

# ENGINE

## CONTENTS

<b>ENGINE COMPONENTS REMOVABLE WITH ENGINE IN PLACE</b>	<b>3- 1</b>
<b>ENGINE REMOVAL AND REINSTALLATION</b>	<b>3- 2</b>
<b>ENGINE DISASSEMBLY</b>	<b>3-20</b>
<b>ENGINE COMPONENTS INSPECTION AND SERVICING</b>	<b>3-30</b>
<b>CYLINDER HEAD</b>	<b>3-30</b>
<b>CYLINDER AND EXHAUST VALVE</b>	<b>3-30</b>
<b>PISTON</b>	<b>3-31</b>
<b>PISTON PIN O. D.</b>	<b>3-32</b>
<b>PISTON RINGS</b>	<b>3-32</b>
<b>BEARINGS</b>	<b>3-33</b>
<b>OIL SEALS</b>	<b>3-33</b>
<b>CRANKSHAFT</b>	<b>3-34</b>
<b>CLUTCH PLATES</b>	<b>3-34</b>
<b>GEARSHIFT FORK CLEARANCE</b>	<b>3-35</b>
<b>ENGINE REASSEMBLY</b>	<b>3-37</b>
<b>TRANSMISSION GEARS AND RELATED PARTS</b>	<b>3-39</b>
<b>COUNTER SHAFT</b>	<b>3-40</b>
<b>DRIVE SHAFT</b>	<b>3-40</b>
<b>KICK</b>	<b>3-44</b>
<b>CLUTCH</b>	<b>3-44</b>
<b>PISTON AND RINGS</b>	<b>3-50</b>
<b>EXHAUST VALVE</b>	<b>3-51</b>
<b>CYLINDER</b>	<b>3-52</b>
<b>CILINDER HEAD</b>	<b>3-52</b>

## ENGINE COMPONENTS REMOVABLE WITH 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 the section for removal and reinstallation instructions.

ENGINE LEFT SIDE	ENGINE CENTER	ENGINE RIGHT SIDE
• Engine sprocket and drive chain . . . . . 3- 5	• Carburetors . . . . . 3- 3	• Clutch cover . . . . . 3-22
• Magneto cover . . . . . 3- 5	• Radiator . . . . . 3- 4	• Water pump . . . . . 3-22
• Oil pump . . . . . 3-16	• Muffler . . . . . 3- 6	• Clutch . . . . . 3-23
• Gearshift lever . . . . . 3-17	• Actuator . . . . . 3- 8	• Gearshift shaft . . . . . 3-24
• Magneto stator . . . . . 3-20	• Cylinder head . . . . . 3-18	• Transmission assembly . . . . . 3-24
• Pick-up coil . . . . . 3-20	• Cylinder and exhaust valve . . . . . 3-18	• Primary drive and driven gears . . . . . 3-25
• Neutral indicator switch . . . . . 3-21	• Piston . . . . . 3-20	
	• Crankshafts . . . . . 3-27	
	• Upper crankcase . . . . . 3-29	

## ENGINE REMOVAL AND REINSTALLATION

### ENGINE REMOVAL

Before taking the engine out of the frame, wash the engine with a steam cleaner, and drain transmission oil and cooling solution etc. The procedure of engine removal is sequentially explained in the following steps, and engine installation is effected by reversing the removal procedure.

- Remove the lower fairings. (Refer to page 7-1.)
- Loosen the seat attaching bolt and remove the seat.
- Loosen the left frame cover attaching screws to detach the left frame cover.

#### NOTE:

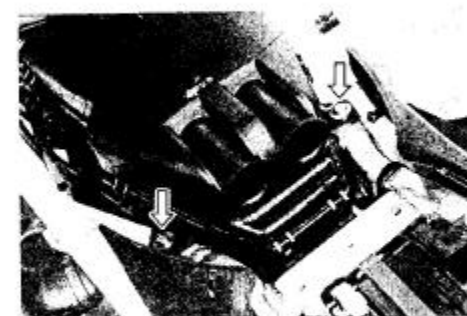
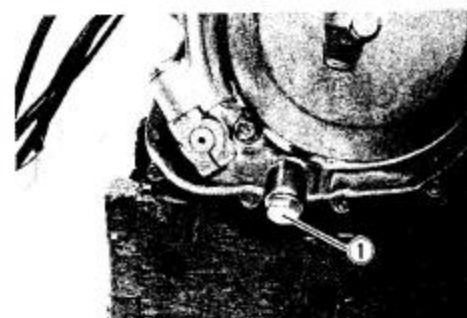
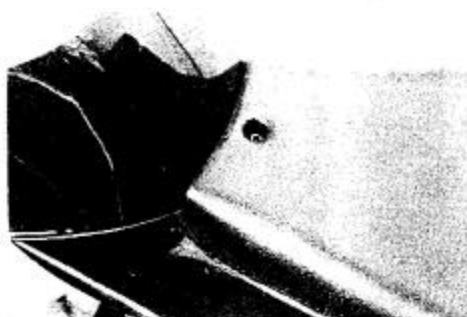
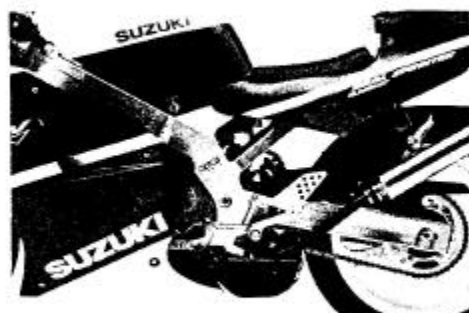
*To prevent damage to the frame cover, the seat must be removed before frame cover is detached.*

- Turn the fuel cock to the OFF position.
- Shift the hose clip sideways and disconnect the fuel hose.
- Remove the fuel tank.

- Place an remove the oil drain plug and filler plug to drain out transmission oil.
- Remove the radiator cap and drain hose, and drain cooling solution completely.

① Transmission oil drain plug

- Remove the air cleaner clamp screws.
- Remove the battery  $\ominus$  and  $\oplus$  lead wires.

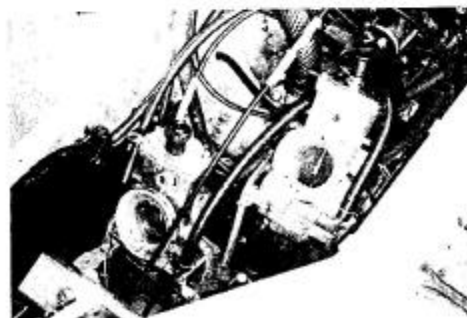


### 3-3 ENGINE

- Remove the idle adjustment bracket screws.
- Shift the hose clip sideways and disconnect the Suzuki Intake Pulse Control (S.I.P.C.) hoses.



- Loosen the carburetor clamp screws.
- Move the air cleaner case rearward, and remove the carburetors.
- Remove the gearshift lever.

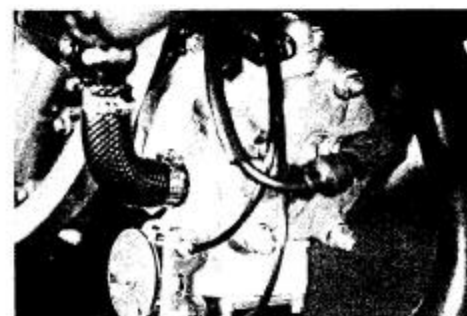


- Loosen the clamps and disconnect the following lead wires.

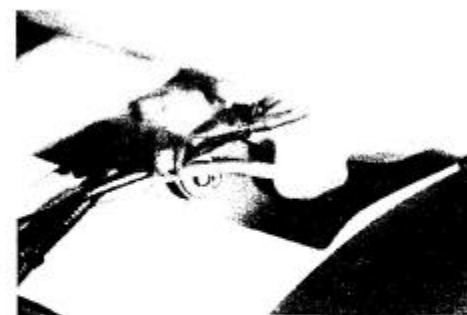
- Neutral indicator switch lead.
- Magneto lead
- Regulator/Rectifier lead



- Disconnect the spark plug caps from the spark plugs.



- Shift the hose clip sideways and disconnect the oil hose.



- Unclamp the radiator hoses at engine side and remove the radiator from the chassis.

**CAUTION:**

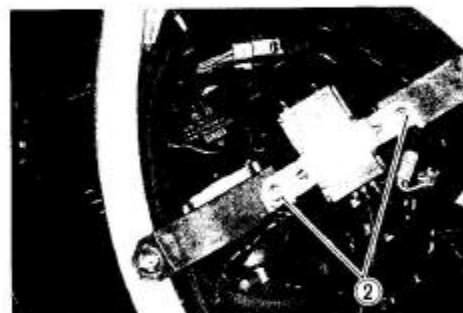
When loosening the radiator mounting nuts, hold the damper with open end wrench.

Radiator mounting nut  
tightening torque: 7 – 9 N·m (0.7 – 0.9 kg·m)

- Disconnect the clutch cable ①.



- Loosen the box bracket screws ②.



- Remove the junction box cap ③.



- Remove the magneto cover.



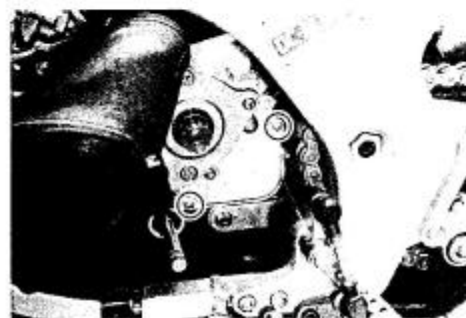
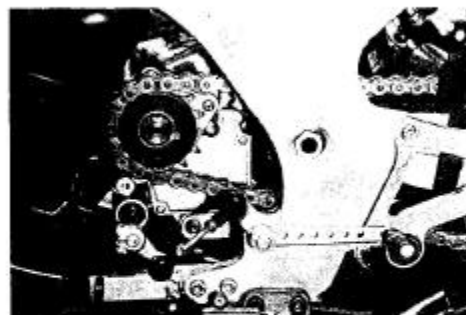
### 3-5 ENGINE

- Remove the engine sprocket from the drive shaft using the snap ring pliers.

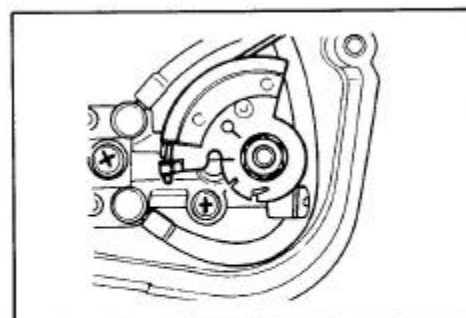
#### 09900-06107: Snap ring pliers

- Remove the gear shift lever.
- Loosen the rear axle nut and drive chain adjusters.
- Push the rear wheel forward or remove the rear wheel, and disengage the drive chain from the rear sprocket.
- Disengage the drive chain from the engine sprocket, and remove the engine sprocket.

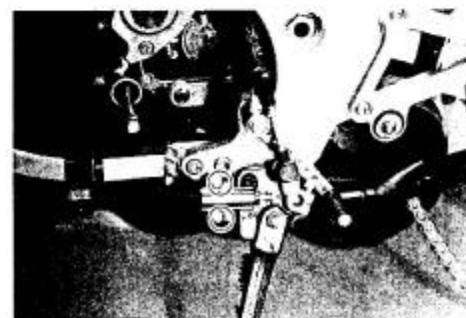
- Remove the oil pump inspection cap.



- Slightly pry the tab on the oil pump lever to remove the control cable.



- Remove the side stand switch.



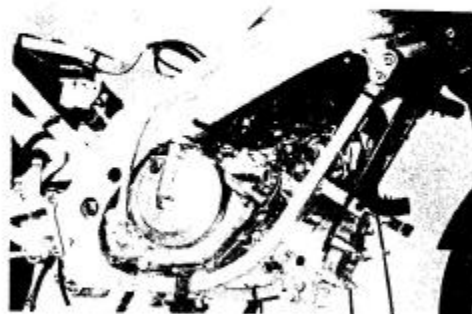
- Remove the right and left mufflers by unscrewing muffler mounting bolts and exhaust pipe clamp nuts.

#### NOTE:

*When reinstalling the mufflers, always use a new exhaust pipe gasket.*



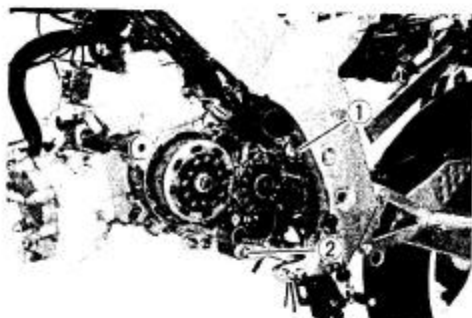
- Remove the three engine mounting nuts.
- Remove the engine mounting brackets.



- Remove the engine mounting bolt ① and engine mounting bolt ②.

**CAUTION:**

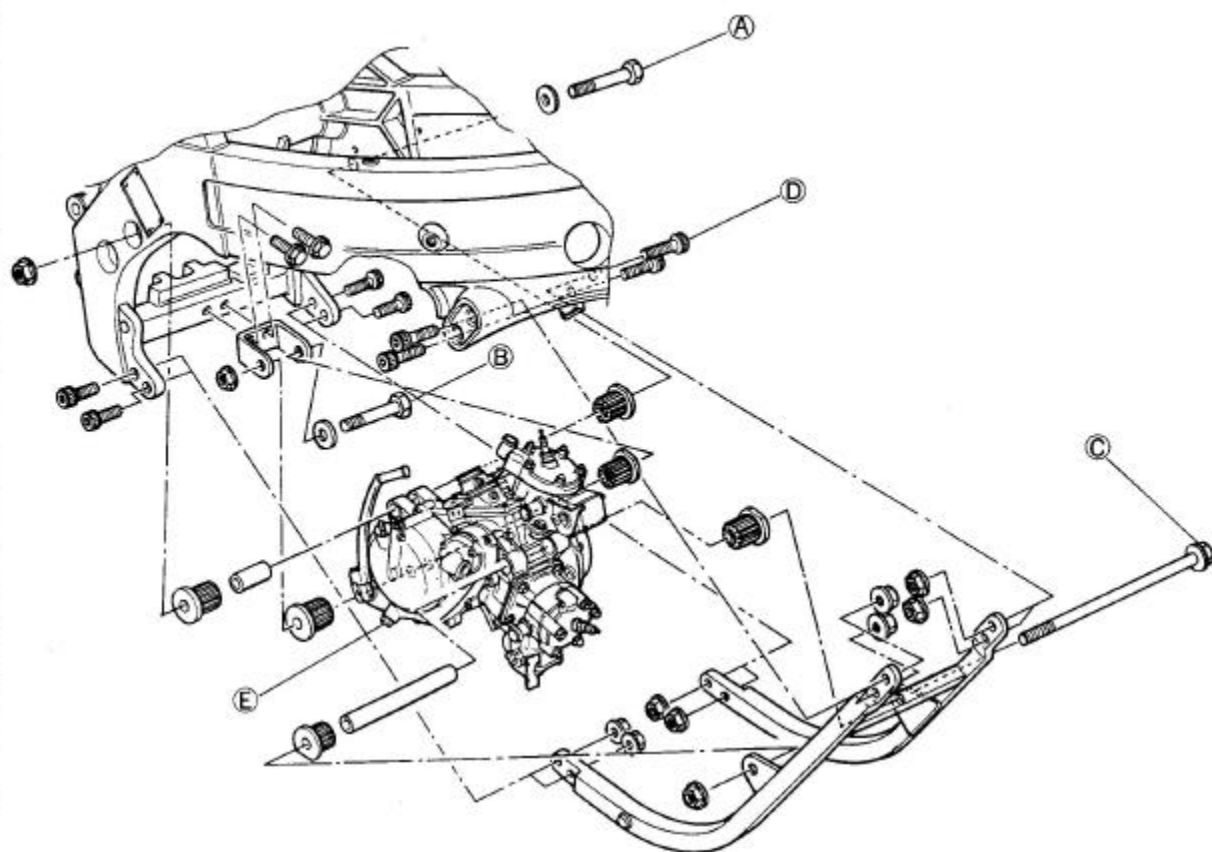
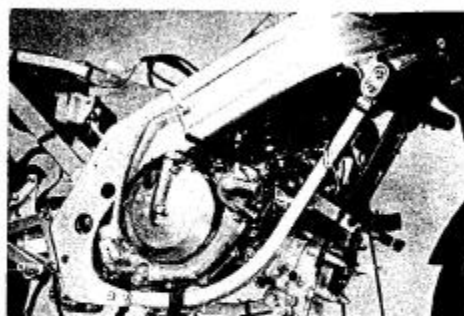
Care should be taken not to drop the engine accidentally when the engine mounting bolts are removed.



**ENGINE REINSTALLATION**

Reinstall the engine in the reverse order of engine removal.

- When remounting the engine, engage the drive chain to the engine sprocket and mount the engine sprocket to the drive shaft.



Tightening torque

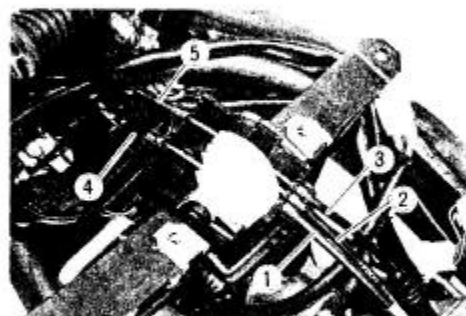
⑤	N·m	kg·m
Transmission oil drain plug	20 - 25	2.0 - 2.5

Tightening torque

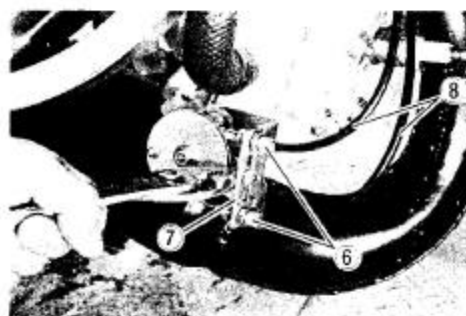
Item	N·m	kg·m
①	60 - 70	6 - 7
②	28 - 34	2.8 - 2.4
③	60 - 72	6.0 - 7.2
④	22 - 28	2.2 - 2.8



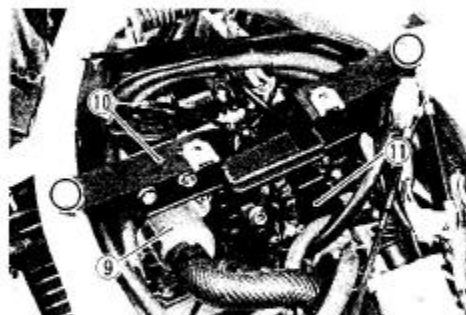
- Disconnect the oil control cable ①.
- Disconnect the throttle cables ② and ③.
- Disconnect the actuator cable ④.
- Disconnect the throttle cable ⑤.



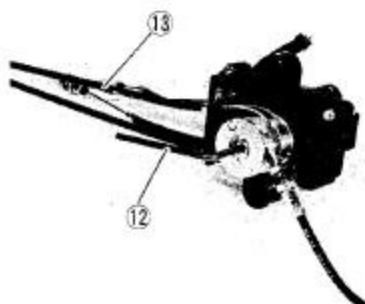
- Loosen the exhaust valve cable adjuster ⑥.
- Remove the exhaust valve cable bracket ⑦.
- Remove the exhaust valve cables ⑧ from the pulley.



- Remove the thermostat case ⑨.
- Remove the electric parts holder ⑩ from the frame.
- Remove the actuator assembly ⑪.

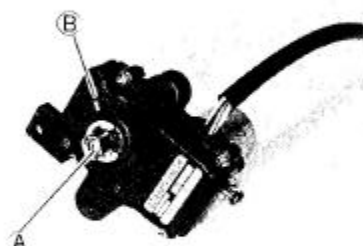


- Remove the actuator pulley ⑫ from the shaft.
- Disconnect the cables ⑬.



## ACTUATOR AND CABLE ASSEMBLY

- Verify that the line ① on the actuator shaft is pointing the line ② on the body.

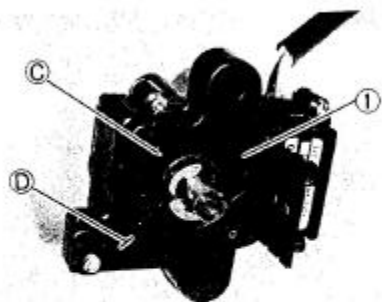


### 3-9 ENGINE

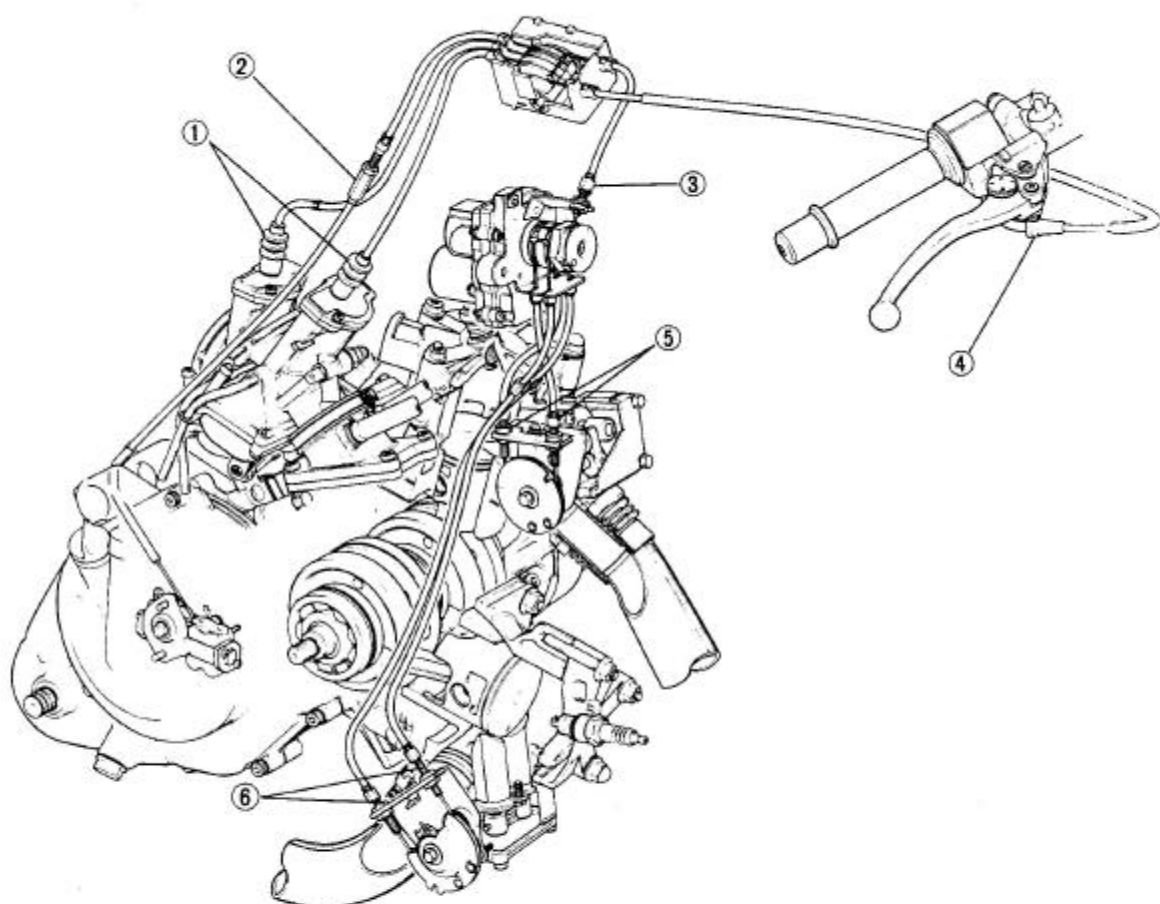
- Install the actuator cable bracket ① on the actuator assembly. Note that there are two lines, ③ and ④, on the bracket:

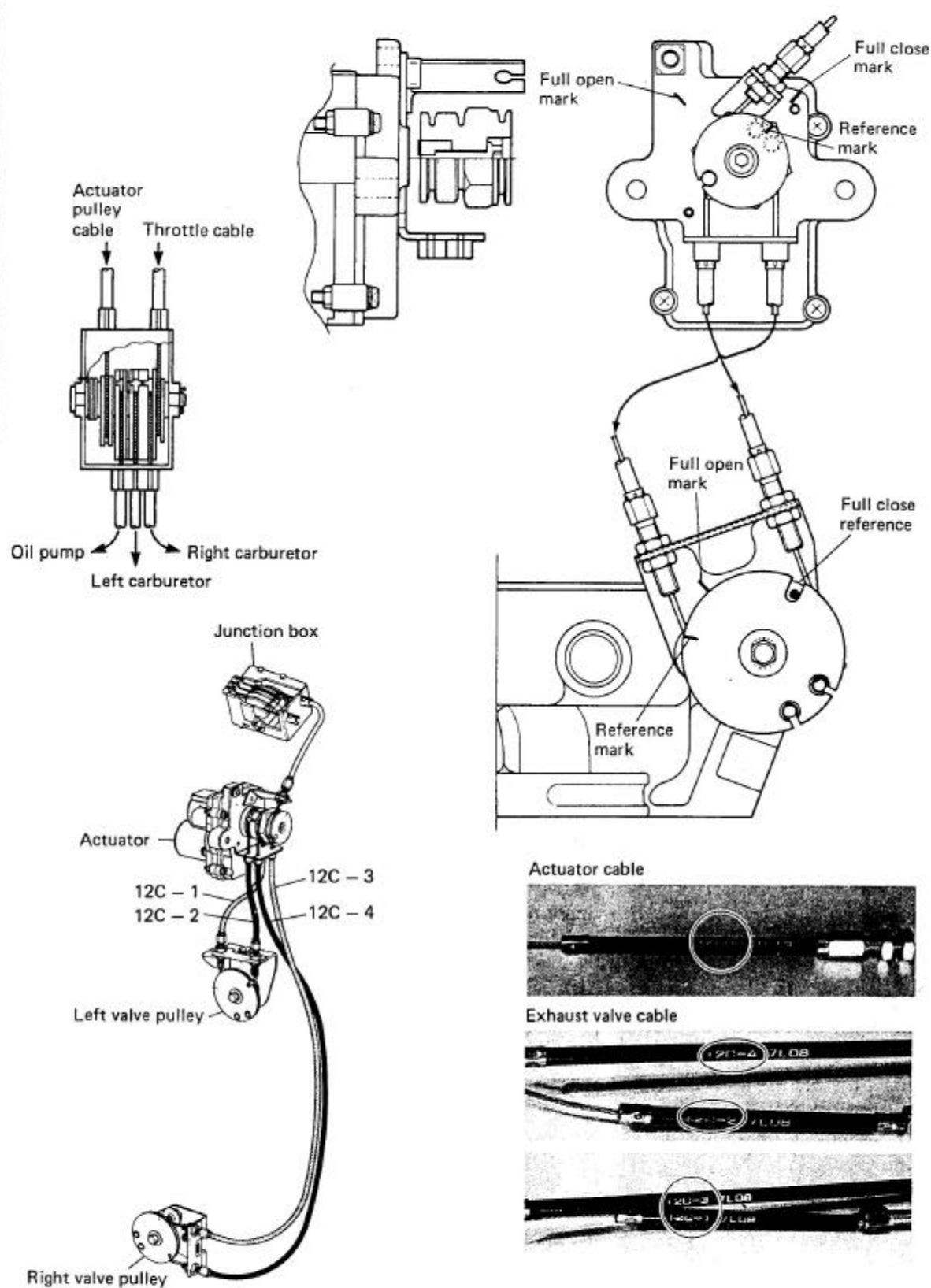
Line ③ — full close position;

Line ④ — full open position.



- ① Throttle cable adjuster (carburetor side)
- ② Oil pump cable adjuster
- ③ Actuator cable adjuster
- ④ Throttle cable adjuster (throttle grip side)
- ⑤ Left exhaust valve cable adjuster
- ⑥ Right exhaust valve cable adjuster



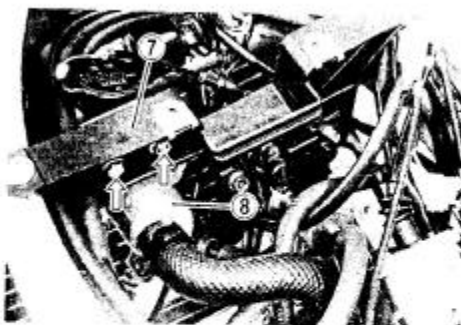
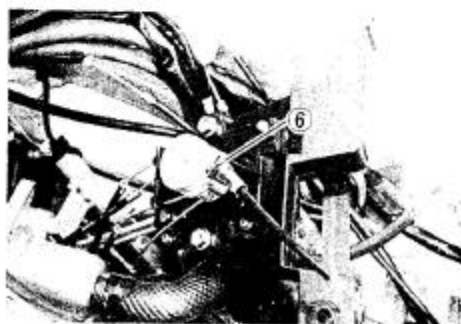
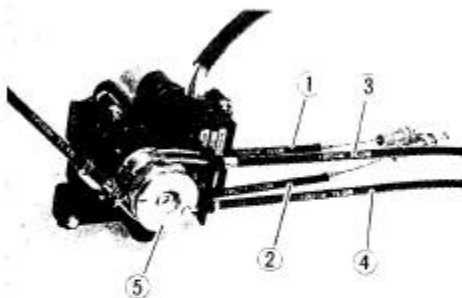


### 3-11 ENGINE

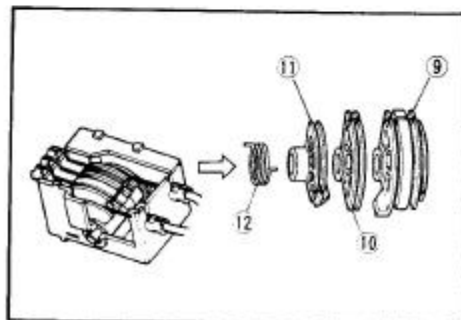
- Connect all the cables to the actuator pulley ⑤ properly.
  - Cable ① identification marking: (12C-1)
  - Cable ② identification marking: (12C-2)
  - Cable ③ identification marking: (12C-3)
  - Cable ④ identification marking: (12C-4)
- Mount the pulley ⑤ on the actuator.

Tightening torque: 4 – 6 N·m (0.4 – 0.6 kg·m)

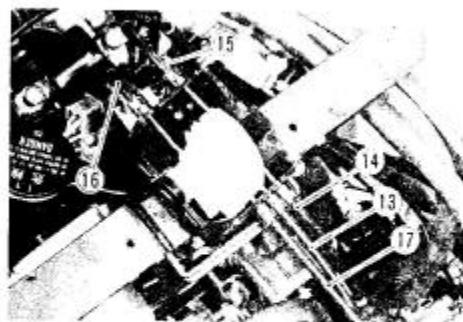
- Install the actuator assembly ⑥ to the electric parts holder.
- With the actuator mounted, install the electric part holder ⑦ on the frame.
- Install the thermostat case ⑧.



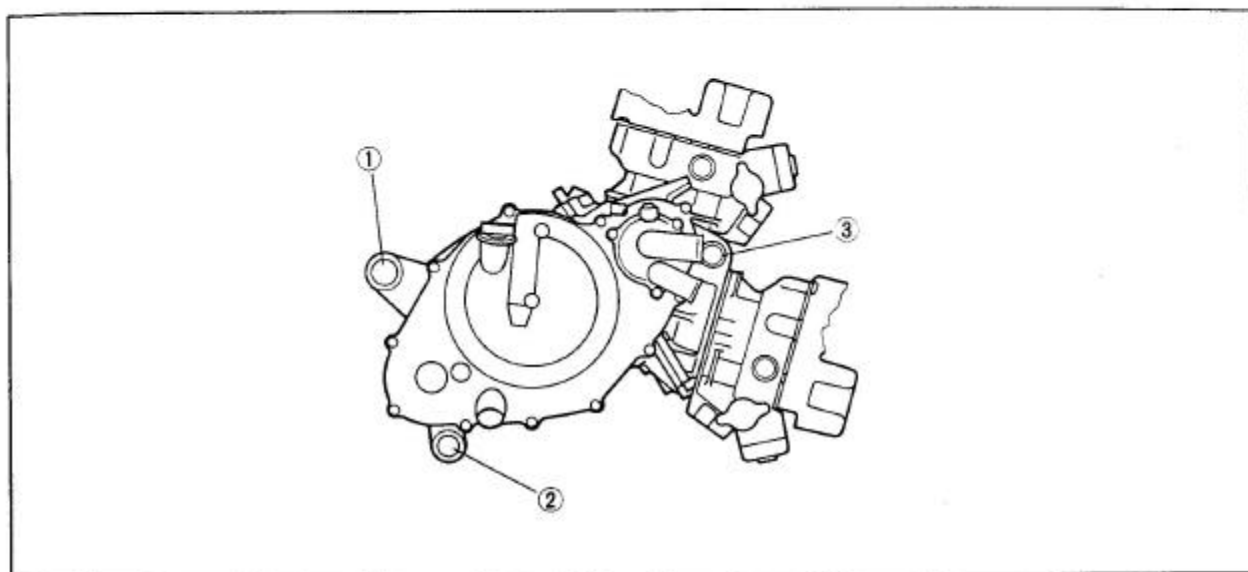
- Assemble the throttle cable pulleys.
  - Throttle cable pulley ⑨
  - Oil pump pulley ⑩
  - Actuator pulley ⑪
  - Spring ⑫
- Insert the pulley shaft in position.



- Connect the cables.
  - Throttle cable No. 1: ⑬
  - Throttle cable No. 2: ⑭
  - Throttle cable No. 3: ⑮
  - Actuator cable ⑯
  - Oil pump cable ⑰
- Cover the junction box properly with its cap.



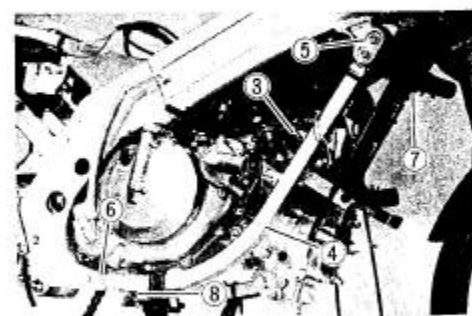
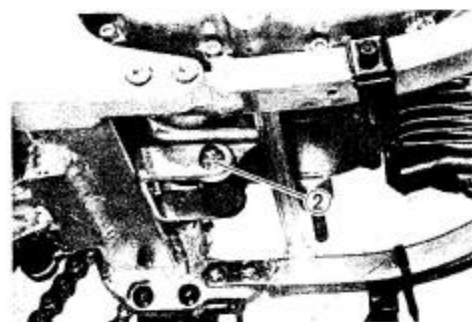
## ENGINE REINSTALLATION



- Position the engine assembly on the frame and insert the rear mounting bolt ① then the under mounting bolt ②.

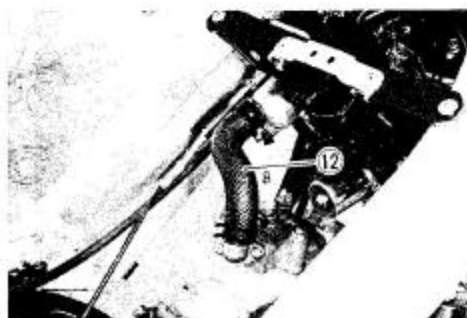
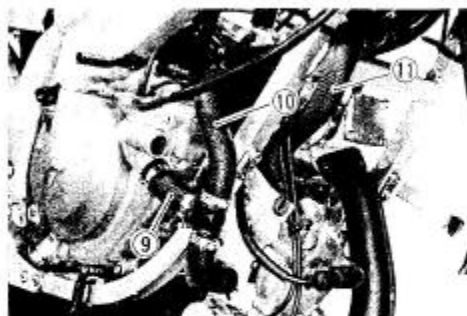


- Attach the frame down tube ④ on the frame and insert the engine front mounting bolt ③.
- Tighten the frame down tube attaching bolts and nuts ⑤, ⑥, ⑦ and ⑧ temporarily.
- When all the fasteners are positioned properly, tighten them to the specified torque:

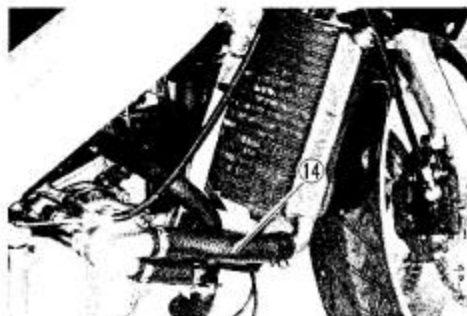


### 3-13 ENGINE

- Install the water hoses ⑨, ⑩, ⑪ and ⑫.
- Secure the water hoses with clamp properly.



- Install the radiator assembly.
- Install the water hoses, ⑬ and ⑭.
- Secure the water hoses with clamp properly.



- Connect the transmission oil overflow hose ⑮.

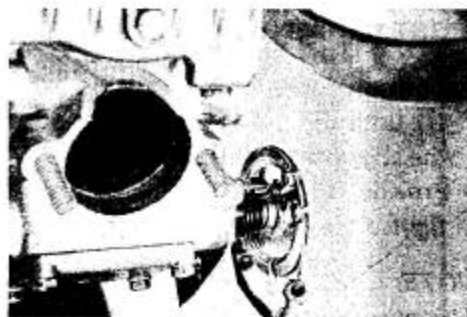


## EXHAUST VALVE PULLEY ADJUSTMENT

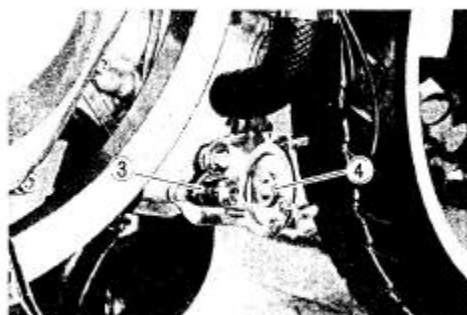
- Turn on the ignition switch.
- Check that the index line ① on the actuator pulley is pointing to the line ② on the bracket.



- Connect the exhaust valve control cables to the pulleys.

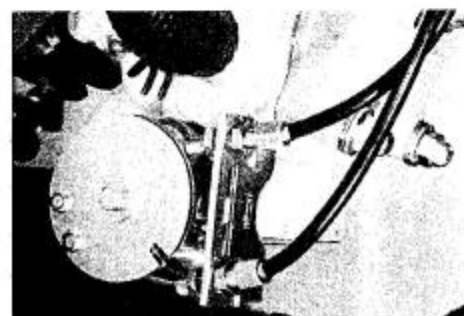
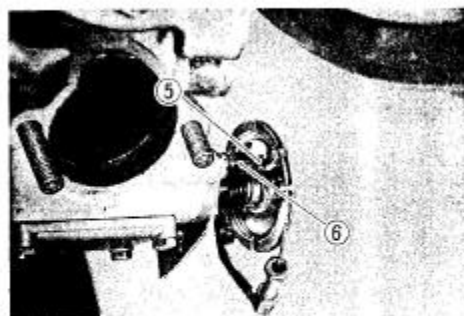


- Hitch the spring end ③ to the pulley lever ④ and tighten the pulley.

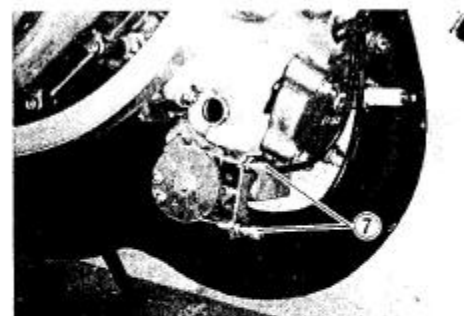




- Verify that the spring end ⑤ is securely hitched to the exhaust valve lever ⑥.



- Slacken the cable by loosening the cable adjusters ⑦. Do the same procedure also on the left exhaust valve.

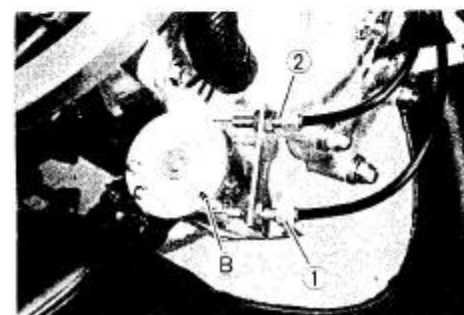


#### RIGHT EXHAUST VALVE CABLE ADJUSTMENT

- Turn the lock nut to move the exhaust valve cable adjuster ① until the pulley alignment slot comes in alignment with the alignment hole ②.
- Provide 0.5 mm (0.02 in) of play on the cable ③ and tighten the adjuster lock nuts.

#### NOTE:

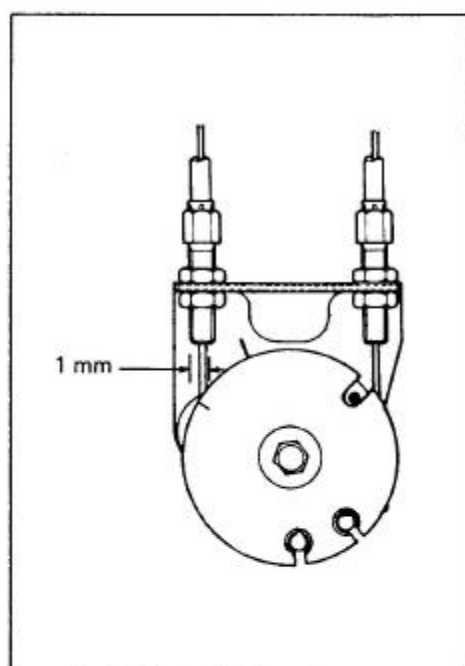
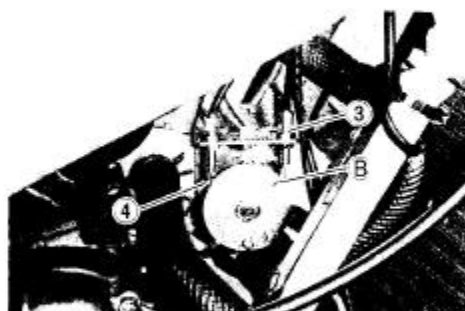
*This alignment procedure is carried out with the pulley spring tension effective.*





## LEFT EXHAUST VALVE CABLE ADJUSTMENT

- Turn the lock nut to move the exhaust valve cable adjuster ③ until the pulley alignment slot comes in alignment with the alignment hole ②.
- Give the cable ④ 1 mm of slack as measured by deflection when the inner cable is lightly pushed sideways by finger.
- Tighten the lock nuts.



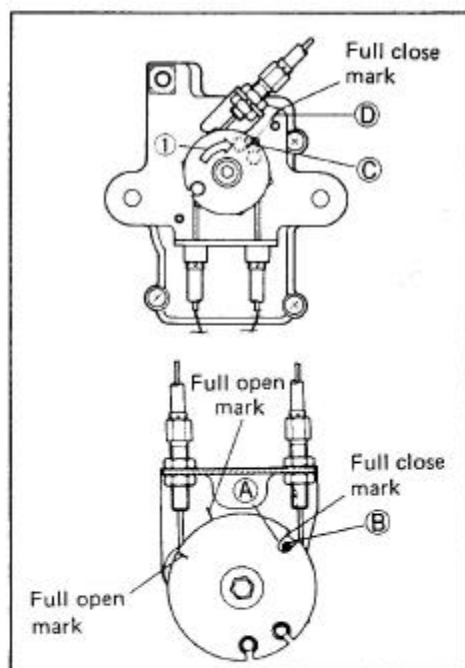
## ACTUATOR AND EXHAUST VALVE FUNCTION CHECK

### NOTE:

The ignitor checker can be used for this check.

- When the ignition switch is turned on, the actuator slowly turns until it reaches the full close position (from which the operation begins).

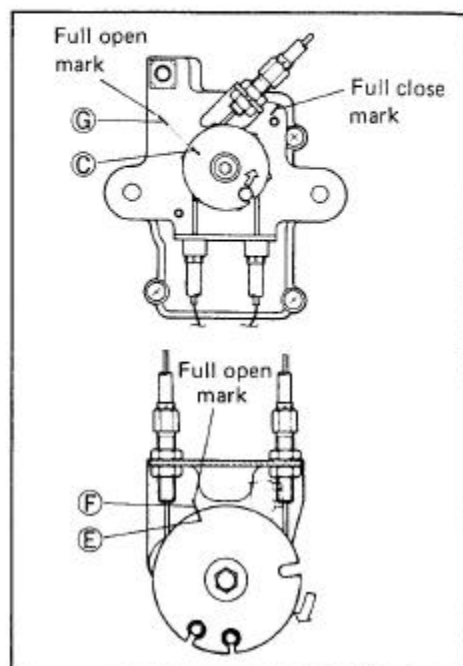
With the pulley's index line ③ aligned with line ④ on the bracket, check the exhaust valve pulley position. The exhaust valve pulley should take the position where its alignment slot ① aligns with the alignment hole ②.



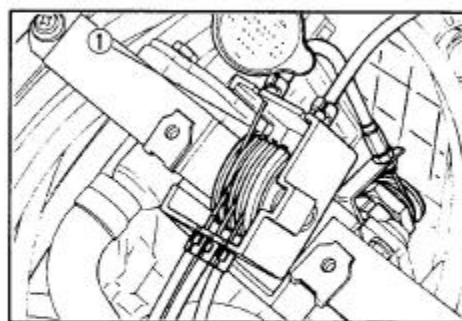
- Start the engine and raise the revolutions to more than 8 000 – 8 500 rpm and check that the actuator pulley returns to the full open position where the pulley's index line (C) is pointing the line (G). With the actuator held in this position, check the exhaust valve pulley position. The exhaust valve pulley index line (E) should be approximately at the line (F).

**NOTE:**

The actuator stops and holds the current pulley position the moment the ignition switch is turned off. This feature may be used for facilitating the pulley alignment inspection procedure.

**ACTUATOR CABLE ADJUSTMENT**

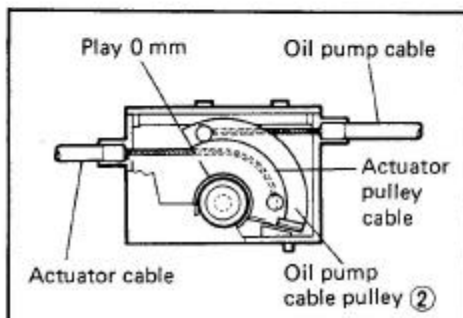
- Verify that the actuator pulley adjustment is properly made.
- Verify that the oil pump cable is properly adjusted relative to the throttle cable (adjusted at the 1/2 opening).
- Verify that the throttle cable is not tensioned.
- Turn the actuator cable adjuster (1) to pull the cable and stop it at the position where the oil pump cable pulley (2) begins to move. At this position, set the actuator cable adjuster and tighten the lock nut.

**CAUTION:**

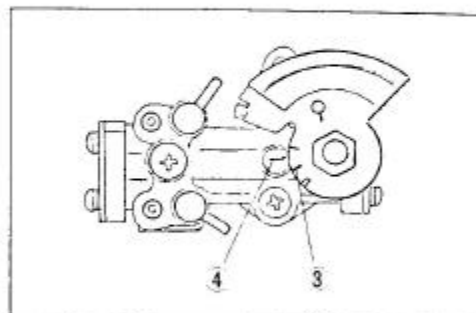
This adjustment must be made when the junction box is positioned in the actual location.

**NOTE:**

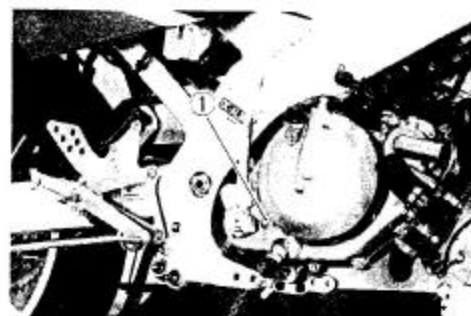
Actuator cable play: 0 mm (0 in)



- The oil pump lever line ③ should come approximately to the line ④ on the body when the engine is revved over 8 500 rpm.

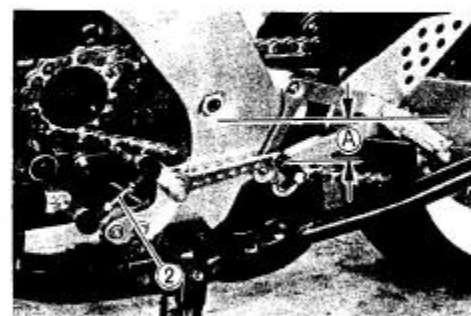


- Pour 700 ml (23.7/24.6 US/Imp oz) (when overhauling engine) of transmission oil **SAE 10W/40 MOTOR OIL** into the engine. Check the oil level by removing the transmission oil level screw ①.



- Install the gear shift lever and adjust the height ① by turning the adjuster ②.

Gearshift pedal height: 50 – 60 mm (1.97 – 2.36 in)



### 3-19 ENGINE

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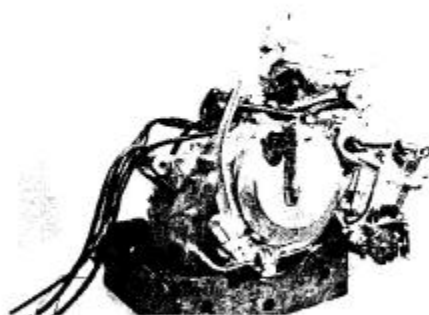
- After remounting the engine, route wiring harness, hoses and cables properly by referring to the sections, wire routing and cable routing, and adjust the following items to the specification.

	Page
* Rear brake pedal .....	2-12
* Brake light switch .....	2-12
* Clutch cable .....	2- 8
* Throttle cables .....	2- 6
* Choke cables .....	2- 6
* Idling adjustment .....	2- 5
* Filling cooling solution .....	2- 8
* Exhaust valve operation .....	6-11
* Oil pump control cable .....	2- 7
* Bleeding air from oil pump .....	4- 9

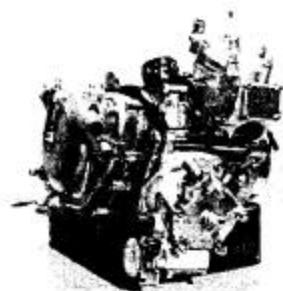
## ENGINE DISASSEMBLY

- Remove the kick starter lever.

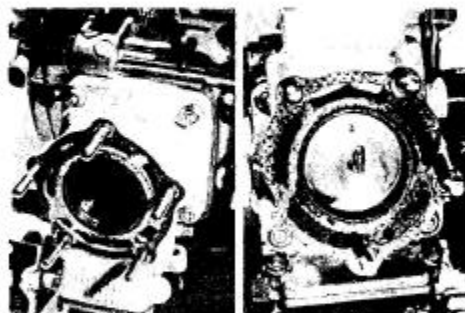
Tightening torque: 18 – 28 N·m (1.8 – 2.8 kg·m)



- Remove the cylinder head.



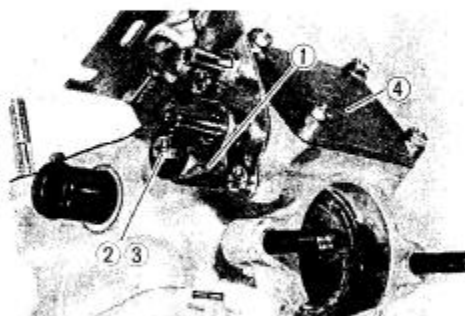
- Remove the cylinder.



- Remove the exhaust valve pulley (A).

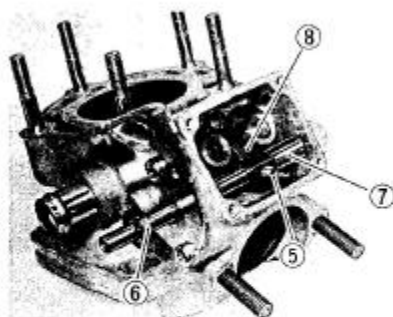


- Remove the exhaust valve pulley lever (1).
- Remove the exhaust valve lever set screw (2) and washer (3).
- Remove the cylinder cover (4).

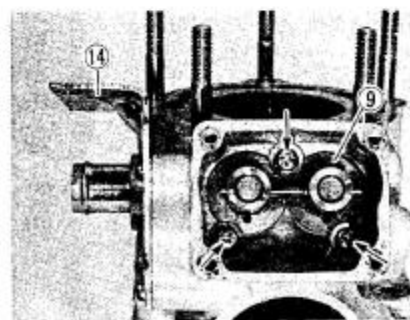


### 3-21 ENGINE

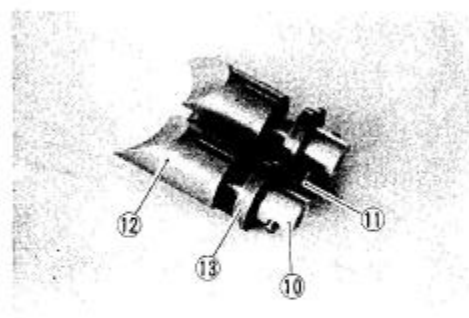
- Loosen the exhaust valve shaft arm bolt (5).
- Pull out the shaft (6).
- Remove the spacer (7).
- Remove the exhaust valve shaft arm (8).



- Slide out the exhaust valve assembly (9).



- Disassemble the spacer (10), pin (11), valve (12) and guide (13).



- Remove the oil seal retainer (14).
- Remove the oil seal (15).

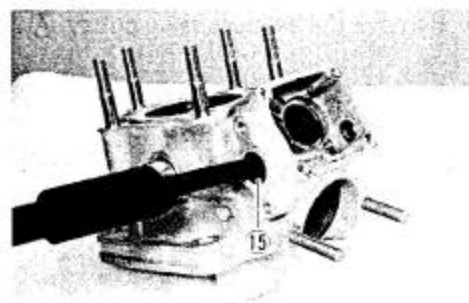
09921-20200: Bearing remover

**NOTE:**

*Disassemble the Right cylinder in the same way at Left.*

**CAUTION:**

Do not confuse the disassembled parts between the Left and Right cylinders.



- Place a cloth beneath the piston so as not to drop the parts in the crankcase, and remove the circlip.



- Remove the piston, piston pin bearing and thrust washers.

09910-34510: Piston pin pulley

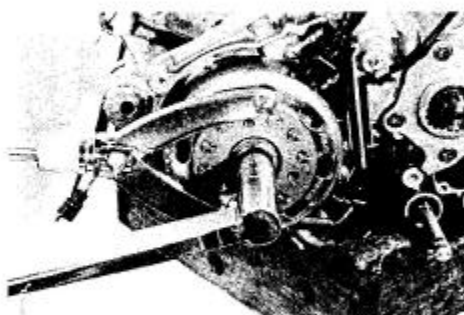
**NOTE:**

*Scribe the cylinder No. on the piston crown.*



- Remove the magneto rotor nut while holding the rotor with the special tool.

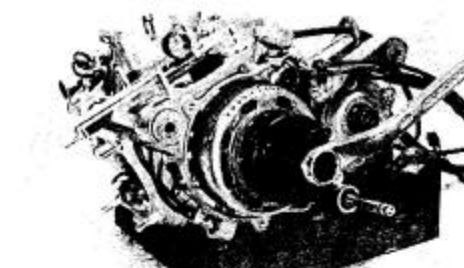
09930-40113: Rotor holder



- Remove the rotor with the special tool.

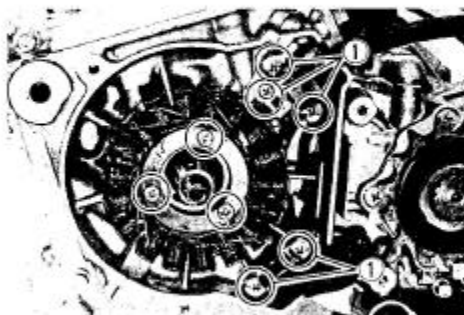
09930-30190: Attachment F

- Remove the key from the crankshaft.



- Remove the signal generator lead wire clamp screws ① and remove the stator bolts with the impact driver.

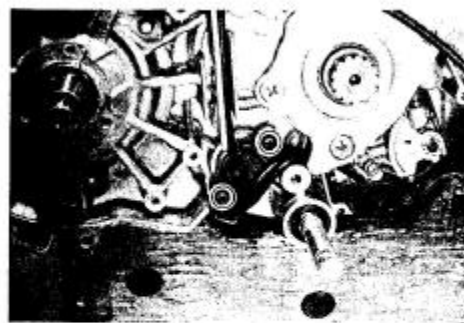
09900-09003: Impact driver set



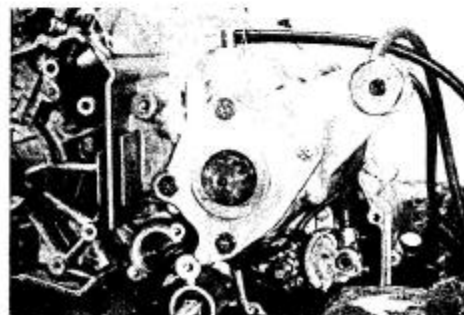
### 3-23 ENGINE

- Remove the circlip from the drive shaft with a snap ring pliers.

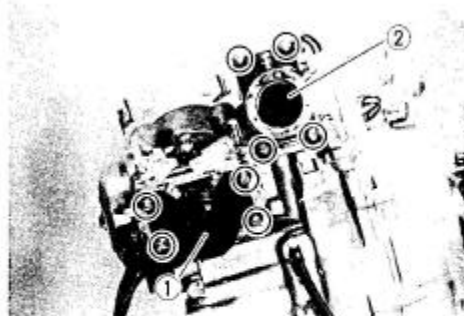
09900-06107: Snap ring pliers



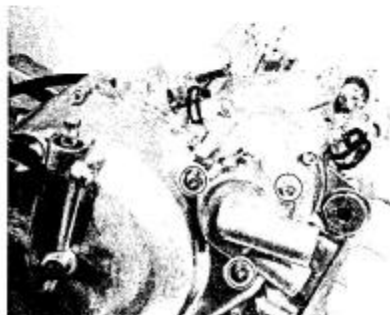
- Remove the oil pump.
- Remove the neutral switch body, O-ring, switch contact and spring.



- Remove the intake pipes ① and ②.
- Remove the reed valve.



- Remove the water pump case.

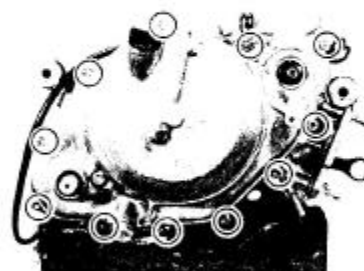


- Remove the impeller.

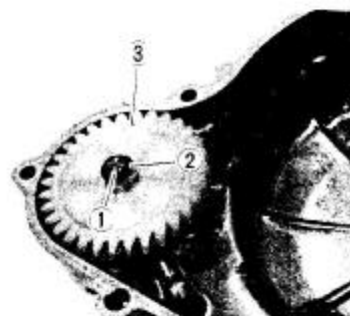




- Remove the clutch cover and gasket.



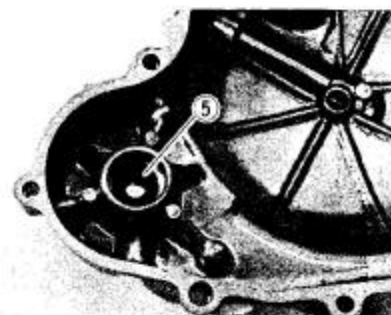
- Remove the water pump driven gear circlip ①.
- Remove the wave washer ②.
- Remove the water pump driven gear ③.
- Remove the pin and washer.



- Remove the water pump shaft ④.

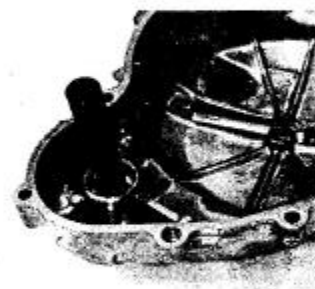


- Remove the water pump shaft oil seal ⑤.



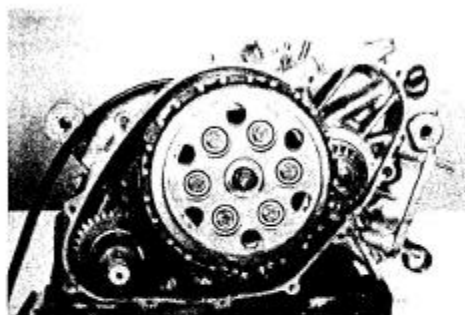
- Remove the mechanical seal.

09925-98220: Bearing installer



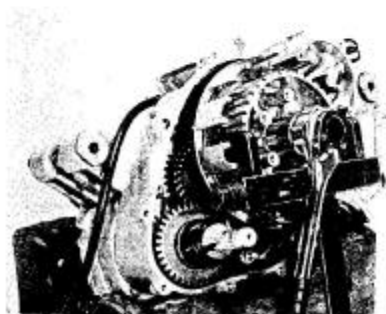
- Remove the clutch springs and pressure plate with clutch release rack.

09910-20115: Conrod holder

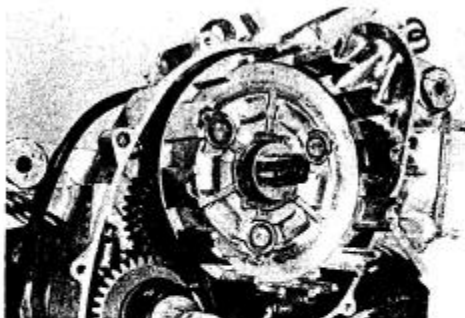


- Flatten the clutch sleeve hub nut lock washer with a chisel.
- Hold the clutch sleeve hub securely with a clutch sleeve hub holder and loosen the hub nut with a socket wrench.

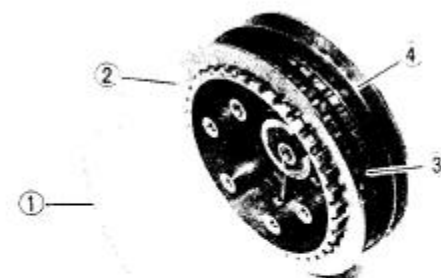
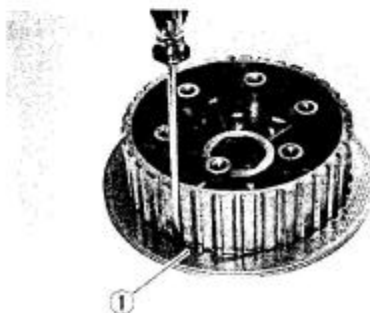
09920-53710: Clutch sleeve hub holder



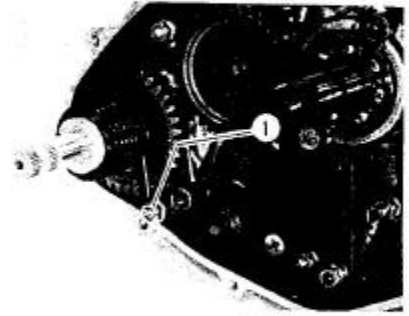
- Remove the clutch sleeve hub, thrust washer and primary driven gear.



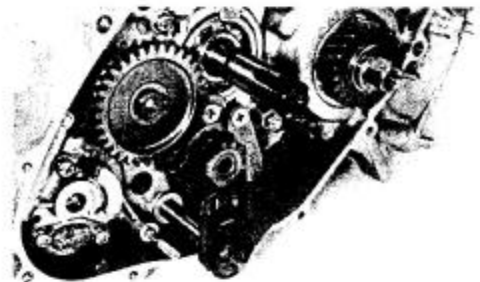
- Remove the clutch sleeve hub assembly and disassemble the following parts:  
Ring ①, Driven plate No. 2 ②, Wave washer ③ and seat ④.



- Remove the kick spring stopper nut ①.
- Remove the spring hook.
- Remove the spring guide.
- Remove the spring.
- Remove the kick gear.
- Remove the kick shaft.

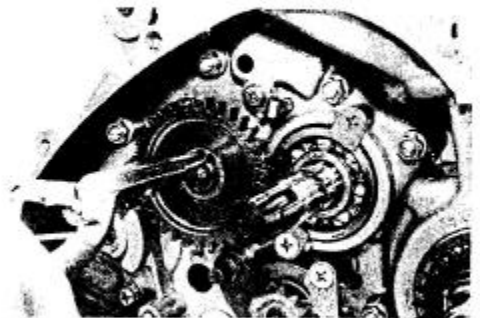


- Remove the gearshift shaft.

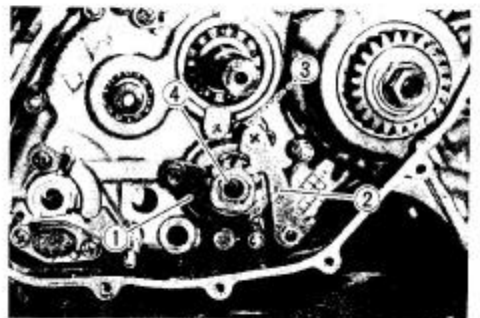


- Remove the circlip with the special tool and detach the flat washer or wave washer, whichever is fitted. Then, draw out the kick starter idle gear and washer.

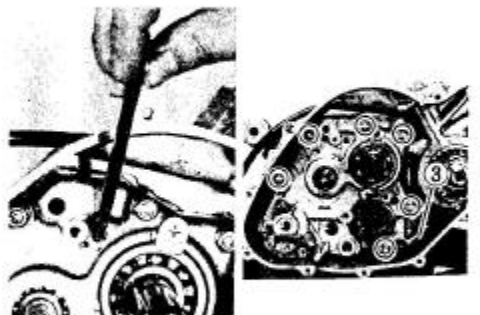
09900-06107: Snap ring pliers



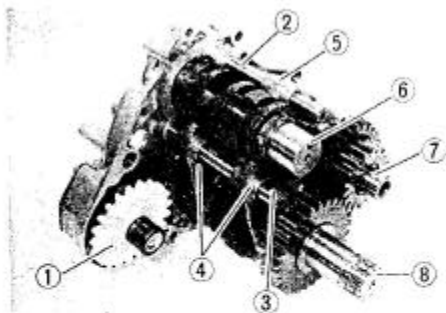
- Remove the pawl lifter ①, cam guide ②, cam stopper ③ and driven gear ④.



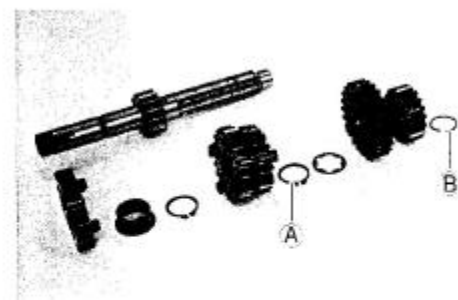
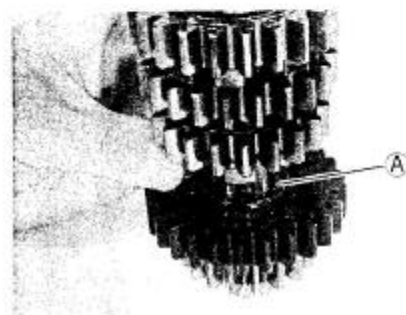
- Remove the transmission oil guide.
- Flatten the lock washers and loosen the bolt and nuts of the transmission gearcase.



- Remove the oil pump driven gear ①.
- Pull out the gearshift fork shafts ② and ③, and remove the gearshift fork shafts ④ and ⑤.
- Pull out the gearshift cam shaft ⑥.
- Remove the countershaft ⑦ and drive shaft ⑧.
- Disassemble the gears following the instructions below.



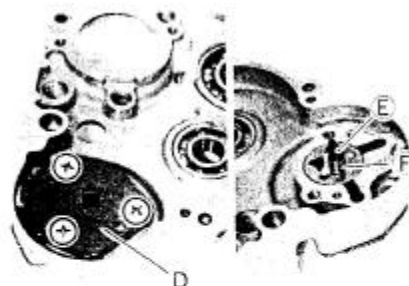
- Countershaft gears: To disassemble the 2nd drive gear, the ring (B) should be removed after the circlip (A).



- Remove the oil pump strainer (C).



- Remove the trochoid oil pump cover (D).
- Pull off the pump shaft (E) and pin (F).



- Remove the drive shaft bearing retainer ①.



- Carefully force out the drive shaft bearing with the special tool.

09943-88211: Bearing installer



- Remove the countershaft bearing in the same manner as drive shaft bearing.

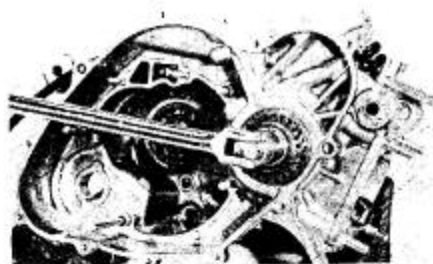
09913-80112: Bearing installer



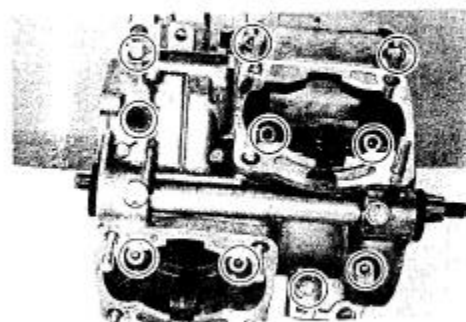
- Flatten the lock washer and remove the primary drive gear nut with the special tool.

09910-20116: Conrod holder

- Remove the primary drive gear and washer.



- Loosen the crankcase bolts.



**NOTE:**

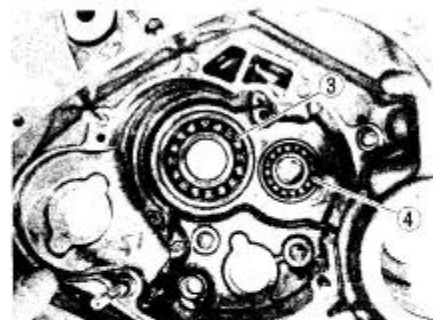
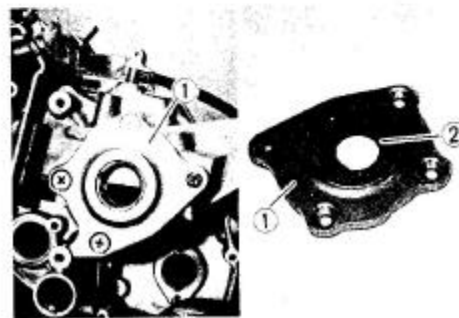
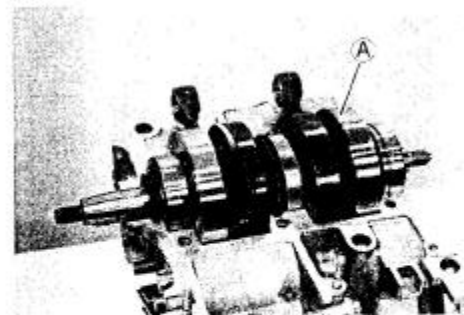
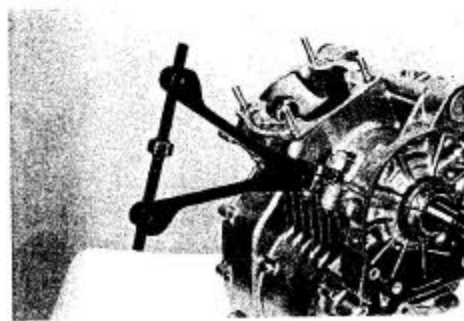
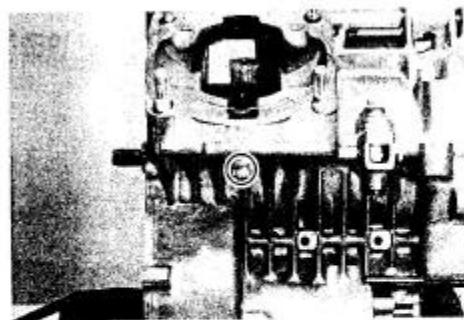
When loosening the bolts, proceed with smaller diameter bolts first. Also, loosen them evenly little by little in a diagonal fashion.

- Separate the crankcase halves evenly at front and at rear.

09912-34510: Cylinder disassembling tool

- Remove the crankshaft (A) from the crankcase.

- Remove the countershaft bearing retainer (1).
- Remove the oil seal (2) from the retainer.
- Carefully force out the drive shaft left bearing (3).
- Remove the countershaft left bearing (4) by slightly heating the crankcase.



## ENGINE COMPONENTS INSPECTION AND SERVICING

### CYLINDER HEAD

Remove the carbon and clean the cylinder head.

Check for scratches on the mating surface.

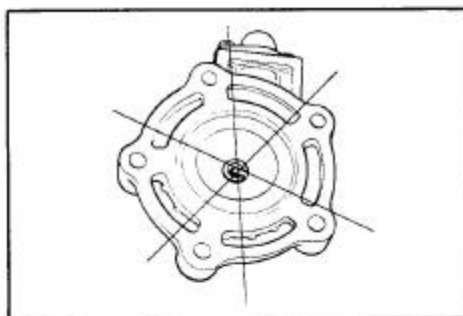
Check the gasketed surface of the cylinder head for distortion with a straightedge and thickness gauge, taking a clearance reading at several places indicated. If the largest reading at any position of the straightedge exceeds the limit, replace the cylinder head.

**09900-20803: Thickness gauge**

**Service Limit: 0.1 mm**

If the largest reading at any portion of the straightedge exceeds the limit, rework the surface by rubbing it against emery paper (of about # 400) laid flat on the surface plate in a lapping manner.

The gasketed surface must be smooth and perfectly flat in order to secure a tight joint. A leaky joint can be the cause of reduced power output and increased fuel consumption.



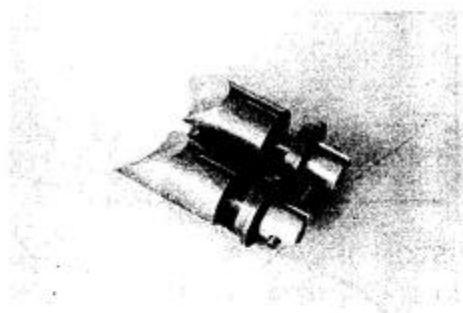
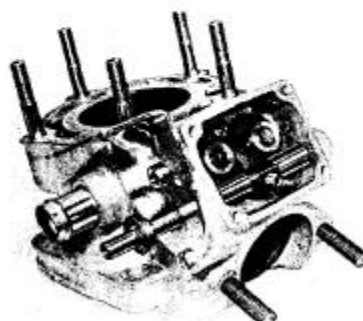
### CYLINDER AND EXHAUST VALVE

Move the exhaust valve by hand and check that the exhaust valve slides smoothly.

Remove the exhaust valves from the respective cylinders.

Decarbon the exhaust port, exhaust valves and the upper part of the cylinder, taking care not to damage the cylinder wall surface.

Inspect the exhaust valve and cylinder sliding surface for nicks, scratches, wear or other damage.



## CYLINDER BORE

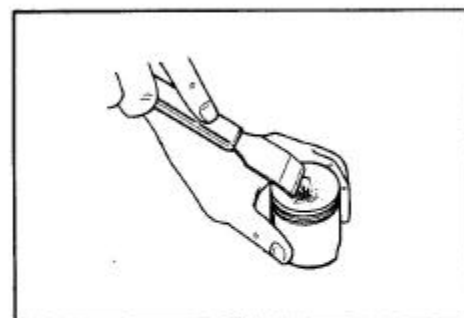
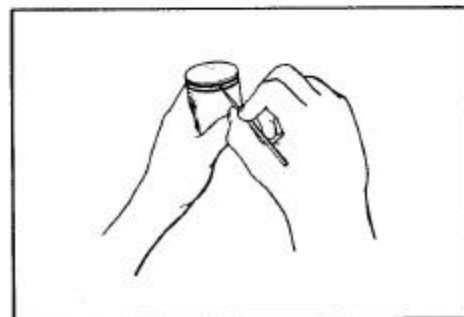
Inspect the cylinder wall for nicks, scratches or other damage.

## PISTON

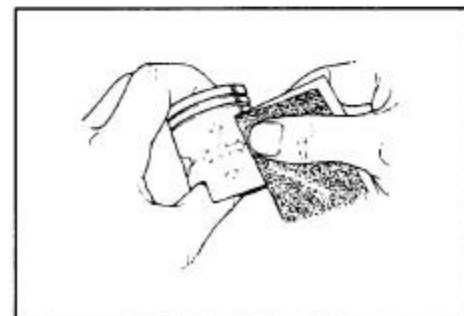
### DECARBON

De-carbon the crown of the piston and piston ring grooves. After cleaning the grooves, fit the rings and rotate them in their respective grooves to be sure that they move smoothly. Carbon in groove is liable to cause the piston ring to get stuck in the groove, and this condition will lead to reduced engine power output.

A piston whose sliding surface is badly grooved or scuffed due to overheating must be replaced.



- Shallow grooves or minor scuff can be removed by grinding with emery paper of about # 400.



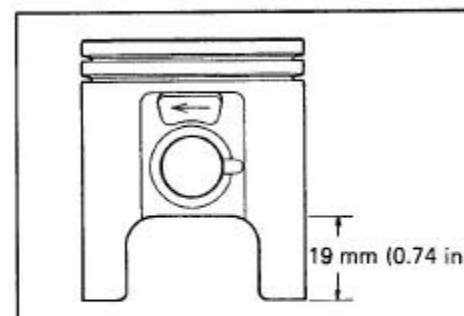
### PISTON DIAMETER

Using a micrometer, measure the piston outside diameter at the place 19 mm (0.7480 in) from the skirt end as shown in the illustration.

If the measurement is less than the limit, replace the piston with a new one.

09900-20203: Micrometer (50 – 75 mm)

Service Limit: 55.815 mm (2.1974 in)

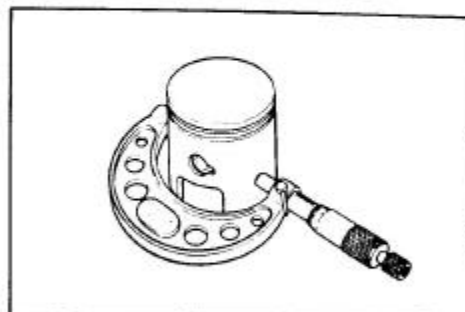




**PISTON-CYLINDER CLEARANCE**

As a result of the above measurement, if the piston to cylinder clearance exceeds the limit shown in the table below.

**Service Limit: 0.120 mm (0.0047 in)**

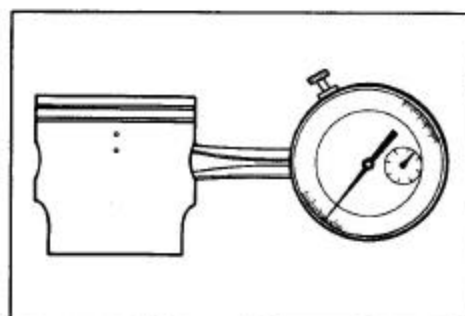
**PISTON PIN BORE**

Using a caliper gauge, measure the piston pin bore inside diameter.

If reading exceeds the following service limit, replace it with a new one.

**Service Limit: 16.036 mm (0.6313 in)**

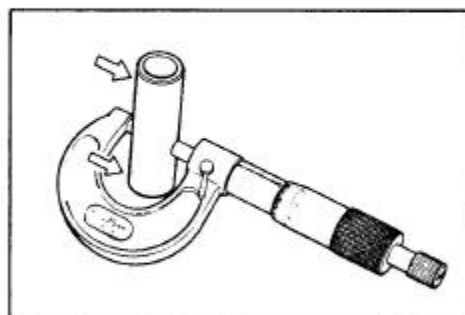
**09900-20605: Dial calipers**

**PISTON PIN O.D.**

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

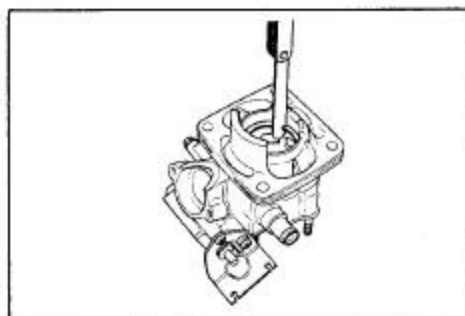
**09900-20205: Micrometer (0 – 25 mm)**

**Service Limit: 15.980 mm (0.6291 in)**

**PISTON RINGS****PISTON RING END GAP**

Check each ring for end gap, reading the gap with a thickness gauge as shown in the illustration. If the end gap is found to exceed the limit, indicated below, replace it with a new one.

The end gap of each ring is to be measured with the ring fitted squarely into the cylinder bore and held at the least worn part near the cylinder bottom, as shown in the illustration.



**09900-20803: Thickness gauge**

**Service Limit: 0.80 mm (0.0314 in)**

**PISTON RING FREE END GAP**

As the piston ring wears, its end gap increases reducing engine power output because of the resultant blowby through the enlarged gap. Here lies the importance of using piston rings with end gaps within the limit.

Measure the piston ring free end gap to check the spring tension.

**Service Limit (Top & 2nd rings): 4.0 mm (0.16 in)**

**PISTON RING TO GROOVE CLEARANCE**

Fix the piston ring in the piston ring groove, measure the ring side clearance with the thickness gauge while matching the sliding surface of piston and ring.

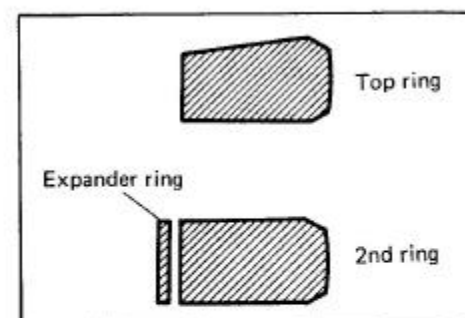
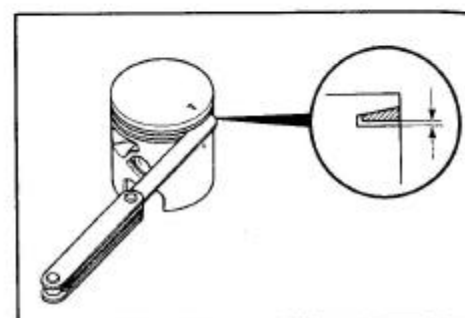
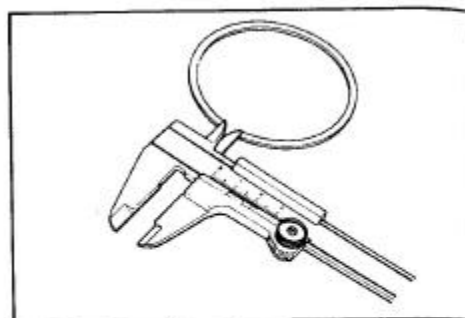
**Standard clearance**

1st : 0.02 – 0.06 mm (0.0008 – 0.0024 in)

2nd: 0.02 – 0.06 mm (0.0008 – 0.0024 in)

**NOTE:**

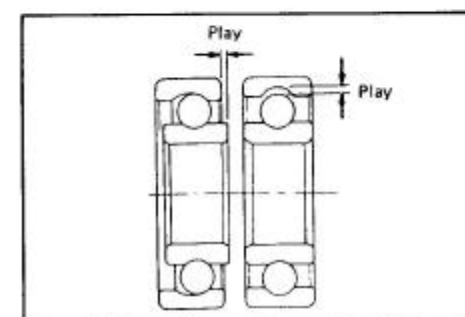
1st ring and 2nd ring differ in the shape. Be sure to bring the "T"-marked side to top when fitting them to the piston.

**BEARINGS**

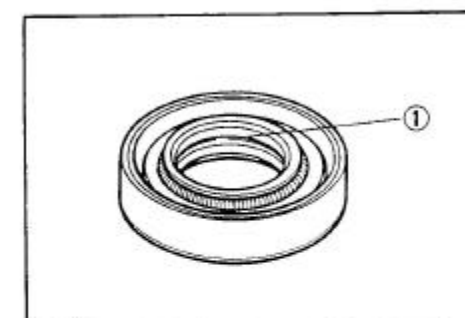
Wash the bearing with cleaning solvent and lubricate with motor oil before inspecting.

Turn the inner race and check to see that the inner race turns smoothly.

If it does not turn lightly, quietly and smoothly, or if noise is heard, the bearing is defective and must be replaced with a new one.

**OIL SEALS**

Damage to the lip ① of the oil seal may result in leakage of the fuel-air mixture or oil. Inspect for damage and be sure to replace damaged oil seals with new ones.



## CRANKSHAFT

### CRANKSHAFT RUNOUT

Support crankshaft by "V" blocks ①, with the dial gauge ② rigged to read the runout as shown.

**Service Limit: 0.05 mm (0.0019 in)**

Excessive crankshaft runout is often responsible for abnormal engine vibration. Such vibration shortens engine life.

09900-21304: V-block

09900-20701: Magnetic stand

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

### CONDITION OF BIG END BEARING

Turn the crankshaft with the conrod to feel the smoothness of rotary motion in the big end. Move the rod up and down while holding the crankshaft rigidly to be sure that there is no rattle in the big end.

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

If wear exceeds the limit, conrod, crank pin and crank pin bearing should all be replaced.

**Service Limit: 3.0 mm (0.11 in)**

### CONROD SMALL END BORE I.D.

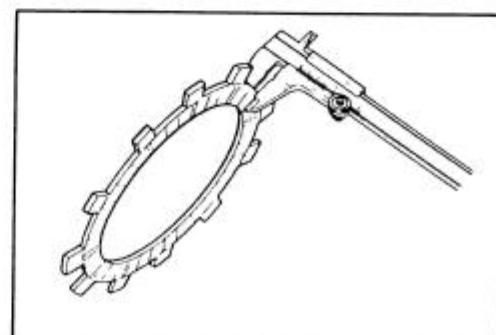
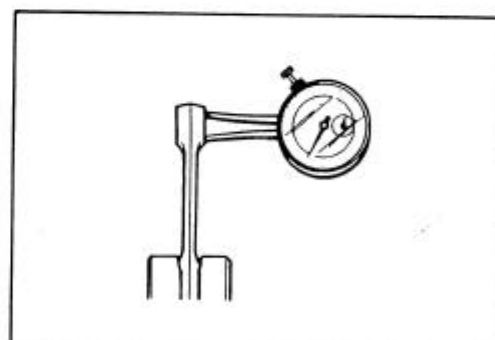
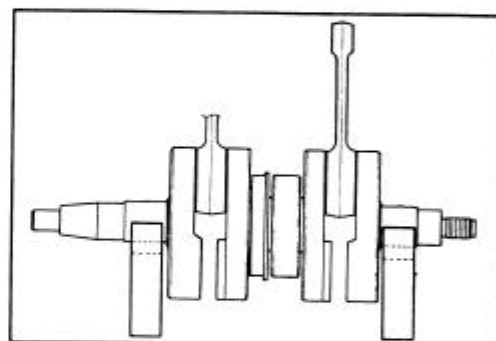
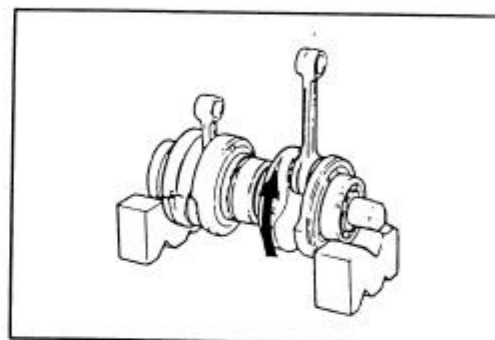
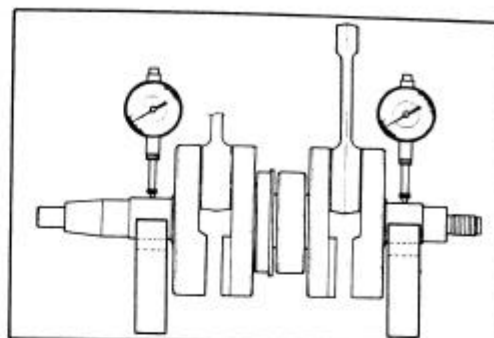
Using a caliper gauge, measure the conrod small end diameter.

**Service Limit: 20.0 mm (0.79 in)**

09900-20605: Dial calipers

## CLUTCH PLATES

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.



Checking thickness

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.

09900-20102: Vernier calipers

09900-20803: Thickness gauge

Unit: mm (in)

Service Limit	Drive plate	Driven plate
Thickness	2.35 (0.09)	—
Distortion	—	0.1 (0.004)
Claw width	15.3 (0.60)	—

### CLUTCH SPRING FREE LENGTH

Measure the free length of each coil spring with 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: 34.77 mm (1.368 in)**

### CLUTCH BEARINGS

Inspect clutch bearing for any abnormality, particularly cracks, upon removal from the clutch, to decide whether it can be re-used or should be replaced.

Smooth engagement and disengagement of the clutch depends much on the condition of this bearing.

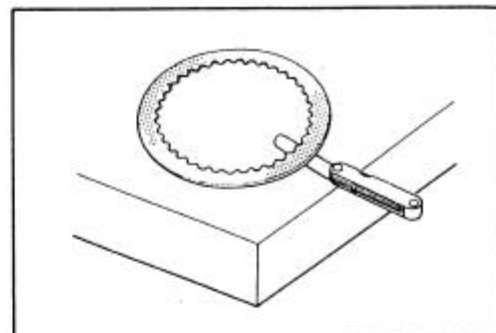
#### NOTE:

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

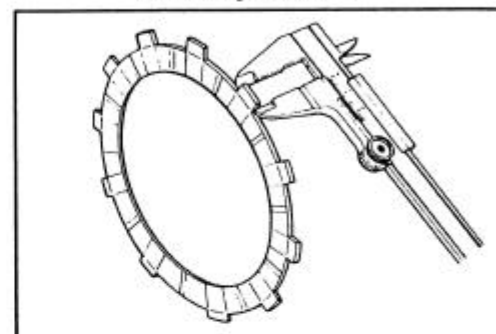
### GEARSHIFT FORK CLEARANCE

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

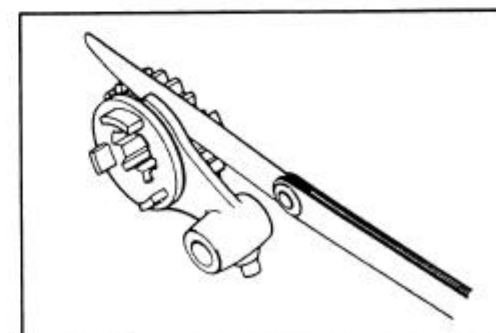
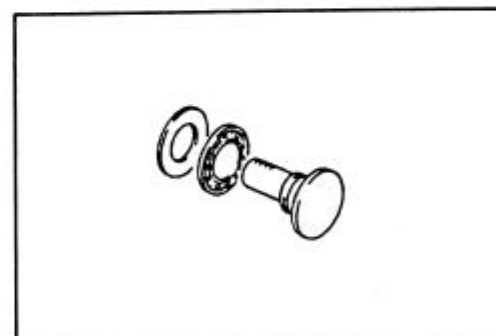
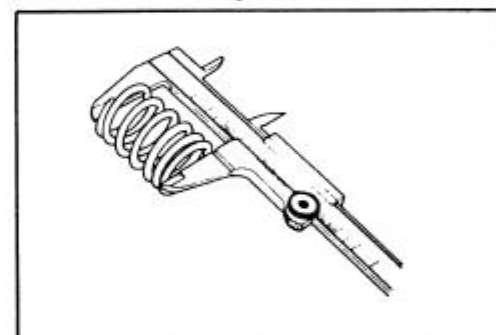
This clearance for each of the three shifting forks plays an important role in the smoothness and positiveness of shifting action. Each fork has its prongs fitted into the annular groove provided in its gear. In operation, there is sliding contact between fork and gear and, when a shifting action is initiated, the fork pushes the gear axially. Too much a clearance is, therefore, liable to cause the meshed gears to slip apart.



Checking distortion



Checking claw width



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

09900-20803: Thickness gauge

Shift fork—groove clearance

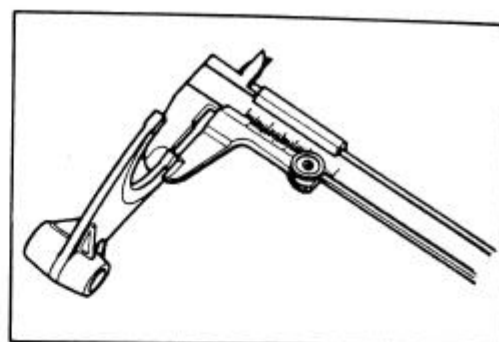
Service Limit: 0.5 mm (0.0196 in)

Shift fork groove width

Standard	No. 1 & No. 2	4.0 – 4.1 mm (0.157 – 0.161 in)
	No. 3	5.5 – 5.6 mm (0.216 – 0.220 in)

Shift fork thickness

Standard	No. 1 & No. 2	3.8 – 3.9 mm (0.149 – 0.153 in)
	No. 3	5.3 – 5.4 mm (0.208 – 0.212 in)



## 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:

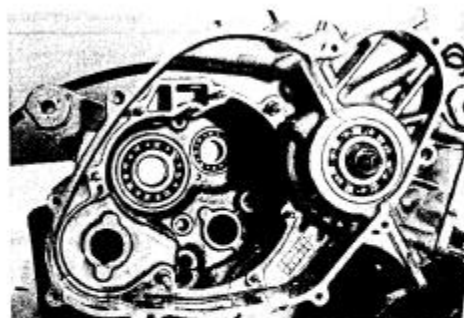
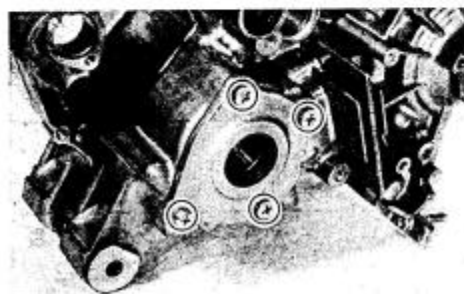
*Apply engine oil to each running and sliding part before reassembling.*

- Apply a little grease to the oil seal lip.

**99000-25010: SUZUKI SUPER GREASE "A"**

- Install the drive shaft bearing retainer together with the gasket.
- When tightening the screws, apply SUZUKI BOND No. 1215 to threads of them.

**99000-31110: SUZUKI BOND No. 1215**



- Position the crankshaft ② in the crankcase lower half ①. This time, position the bearing locating pins A, B and C at the mating face as shown. Also, insert the C-ring ③ into the crankcase groove properly.

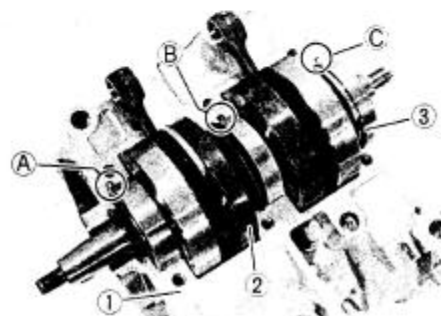
### CAUTION:

Position the oil seal squarely to the crankshaft.

- Apply oil to the bearings.

### NOTE:

*Use Suzuki CCI Oil or equivalent. Keep the crankcase mating surface clean, free from oil.*



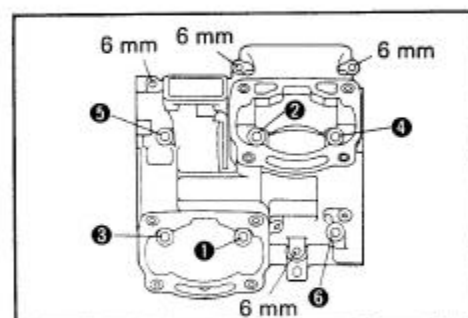
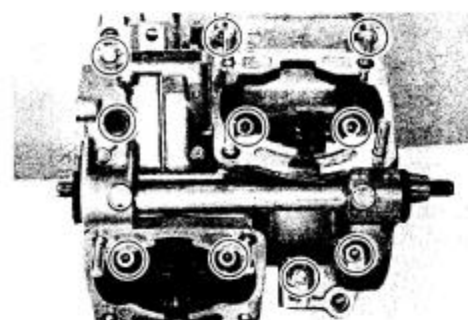
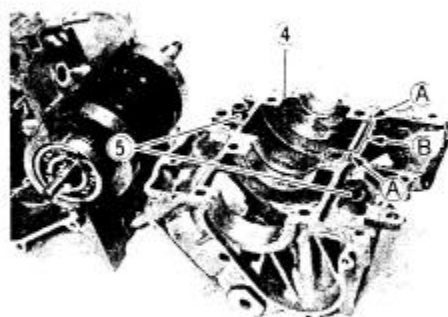
- Coat the crankcase upper half mating surface ④ with SUZUKI BOND No. 1215.

## NOTE:

- SUZUKI BOND No. 1215 should be coated evenly and continuously.
- Care should be taken not to apply SUZUKI BOND No. 1215 so thick as to block the oil passage (A).
- Do not coat SUZUKI BOND No. 1215 in the area shown as (B).
- Press in the dowel pin ⑤ by hand.

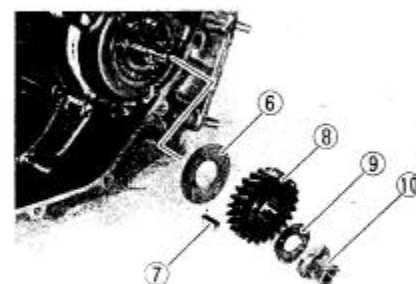
- Position the upper crankcase half properly and tighten the bolts. When tightening, proceed with larger diameter bolts, then smaller bolts. With the same diameter bolts in one group, tighten them evenly in a diagonal fashion.

Crankcase bolt tightening torque	8 mm	Initial tightening	12 – 16 N·m (1.2 – 1.6 kg-m)
		Final tightening	20 – 24 N·m (2.0 – 2.4 kg-m)
	6 mm		0.9 – 1.3 N·m (0.9 – 1.3 kg-m)



- Assemble the following parts:  
Primary drive gear washer ⑥; Key ⑦; Primary drive gear ⑧;  
Lock washer ⑨ and Primary drive gear nut ⑩.

Tightening torque: 60 – 80 N·m (6 – 8 kg-m)





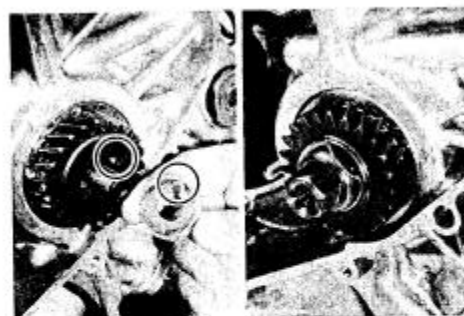
- Tighten the nut ⑩ with the crankshaft locked with the special tool.

#### 09910-20115: Conrod holder

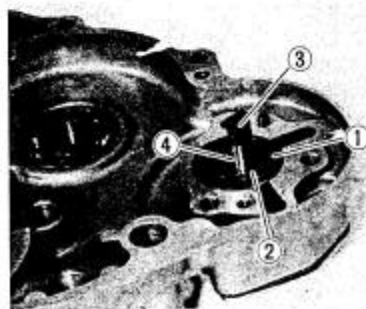
- Bend the washer ⑨ to prevent the nut from loosening.

#### NOTE:

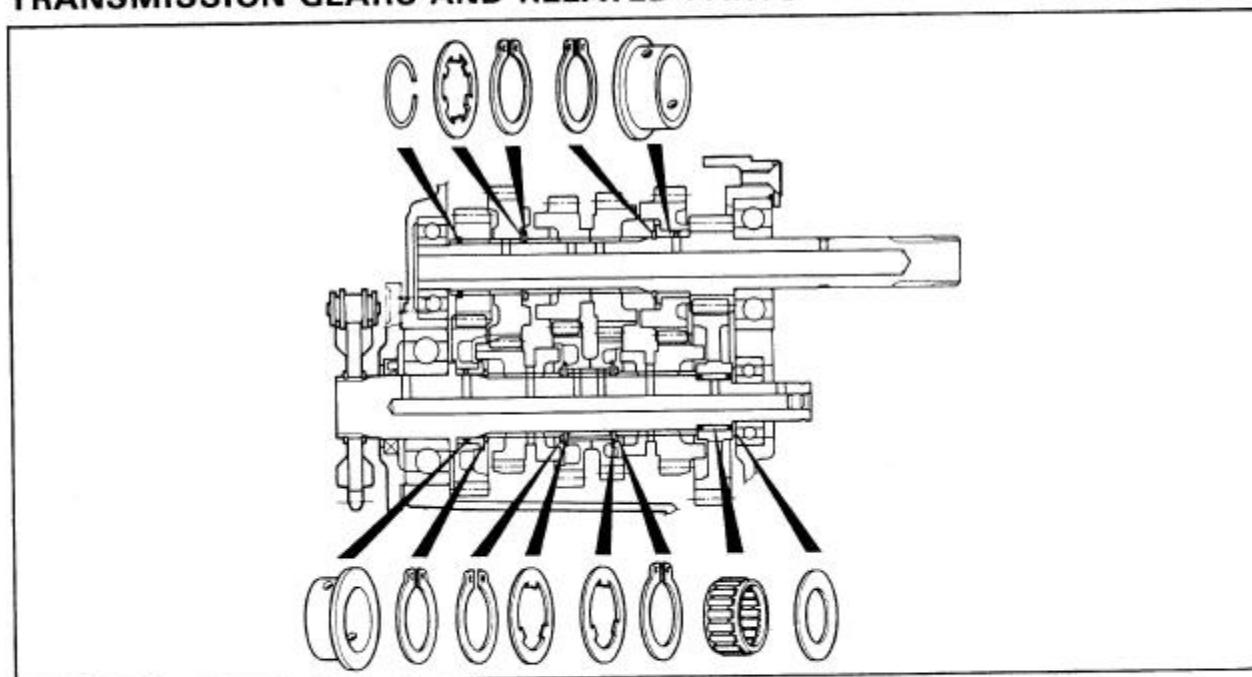
Check that the crankshaft rotates smoothly by hand.



- Assemble the following oil pump parts:  
Trochoid oil pump outer rotor ①; Trochoid oil pump inner rotor ②; Pump shaft ③; Pin ④ [to be installed as shown in the photograph]; Oil pump cover ⑤ and Oil strainer ⑥.



## TRANSMISSION GEARS AND RELATED PARTS





## COUNTERSHAFT

- Assemble the countershaft gears. The circlip **B** locating the 2nd drive gear **A** in position should be fitted before the circlip **C** is fitted in the shaft groove.
- When mounting circlip, pay attention to the direction of the thrust is as shown in the figure with the rounded side against the gear surface.

### NOTE:

*Always use a new circlip.*

### CAUTION:

Never reuse a circlip after a circlip has been removed from a shaft. A used circlip should be discarded and a new circlip must be installed.

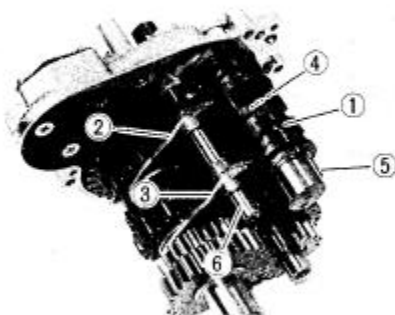
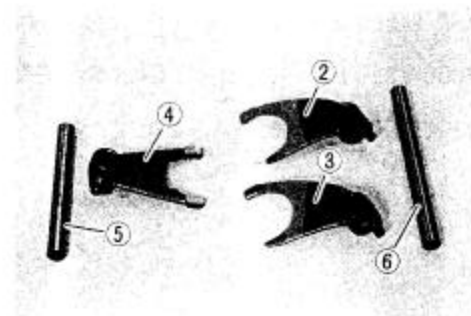
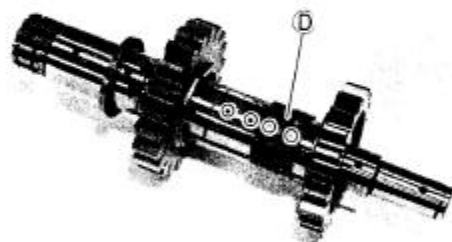
When installing a new circlip, care must be taken not to expand the end gap larger than required to slip the circlip over the shaft.

After installing a circlip, always insure that it is completely seated in its groove and securely fitted.

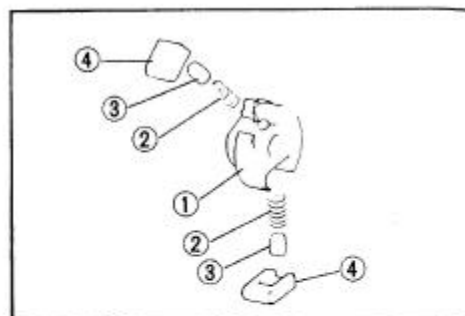


## DRIVE SHAFT

- Slide the bushing **D** over the shaft with its oil holes aligned with the drive shaft oil holes.
- Assemble the drive shaft gears, countershaft gears and the following shifter parts on the transmission case:  
Shifting cam shaft **1**; Shifting forks **2** & **3**; Shifting fork **4** and Shifting fork shafts **5** & **6**.

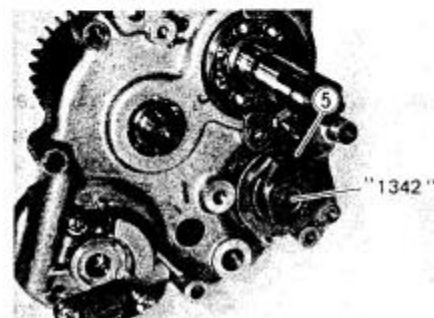


- Fit the springs ②, pins ③ and pawls ④ on the shifting cam driven gear ①.
- The pawl shape is not symmetrical. Install the wider width side facing the gear as shown.



- Insert the counter shaft bearing retainer ⑤ and shifting cam driven gear subassembly into the shifting cam shaft ⑥.

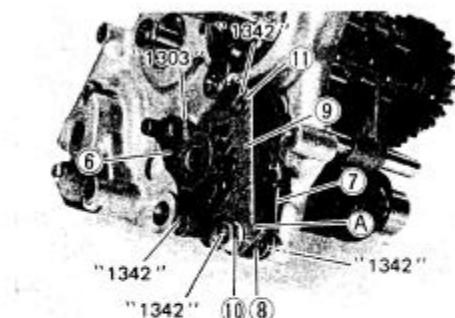
99000-32050: THREAD LOCK "1342"



- Install the gearshift pawl lifter ⑥.
- Install the gearshift cam stopper ⑦ and spring ⑧.

Tightening torque: 15 – 23 N·m (1.5 – 2.3 kg·m)

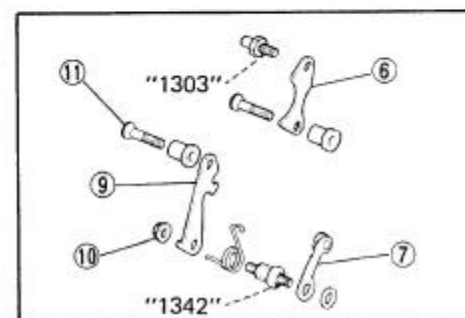
- With the spring hook (A) hitched on the shifting cam guide ⑨, install the guide by first tightening the nut ⑩ lightly and then tighten the screw ⑪.



- All threads must be secured with thread lock cement.

99000-32030: THREAD LOCK SUPER "1303"

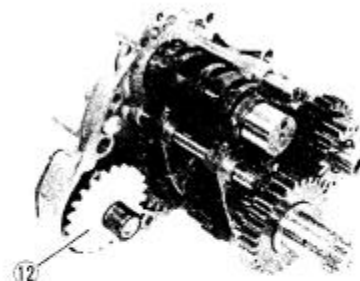
99000-32050: THREAD LOCK "1342"



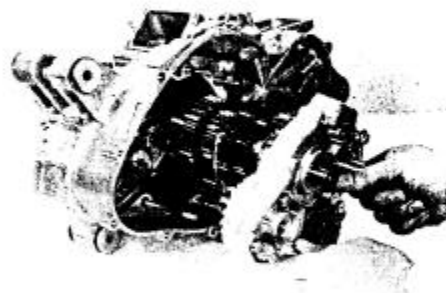
#### NOTE:

Verify that all gears and shifting parts function smoothly as designed by manually operating the mechanism.

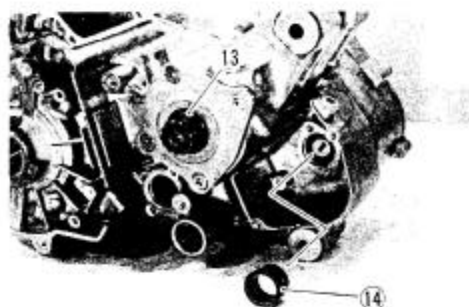
- Install the oil pump gear ⑫.



- Install the transmission subassembly into the crankcase.
- Care must be taken at this time not to cause damage on the oil seal lip by the drive shaft being inserted ⑬.

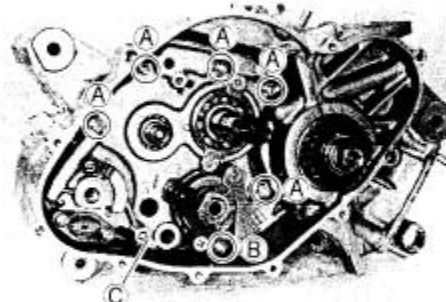


- Insert the oil pump spacer ⑭.
- Apply oil to the spacer.



- Tighten all the nuts ① through ⑧ except for ③ which is tightened after the kick starter shaft is installed.

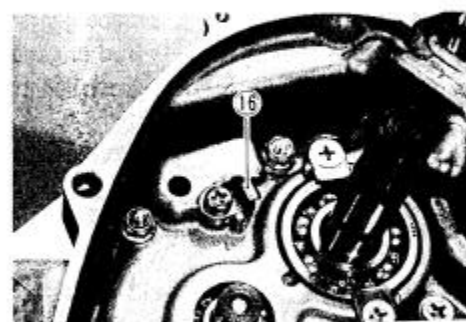
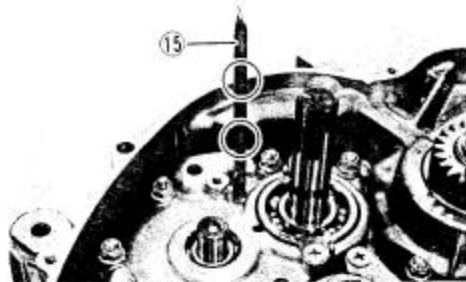
Tightening torque: 8 – 12 N·m (0.8 – 1.2 kg-m)



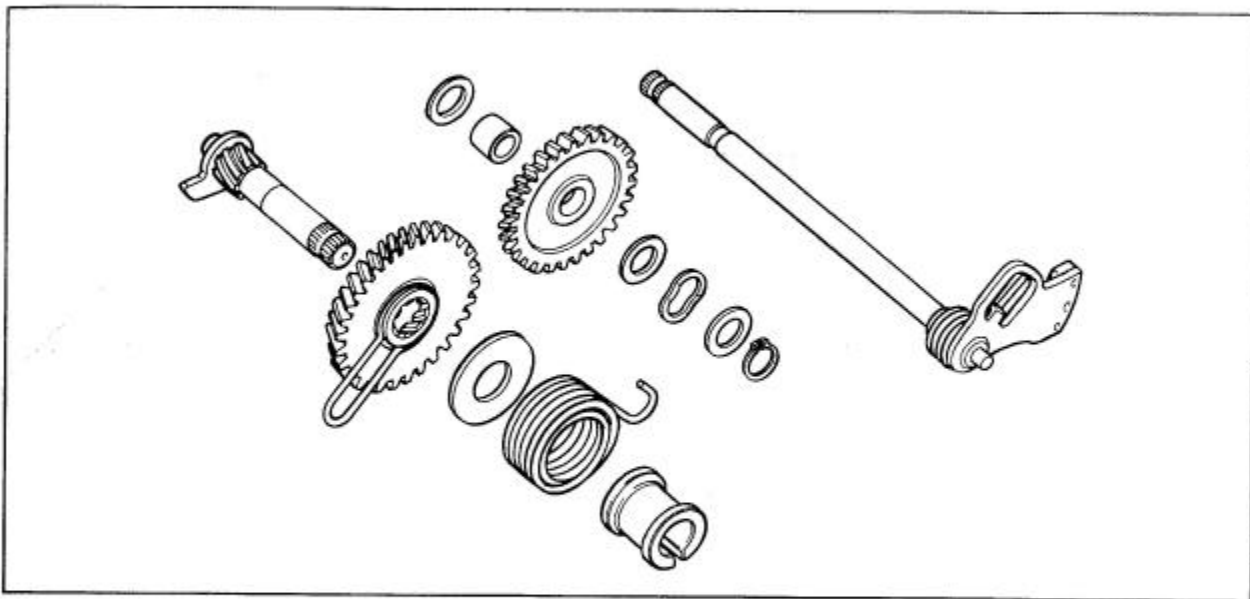
- Insert the oil guide ⑮.
- Install the oil guide stopper ⑯.

**NOTE:**

*When inserting the oil guide, be sure that the open end faces inside.*

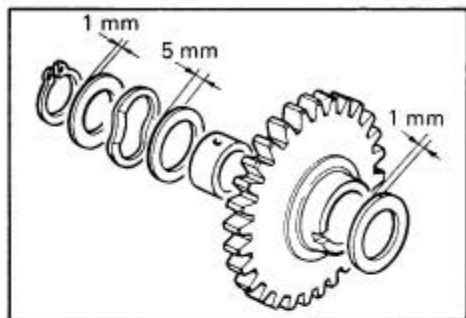
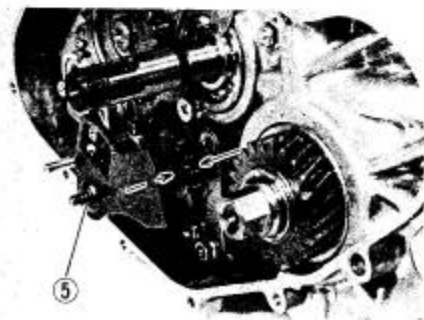


## KICK

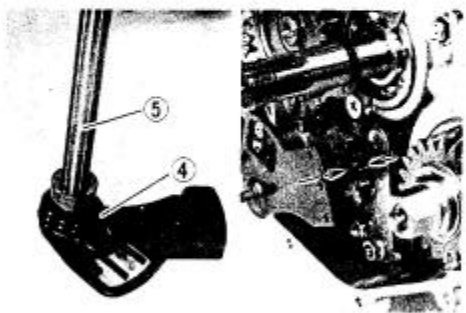


- Install the kick starter idler gear together with washers, bushing, spring washer, washer ① and circlip ② as shown.
- Install the kick starter shaft stopper ③. Thread lock should be applied to the screw threads.

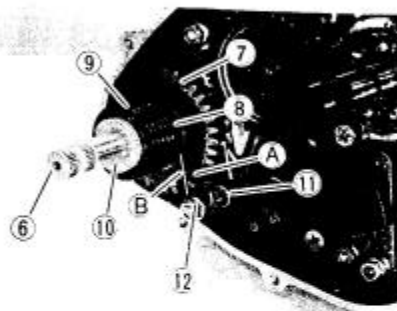
99000-32030: THREAD LOCK SUPER "1303"



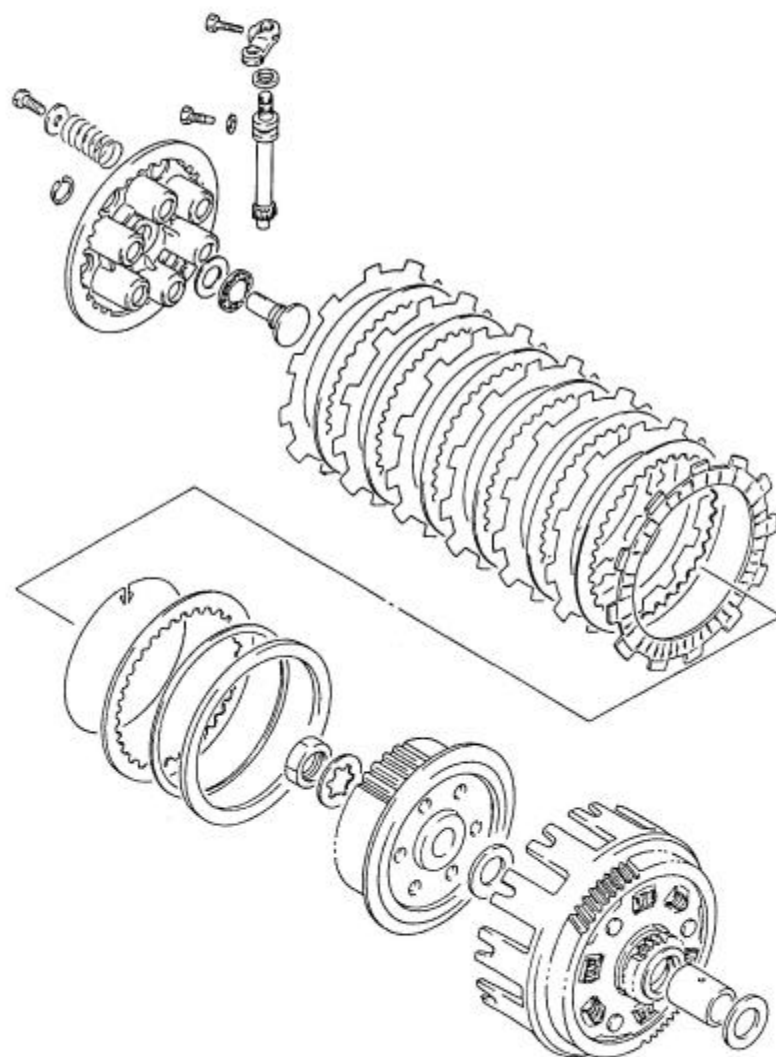
- Fit the return spring ④ on the gearshift shaft ⑤.
- Insert the gearshift shaft and engage its gear with the driven gear so that the center tooth of these two gears mesh as shown.



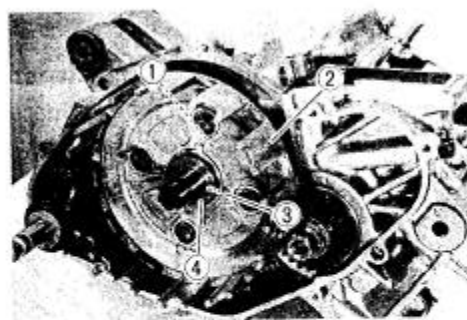
- Install the following parts:  
Kick starter shaft ⑥ ; Kick starter gear ⑦ ; Washer ⑧ ;  
Spring ⑨ ; Spring guide ⑩ and Spacer ⑪ .
- Fit the kick starter gear spring hook (A) to the spacer ⑪ .
- Also fit the kick starter gear spring hook (B) to the spacer ⑪ .
- Tighten the kick starter spring stopper nut ⑫ .



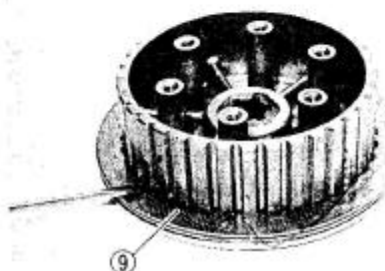
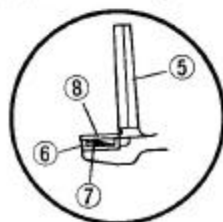
## CLUTCH



- Install the following clutch housing parts:  
Washer ①; Clutch housing ②; Spacer ③ and Washer ④.



- Prepare the clutch sleeve hub subassembly ⑤ using the following parts:  
Wave washer seat ⑥; Wave washer ⑦; Clutch driven plate No. 2 ⑧ and Ring ⑨.



- Install the clutch sleeve hub subassembly ⑤ using lock washer ⑩ and nut ⑪.

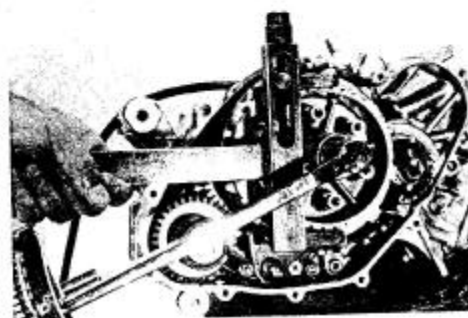


- When tightening the nut ⑪, lock the sleeve hub rotation with special tool.

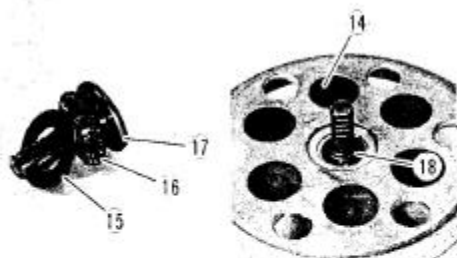
Tightening torque: 40 – 60 N·m (4.0 – 6.0 kg·m)

09920-53710: Clutch sleeve hub holder

- Bend the washer to prevent the nut from loosening.
- Install the clutch drive plate ⑫ and driven plate ⑬ alternately in the clutch housing. Oil all the plates.

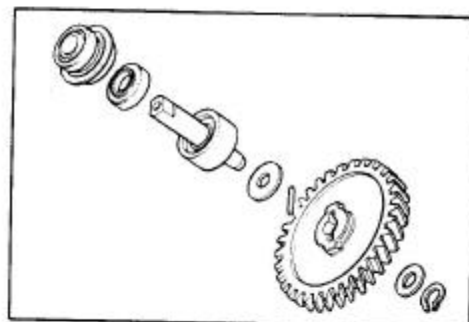
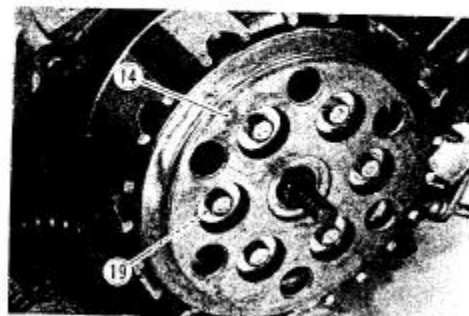


- Prepare the pressure plate subassembly ⑭ using the following parts:  
Washer ⑮; Bearing ⑯; Release rack ⑰ and circlip ⑱.



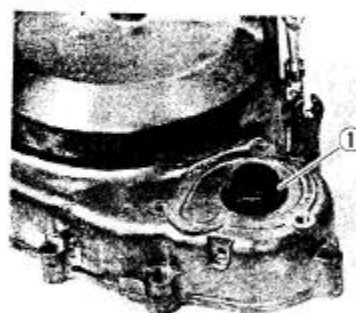
- Position the pressure plate subassembly ⑭ and springs ⑲, and tighten the bolts to specification.

Tightening torque: 8 – 12 N·m (0.8 – 1.2 kg·m)

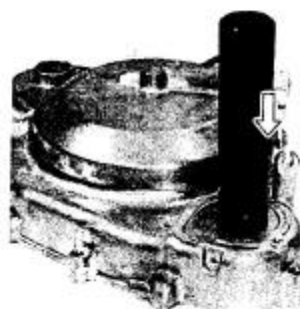


- Apply SUZUKI BOND No. 1215 to the water pump mechanical seal housing ① and press in the clutch cover with the special tool.

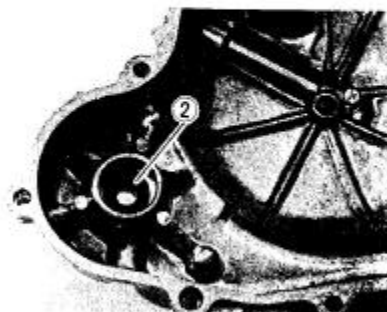
99000-31110: SUZUKI BOND No. 1215



09913-80112: Bearing installer



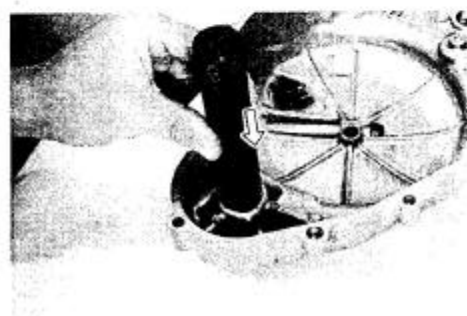
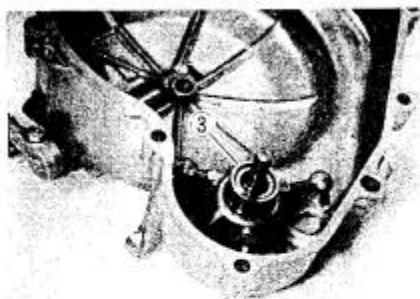
- Install the oil seal ②.



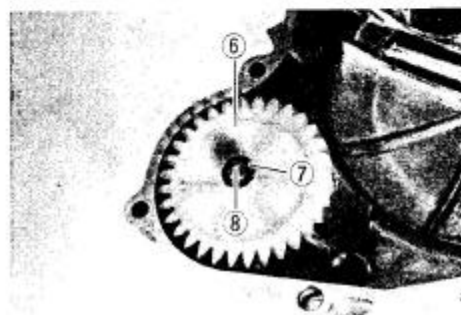
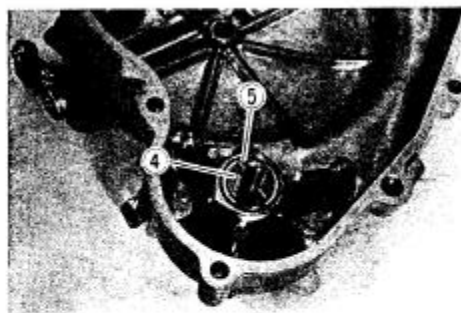


- Insert the water pump shaft assembly ③.
- At this time, use care not to bend the oil seal lip.

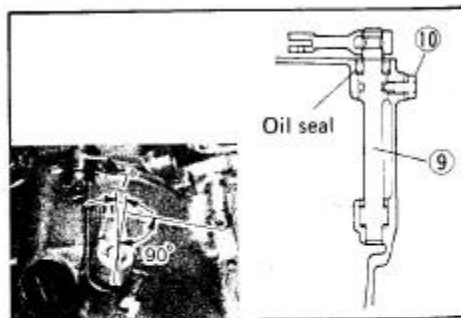
09925-98220: Bearing installer



- Assemble the following parts on the pump shaft:  
Washer ④ ; Pin ⑤ ; Water pump gear ⑥ ; Spring washer ⑦  
and Circlip ⑧.



- Insert the clutch release pinion ⑨ into the clutch cover and tighten the stopper bolt ⑩.



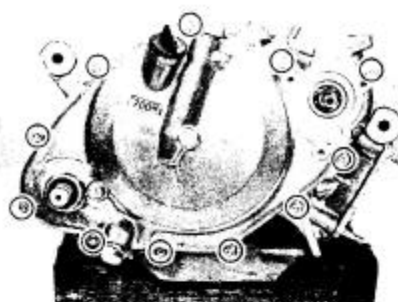
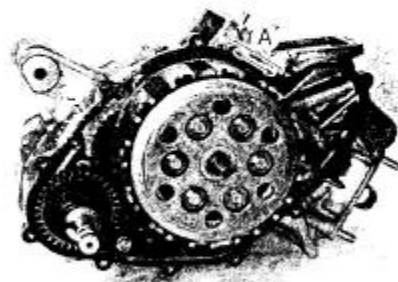


- Apply SUZUKI BOND No. 1215 to the crankcase mating surface at the areas **A**, each 20 – 30 mm in length.

**NOTE:**

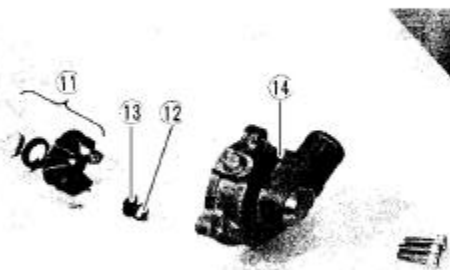
- Position the clutch release rack so that the teeth face the release pinion when assembled.
- Fit the clutch cover subassembly to the crankcase so that the water pump gear and clutch release rack engage properly with the respective gears on crankcase side.

**Tightening torque: 6 – 10 N·m (0.6 – 1.0 kg·m)**

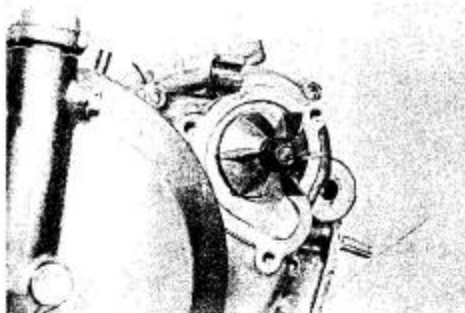


- Position the impeller **11** on the shaft.
- When installing the seal, make sure that the painted mark faces inside. Also, apply soapsuds for initial lubrication.
- Using the bolt, wave washer **12** and gasket **13**, tighten the impeller.

**Tightening torque: 7 – 9 N·m (0.7 – 0.9 kg·m)**

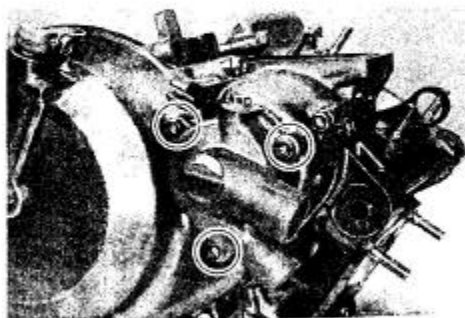


- The gasket should be positioned with its sealing face contacting the impeller.

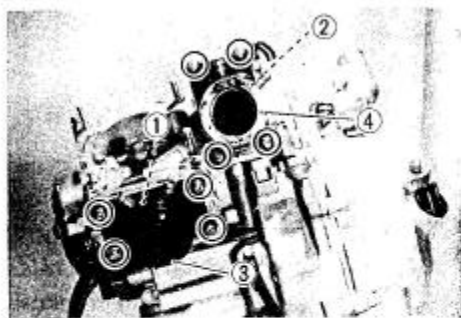


- Install the water pump case **14**.

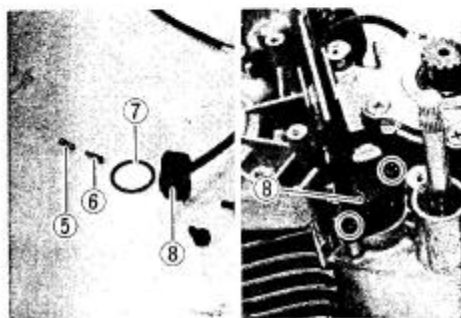
**Tightening torque: 6 – 10 N·m (0.6 – 1.0 kg·m)**



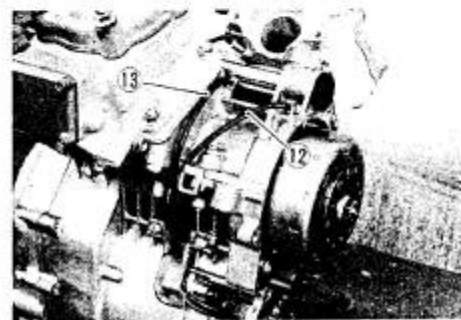
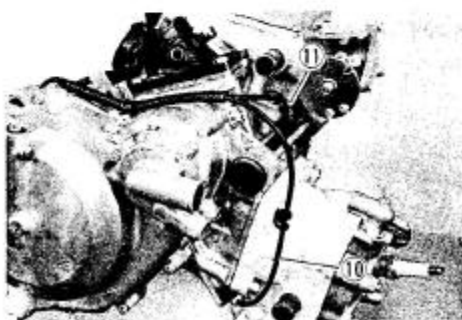
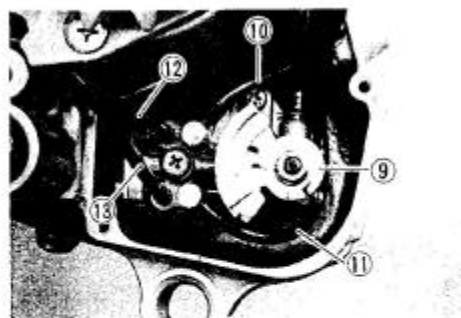
- Install the left and right reed valve assemblies ① and ② on the crankcase.
- Install the intake pipes ③ and ④.
- The clamp should be installed together with the screw.



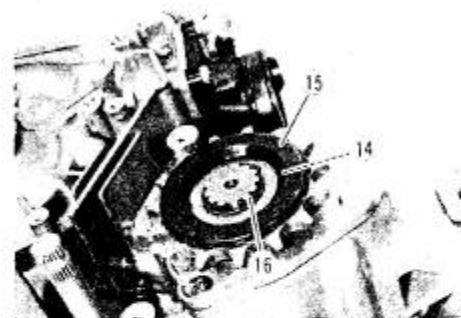
- Assemble the following parts on the case:  
Spring ⑤; Contact piece ⑥; O ring ⑦ and Switch body ⑧.
- After the switch body is tightened, route the lead wire through the clearance.
- Secure the lead wire with the clamp located on the intake pipe.



- Install the oil pump ⑨ on the engine.
- Connect the oil hoses ⑩ and ⑪ to cylinders as shown.
- Secure the hose with clamp at the connection.
- Connect the oil hoses ⑫ and ⑬ to crankcase as shown.

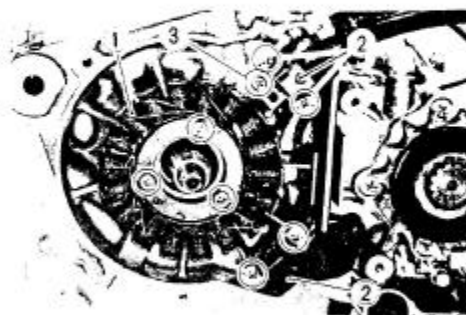


- Fit the circlip ⑭ on the drive shaft.
- Mount the sprocket ⑮.
- Secure the sprocket with the circlip ⑯.

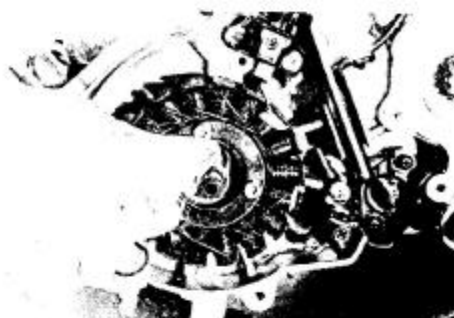


- Mount the stator ① and the signal generators ②.
- Install the lead wire guide and screw ③.
- Apply THREAD LOCK "1342" to the stator screws and tighten them.

99000-32050: THREAD LOCK "1342"



- Degrease the tapered portion of the rotor and also the crankshaft. Use nonflammable cleaning solvent to wipe off the oily matter to make these surfaces completely dry.

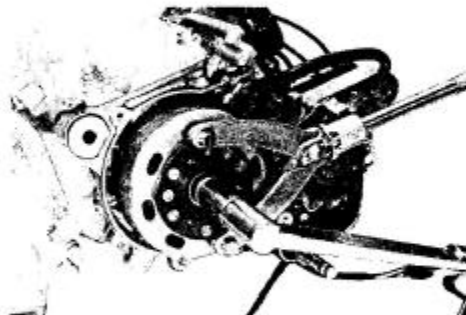


- Apply THREAD LOCK SUPER "1324" to the nut and tighten it to the specified torque with the special too.

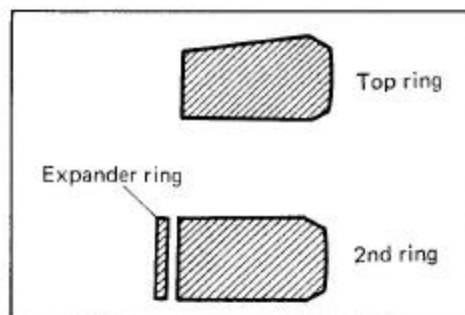
99000-32120: THREAD LOCK SUPER "1324"

09930-40113: Rotor holder

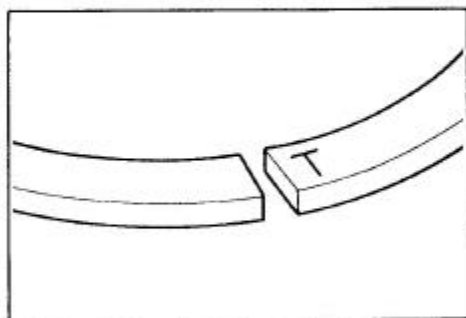
Tightening torque: 85 – 105 N·m (8.5 – 10.5 kg·m)



- Mount the piston rings in the order of expander ring, 2nd ring and top ring.

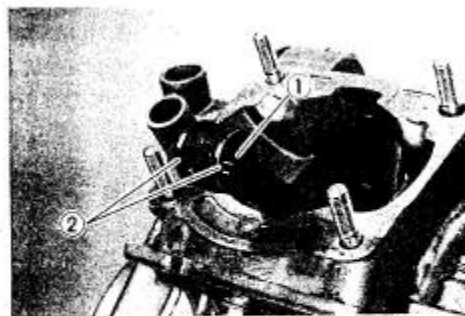


- Top and 2nd rings have letter "T" marked on the side. Be sure to bring the marked side to top when fitting them to the piston.



### 3-51 ENGINE

- Install the bearing ① and two thrust washers ② to the conrod.
- Be sure to install the pistons in the cylinders from which they were taken out in disassembly, refer to the letter mark, "1" and "2", scribed on the piston.
- Apply engine oil to the conrod and crankshaft bearings.



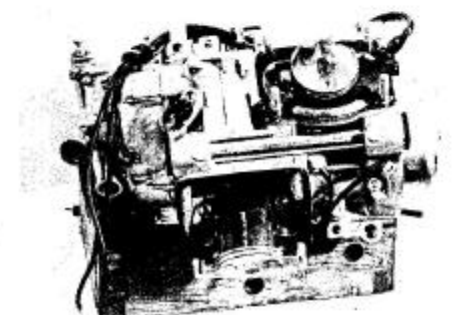
- The arrow mark on the piston crown points to the exhaust port side.



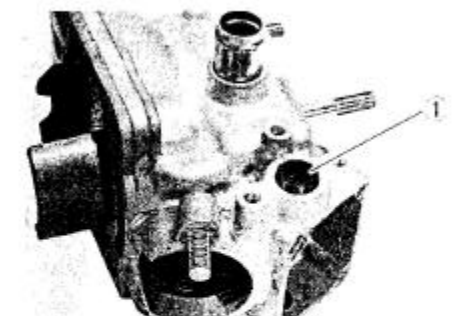
- The circlip should be mounted in such a position that the mating ends of the circlip do not coincide with the groove portion ③ of the piston.
- Before inserting the piston in the cylinder, be sure to apply oil to the outer surface of the piston ring grooves.



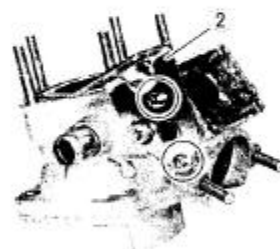
- It is extremely important that, when the piston is fed into the cylinder, each ring in place should be so positioned as to hug the locating pin.
- Install new gaskets and positioning pins properly.



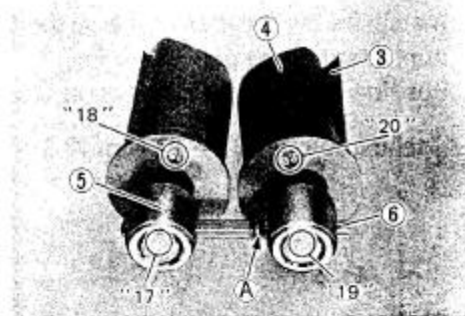
- Press in the oil seal ①. Apply oil to the lip part of oil seal.



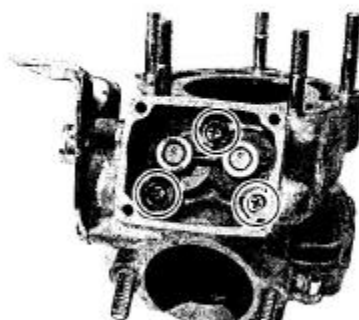
- Install the oil seal retainer ②.



- Assemble the exhaust valve ③ and valve guide ④ properly referring to the markings:  
Mark "17" on valve to match with mark "18" on guide.  
Mark "19" on valve to match with mark "20" on guide.
- Install the spacer ⑤ with its chamfer side facing top.
- Install the valve pin ⑥ with the flange (A) side facing the markings "19" and "20".

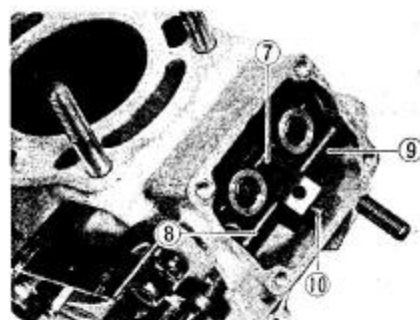


- Insert the exhaust valve assembly into the cylinder.

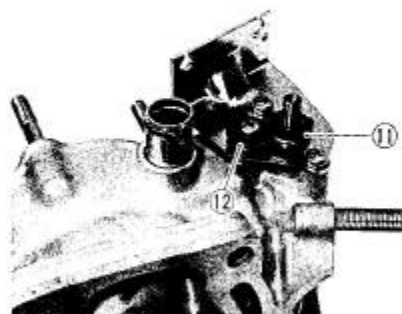


- Assemble the valve shaft ⑧, shaft arm ⑦ and spacer ⑨ on the cylinder.
- Tighten the lock bolt ⑩ on the arm so that the screw point engages with a hole drilled in the shaft. Apply THREAD LOCK "1342" to the lock bolt.

99000-32050: THREAD LOCK "1342"



- Install the valve pulley lever ⑪ and washer ⑫.



- Install the cylinder cover.
- Position the cylinder gasket ① on the crankcase.
- Apply oil to the piston and cylinder sliding surfaces.

## NOTE:

*Make sure that each piston ring end gap position is properly matching the locating pin.*

- Push in the cylinder dowel pin ② by hand.
- Install the cylinder over the piston slowly and carefully so as not to damage the piston ring.
- Position the cylinder head gasket ③.

**Tightening torque: 23 – 27 N·m (2.3 – 2.7 kg·m)**

- Install the cylinder head ④. On the two stud bolts out of total five, a copper washer and cap nut ⑤ should be fitted.
- Install the water pipe elbow connector ⑥ together with the clamp ⑦.

**Tightening torque: 23 – 27 N·m (2.3 – 2.7 kg·m)**

## NOTE:

*Carry out the same procedures to assemble the Left cylinder parts. Note that the clamp is not needed on the hose elbow connector ⑦ for the Left cylinder.*

