conrod, be sure to fix the stopper part ① first and press in the other end.



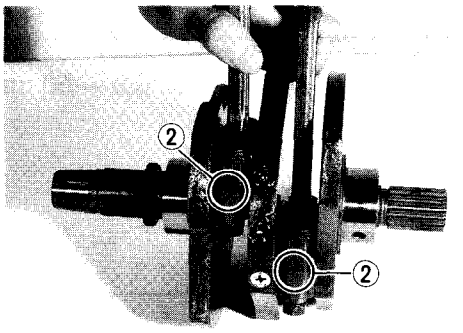
- Apply engine oil or SUZUKI MOLY PASTE to the crank pin and bearing surface.

99000-25140 : SUZUKI MOLY PASTE



- When mounting the conrod on the crankshaft, make sure that I.D. code ② of the conrod faces rearward.
- Tighten the conrod fitting nuts with specified torque after applying engine oil to the nut thread.

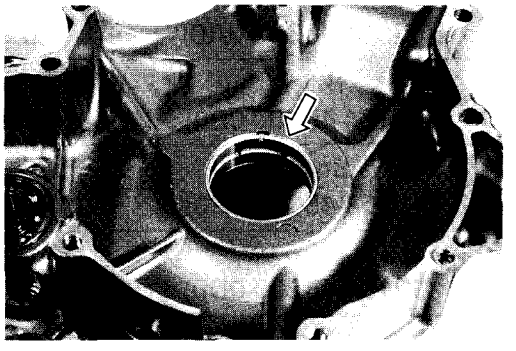
Tightening torque
Initial : 22 – 28 N·m (2.2 – 2.8 kg-m, 16.0 – 20.0 lb-ft)
Final : 49 – 53 N·m (4.9 – 5.3 kg-m, 35.5 – 38.5 lb-ft)



- Check the conrod movement for smooth turning.

CRANKCASE-CRANKSHAFT BEARING SELECTION

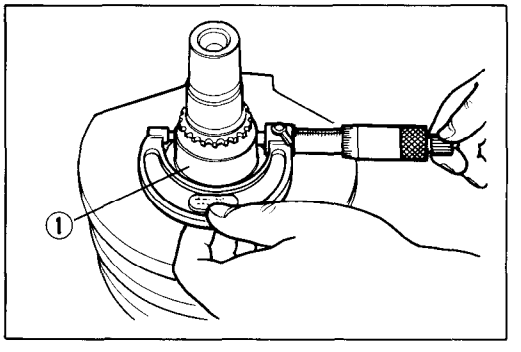
- Inspect the crankshaft and crankshaft journal bearings for any damage.



- Measure the crankshaft journal O.D. ① by using the special tool.

09900-20202 : Micrometer (25 – 50 mm)

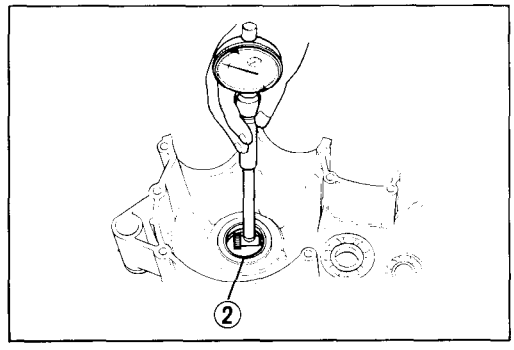
Crankshaft journal O.D. ①
Standard : 47.965 – 47.980 mm (1.8884 – 1.8890 in)



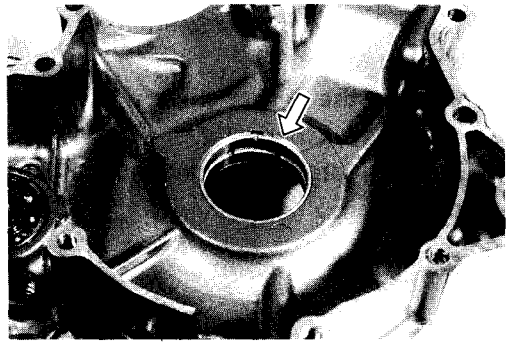
- Measure the crankshaft journal bearing I.D. ② by using the special tool.

09900-20508 : Cylinder gauge set

Crankshaft journal bearing I.D. ②
Standard : 48.000 – 48.015 mm (1.8898 – 1.8904 in)



If each crankshaft journal bearing I.D. is not within the standard range, replace them with new ones.



- Remove the crankshaft bearing with taking care not to damage the crankcase journal bearing hole.
- Inspect the journal bearing hole of crankcase for any sign of pitting or flaw.
  If any, repair it with emery paper.
- Install the new journal bearings into the crankcases by hydraulic press.
- Hone the new journal bearings with the specified value by honing machine.

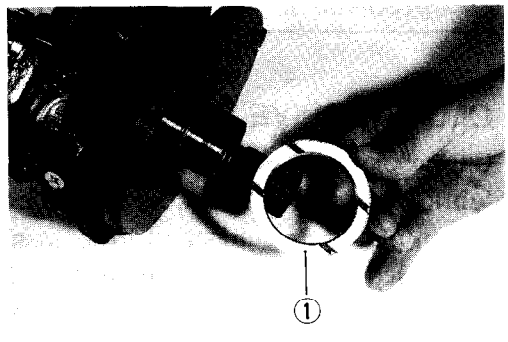
CAUTION:
When honing the new journal bearings, be sure to mate the left and right crankcases.

Crankshaft journal bearing I.D. : 48.000 – 48.015 mm (1.8898 – 1.8904 in)

CRANKSHAFT THRUST CLEARANCE

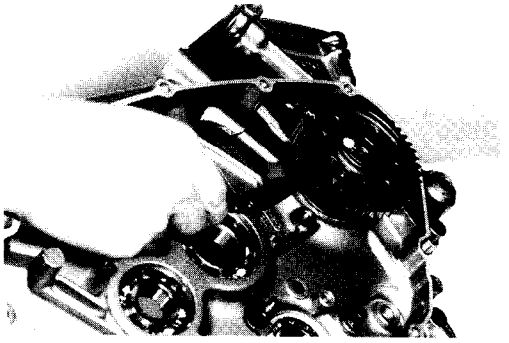
Install the crankshaft in the right crankcase half after installing the thrust shim on the crankshaft.

NOTE:
The oil grooved face of thrust shim ① is faced to crankshaft web side.



Place the thrust washer, camshaft drive sprocket and primary drive gear on the right end of the crankshaft and tighten primary drive gear bolt to the specified torque. Use a thickness gauge to measure the thrust clearance between right crankcase and thrust washer.

Tightening torque : 80 – 110 N·m
(8.0 – 11.0 kg-m, 58.0 – 79.5 lb-ft)

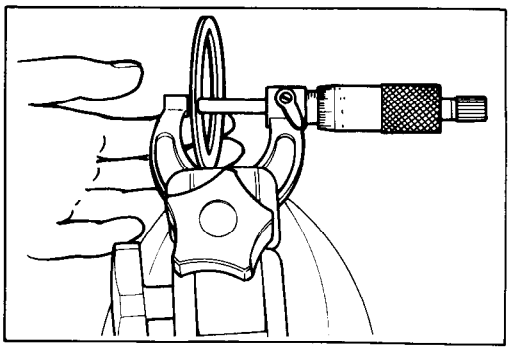


Crankshaft thrust clearance
Standard : 0.05 – 0.10 mm (0.002 – 0.004 in)

09900-20803 : Thickness gauge

If the thrust clearance exceeds the standard range, adjust the thrust clearance by the following procedures.

- Remove the thrust shim, and measure its thickness with a micrometer.
- Change the thrust shim with the other shim if the thrust clearance is incorrect.
- Perform the thrust clearance measurement described above once again.



09900-20205 : Micrometer (0 – 25 mm)

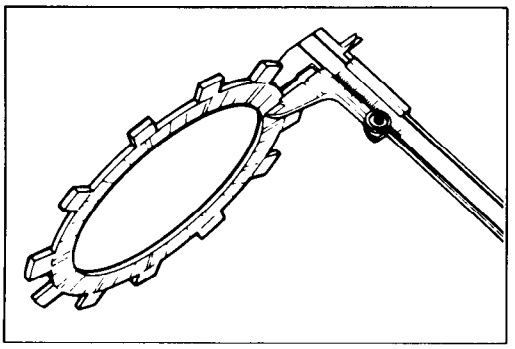
Checking to make sure it is within standard

Unit: mm (in)

Part number	Thrust shim thickness
09160-48001	1.925 – 1.950 (0.0758 – 0.0768)
09160-48002	1.950 – 1.975 (0.0768 – 0.0778)
09160-48003	1.975 – 2.000 (0.0778 – 0.0787)
09160-48004	2.000 – 2.025 (0.0787 – 0.0797)
09160-48005	2.025 – 2.050 (0.0797 – 0.0807)
09160-48006	2.050 – 2.075 (0.0807 – 0.0817)
09160-48007	2.075 – 2.100 (0.0817 – 0.0827)
09160-48008	2.100 – 2.125 (0.0827 – 0.0837)
09160-48009	2.125 – 2.150 (0.0837 – 0.0847)
09160-48010	2.150 – 2.175 (0.0847 – 0.0856)

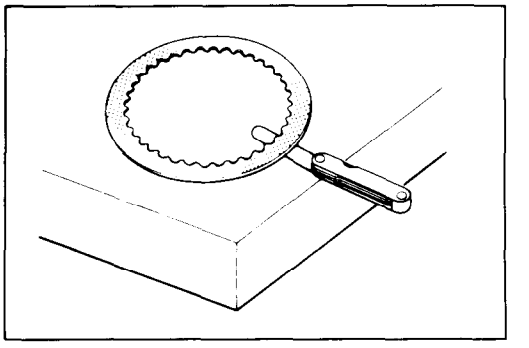
CLUTCH DRIVE PLATE AND DRIVEN PLATE

Clutch plates in service remain in oily condition as they were lubricated with oil. Because of this condition, both drive and driven plates are subject to little wearing action and therefore last much longer. Their life depends largely on the quality of oil used in the clutch and also on the way the clutch is operated.



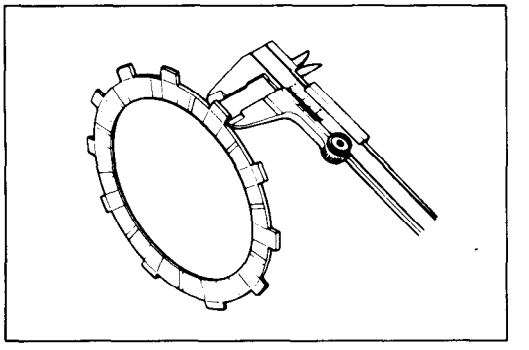
These plates are expendable: they are meant to be replaced when found worn down or distorted to the respective limit: use a caliper to check thickness and a thickness gauge and surface plate to check distortion.

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



Unit: mm (in)

Service Limit	Drive plate		Driven plate
	No. 1	No. 2	
Thickness	2.35 (0.093)	3.15 (0.124)	–
Distortion	–	–	0.1 (0.004)
Claw width	15.0 (0.59)	15.0 (0.59)	–

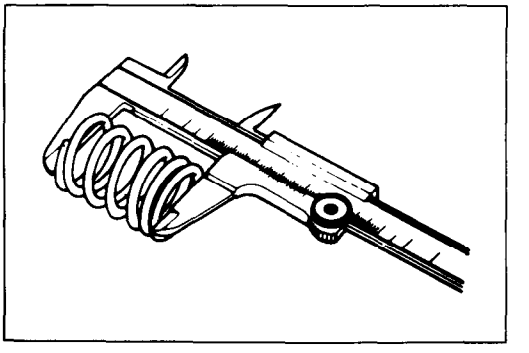


CLUTCH SPRING FREE LENGTH

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

Clutch spring free length

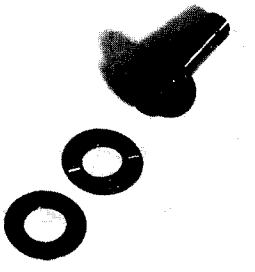
Service Limit **No. 1 : 24.6 mm (0.97 in)**
No. 2 : 23.3 mm (0.92 in)



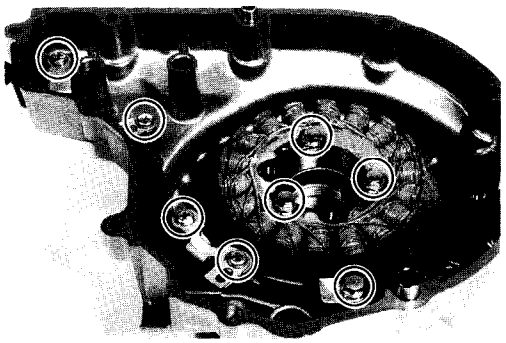
CLUTCH BEARING

Inspect clutch push piece bearing for any abnormality, particularly cracks, upon removal from the clutch, to decide whether it can be reused or should be replaced.
Smooth engagement and disengagement of the clutch depends much on the condition of this bearing.

NOTE:
Thrust washer is located between the pressure plate and thrust bearing.



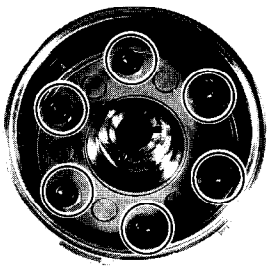
GENERATOR AND SIGNAL GENERATOR SERVICING



- When replacing the generator coil or signal generator coil, apply THREAD LOCK "1342" (99000-32050) to the stator set screws and its lead wire guide screws.

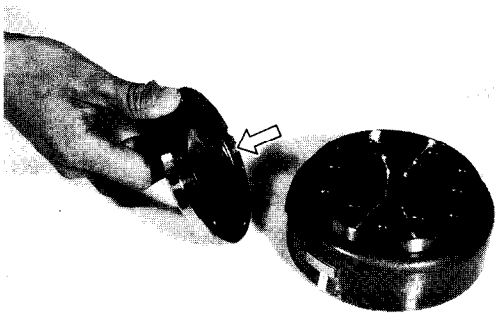
NOTE:
Wipe off oil or grease on screw completely, and then apply THREAD LOCK "1342".

STARTER CLUTCH SERVICING

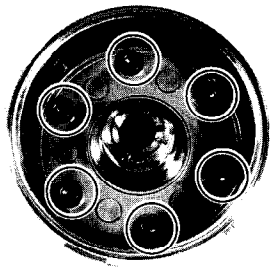


- Hold the rotor with off-set wrench and remove the starter clutch securing bolts.

09914-25811 : "T" type hexagon wrench (6 mm)



- When fitting the one way clutch to the guide, position flange side of one way clutch to the rotor side.

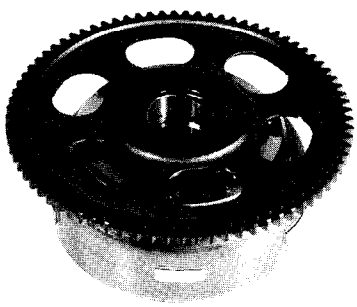


- Apply THREAD LOCK SUPER "1303"/"1305" to the securing bolts and tighten them to the specified torque while holding the rotor with off-set wrench.

(For U.S.A. model)
99000-32030 : THREAD LOCK SUPER "1303"
(For the other models)
99000-32100 : THREAD LOCK SUPER "1305"

09914-25811 : "T" type hexagon wrench

Tightening torque : 23 – 28 N·m
(2.3 – 2.8 kg-m, 16.5 – 20.0 lb-ft)

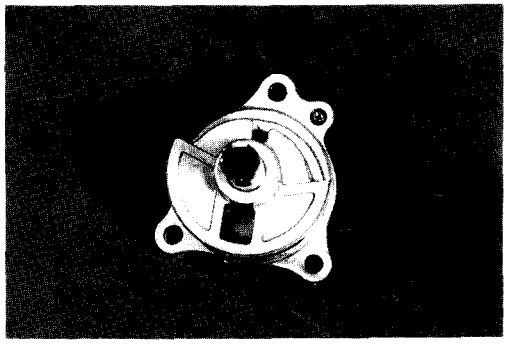


Check the operation of starter clutch by turning the starter driven gear.

NOTE:
The gear turns one direction only.

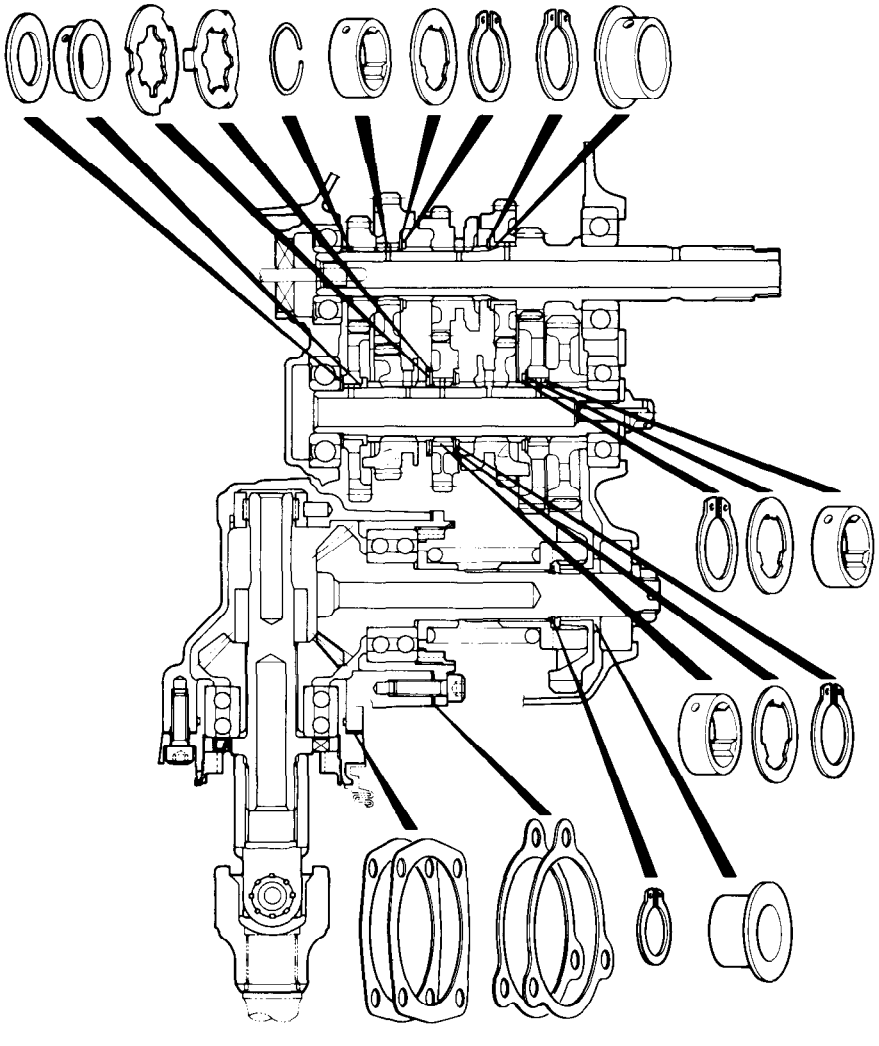
OIL PUMP

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

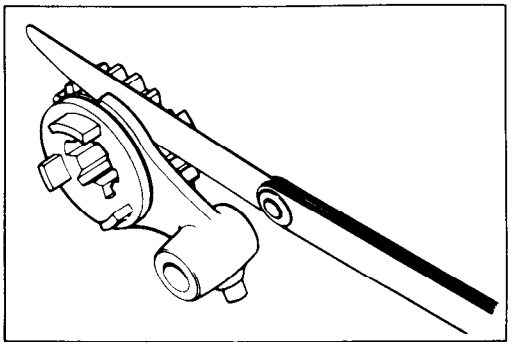


TRANSMISSION

TRANSMISSION GEARS AND RELATED PARTS

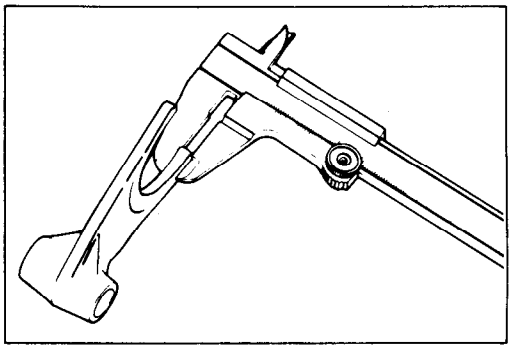


GEAR-SHIFTING FORK CLEARANCE



Using a thickness gauge, check the shifting fork clearance in the groove of its gear.
The clearance for each of the three shifting forks plays an important role in the smoothness and positiveness of shifting action.
If the clearance checked is noted to exceed the limit specified, replace the fork or its gear, or both.

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



Shift fork – Groove clearance
Standard : 0.10 – 0.30 mm (0.004 – 0.012 in)
Service Limit : 0.50 mm (0.020 in)

Shift fork groove width
Standard No. 1 : 5.50 – 5.60 mm (0.217 – 0.220 in)
No. 2 : 4.50 – 4.60 mm (0.177 – 0.181 in)

Shift fork thickness
Standard No. 1 : 5.30 – 5.40 mm (0.209 – 0.213 in)
No. 2 : 4.30 – 4.40 mm (0.169 – 0.173 in)

COUNTERSHAFT AND DRIVESHAFT

REASSEMBLY

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

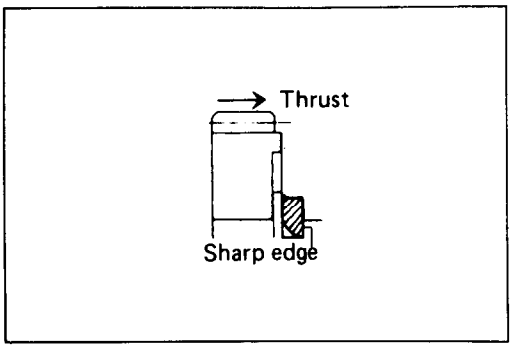
NOTE:
Always use new circlips.

NOTE:
Before installing the gears, coat lightly moly paste or engine oil to the driveshaft and countershaft.

99000-25140 : SUZUKI MOLY PASTE

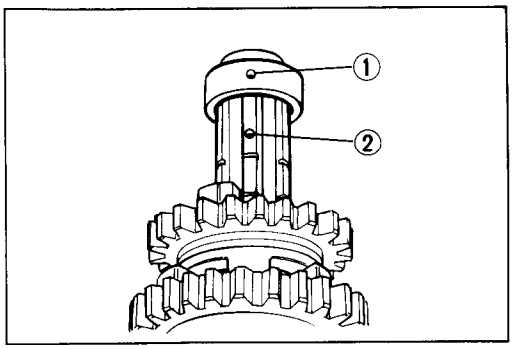
CAUTION:
* **Never reuse a circlip. After a circlip has been removed from a shaft, it should be discarded and a new circlip must be installed.**
* **When installing a new circlip, care must be taken not to expand the end gap larger than required to slip the circlip over the shaft.**
* **After installing a circlip, always insure that it is completely seated in its groove and securely fitted.**

- When installing a new circlip, pay attention to the direction of the circlip. Fit it to the side where the thrust is as shown in figure.



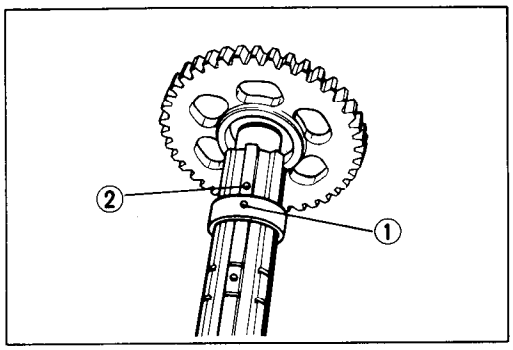
TOP DRIVE GEAR BUSHING

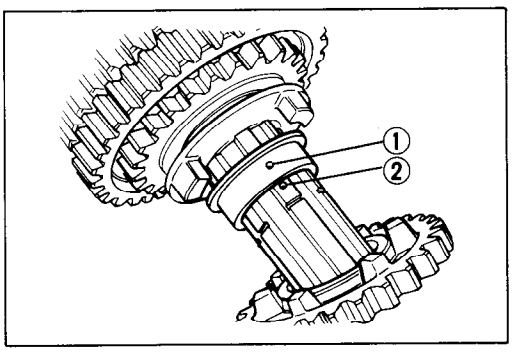
- When installing the top drive gear bushing, align the bushing oil hole ① with the countershaft oil hole ②.



LOW AND 3RD DRIVEN GEAR BUSHINGS

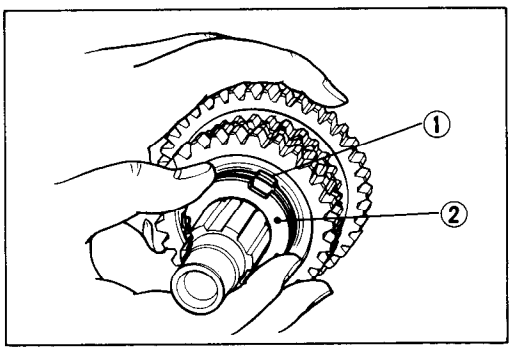
- When installing the low and 3rd driven gear bushings, align the bushing oil hole ① with the driveshaft oil hole ②.





3RD DRIVEN GEAR LOCK WASHERS

- When installing the 3rd driven gear onto the driveshaft, install the lock washer No. 2 ① onto the driveshaft, and turn and fit it into the groove.
- Then, fit the lock washer No. 1 ② in the lock washer No. 2 ①.



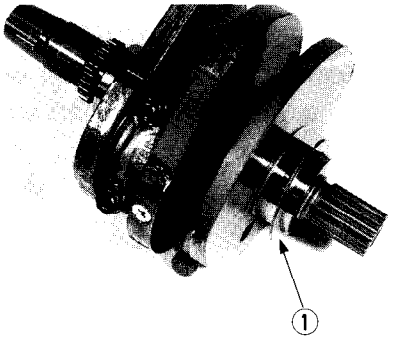
ENGINE REASSEMBLY

This engine is reassembled by carrying out the steps of disassembly in the reverse order, but there are a number of steps which demand special descriptions or precautionary measures.

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

- Install the thrust shim on the crankshaft.

NOTE:
The oil grooved face of thrust shim ① is faced to crankshaft web side.

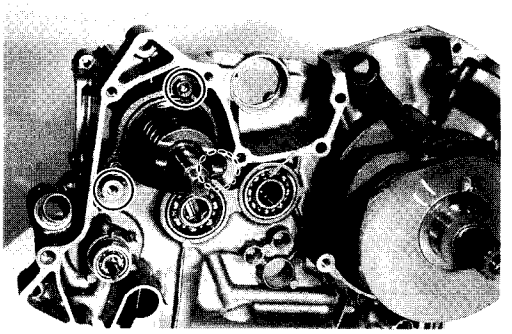


- Install the crankshaft into the left crankcase half.

NOTE:
Coat lightly moly paste to the crankshaft journal bearings.

99000-25140 : SUZUKI MOLY PASTE

CAUTION:
Never fit the crankshaft into the crankcase by striking it with a plastic hammer.
It is easy to install the crankshaft to left crankcase.

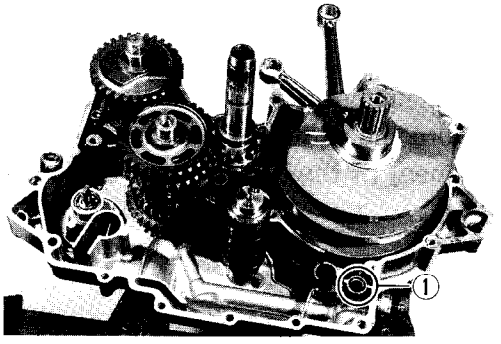


- Install the secondary drive bevel gear assembly.
  Tighten the secondary drive bevel gear housing bolts to the specified torque.

WARNING:
Never hit the secondary drive bevel gear. Maybe, secondary drive bevel gear circlip will be detached.

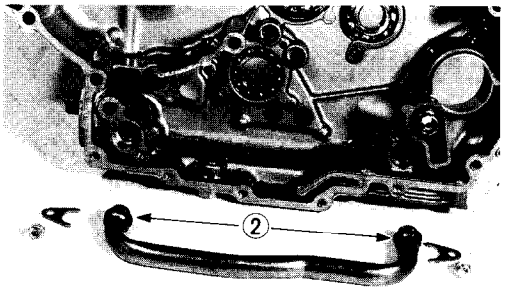
Tightening torque : 18 – 28 N·m
(1.8 – 2.8 kg-m, 13.0 – 20.0 lb-ft)

- Install the countershaft assembly, driveshaft assembly and reduction driven gear.
- Install the gearshift forks, gearshift fork shafts and gearshift cam.
- Install a new O-ring ①.



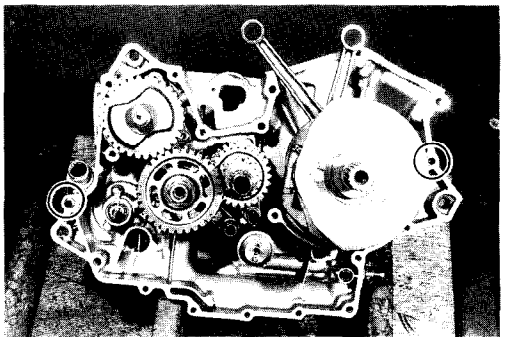
- Install the new O-rings ②.
- Apply engine oil to the oil pipe end.
- Tighten the oil pipe bolts with the specified torque after applying THREAD LOCK SUPER "1322"/"1333B" to securing bolts.

Tightening torque : 8 – 12 N·m
(0.8 – 1.2 kg-m, 6.0 – 8.5 lb-ft)



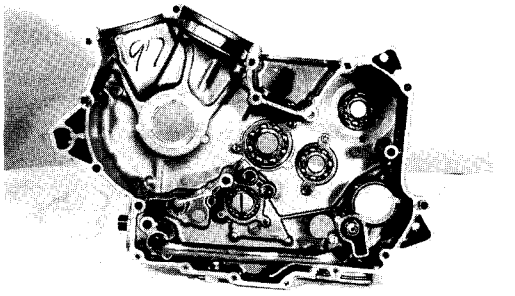
(For U.S.A. model)
99000-32020 : THREAD LOCK SUPER "1333B"
(For the other models)
99000-32110 : THREAD LOCK SUPER "1322"

- Clean the mating surfaces of the left and right crankcases.
- Fit the dowel pins on the left crankcase.
- Apply SUZUKI BOND NO. 1215/No. 1207B to the mating surface of the right crankcase.

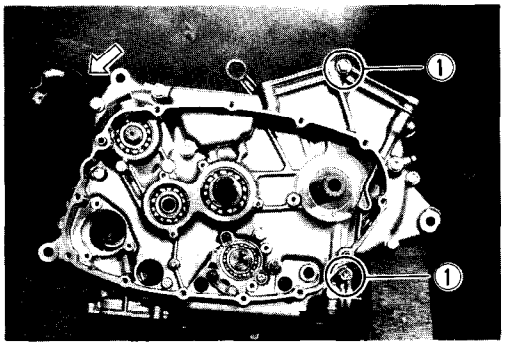


(For U.S.A. model)
99104-31140 : SUZUKI BOND NO. 1207B
(For the other models)
99000-31110 : SUZUKI BOND NO. 1215

NOTE:
Use of SUZUKI BOND NO. 1215/NO. 1207B 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 NO. 1215/No. 1207B to the oil hole, oil groove and bearing.*
* *Apply to distorted surfaces as it forms a comparatively thick film.*



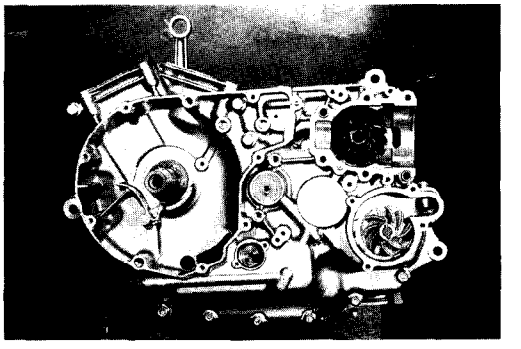
- Place the gaskets ① as shown in Fig.
- Fit the engine ground wire to the correct position as shown in Fig.
- Check that shafts turn smoothly.



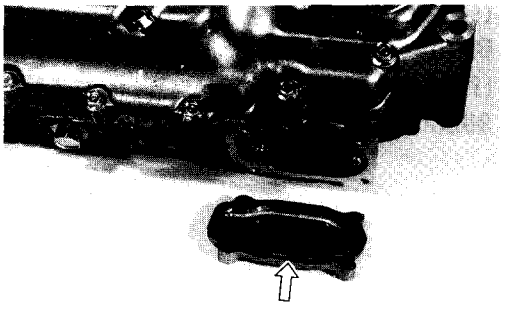
CAUTION:
Use new gasket to prevent oil leakage.

- When securing the right and left crankcases, tighten each bolt a little at a time to equalize the pressure. Tighten all the securing bolts to the specified torque values.

Tightening torque		6 mm bolt	8 mm bolt
Initial	N·m		12 – 18
	kg-m		1.2 – 1.8
	lb-ft		8.5 – 13.0
Final	N·m	9 – 13	20 – 24
	kg-m	0.9 – 1.3	2.0 – 2.4
	lb-ft	6.5 – 9.5	14.5 – 17.5



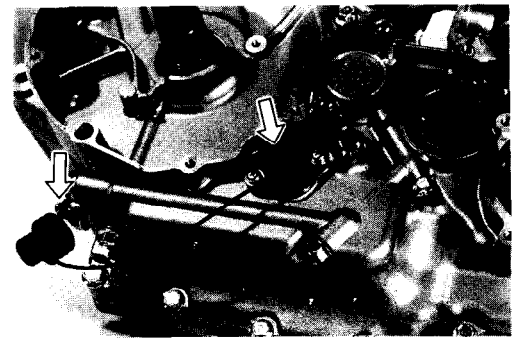
- Install the oil sump filter.
- Fit the O-ring to the oil sump filter cap.



CAUTION:
Use new O-ring to prevent oil leakage.

- Coat grease to the O-ring and install the oil sump filter cap.

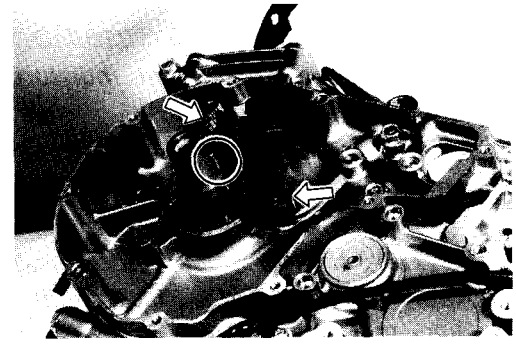
- Connect the oil pressure switch lead wire and install the neutral switch.



- Install the cam chain and cam chain guide.
- Tighten the cam chain guide set bolt to the specified torque.

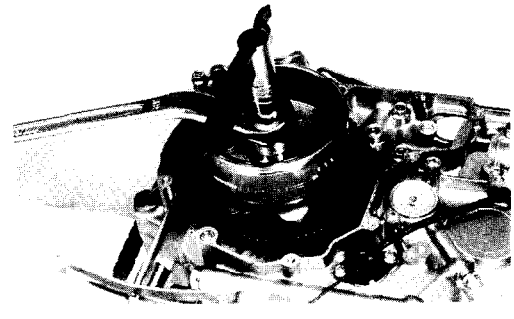
Tightening torque : 8 – 12 N·m
(0.8 – 1.2 kg-m, 6.0 – 8.5 lb-ft)

- Fit the key in the key slot on the crankshaft.



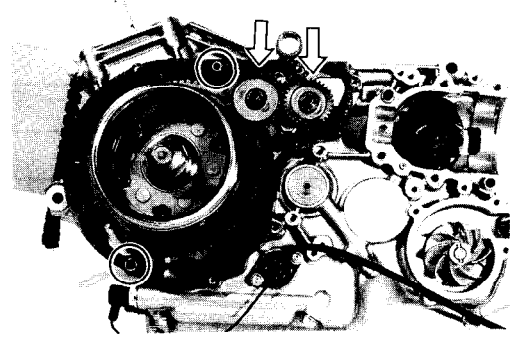
- Degrease the tapered portion of the rotor and also the crankshaft. Use nonflammable cleaning solvent to wipe off the oily or greasy matter to make these surfaces completely dry.
- Install the rotor onto the crankshaft.
- Apply THREAD LOCK SUPER "1303"/"1305" to the rotor bolt and tighten it to the specified torque.

Tightening torque : 140 – 160 N·m
(14.0 – 16.0 kg-m, 101.5 – 115.5 lb-ft)



(For U.S.A. model)
99000-32030 : THREAD LOCK SUPER "1303"
(For the other models)
99000-32100 : THREAD LOCK SUPER "1305"

- Install the starter driven gear and its idle gear.
- Fit the dowel pins and attach new gasket.
- Apply SUZUKI BOND NO. 1207B/NO. 1215 to the groove of generator lead wire grommet.

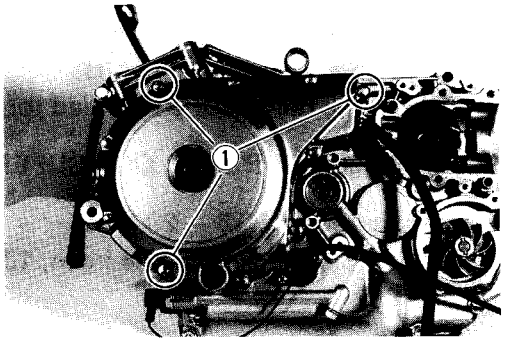


(For U.S.A. model)
99104-31140 : SUZUKI BOND NO. 1207B
(For the other models)
99000-31110 : SUZUKI BOND NO. 1215

- Install the generator cover.

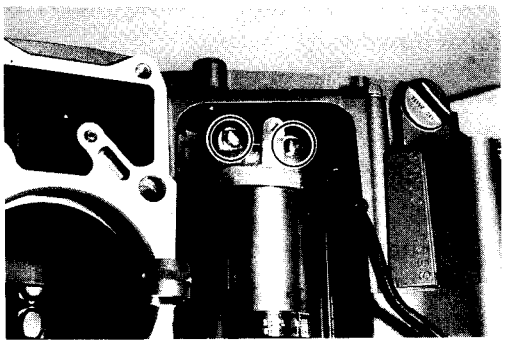
NOTE:
Fit the new gaskets ① to the correct positions as shown in Fig.

CAUTION:
Use new gasket to prevent oil leakage.



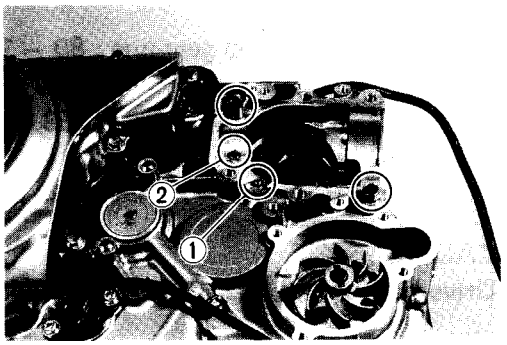
- Mount the starter motor to the crankcase and route the starter motor lead wire properly.

NOTE:
Pass the generator lead wire through the crankcase hole before installing the starter motor.



- Install the dowel pins.
- Check the oil jet ① for clogging.
- Install the secondary driven bevel gear assembly, correct shims and a new O-ring.
- Apply engine oil to the bearing and gears.

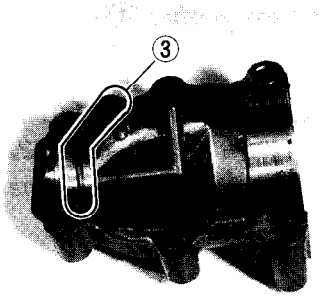
NOTE:
Be sure to align the bearing pin ② with the bearing pin hole.



- Apply SUZUKI BOND NO. 1207B/NO. 1215 to the secondary bevel gear case.

CAUTION:
Be careful not to block the oil passage ③.

(For U.S.A. model)
99104-31140 : SUZUKI BOND NO. 1207B
(For other models)
99000-31110 : SUZUKI BOND NO. 1215



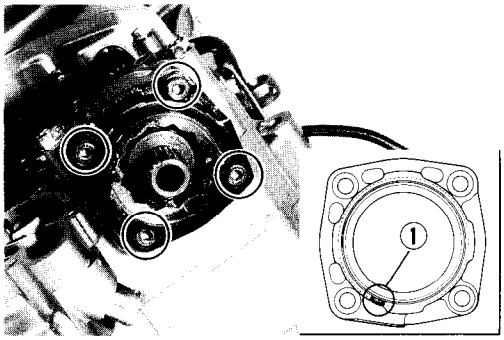
- Tighten the secondary bevel gear case bolts to the specified torque.

	ITEM	Initial	Final
Tightening torque	N·m	12 – 18	20 – 24
	kg-m	1.2 – 1.8	2.0 – 2.4
	lb-ft	8.5 – 13.0	14.5 – 17.5

- Apply THREAD LOCK SUPER "1303" to the secondary driven bevel gear housing bolts.
- Tighten the bolts to the specified torque.

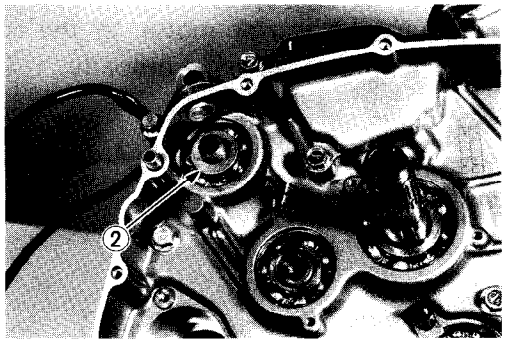
99000-32030 : THREAD LOCK SUPER "1303"

Tightening torque : 18 – 28 N·m
(1.8 – 2.8 kg-m, 13.0 – 20.0 lb-ft)

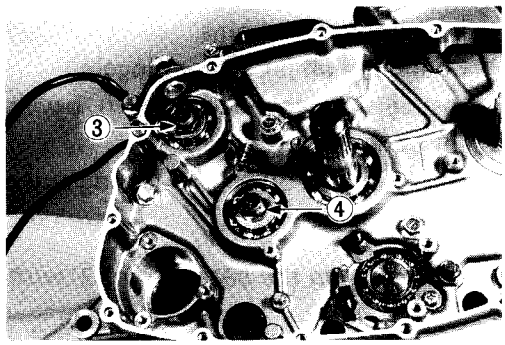


NOTE:
The cutaway portion ① of secondary driven bevel gear housing faces downward.

- Install the washer ② onto the secondary drive bevel gear shaft.
- Install the universal joint into the secondary driven bevel gear.
- Tighten the secondary drive bevel gear shaft nut ③ and driveshaft bolt ④ to the specified torque while holding the universal joint.



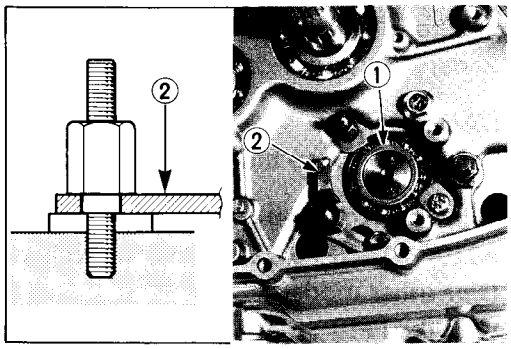
Tightening torque
Secondary drive bevel gear nut : 80 – 110 N·m
(8.0 – 11.0 kg-m,
58.0 – 79.5 lb-ft)
Driveshaft bolt : 60 – 70 N·m
(6.0 – 7.0 kg-m, 43.5 – 50.5 lb-ft)



CAUTION:
Driveshaft bolt ④ has left-hand thread.

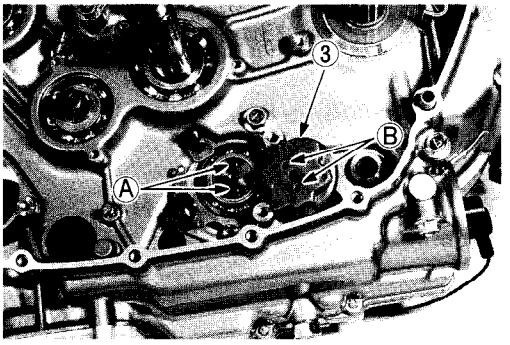
- Install the washer ① on the gearshift cam.

NOTE:
When replacing the gearshift cam stopper ②, apply THREAD LOCK SUPER "1333B"/"1322" to the thread of bolt.
After tightening the bolt, make sure that the gearshift cam stopper moves properly.



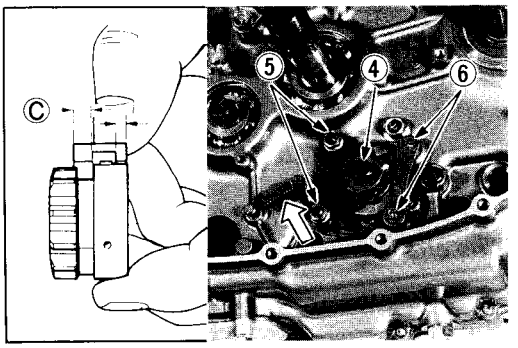
(For U.S.A. model)
99000-32020 : THREAD LOCK SUPER "1333B"
(For the other models)
99000-32110 : THREAD LOCK SUPER "1322"

- Check the neutral position.
- Install the gearshift cam stopper plate ③ after aligning the gearshift cam pins Ⓐ with the gearshift cam stopper plate holes Ⓑ.



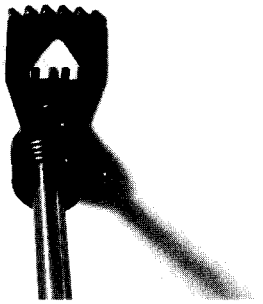
- Install the gearshift pawls into the cam driven gear. The large shoulder Ⓒ must face to the outside as shown in the illustration.
- Apply THREAD LOCK SUPER "1333B"/"1322" to the bolt ④, nuts ⑤ and screws ⑥.

(For U.S.A. model)
99000-32020 : THREAD LOCK SUPER "1333B"
(For the other models)
99000-32110 : THREAD LOCK SUPER "1322"



- Hook the gearshift cam stopper spring.

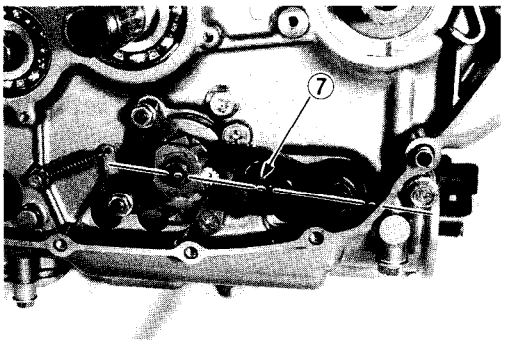
- Install the gearshift shaft return spring properly.



- Install the gearshift shaft. Match the center teeth of the gear on the gearshift shaft with the center teeth on the cam driven gear as shown.

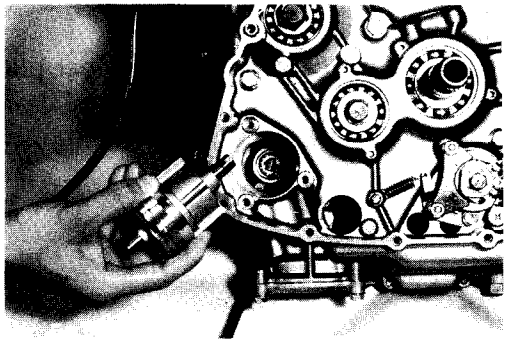
NOTE:
When replacing the gearshift arm stopper ⑦, apply a small quantity of THREAD LOCK SUPER "1303" to its threaded part and tighten it to the specified torque.

99000-32030 : THREAD LOCK SUPER "1303"



Tightening torque
Gearshift arm stopper : 15 – 23 N·m
(1.5 – 2.3 kg-m, 11.0 – 16.5 lb-ft)

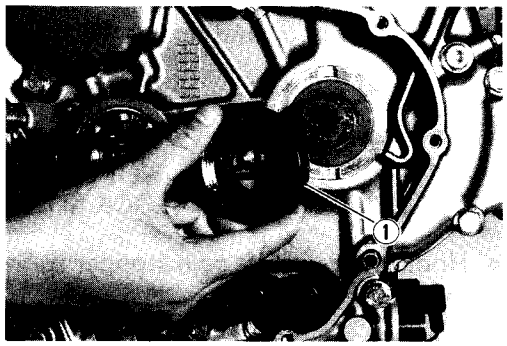
- Install the oil pump to the crankcase.
- Apply THREAD LOCK SUPER "1333B"/"1322" to the oil pump securing bolts.



Oil pump bolt
Tightening torque : 9 – 13 N·m
(0.9 – 1.3 kg-m, 6.5 – 9.5 lb-ft)

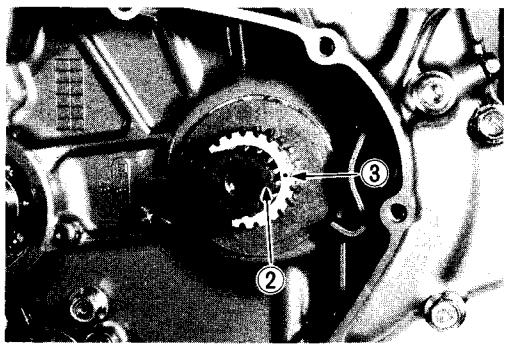
(For U.S.A. model)
99000-32020 : THREAD LOCK SUPER "1333B"
(For the other models)
99000-32110 : THREAD LOCK SUPER "1322"

- Install the thrust washer onto the crankshaft.

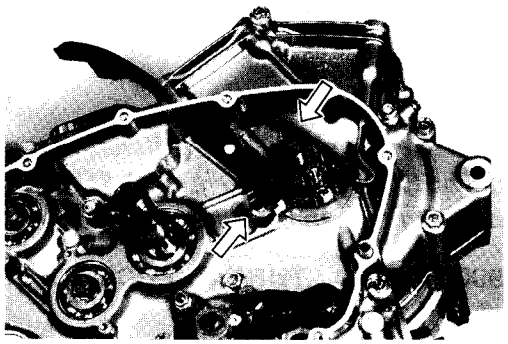


NOTE:
The chamfer side of thrust washer ① faces crankcase side.

- Align the punch mark ② on the crankshaft with the punch mark ③ on the camshaft drive sprocket.



- Install the cam chain and cam chain guide.
- Tighten the cam chain guide set bolt.



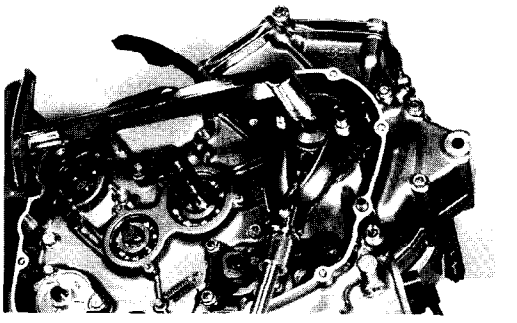
Cam chain guide set bolt
Tightening torque : 8 – 12 N·m
(0.8 – 1.2 kg-m, 6.0 – 8.5 lb-ft)

- Tighten the primary drive gear bolt to the specified torque.

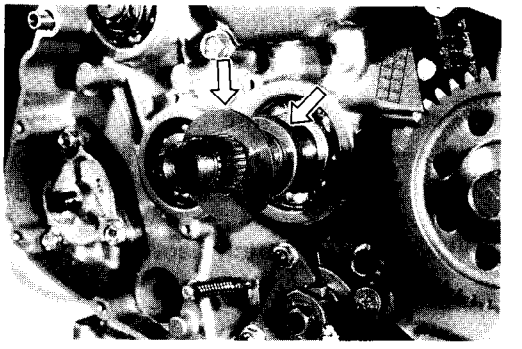
09930-40113 : Rotor holder

Tightening torque : 80 – 110 N·m
(8.0 – 11.0 kg-m, 58.0 – 79.5 lb-ft)

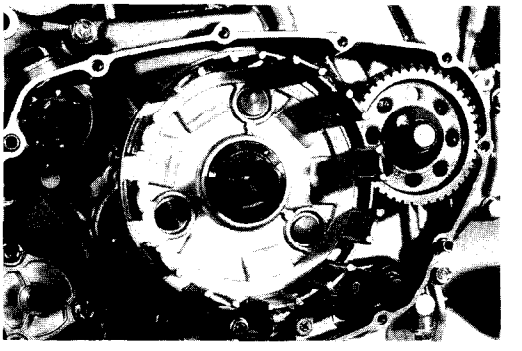
NOTE:
This bolt has left-hand thread.



- Install the spacer and washer onto the countershaft.

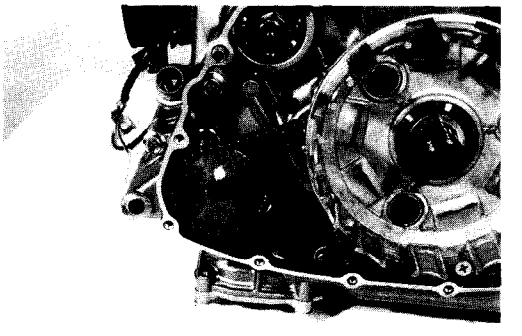


- Apply engine oil to the primary driven gear bearing and spacer.
- Engage the oil pump drive chain onto the oil pump drive gear.
- Install the primary driven gear assembly onto the countershaft.



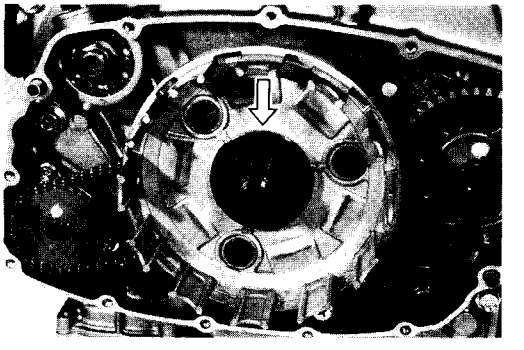
- Engage the oil pump drive chain onto the oil pump driven gear and fix the oil pump driven gear with circlip.

09900-06107 : Snap ring pliers



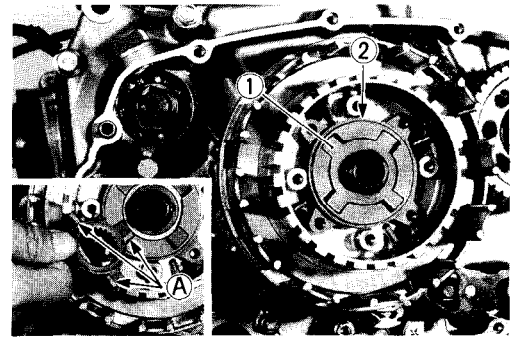
- Install the thrust washer onto the countershaft.

NOTE:
The groove of thrust washer faces outside.



- Install the clutch sleeve hub onto the countershaft.
- Install the back torque limiter (clutch cam No. 2 ② and clutch cam No. 1 ①) onto the clutch sleeve hub.

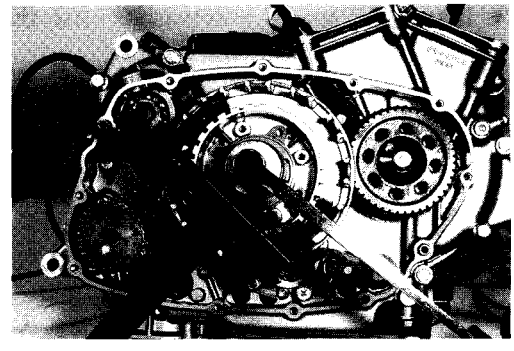
NOTE:
The chamfer side Ⓐ of clutch cam No. 1 faces clutch cam No. 2.



- Tighten the clutch sleeve hub nut to the specified torque by using the special tool.

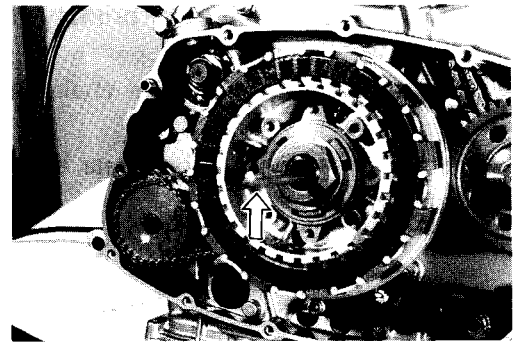
Clutch sleeve hub nut
Tightening torque : 50 – 70 N·m
(5.0 – 7.0 kg-m, 36.0 – 50.5 lb-ft)

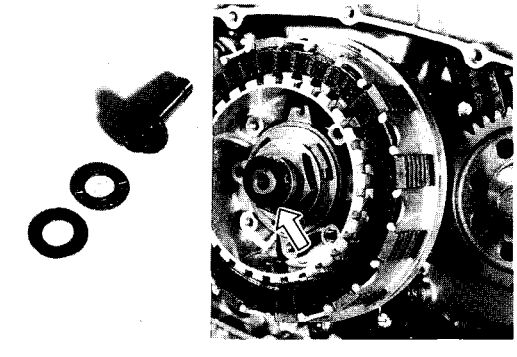
09920-50710 : Clutch sleeve hub holder



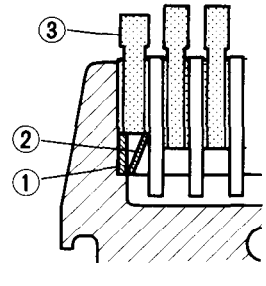
- Install the clutch push rods into the countershaft so that the long push rod touches clutch push piece.
- Install the clutch push piece, bearing and thrust washer in that order.
- Apply engine oil to the bearing.
- Install the wave washer seat ①, wave washer ② and drive plate No. 2 ③ (thicker plate as shown in the figure.)

NOTE:
Install the clutch drive plate and driven plate one by one into the clutch sleeve hub in the prescribed order, drive plate No. 2 first.

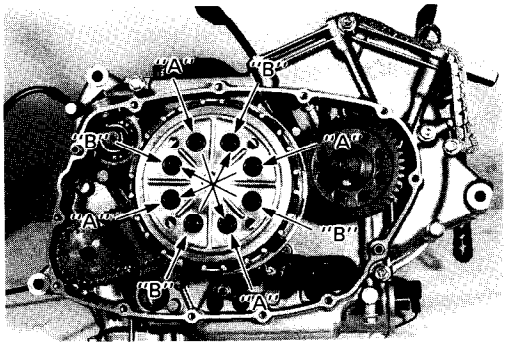




① Wave washer seat
② Wave washer
③ Drive plate No. 2



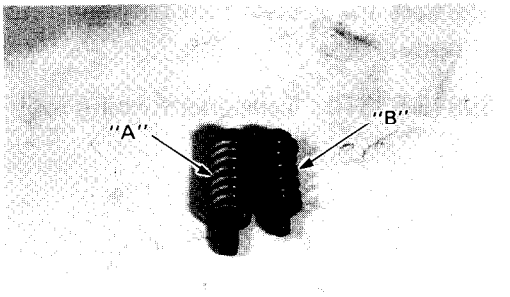
- Install the pressure plate and tighten the clutch spring mounting bolts.



NOTE:
Tighten the clutch spring mounting bolts in the criss-cross manner, tightening them by degrees until they attain a uniform tightness.

Clutch spring mounting bolt
Tightening torque : 11 – 13 N·m
(1.1 – 1.3 kg-m, 8.0 – 9.5 lb-ft)

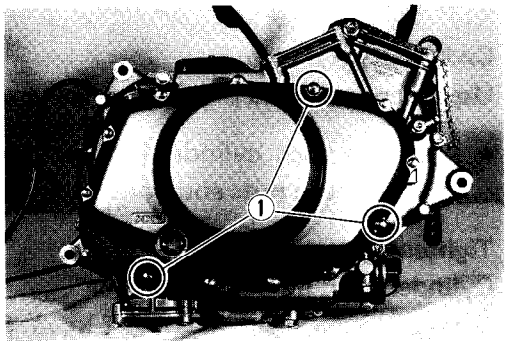
- Set "A" is used for clutch sleeve hub side.
  Set "B" is used for back torque limiter side.
  "A" : bolt L: 40 mm (1.6 in)
  Spring L: 25.85 mm (1.02 in)
  Spacer L: 24.1 mm (0.95 in)
  "B" : bolt L: 35 mm (1.4 in)
  Spring L: 24.5 mm (0.96 in)
  Spacer L: 24.1 mm (0.95 in)



- Fit the new clutch cover gasket and dowel pins.
- Install the clutch cover.

NOTE:
Fit the new gaskets ① to the correct positions as shown in Fig.

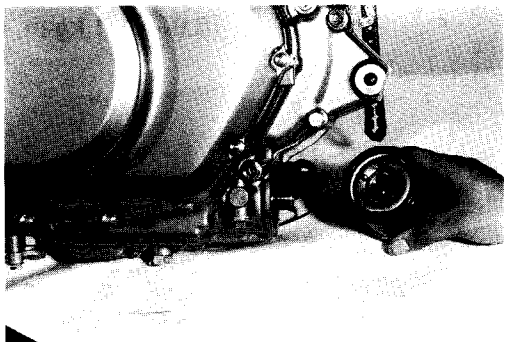
CAUTION:
Use a new gasket to prevent oil leakage.



- Apply engine oil lightly to the gasket of the new filter before installation.
- Install the new filter turning it by hand until you feel that the filter gasket contacts the mounting surface. Then tighten it 2 turns using the oil filter wrench.

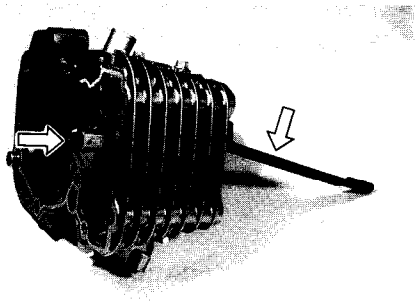
09915-40611 : Oil filter wrench

NOTE:
To properly tighten the filter, use the special tool. Never tighten the filter by hand.



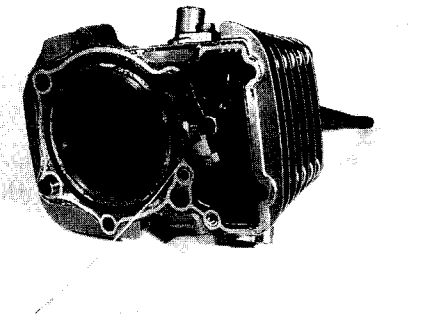
- Install the front and rear cam chain tensioners and chain guides on each cylinder.

Chain tensioner mounting bolt
Tightening torque : 8 – 12 N·m
(0.8 – 1.2 kg-m, 6.0 – 8.5 lb-ft)



- Compress the chain tensioner spring by releasing ratchet. Insert the special tool between ratchet and chain tensioner body.

09918-53810 : Tensioner locking tool

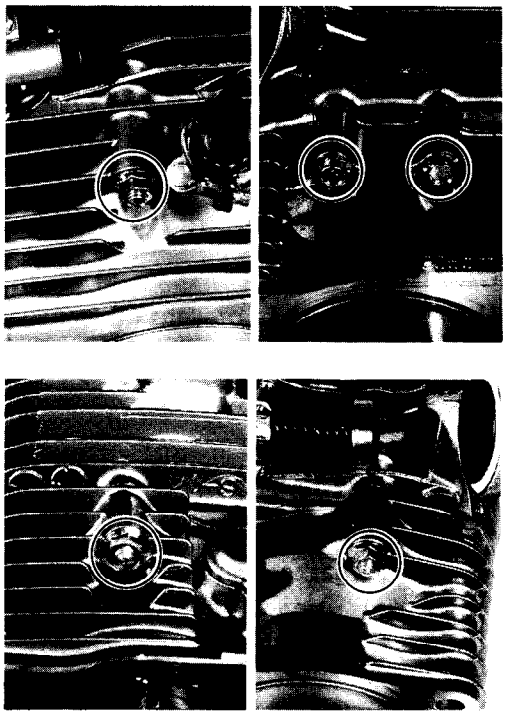


- Fit the dowel pins and new cylinder head gaskets to each cylinder.

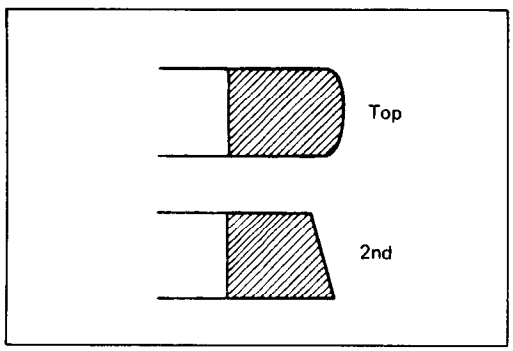
CAUTION:
Use a new gasket to prevent gas leakage.

- Assemble each cylinder head and cylinder, and tighten the cylinder head nuts and bolts to the specified torque.

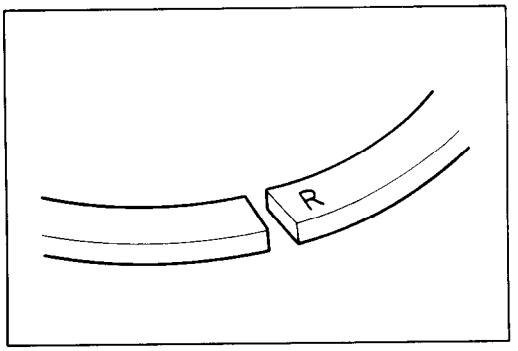
Tightening torque
Cylinder head nuts : 8 – 12 N·m
(0.8 – 1.2 kg-m, 6.0 – 8.5 lb-ft)
Cylinder head bolts : 9 – 11 N·m
(0.9 – 1.1 kg-m, 6.5 – 8.0 lb-ft)



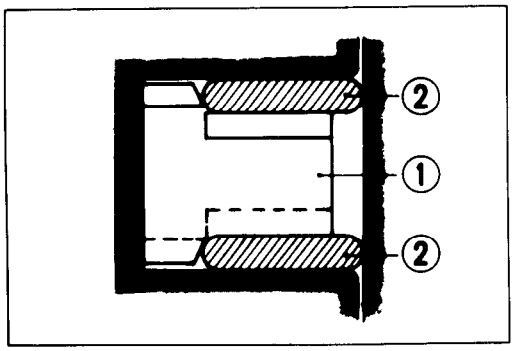
- Install the piston rings in the order of oil ring, 2nd ring and top ring.
- Top ring and 2nd (middle) ring differ in the shape of the ring face, and the face of top ring is chrome-plated whereas that of 2nd ring is not. The color of 2nd ring appears darker than that of the top one.



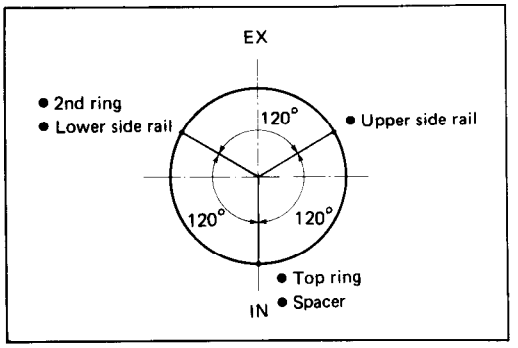
- Top and 2nd (middle) rings have a letter "R" marked on the side. Be sure to bring the marked side to top when fitting them to the piston.



- The first member to go into the ring groove is spacer ①. After placing the spacer, fit the two side rails ②. Side designations, top and bottom, are not applied to the spacer and side rails: you can position each either way.



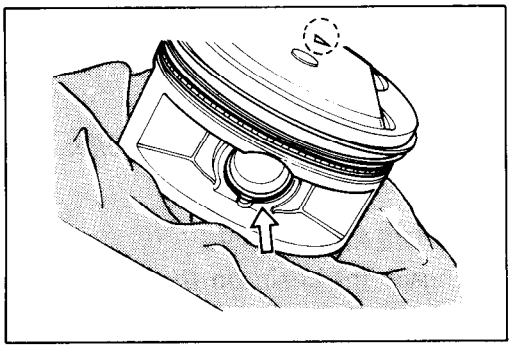
- Position the gaps of the three rings as shown. Before inserting each piston into the cylinder, check that the gaps are so located.



- Rub a small quantity of SUZUKI MOLY PASTE onto the piston pin.

99000-25140 : SUZUKI MOLY PASTE

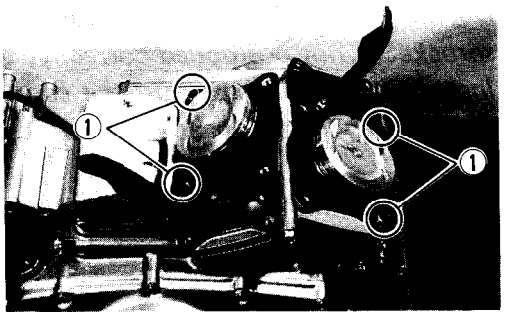
- Place a clean rag over the cylinder base to prevent the piston pin circlips from dropping into the crankcase.
- When fitting the piston, turn the triangle mark on the piston head to exhaust side.
- Fit the piston pin circlips with long-nose pliers.



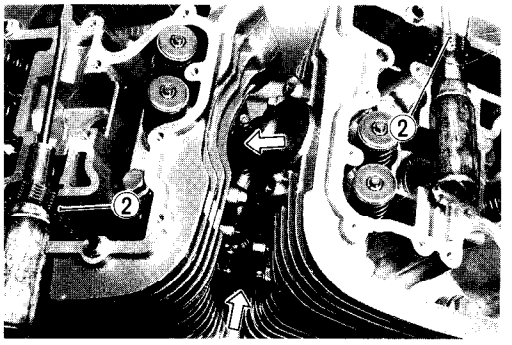
CAUTION:
Use new piston pin circlip to prevent circlip failure which will occur with a bent one.

- Apply engine oil to the sliding surface of the piston.
- Fit the dowel pins ① and new gaskets to the crankcase.

CAUTION:
Use a new gasket to prevent oil leakage.

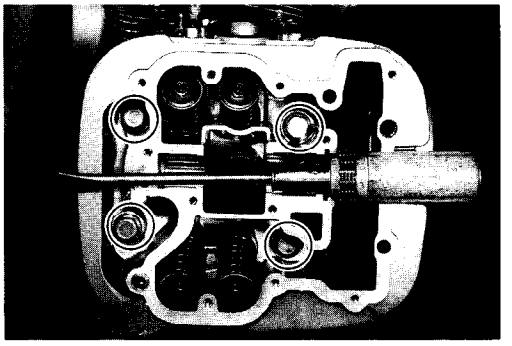


- Hold each piston ring with properly position, and insert each piston into the respective cylinders.
- Tighten the water hose clamp screws.



NOTE:
When mounting the cylinders, keep the camshaft drive chains ② taut. The camshaft drive chain must not be caught between cam drive chain sprocket and crankcase when crankshaft is rotated.
There is a holder for the bottom end of the cam chain guide cast in the crankcase. Be sure that the cam chain guide is inserted properly. (Refer to page 3-59.)

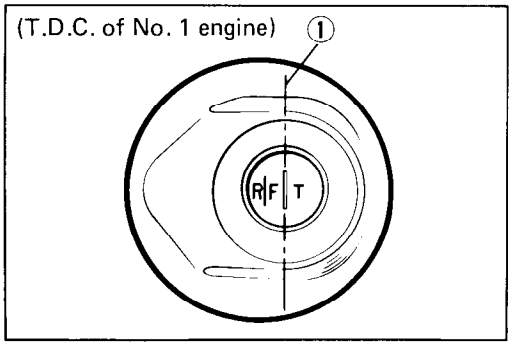
- Tighten the cylinder head bolts diagonally to the specified torque.



Cylinder head bolts
Tightening torque : 35 – 40 N·m
(3.5 – 4.0 kg-m, 25.5 – 29.0 lb-ft)

CAMSHAFT TIMING

- Turn the crankshaft counterclockwise with the box wrench and align "T" line ① on the magneto rotor with the center of generator cover hole keeping the camshaft drive chain pulled upward.

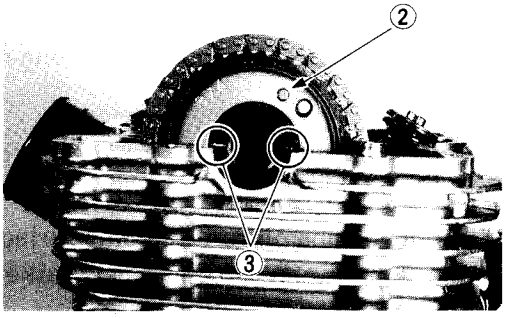


CAUTION:
If crankshaft is turned without drawing the camshaft drive chain upward, the chain will be caught between crankcase and cam chain drive sprocket.

NOTE:
Apply grease on the cam sprocket locating pin and install the pin into the camshaft.

No. 1 (REAR) ENGINE

- Engage the chain on the cam sprocket with the locating pin hole ② at the one o'clock position.

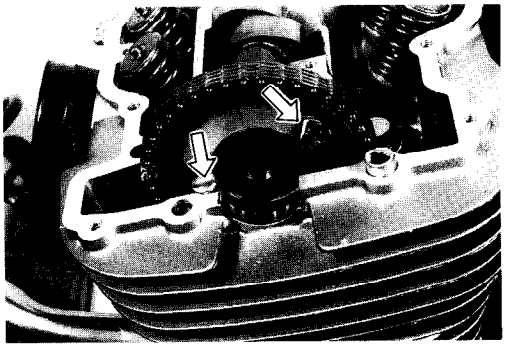


NOTE:
Do not rotate the magneto rotor while doing this. When the sprocket is not positioned correctly, turn the sprocket. When installing the camshaft into the cam sprocket, pay attention not to dislodge the locating pin or it may fall into the crankcase.

- Align the mark ③ on the camshaft so it is parallel with the surface of the cylinder head.

NOTE:
Arrow mark is located to forward.

- Fit the lock washer so that it is covering the locating pin.
- Apply THREAD LOCK SUPER "1303" to the bolts and tighten them.

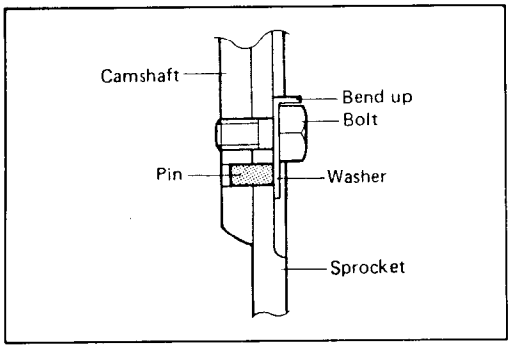


Tightening torque : 14 – 16 N·m
(1.4 – 1.6 kg-m, 10.0 – 11.5 lb-ft)

99000-32030 : THREAD LOCK SUPER "1303"

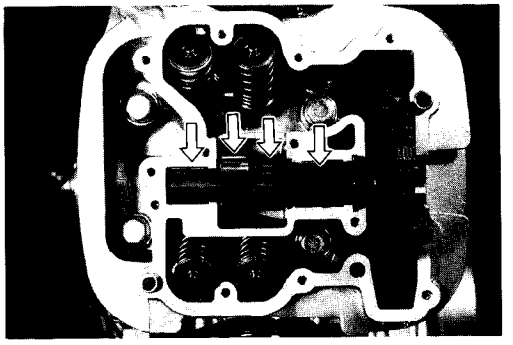
- Bend up the washer tongue positively to lock the bolts.
- Remove the cam chain tensioner locking tools.

NOTE:
Click sound is heard when the cam chain tensioner is released.



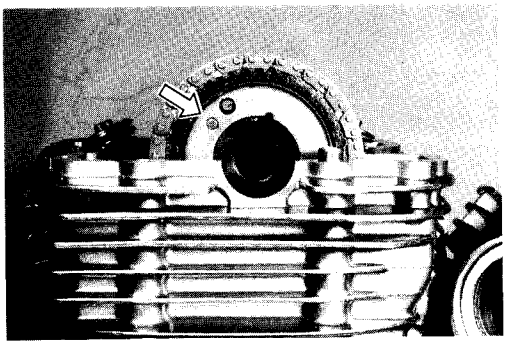
- Apply SUZUKI MOLY PASTE to the camshaft journals and cam faces.

99000-25140 : SUZUKI MOLY PASTE



No. 2 (FRONT) ENGINE

- At this position, engage the chain on the cam sprocket with the locating pin hole at the nine half o'clock position.

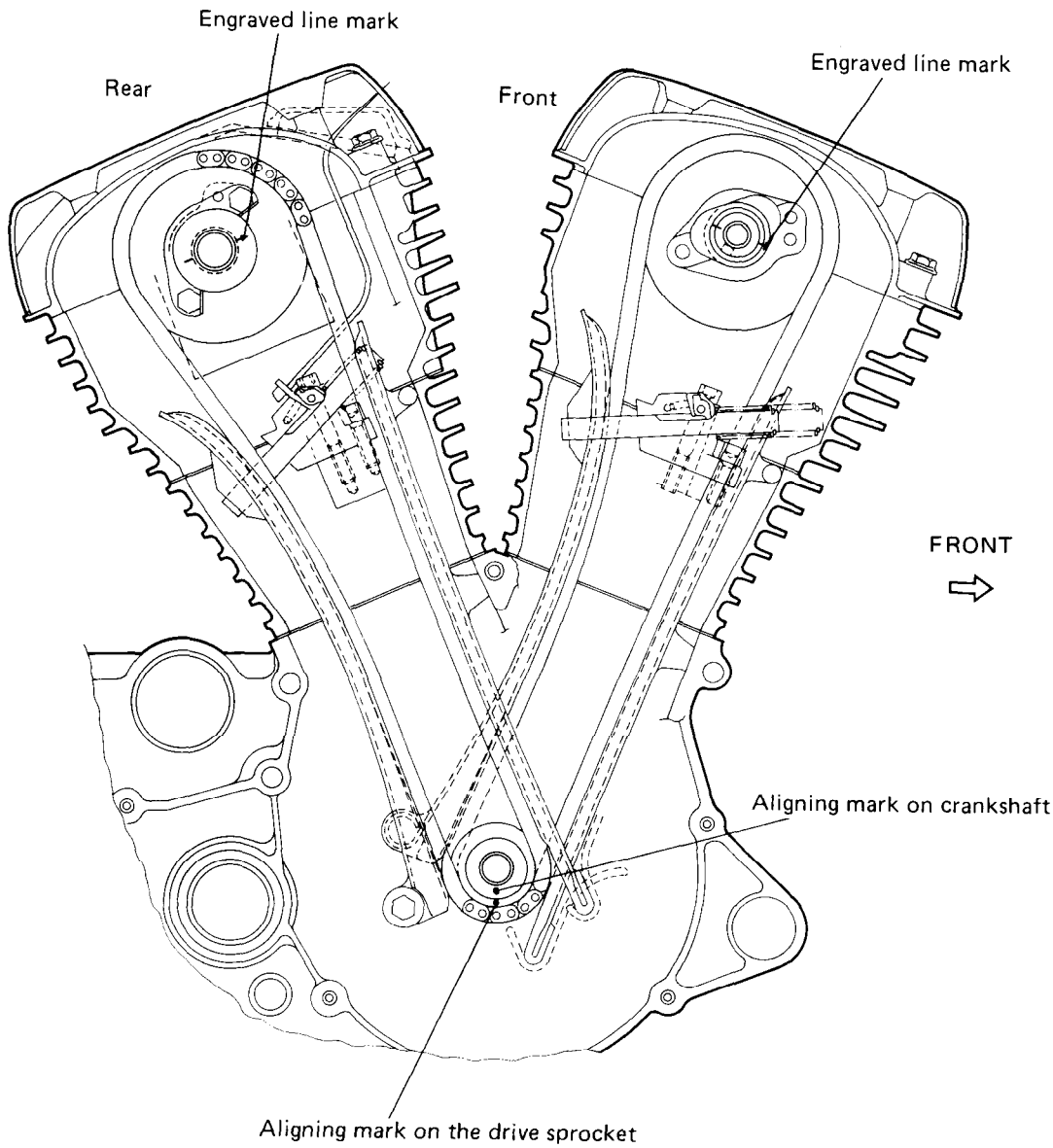


NOTE:
Do not rotate the magneto rotor while doing this. When the sprocket is not positioned correctly, turn the sprocket. When installing the camshaft into the cam sprocket, pay attention not to dislodge the locating pin or it may fall into the crank-case.

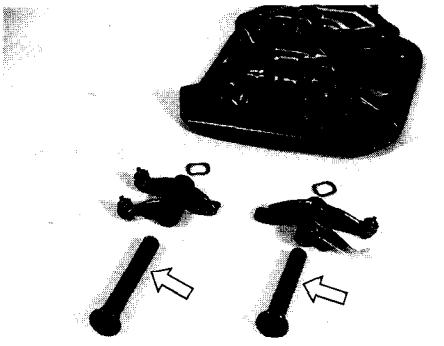
- Other procedures are the same manner of No. 1 (REAR) engine.

CAM SHAFT TIMING

- Turn the crankshaft so that the No. 1 (REAR) engine position is positioned at T.D.C.



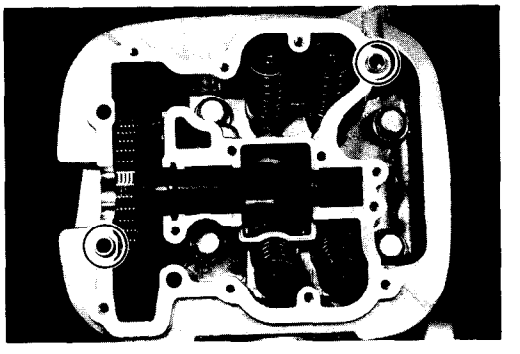
- Apply SUZUKI MOLY PASTE to the rocker arms and shafts.
- After inserting the shafts, tighten the shafts.



Tightening torque : 25 – 30 N·m
(2.5 – 3.0 kg-m, 18.0 – 21.5 lb-ft)

CAUTION:
* **Do not forget the wave washer.**
* **Use a new gasket on the rocker arm shaft to prevent oil leakage.**

- Thoroughly wipe off oil from the mating surfaces of cylinder head and cover.
- Fit the two dowel pins to the cylinder head side.
- Uniformly apply SUZUKI BOND NO. 1216 to the cylinder head surface.

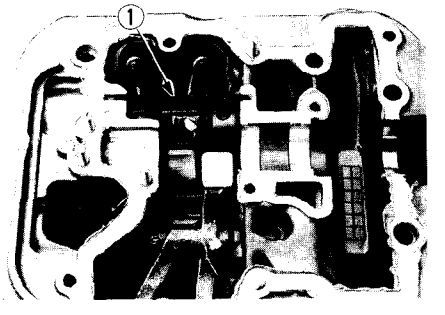


(For U.S.A. model)
99104-31160 : SUZUKI BOND NO. 1216
(For the other models)
99000-31160 : SUZUKI BOND NO. 1216

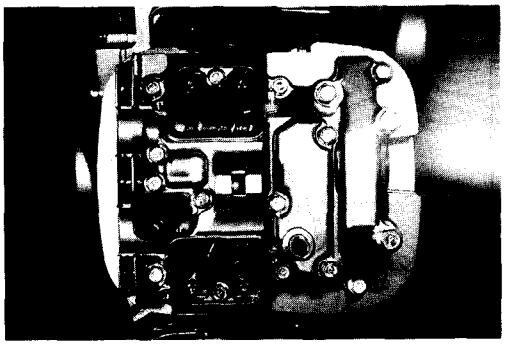
NOTE:
Do not apply SUZUKI BOND NO. 1216 to the camshaft end cap.

NOTE:
When tightening the cylinder head cover bolts, the piston must be at top dead center on the compression stroke.

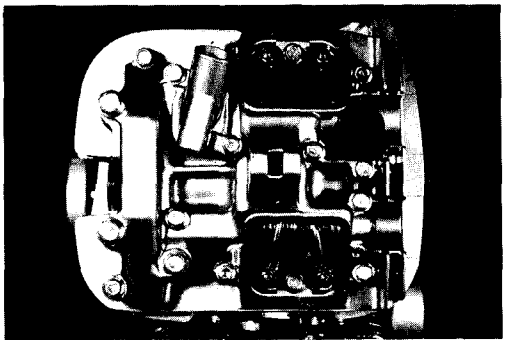
NOTE:
Do not forget the plate ① on No. 1 (rear) cylinder head cover.



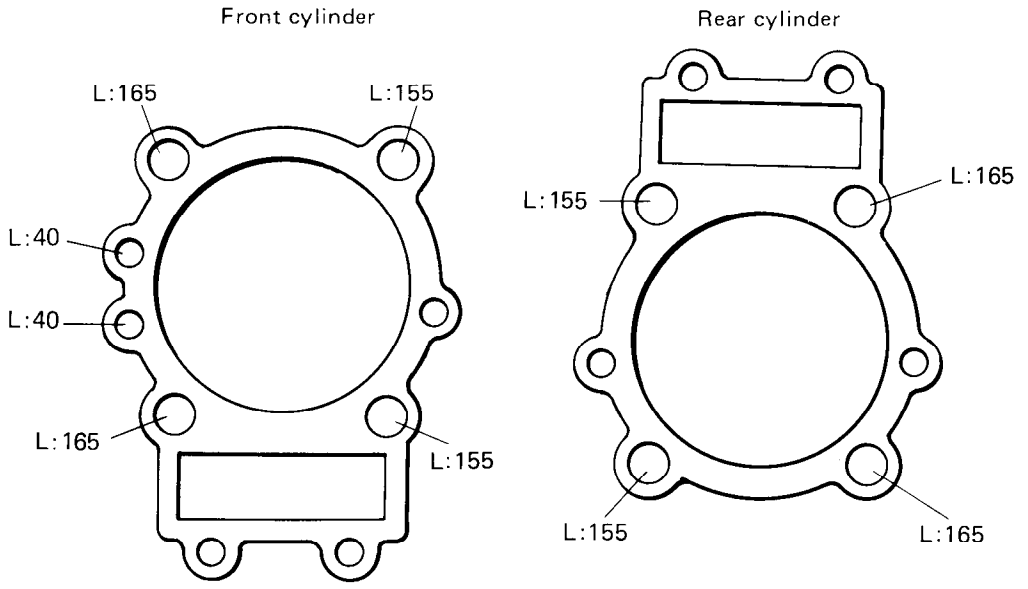
- Lightly tighten the cylinder head cover bolts diagonally, and then if everything is satisfactory, tighten securely with a torque wrench to the specified torque.



Tightening torque
6 mm : 9 – 11 N·m (0.9 – 1.1 kg-m, 6.5 – 8.0 lb-ft)
8 mm : 21 – 25 N·m (2.1 – 2.5 kg-m, 15.0 – 18.0 lb-ft)

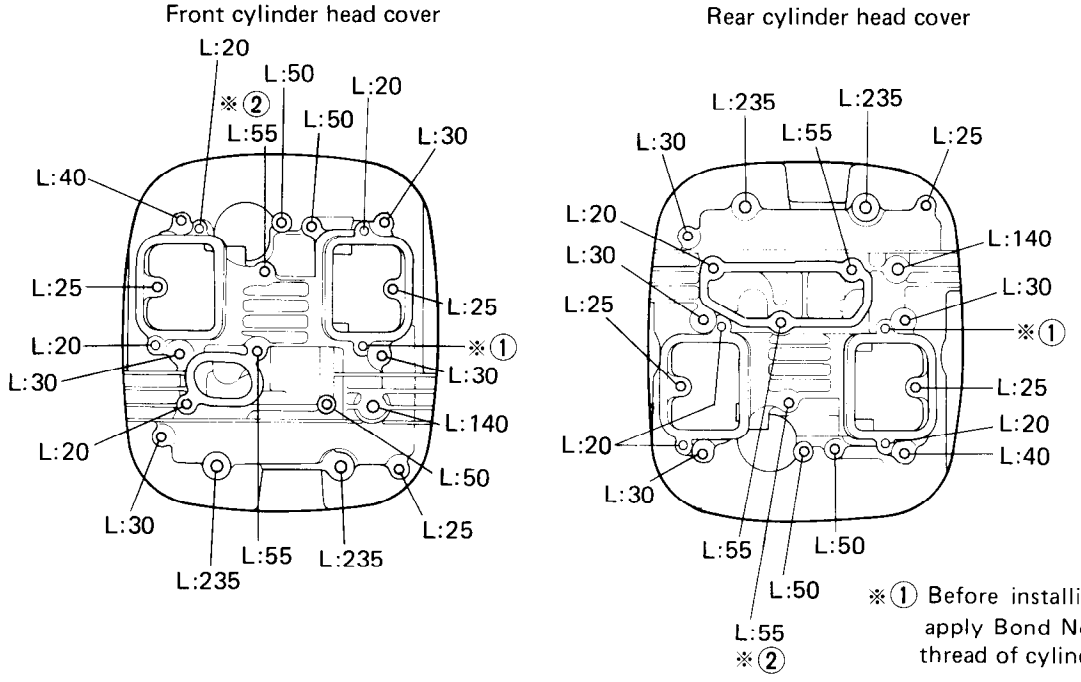


LOCATION OF CYLINDER HEAD BOLT



L: Length
Unit: mm

LOCATION OF CYLINDER HEAD COVER BOLT



※① Before installing the stud bolt apply Bond No. 1216 to the thread of cylinder head cover side.

※② Apply Bond No. 1215 to the thread of bolt.

L : Length Unit : mm

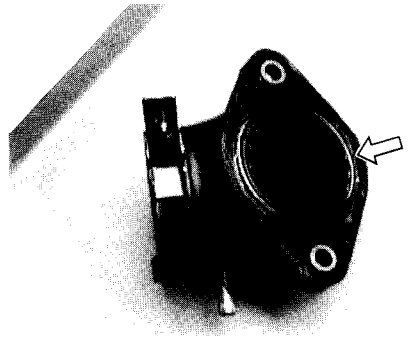
VALVE CLEARANCE

- Check and adjust the valve clearance. (Refer to page 2-5 for procedures.)

INTAKE PIPE

CAUTION:
When replacing the intake pipe, use a new O-ring to prevent sucking air from the joint.

- Coat the O-ring with grease.



VALVE INSPECTION CAP AND CAM TIMING INSPECTION CAP

- Before installing the valve inspection caps and cam timing inspection cap, coat the respective O-rings with grease.

CAUTION:
Replace the respective O-rings with new ones.