

CHAPTER 3. ENGINE OVERHAUL

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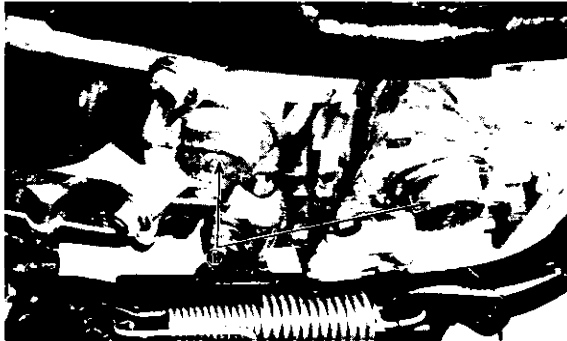
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CHAPTER 3. ENGINE OVERHAUL

31. ENGINE REMOVAL

A. Preparation for removal

1. All dirt, mud, dust and foreign material should be thoroughly removed from the exterior of the engine before removal and disassembly.
2. Place machine on center stand. Start engine and allow it to warm up. Stop engine and drain engine/transmission oil.



1. Drain plugs

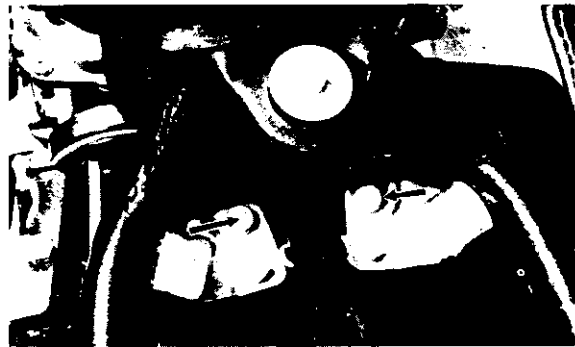
B. Fuel tank removal

1. Turn fuel petcocks to "on" (there is no "off" position – fuel will not flow from a petcock on the "on" position unless the engine is operating). Disconnect fuel pipes and vacuum pipes from petcock.
2. Lift seat and remove fuel tank holding bolt. Remove fuel tank.

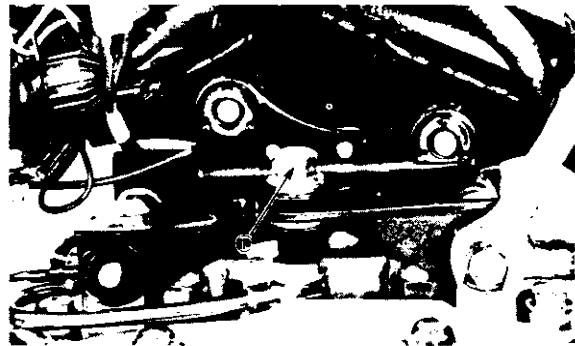
C. Removal of other parts

Remove the following parts in the order given.

1. Exhaust pipes
2. Horn (as a unit)
3. Both side footrests
4. Change pedal and drive chain guide
5. Left-hand crank case cover and clutch cable.
6. Side covers
7. Air cleaner assembly and ventilation hoses.



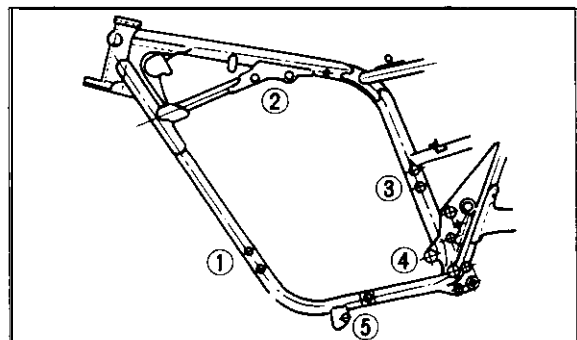
8. Carburetor (to the left), and throttle cable
9. Brake pedal
10. All wires and cables connecting engine and chassis
11. Top center engine mounting brackets (Remove only four bolts for easier re-assembly)



1. Better not to remove this
12. Drive chain (with special tool)

D. Engine mounting bolts and engine removal

1. Remove mounting bolts in the order as shown.



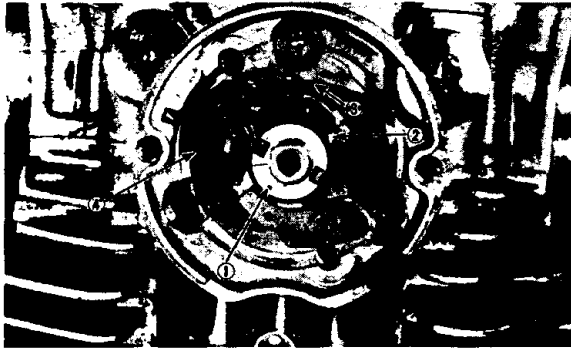
2. Remove the engine to the right.

3-2 ENGINE DISASSEMBLY

A. Governor and breaker assembly removal

Remove the following parts in the order given.

1. Breaker cover
2. Breaker backing plate
3. Breaker housing
4. Governor cover
5. Notched plate
6. Lock nut (using punch and hammer)
7. Governor assembly



1. Notched plate
 2. Lock nut
 3. Loosen
 4. Governor assembly
8. Breaker shaft (to the point side)

9. Dowel pin

10. Advance unit housing

B. Cylinder head and cylinder removal

1. Remove the oil delivery and pipe fitting attached to the crankcase. Note place of copper gaskets.
2. Remove all tappet covers.
3. Remove spark plugs.
4. Remove four cylinder head cover holding bolts, three cylinder head holding bolts and eight cylinder head holding nuts.
5. Remove the head cover. It may be necessary to tap each lightly with a soft hammer.
6. Remove the camshaft as follows.
 - a. Remove tensioner adjusting bolt to make the chain tension loose.
 - b. Push out the master link pins with the cam chain cutter.
 - c. Tie each end of the camchain with a wire to prevent it from falling into the crankcase.
7. Remove the cylinder head and cylinder.

NOTE:

It is advisable to remove the stator and rotor after finding the place of the master link pins. Refer to item "F. Generator removal."

C. Rocker arm removal

1. Remove rocker shaft covers.
2. Remove shouldered sleeves and O-rings.
3. Withdraw rocker shafts with the special tool or 6 mm bolt.

D. Valve removal

1. Compress the valve spring and then remove both retainer locks. Remove the compressor and lift off the retainer and springs.
2. Remove valve stem seals.
3. Remove valves.

NOTE:

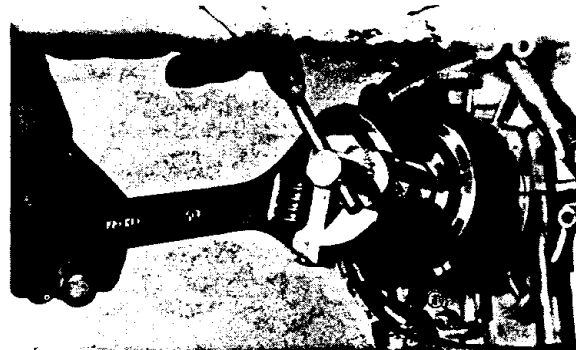
Deburr any deformed valve stem end. Use an oil stone to smooth the stem end. This will help prevent damage to the valve guide during valve removal.

E. Piston removal

Remove piston pin clips, piston pins and pistons.

F. Generator removal

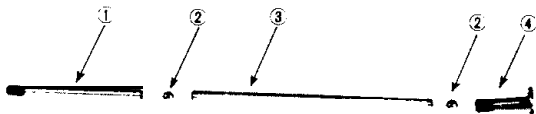
1. Remove the stator.
2. Remove the securing nut and lock washer.
3. Mount the rotor puller (special tool) onto the rotor and pull the rotor off.



1. Rotor puller (90890-01070)

G. Primary drive gear and clutch assembly removal

1. Remove the crankcase cover (right).
2. Loosen the drive gear securing nut by first placing a rag folded into many layers between the teeth of gears to lock them.
3. Remove six clutch spring screws and pressure plate.
4. Remove clutch plates, friction plates, push crown, two push rods and two balls.



1. Push rod
2. Ball
3. Push rod (Aluminum)
4. Push crown

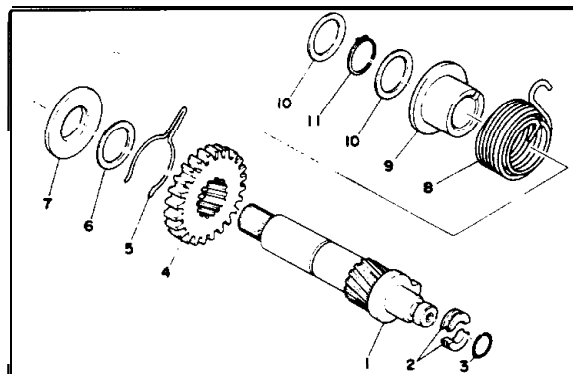
5. Hold the clutch unit with the holding tool (special tool), and unscrew the clutch boss lock nut.

H. Kick axle and change shaft removal

1. Slip the bent spring off and pull the kick axle assembly out.
2. Remove circlip from left side of change shaft and pull the shaft out.

I. Electric starter unit removal

1. Remove the gear train cover, and idle gear 1 and 2.



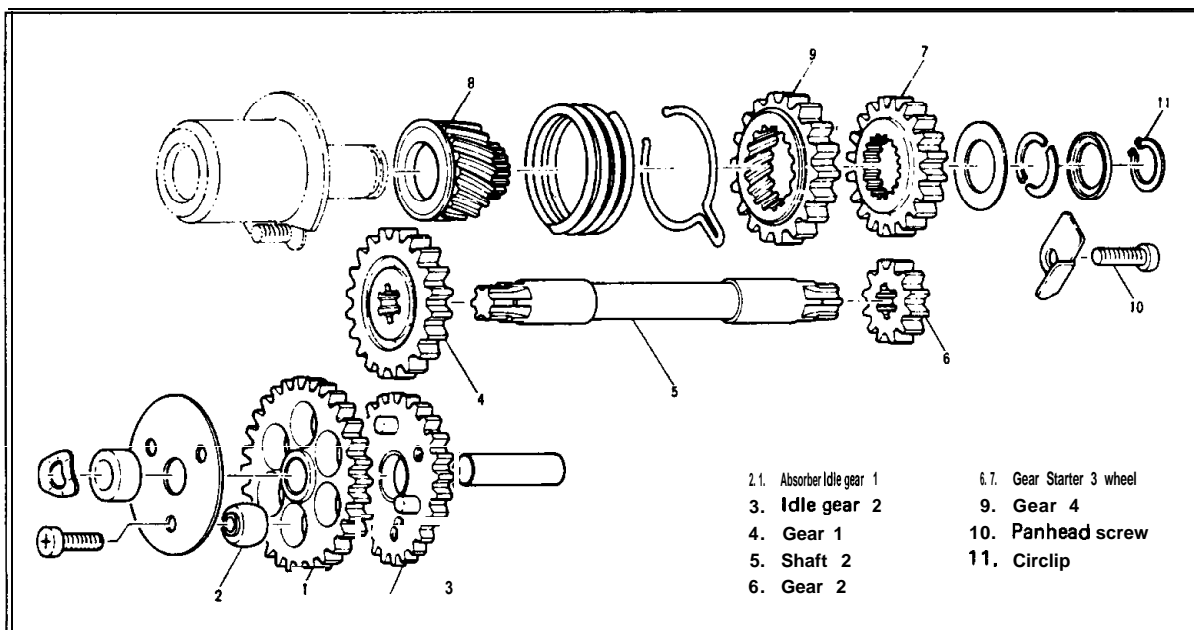
1. Kick axle
2. Holder
3. Clip
4. Kick gear
5. Kick clip
6. Shim
7. Spacer
8. Kickspring
9. Spring guide
10. Washer
11. Circlip

2. Remove the four mounting bolts and motor.

3. Remove the panhead screw (10), gear 2 (6), shaft 2 (5), and gear 1 (4).

4. Remove the circlip (11), and gear assembly (7) (8) (9).

5. Starter gears illustration



J. Oil pump removal

1. Remove the tachometer drive gear, oil pump driven gear, and key.
2. Remove the three Phillips screws.
3. Remove the pump unit.

K. Crankcase disassembly

1. Loosen all case securing bolts and nuts 1/4 turn at a time to avoid case warpage, and remove them.
2. Use a soft rubber hammer to carefully separate the crankcases.

CAUTION:

There is one hidden crankcase holding nut. This nut is located near the primary drive gear.

Transmission

1. Main axle (13T)	1' 1st wheel gear (32T)
2. 2nd pinion gear (17T)	2' 2nd wheel gear (27T)
3. 3rd pinion gear (20T)	3' 3rd wheel gear (26T)
4. 4th pinion gear (21T)	4' 4th wheel gear (23T)
5. 5th pinion gear (23T)	5' 5th wheel gear (22T)
6. Drive sprocket (17T)	

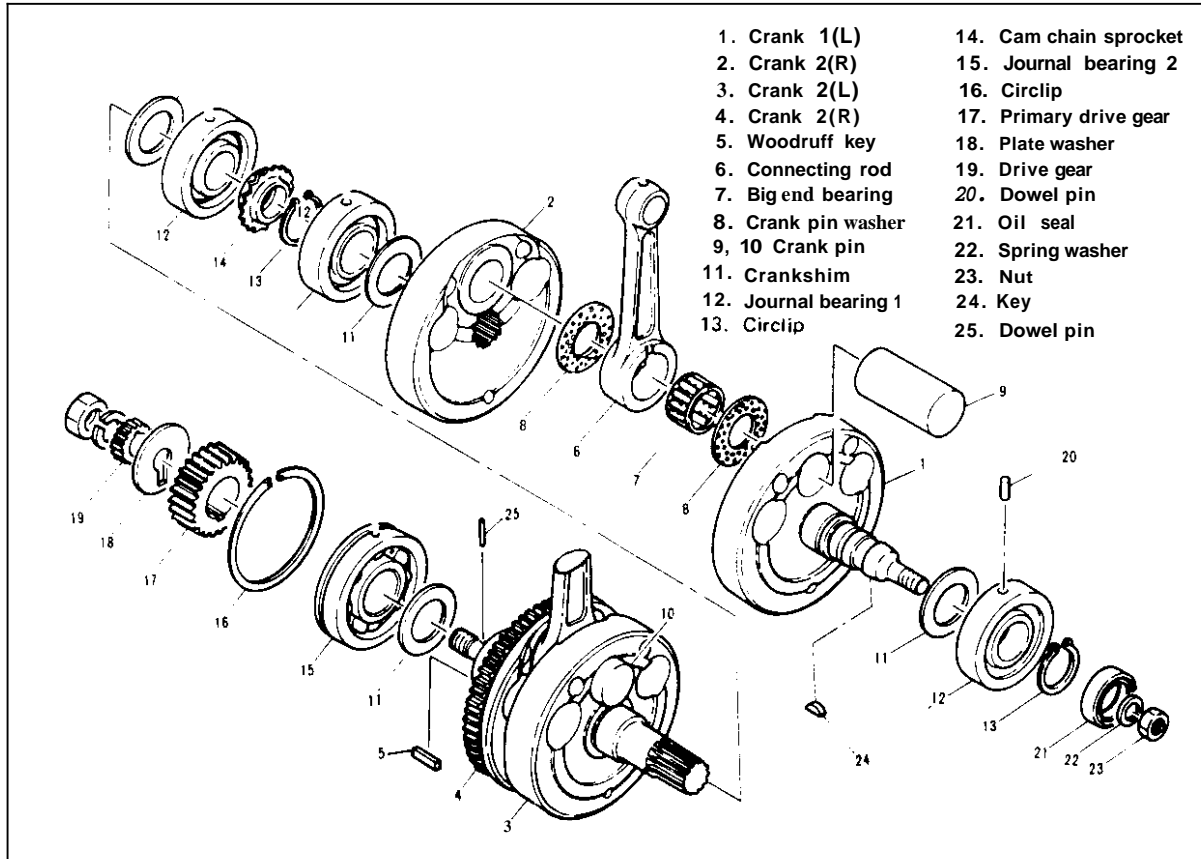
The diagram illustrates the assembly of a transmission. At the top, a horizontal shaft (1) is shown with five pinion gears (4, 3, 5, 2, 1) mounted on it. Below this, a drive sprocket (6) is shown with a chain link. At the bottom, the main axle (1) is shown with five wheel gears (4', 3', 5', 2', 1') mounted on it. The gears are numbered 1 through 6 and 1' through 5' to correspond with the legend. The diagram shows the relative positions of the components and how they mesh together.

[illegible]

1. Release the stopper spring (6).
2. Remove the bolts (1) and stopper plate(3).
3. Pull the guide bar (14) out.
4. Remove the neutral detent unit (15-18).
5. Remove cotter pins (13). and pin (12)
6. Pull out the shift cam (7).

N. Crankshaft removal

1. Tap the crankshaft with a rubber hammer to loosen it, then lift it out.
2. Crankshaft illustration



3-3. INSPECTION AND REPAIR

A. Cylinder head cover

Place head cover on a surface plate. There should be no warpage. Correct **by** re-surfacing as follows:

Place #400 or #600 grit wet sandpaper on surface plate and re-surface head cover using a figure-eight sanding pattern. Rotate head cover several times to avoid removing too much material from one side.

B. Cylinder head

1. Remove spark plugs.
2. Remove valves.

3. Using a rounded scraper, remove carbon deposits from combustion chamber. Take care to avoid damaging spark plug threads and valve seats. **Do not use** a sharp instrument. Avoid scratching the aluminum.

4. Place on a surface plate. There should be no warpage. Correct by re-surfacing as follows:

Place #400 or #600 grit wet sandpaper on surface plate and re-surface head using a figure-eight sanding pattern. Rotate head several times to avoid removing too much material from one side.

C. Valve, valve guide and valve seat

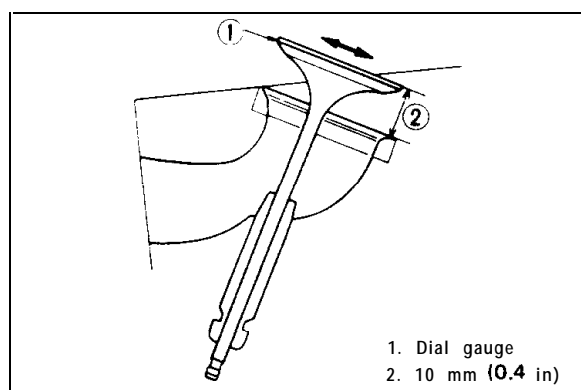
1. Valve guide

- a. If the valve guide inside diameter is beyond serviceable limits, replace with an oversize valve guide.

	Standard
Guide diameter (I.D.) (IN/EX)	8.010 – 8.019 mm (0.315 – 0.316 in)

- b. Measuring the clearance between valve and valve guide.

- 1) Insert the valve into the valve guide in the cylinder head and measure the clearance in both the X and Y axes, using a small dial gauge.



- 2) If the measured clearance is greater than 0.10 mm (0.0039 in) for the inlet valve or 0.12 mm (0.0047 in) for the exhaust valve, both the valve and valve guide should be replaced. The replacement valve guide should be one that is oversize.

Valve guide oversize:	
Part No.	Size (O.D.)
256-I 1133-I 1 (IN)	15.1 mm (0.594 in)
256-I 1133-21	15.2 mm (0.598 in)
256-I 1134-I 1 (EX)	15.1 mm (0.594 in)
256-I 1134-21	15.2 mm (0.598 in)

- c. To ease guide removal and reinstallation, and to maintain the correct interference fit, heat the head to 100°C. Use an oven to avoid any possibility of head warpage due to uneven heating.

- d. Use the appropriate shouldered punch (special tool) to drive the old guide out and drive the new guide in.
- e. After installing the valve guide, use 8 mm reamer (special tool) to obtain the proper valve clearance.
- f. After fitting the valve guide into the cylinder head, be sure to grind the valve seat, and perform valve lapping. The valve must be replaced with a new one.

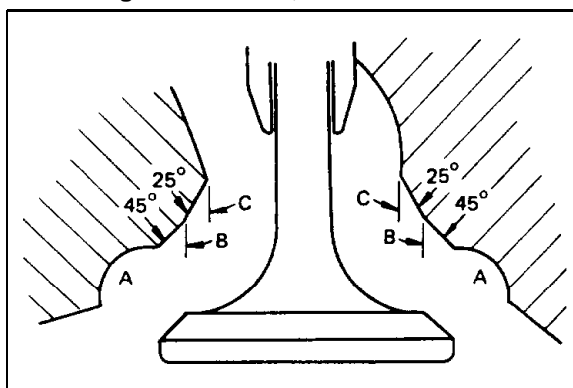
2. Grinding the valve seat.

- a. The valve seat is subject to severe wear similar to valve face. Whenever the valve face is resurfaced, the valve seat should also be re-surfaced at a 45° angle. In addition, if a new valve guide has been installed (without any valve repair), the valve seat should be checked to guarantee complete sealing between the valve face and seat.

CAUTION :

If the valve seat is obviously pitted or worn, it should be cleaned with a valve seat cutter. Use the 45° cutter, and when twisting the cutter, keep an even downward pressure to prevent chatter marks.

If cutting section "A" of the valve seat, use the 8R cutter (radius cutter). If cutting section "B", use the 45° cutter.



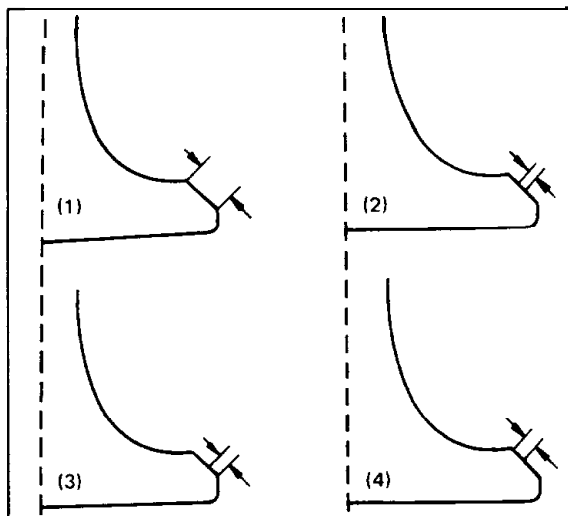
- b. Measure valve seat width. Apply mechanic's bluing dye (such as Dykem) to the valve face, apply a very small amount of fine grinding compound around the surface of the valve seat, insert the valve into position, and spin the valve quickly back and forth. Lift the valve, clean off all grinding compound, and check valve seat

width. The valve seat will have removed the bluing wherever it contacted the valve face. Measure the seat width with vernier calipers. It should measure approximately 1.3 mm. Also, the seat should be uniform in contact area. If valve seat width varies, or if pits still exist, then continue to cut with the 45° cutter. Remove just enough material to achieve a satisfactory seat.

	Standard width	Wear limit
Seat width	1.3 mm (0.051 in)	2.0 mm (0.079 in)

c. If the valve seat is uniform around the perimeter of the valve face, but is too wide or not centered on the valve face, it must be altered. Use either the 8R, 45° or 25° cutters to correct the improper seat location in the manner described below:

- 1) If the valve face shows that the valve seat is centered on the valve face, but too wide, then lightly use both the 8R and the 25° cutters to reduce the seat width to 1.3 mm.
- 2) If the seat shows to be in the middle of the valve face, but too narrow, use the 45° cutter until the width equals 1.3 mm.
- 3) If the seat is too narrow and right up near the valve margin, then first use the 8R cutter and then the 45° cutter to get the correct seat width.
- 4) If the seat is too narrow and down near the bottom edge of the valve face, then first use the 25° cutter and then the 45° cutter.



3. Lapping the valve/valve seat assembly.

a. The valve/valve seat assembly should be lapped if (1) neither the seat nor the valve face are severely worn, or (2) if the valve face and valve seat have been resurfaced and now require a final light grinding operation for perfect sealing.

b. Apply a small amount of coarse lapping compound to valve face. Insert the valve into the head. Rotate the valve until the valve and valve seat are evenly polished. Clean off the coarse compound, then follow the same procedure with fine compound.

Continue lapping until the valve face shows a complete and smooth surface all the way around. Clean off the compound material. Apply bluing dye to the valve face and rotate the valve face for full seat contact which is indicated by a shiny surface all around the valve face where the bluing has been rubbed away.

c. Valve leakage check

After all work has been performed on the valve and valve seat, and all head parts have been assembled, check for proper valve/valve seat sealing by pouring solvent into each of the intake ports, then the exhaust ports. There should be no leakage past the seat. If fluid leaks, disassemble and continue to lap with fine lapping compound. Clean all parts thoroughly, reassemble and check again with solvent. Repeat this procedure as often as necessary to obtain a satisfactory seal.

D. Valve spring

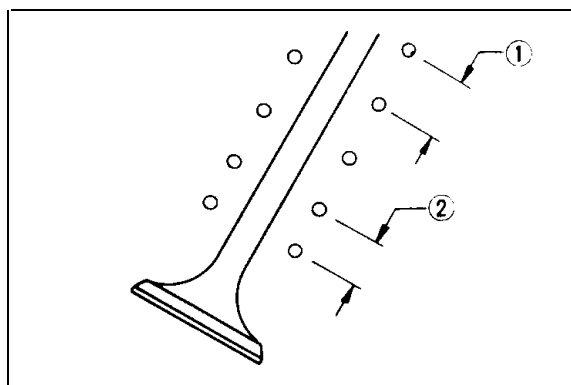
1. Checking the valve springs

a. This engine uses two springs of different sizes to prevent valve float or surging. The chart below shows the basic valve characteristics.

b. Even though the spring is constructed of durable spring steel, it gradually loses some of its tension. This is evidenced by a gradual shortening of free length. Use a vernier caliper to measure spring free length. If the free length of any spring has decreased more than 2 mm (0.08 in) from its specification, replace it.

c. Another symptom of a fatigued spring is insufficient spring pressure when compressed. This can be checked using a valve spring compression rate gauge. Test each spring individually. Place it in the gauge and compress the spring first to the specified compressed length with the valve closed (all spring specifications can be found in the previous section, valve spring), then to length with the valve open. Note the poundage indicated on the scale at each setting. Use this procedure with outer springs, then the inner spring.

NOTE: _____
All valve springs must be installed with greater pitch upward as shown.



1. Larger pitch
2. Smaller pitch

d. Valve spring specifications

	Outer	Inner
Free length	42.55 mm (1.675 in)	42 mm (1.645 in)
Installed pressure	16.5 ~ 19.0 kg (36.4 ~ 41.9 lb)	9.3 ~ 10.7 kg (20.5 ~ 23.6 lb)
and length (valve closed)	37 mm (1.457 in)	35 mm (1.378 in)
Compressed pressure	53.5 ~ 61.5 kg (117.9 ~ 135.6 lb)	25.5 ~ 29.0 kg (56.2 ~ 63.9 lb)
and length (valve open)	27.5 mm (1.083 in)	25.5 mm (1.004 in)
Allowable tilt from vertical	1.6 mm or 2.5° (0.063 in)	←

E. Rocker arm and rocker shaft.

- The rocker arm usually wears at two locations: (1) at the rocker shaft hole, (2) at the cam lobe contacting surface.
- Measure the rocker shaft hole in the rocker arm.

Standard size:

15.000 ~ 15.018 mm
(0.5906 ~ 0.5913 in)

- The shaft has been hardened and it should not wear excessively. If a groove has developed in this surface that can be felt, or if it shows a blue discoloration, then the shaft should be replaced and the lubrication system (pump and passages) checked.

Standard shaft diameter:

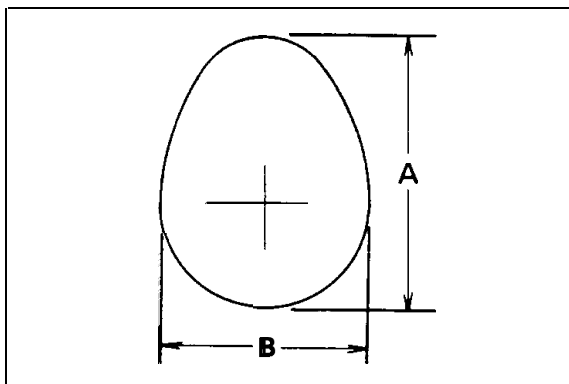
14.985 ~ 14.991 mm
(0.5900 ~ 0.5902 in)

- Standard clearance between the rocker shaft and hole should be 0.009 ~ 0.033 mm (0.00035 ~ 0.00130 in). If measurement shows more than 0.1 mm (0.0004 in) clearance, replace either or both parts as necessary.

F. Camshaft wear

- The cam lobe metal surface may have a blue discoloration due to excessive friction. The metal surface could also start to flake off or become pitted. This is due to poor lubrication, incorrect clearances (from poor adjustment or valve bounce), or due to normal wear.
- If any of the above wear conditions are readily visible, the camshaft should be replaced. Also, the corresponding rocker arm contacting surface should be checked for similar wear and replaced if obvious wear is noted.
- Even though the cam lobe surface appears to be in satisfactory condition, the lobes should be measured with a micrometer. Cam lobe wear can occur without scarring the surface. If this wear exceeds a predetermined amount, valve timing and lift are affected. Replace the camshaft if wear exceeds the limits listed below.

	Cam Lift(A)		Width (B)	
	Standard Value	Wear Limit	Standard Value	Wear Limit
Intake	39.99±0.05 mm (1.574±0.002 in)	39.84 mm (1.569 in)	32.24±0.05 mm (1.269±0.002 in)	32.09 mm (1.263 in)
Exhaust	40.03±0.05 mm (1.576±0.002 in)	39.88 mm (1.570 in)	32.30±0.05 mm (1.272±0.002 in)	32.15 mm (1.266 in)



4. All camshaft bearings should be removed, cleaned, dried, and the races visually checked for pits, rust spots or chatter marks where the balls have dragged, If any of these conditions exists the bearing(s) should be replaced.

G. Cam chain, sprocket and dampers

1. Cam chain

Except in cases of oil starvation, the cam chain wears very little. If the cam chain has stretched excessively and it is difficult to keep the proper cam chain tension, the chain should be replaced.

2. Cam sprockets

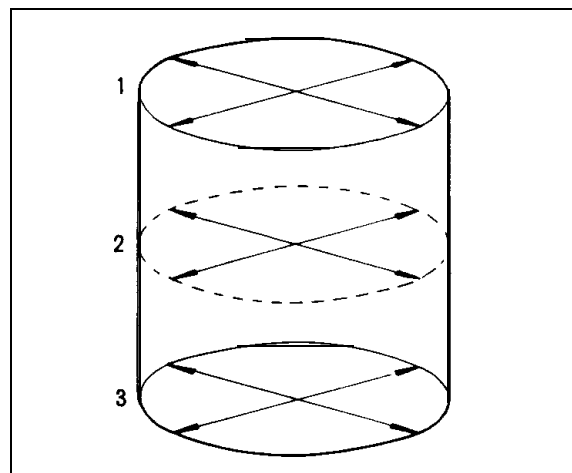
Check cam sprockets for obvious wear.

3. Cam chain dampers

Inspect the two vertical (slipper-type) dampers for excessive wear. Any that shows excessive wear should be replaced. Worn dampers may indicate an improperly adjusted or worn-out cam chain,

H. Cylinder

1. Inspect the cylinder walls for scratches. If vertical scratches are evident, the cylinder wall should be rebored or the cylinder should be replaced.
2. Measure cylinder wall wear as shown. If wear is excessive, compression pressure will decrease. Rebore the cylinder wall and replace the piston and piston rings. Cylinder wear should be measured at three depths with a cylinder bore gauge. (See illustration.)



	Standard	Wear limit
Cylinder bore	75.00 ~ 75.02 mm (2.9528 ~ 2.9536 in)	75.1 mm (2.9567 in)
Cylinder taper	—	0.05 mm (0.002 in)
Cylinder out-of-round		0.01 mm (0.0004 in)

If the cylinder wall is worn more than wear limit, it should be rebored.

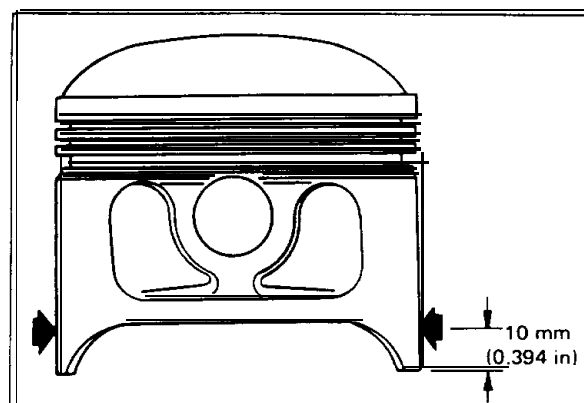
I. Piston and piston rings

1. Piston

- a. Measure the outside diameter of the piston at the piston skirt.

Measurement should be made at a point 10 mm (0.394 in) above the bottom edge of the piston. Place the micrometer at right angles to the piston pin.

Standard:	74.96, 74.97 mm (2.951, 2.952 in)
Oversize 1:	75.25 mm (2.963 in)
Oversize 2:	75.50 mm (2.972 in)
Oversize 3:	75.75 mm (2.982 in)
Oversize 4:	76.00 mm (2.992 in)



b. Determine piston clearance as follows:

Minimum bore measurement
– Maximum piston measurement
= Piston clearance

Example:

$$\begin{array}{r} 75.02 \text{ mm} \\ -74.97 \text{ mm} \\ \hline =0.05 \text{ mm piston clearance} \end{array}$$

- c. Piston ring/ring groove fit must have correct clearance. If the piston and ring have already been used, the ring must be removed and the ring groove cleaned of carbon. The rings should then be reinstalled. Use a feeler gauge to measure the gap between the ring and the land.

	Top	2nd
Side clearance	0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in)

2. Piston ring

- a. The oversize top and middle ring sizes are stamped on top of the ring.

Oversize 1:	0.25 (mm)
Oversize 2:	0.50 (mm)
Oversize 3:	0.75 (mm)
Oversize 4:	1.00 (mm)

- b. Push the ring into the bore and check end gap clearance with a feeler gauge.

NOTE: _____

The end gap on the expander spacer of the oil control ring is unmeasurable. If oil control ring rails show excessive gap, all three components should be replaced.

	Standard	Limit
Top/2nd ring	0.2 ~ 0.4 mm (0.0079 ~ 0.016 in)	1.0 mm (0.039 in)
Oil control (Rails)	0.2 ~ 0.9 mm (0.0079 ~ 0.0354 in)	Visual inspection

J. Piston pin

1. Apply a light film of oil to pin. install in connecting rod small end. Check for play. There should be no noticeable vertical play. If play exists, check connecting rod small end for wear. Replace pin and connecting rod as required.
2. The piston pin should have no noticeable free play in piston. If the piston pin is loose, replace the pin and/or the piston.

K. Crankshaft

1. Main bearing and big end bearing visually inspect all friction surfaces for obvious pits, scratches, chatter marks, or rust. Replace it if necessary.
2. Small end play(A)

Maximum allowable tolerance:
2.0 mm (0.079 in)

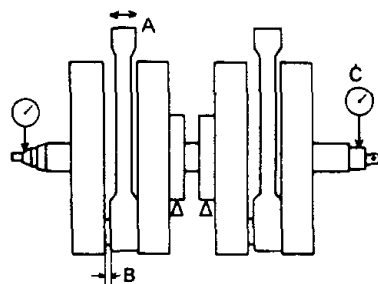
3. Big end side clearance(B)

Standard clearance:
0.15 – 0.4 mm (0.0059 ~ 0.016 in)

4. Crankshaft run out(C)

Mount the crankshaft in V-blocks and check for run out using a dial gauge.

Run out limit: 0.05 mm (0.002 in)



L. Oil pump

1. Check the clearance between housing and outer rotor.

Standard clearance:
0.10 ~ 0.18 mm (0.0039 ~ 0.0071 in)

2. Check the clearance between outer rotor and inner rotor.

Standard clearance:

0.03 ~ 0.09 mm (0.0012 ~ 0.0035 in)

M. Clutch

1. Clutch housing

Check dogs on clutch housing. Look for cracks and signs of galling on edges. If damage is moderate, deburr. If severe, replace clutch housing.

NOTE: _____

Galling on the friction plate dogs of the clutch housing will cause erratic clutch operation.

2. Clutch boss

Check splines on clutch boss for galling. If damage is slight to moderate, deburr. If it is severe, replace clutch boss.

NOTE: _____

Galling on clutch plate splines will cause erratic clutch operation.

3. Friction and clutch plates

Check clutch steel plates and friction plates for heat damage. Measure friction plate thickness at 3 or 4 points. Measure clutch plates for warpage. Replace clutch plate or friction plates as a set if any is faulty or beyond wear limits.

	Standard	Wear limit
Friction plate thickness	3.0 mm (0.118 in)	2.7 mm (0.106 in)
Clutch plate warp limit	—	0.05 mm (0.002 in)

4. Clutch push rod

Check ends of clutch push rod for indentation. If severe, clutch adjustment may be difficult. Check for looseness of the steel ends of the push rod. If ends are loose or indented, replace push rod.

5. Clutch springs

Measure clutch spring free length. Replace springs as a set if necessary.

Clutch spring length:

34.6 mm (1.362 in)

N. Transmission

1. Inspect each shift fork for signs of galling on gear contact surfaces. Check for bending. Make sure each fork slides freely on its guide bar.
2. Roll the guide bar across a surface plate. If bar is bent, replace.
3. Check the shift cam grooves for signs of wear or damage. If any profile has excessive wear and/or damage, replace cam.
4. Check the cam followers on each shift fork for wear. The follower should fit snugly into its seat in the shift fork, but should not be overly tight. Check the ends that ride in the grooves in the shift cam. If they are worn or damaged, replace followers.
5. Check shift cam dowel pins and side plate for looseness, damage or wear. Replace as required.
6. Check the shift cam stopper plate and circlip and stopper for wear. Replace as required.
7. Check the transmission shafts using a centering device and dial gauge. If any shaft is bent beyond specified limit, replace shaft.

Maximum run-out:

0.03 mm (0.001 in)

8. Carefully inspect each gear. Look for signs of obvious heat damage (blue discoloration). Check the gear teeth for signs of pitting, galling or other extreme wear. Replace as required.
9. Check to see that each gear moves freely on its shaft.
10. Check to see that all washers and clips are properly installed and undamaged. Replace bent or loose clips and bent washers.

11. Check to see that each gear properly engages its counterpart on the shaft. Check the mating dogs for rounded edges, cracks, or missing portions. Replace as required.

0. Electric starter gears and clip spring

1. Check the gears for wear or scratches on teeth, particularly in the chamfered area of each gear.
2. The clip spring is fitted to gear (4) (Refer to PAGE 20) and slides in the groove. A too-tight or loose-fitting clip may result in improper operation. If too loose, bend the clip so that the friction increases, or replace clip.

Friction tension:

2.2 ~ 2.5 kg (4.9 ~ 5.5 lb)

P. Kick starter

1. Kick gears

Check the kick gears for wear or scratches on teeth, particularly in the chamfered area of each gear.

2. Kick clip spring

The kick clip is fitted to kick gear and slides in the groove. A too-tight or loose-fitting clip may result in improper operation. If too loose, bend the kick clip so that the friction increases, or replace clip.

Friction tension:

1.2 ~ 1.7 kg (2.0 ~ 3.7 lb)

Q. Crankcases and oil passages

1. Check crankcases for cracks or other damage.
2. Clean all oil passages and blow out with compressed air.

R. Bearings and oil seals

1. After cleaning and lubricating bearings, rotate inner race with a finger. If rough spots are felt, replace the bearing.
2. Check oil seal lips for damage and wear. Replace as required.

3-4. ENGINE ASSEMBLY AND ADJUSTMENT

NOTE:

- 1) All gaskets and seals should be replaced when an engine is overhauled. All gasket surfaces must be cleaned.
- 2) Properly oil all mating engine and transmission parts during assembly.
- 3) All circlips should be inspected before assembly. Replace distorted circlips. Always replace cotter pins and piston pin clips after one use.

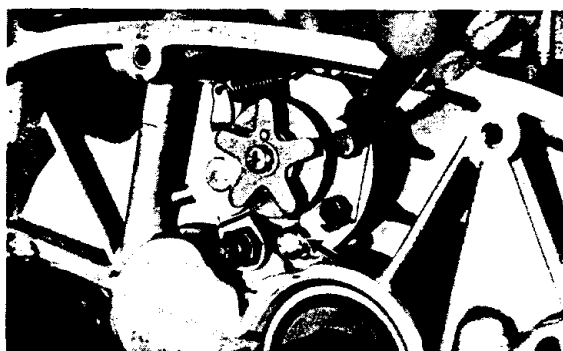
A. Shift

(Refer to PAGE 21)

Install shift forks, shift cam, guide pin, cotter pin, guide bar, stopper plate and detent. Apply LOCK-TITE to eccentric bolt.

NOTE:

Check for smooth and complete shifting after installing transmission.



B. Transmission and crankshaft

1. Rotate shift cam to neutral position.
2. Install the transmission, bearings and seals onto the upper case.
3. Install crankshaft, seal and bearings.

NOTE:

Fit each bearing over each locating pin and push the crankshaft into position by hand. Each bearing has line or punch mark which indicates the position of mating surface.

4. Make sure all bearings are positioned properly as shown.



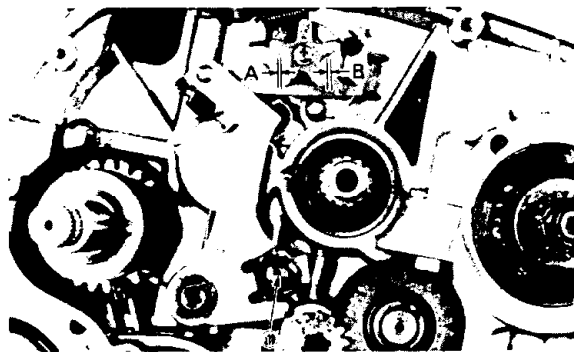
1. No clearance
5. Fit the chain over the cam sprocket,
6. Apply Yamaha Bond No. 4 sealant to crankcase mating surface.
7. Install bottom crankcase and nuts. Install nuts as follows:
 - a. Use copper washers and blind nuts on bolts (1), (2), (3), (4), (12), (13).
 - b. Tighten nuts in two stages in proper torque sequence. Start with bolt number one.

Crankcase torque:
2.2 m-kg (16 ft-lb)

NOTE: _____
Before installing crankcase, make sure electric starter shaft 2 and gear 1 (PAGE 20) is installed.

C. Shifter assembly

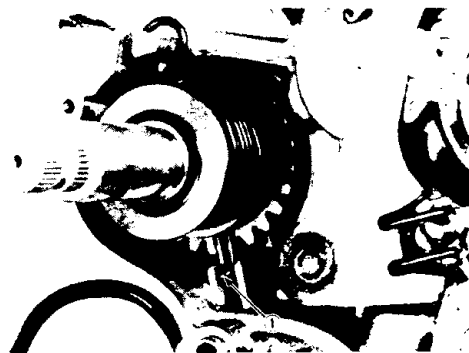
1. Install shift shaft. Install circlip (E-clip) on left side of crankcases.
2. Make sure distances A and B are equal. Adjust them by adjuster if necessary.



1. Adjuster 2. A = B

D. Kick starter assembly

1. Partially insert the assembly until the return spring can be slipped over its anchor point.

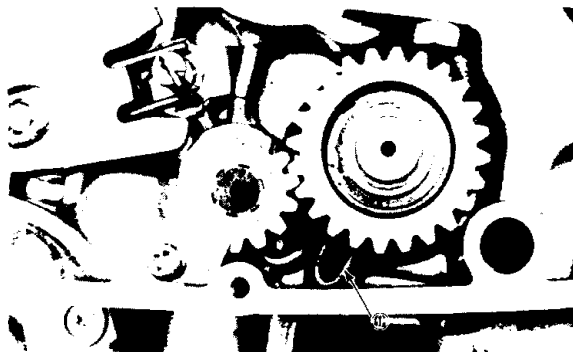


1. Kick clip
2. Positioning the kick clip in the groove, rotate the kick axle by kick lever 1/2 turn counterclockwise.
3. Push the axle in.
4. Check for correct operation.

E. Electric-starter gear assembly

Install the unit as shown.

(Refer to PAGE 20, if necessary.)



1. Clip

F. Clutch

1. Install the following parts in the order given.
 - a. Plate 1, t = 1 mm (0.039 in)
 - b. Plate 2, t = 2 mm (0.079 in)
 - c. Spacer shaft
 - d. Housing
 - e. Bearing plate, t = 1 mm (0.039 in)
 - f. Bearing
 - g. Plate 2, t = 2 mm (0.079 in)
 - h. Clutch boss
 - i. Plane washer, t = 2.6 mm (0.102 in)
 - j. Conical spring
 - k. Nut (using special tool)

Clutch lock nut torque:
6.5 m-kg (47 ft-lb)

- l. Friction plates and clutch plates
- m. Push rods, balls and push crown

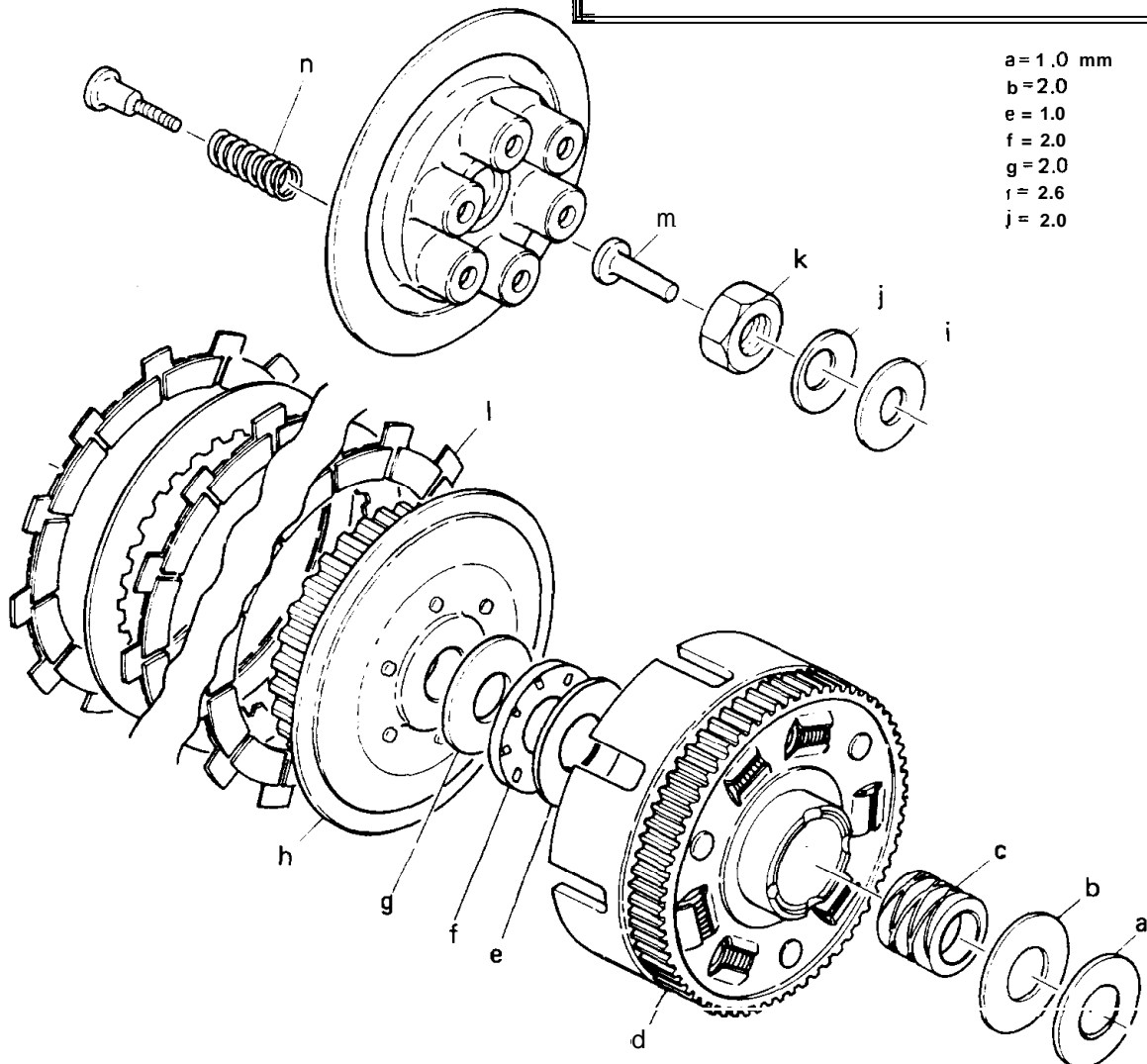
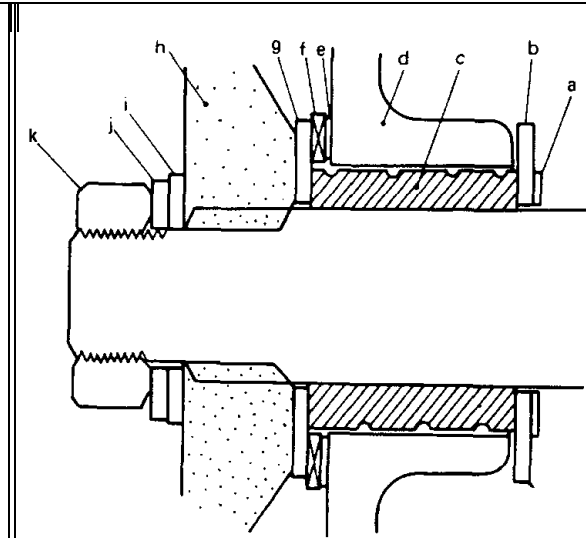
n. Pressure plate and clutch springs

o. Primary drive gear

Clutch screw torque:
1.0 m-kg (7 ft-lb)

Drive gear torque:
9 m-kg (65 ft-lb)

- a. Plate 1
- b. Plate 2
- c. Spacer shaft
- d. Housing
- e. Bearing plate
- f. Bearing
- g. Plate 2
- h. Clutch boss
- i. Plane washer
- j. Conical spring
- k. Nut (using special tool)
- l. Friction plates and clutch plates
- m. Push rods, balls and push crown
- n. Pressure plate and clutch spring



G. Generator

1. Lock the crank rotation at the primary drive gear.
2. Reverse the generator removal sequence.

H. Oil pump

Reverse the oil pump removal sequence.



I. Right-hand crankcase cover

While properly engaging oil pump gear, install new case cover gasket and right-hand crankcase cover. Tighten holding screws gradually until proper torque is reached.

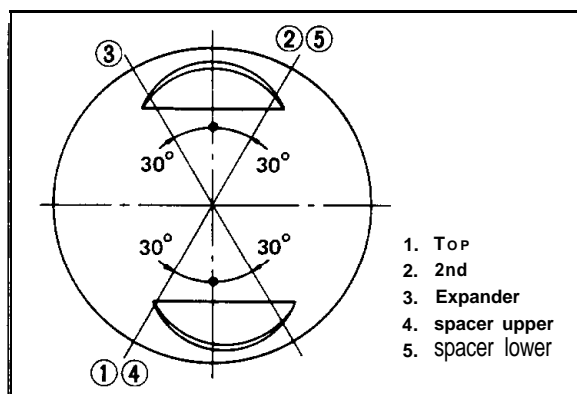
Crankcase cover holding screw torque:
1.0 m-kG (7 ft-lb)

J. Piston

1. Position piston rings as shown.

NOTE: _____

- 1) Make sure ends of oil ring expanders are not overlapped.
- 2) Manufacturer's marks or numbers stamped on the rings are on the top side of the rings. Coat pistons and rings well with oil.



2. Install pistons on rods. The arrow on the pistons must point to the front of the engine.

NOTE: _____

Always install new piston pin clips.

K. Cylinder and cylinder head

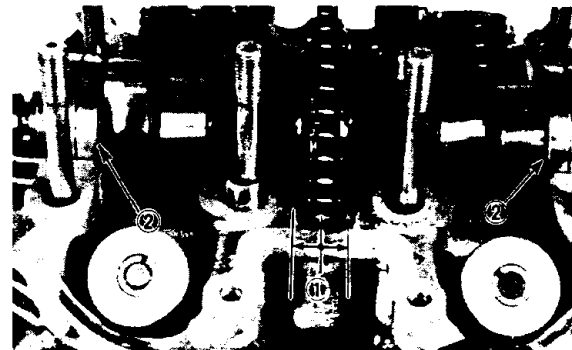
1. Install the tensioner cushion onto crankcase.
2. Install a new cylinder base gasket.
3. Install cylinder using special tool.
4. Install the cylinder head gasket and cylinder head.

NOTE: _____

The assembly of the cylinder head is the reverse of the disassembly procedure. Install valve springs with tighter windings (smaller pitch) down,

L. Camshaft

1. Rotate the piston to TDC.
2. Install the chain onto the camshaft with no slack in the cam chain on the front portion (opposite side from the tensioner).



1. Center
2. No clearance

3. Position the groove in the left side of the cam sprocket so that it lines up with the sprocket centers.

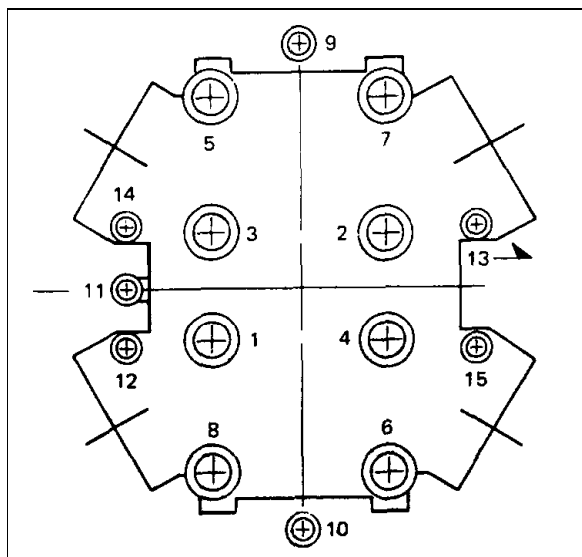


1. 90°

4. Joint the chain together and revet a new link.
5. Install the cam chain tensioner, and adjust chain tension. Refer to PAGE. (8).
6. Make sure the timing is correct.

M. Cylinder head cover

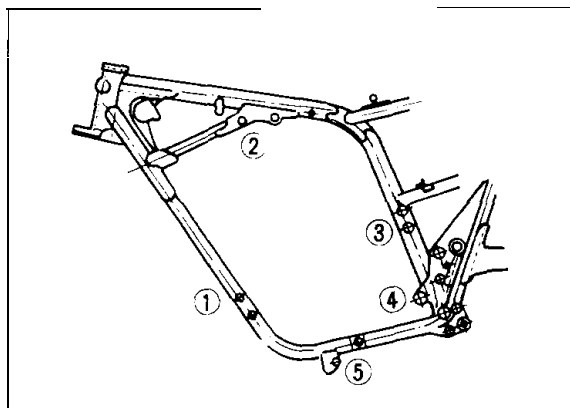
1. Install all components in the head cover.
2. Apply Yamaha No. 4 sealant to cover mating surfaces.
3. Install all head cover retaining nuts and bolts and thread them down until lightly seated.
4. Tighten them with torque wrench in the order given



Tightening torque:

- 1 – 8 3.8 m·kg (27 ft·lb)
 11 1.0 m·kg (7 ft·lb)
 Others 2.2 m·kg (16 ft·lb)

O. Engine



Tightening torque:

1. 4.5 (M10) ; 5.0 m·kg (36 ft·lb)
 2. (M8) ; 2.0 m·kg (14 ft·lb)
 3. (M10) ; 4.5 m·kg (33 ft·lb)

N. Governor and breaker assembly

Reverse the governor and breaker removal sequence.

NOTE:

Before inserting the governor rod, supportive bearings should be lubricated with molybdenum disulfide.