

# 7. Engine Removal/Installation

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## Service Information

- A floor jack or other adjustable support is required to support and maneuver the engine.

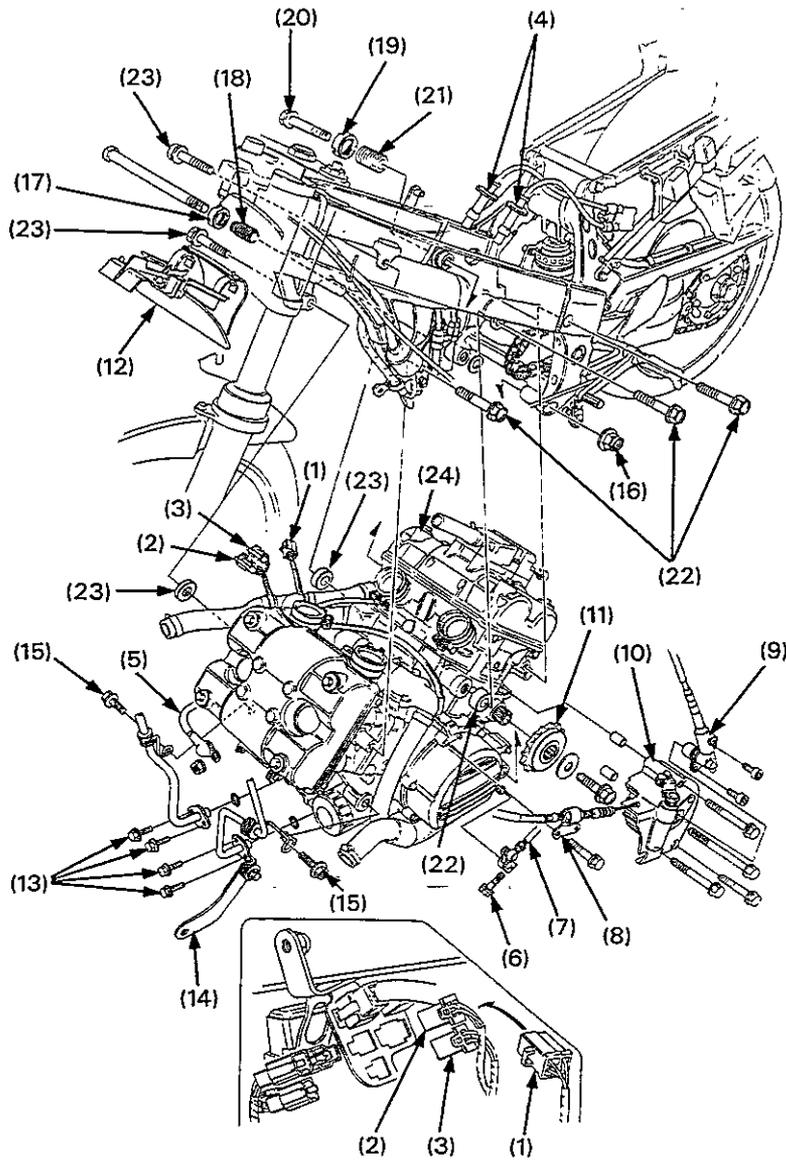
### CAUTION

- Do not jack up the motorcycle using the oil filter.

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- To protect the engine, place a rubber board or equivalent on the floor before removing/installing the engine.
- Place a jack under the engine and support the motorcycle securely. Remove and install the engine with care not to damage the frame, engine, cables, and the harnesses.
- When removing/installing the engine, tape the frame to protect it.
- The following components can be serviced with the engine installed in the frame:
  - alternator (Section 14)
  - cylinder head (Section)
  - clutch (Section 9)
  - gearshift linkage (Section 9)
  - oil pump (Section 4)
  - starter motor (Section 16)
  - water pump (Section 5)
- The following components require engine removal for service:
  - connecting rod (Section 10)
  - crankshaft (Section 10)
  - piston (Section 8)
  - transmission (Section 10)

# Engine Removal



**CAUTION**

- Place a jack under the engine and support the motorcycle securely.
- Turn the ignition switch OFF before disconnecting the cable from the battery negative ( - ) terminal.
- When placing the jack under the engine, take care not to set the jack against the oil filter.
- Take care not to pinch the wire harnesses.

**NOTE**

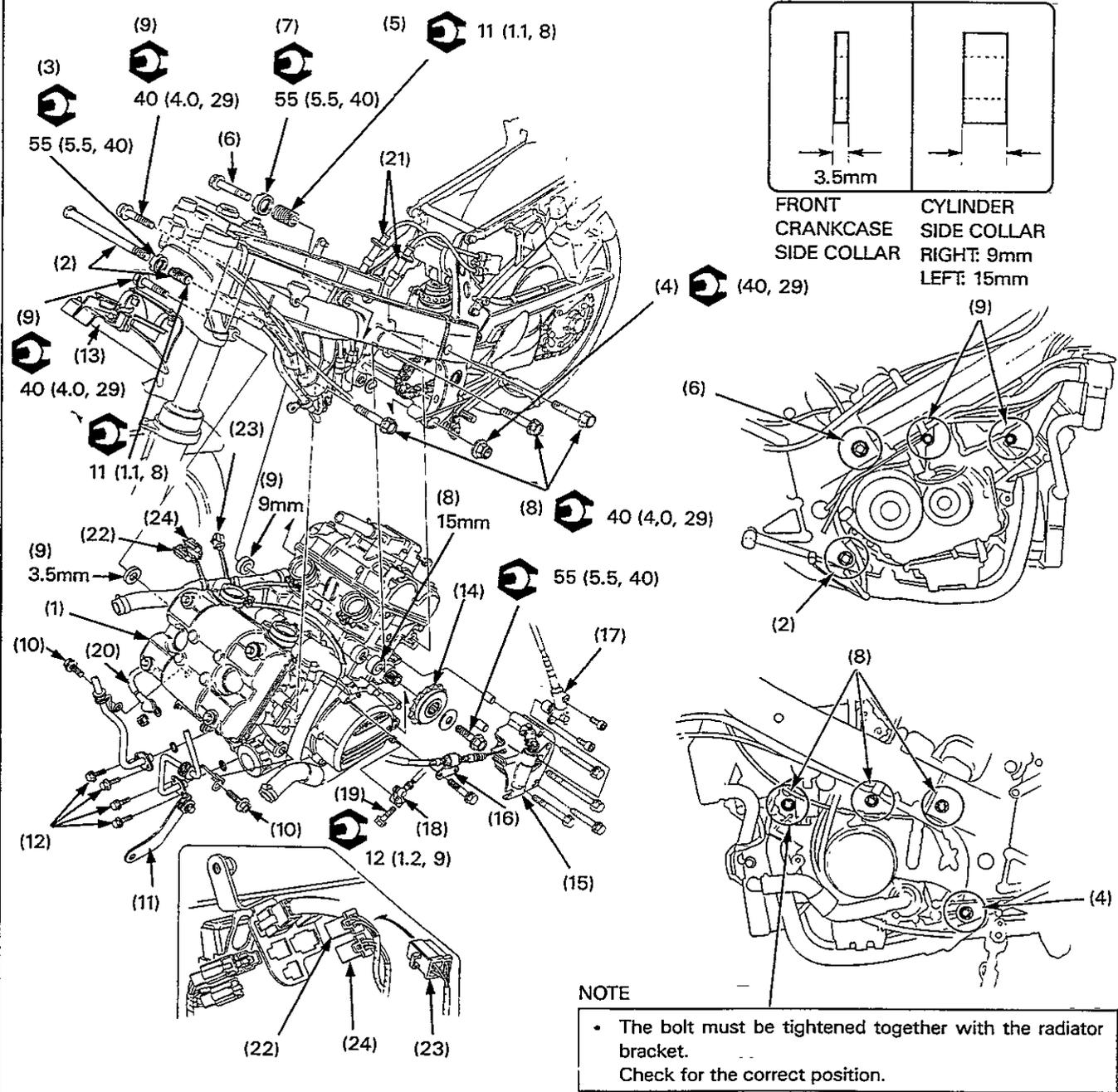
- When the clutch lock nut, primary drive gear bolt, and the flywheel bolt are removed after removing the engine, loosen them in advance to ease removal.

**Requisite Service**

- Engine oil draining (location: page 3-3, step: section 2 of the Common Service Manual).
- Exhaust pipe removal (page 2-10).
- Fuel tank removal (page 2-5).
- Carburetor removal (page 6-8).
- Coolant draining (page 5-3).
- Radiator removal (page 5-6).
- Loosen the drive chain (page 3-11).

Procedure		Q'ty	Remarks
<b>Removal Order</b>			
(1)	Alternator wire connector	1	
(2)	Pulse generator wire connector	1	
(3)	Neutral switch wire connector	1	NOTE • Disconnect the which is integrated with the oil pressure switch.
(4)	Spark plug cap	4	
(5)	Starter motor cable	1	
(6)	Gearshift spindle joint bolt	1	
(7)	Gearshift spindle joint	1	
(8)	Clutch cable	1	NOTE • Loosen the lower adjuster lock nut and remove.
(9)	Speedometer gear box	1	NOTE • Remove the mounting bolt.
(10)	Drive sprocket cover	1	
(11)	Drive sprocket	1	NOTE • Remove the sprocket and remove the drive chain.
(12)	Heat protector	1	
(13)	Oil pipe joint bolt	4	
(14)	Lower radiator stay	1	
(15)	Oil pipe bolt	2	
(16)	Rear lower engine mounting nut	1	
(17)	— adjusting bolt lock nut	1	
(18)	— mounting adjusting bolt	1	NOTE • Turn counterclockwise together with the mounting bolt and remove.
(19)	Rear upper bolt lock nut	1	
(20)	— mounting bolt	1	
(21)	— adjusting bolt	1	NOTE • Loosen until the bolt end is not extruding inside the frame.
(22)	Left mounting bolt/collar	3/1	NOTE • Front bolt must be tightened together with the radiator bracket.
(23)	Right mounting bolt/collar	2/2	
(24)	Engine assembly	1	NOTE • Lower the engine straight, then raise the frame.

# Engine Installation



**CAUTION**

- Place a jack under the engine and support the motorcycle securely. Take care not to damage the frame, engine, etc.
- Take care not to pinch the cable and wires.
- When placing the jack under the engine, take care not to set the jack against the oil filter.
- Loosely tighten the all mounting bolts and check to see that the engine is placed in correct position. Tighten the mounting bolts first that are tightened together with the adjusting bolts (page 7-6).

**Requisite Service**

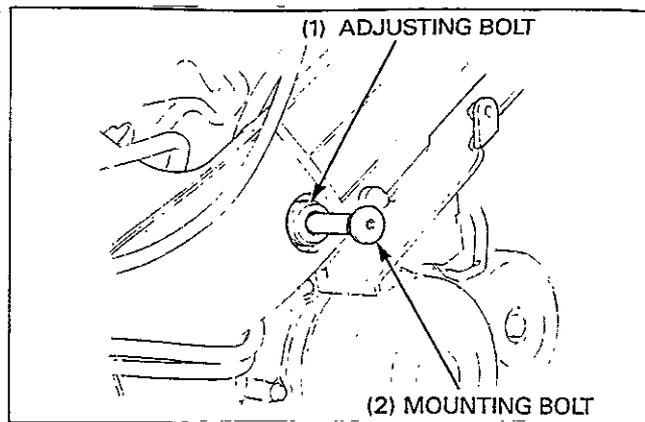
- Exhaust pipe installation (page 2-10).
- Carburetor installation (page 6-8).
- Coolant refill (section 5 of the Common Service Manual).
- Radiator installation (page 5-6).
- Fuel tank installation (page 2-5).

Procedure		Q'ty	Remarks
<b>Installation Order</b>			
(1)	Engine assembly	1	
(2)	Rear lower engine mounting bolt/adjusting bolt	1/1	NOTE • Insert the mounting bolt into the adjusting bolt, engage them, and tighten them together.
(3)	— adjust bolt lock nut	1	
(4)	— mounting nut	1	
(5)	Rear upper adjusting bolt	1	NOTE • Loosely tighten.
(6)	— mounting bolt	1	NOTE • Loosely tighten the bolt first, tighten the adjusting bolt as much as it goes, and install the lock nut.
(7)	— lock nut	1	
(8)	Left mounting bolt/collar	3/1	NOTE • The rearward bolt has a collar (15mm of with). The forward bolt must be tightened together with the radiator bracket. Loosely tighten to check the correct installation position.
(9)	Right mounting bolt/collar	2/2	NOTE • Install the collars in proper positions.
(10)	Oil pipe bolt	4	
(11)	Lower radiator stay	1	NOTE • Install the drive chain on the drive sprocket.
(12)	Oil pipe joint bolt	2	NOTE • Interlock the lifter arm with the lifter rod.
(13)	Heat protector	1	
(14)	Drive sprocket	1	
(15)	Drive sprocket cover	1	
(16)	Clutch cable	1	
(17)	Speedometer gear box	1	NOTE • Engage with the drive sprocket bolt (page 10-2).
(18)	Gearshift spindle joint	1	
(19)	Gearshift spindle joint bolt	1	NOTE • Install the punch mark on the arm aligned with the mark on the spindle (page 10-2).
(20)	Starter motor cable	1	
(21)	Spark plug cap	1	
(22)	Pulse generator wire connector	1	
(23)	Alternator wire connector	1	
(24)	Neutral switch wire connector	1	

## Engine Mounting Bolt Installation

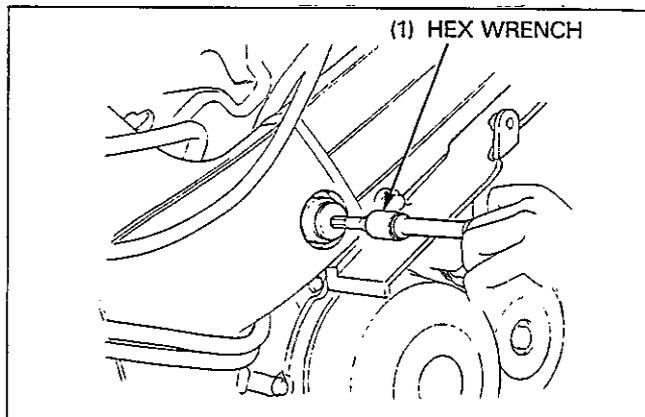
[Rear Upper Mounting Bolt]

Set the adjusting bolt over the mounting bolt and engage them. Push the mounting bolt into the place shown in the drawing as full as it goes.



Tighten the mounting bolt and the adjusting bolt by using a hex wrench.

**TORQUE: 11 N·m (1.1 kg-m, 8 ft-lb)**



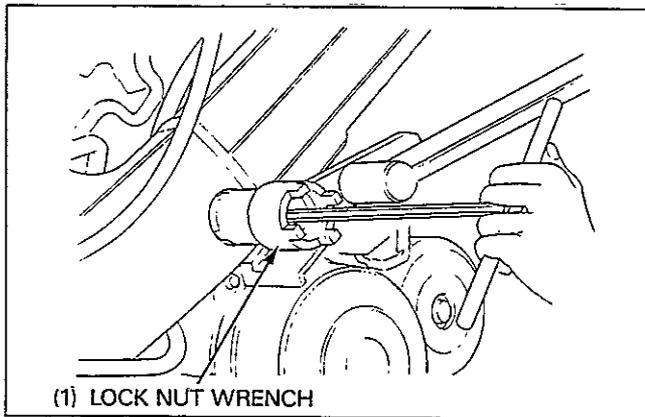
Install the lock nut. Hold the adjusting bolt and tighten the lock nut by using the lock nut wrench.

**TORQUE: 55 N·m (5.5 kg-m, 40 ft-lb)**

**STOOL**

**LOCK NUT WRENCH**

**07HMA-MR70200**

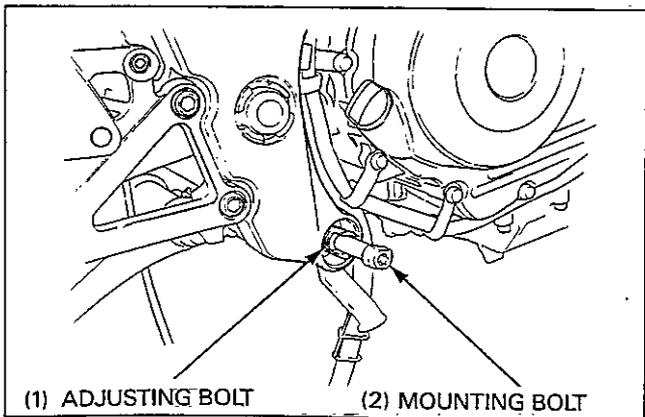


[Rear Lower Mounting Bolt]

Apply a thin coat of grease to the mounting bolt.

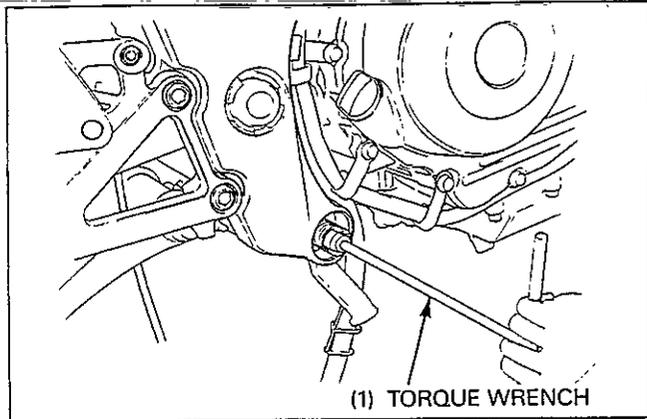
Set the adjusting bolt over the mounting bolt and engage them.

Push the mounting bolt into the place shown in the drawing as full as it goes.



Tighten the mounting bolt and the adjusting bolt by using a hex wrench.

**TORQUE: 11 N·m (1.1 kg-m, 8 ft-lb)**



Install the lock nut. Hold the mounting bolt and tighten the lock nut by using the lock nut wrench.

**TORQUE: 55 N·m (5.5 kg-m, 40 ft-lb)**

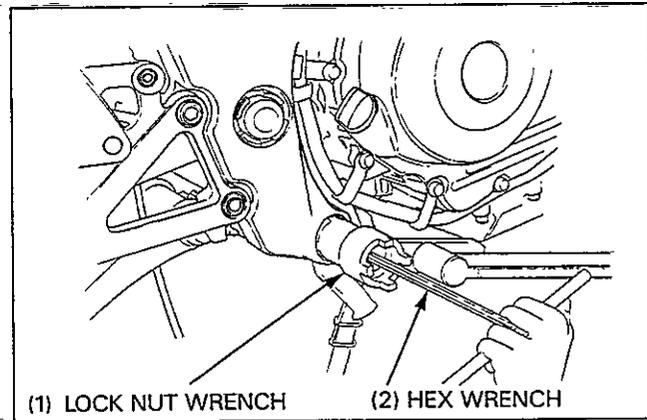
**5 TOOL**

**LOCK NUT WRENCH**

**07HMA-MR70200**

Tighten the mounting nut on the other side.

**TORQUE: 40 N·m (4.0 kg-m, 29 ft-lb)**

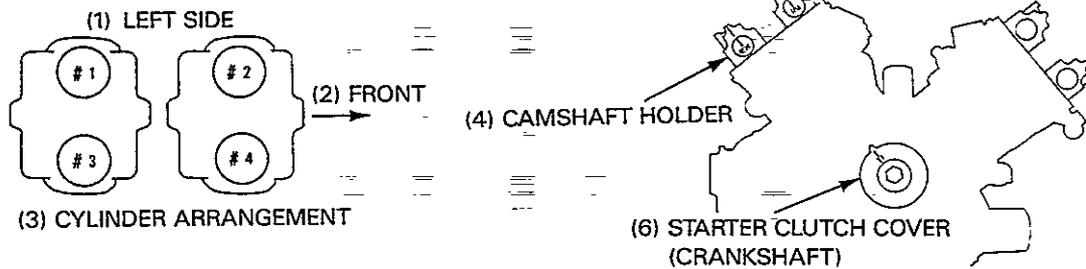


# 8. Cylinder Head/Valves

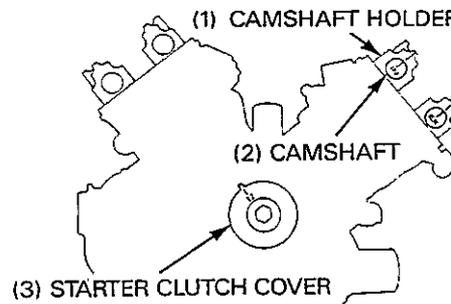
<b>Service Information</b>	8-1	<b>Cylinder Head Disassembly/Assembly</b>	8-6
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## Service Information

- The cylinder head, camshaft, and the cam gear case can be serviced with the engine mounted on the frame.
- If the front or rear camshaft is removed, be sure to check the valve timing on the other cylinder from which the shaft is not removed, then reinstall the removed shaft.
- When servicing the cylinder head, note and record the shim numbers and locations so that they can be set in their original position.
- When assembling the cylinder head, apply molybdenum disulfide grease to the sliding surfaces of the valve stem, rocker arm, rocker arm shaft, and the camshaft.
- Be sure that the No. 1 cylinder is at the top dead center of the compression stroke when the T1 mark is aligned with the alignment mark on the clutch cover (cutout) and the camshaft edge mark is toward up (i.e. aligned with the scribe line on the camshaft holder). Each mark should be positioned as shown in the drawing.
- The crankshaft should rotate clockwise and the camshaft counterclockwise viewed from the clutch cover side.
- The cylinders should be arranged as shown in the drawing.



- Be sure that the No. 4 cylinder is at the top dead center of the compression stroke when the T2 mark is aligned with the alignment mark on the clutch cover (cutout) and the camshaft edge mark is toward up (i.e. aligned with the scribe line on the camshaft holder). Each mark should be positioned as shown in the drawing.



## Troubleshooting

The cylinder head troubles can be detected by the cylinder compression and the abnormal engine noise.

### Cylinder Compression Too Low

- Valve
  - Misadjusted valve clearance
  - Seized or bent valve
  - Damaged valve spring
  - Improper valve timing
  - Improperly seated valve seat
- Cylinder head
  - Leads from the cylinder head
  - Distorted or cracked cylinder head

### Cylinder Compression Too High

- Carbon deposits on the piston and in the combustion chamber

### Abnormal Noise

- Misadjusted valve clearance
- Seized valve or damaged valve spring
- Damaged or worn camshaft holder and camshaft
- Damaged or worn rocker arm
- Damaged or worn cam gear



## NOTE

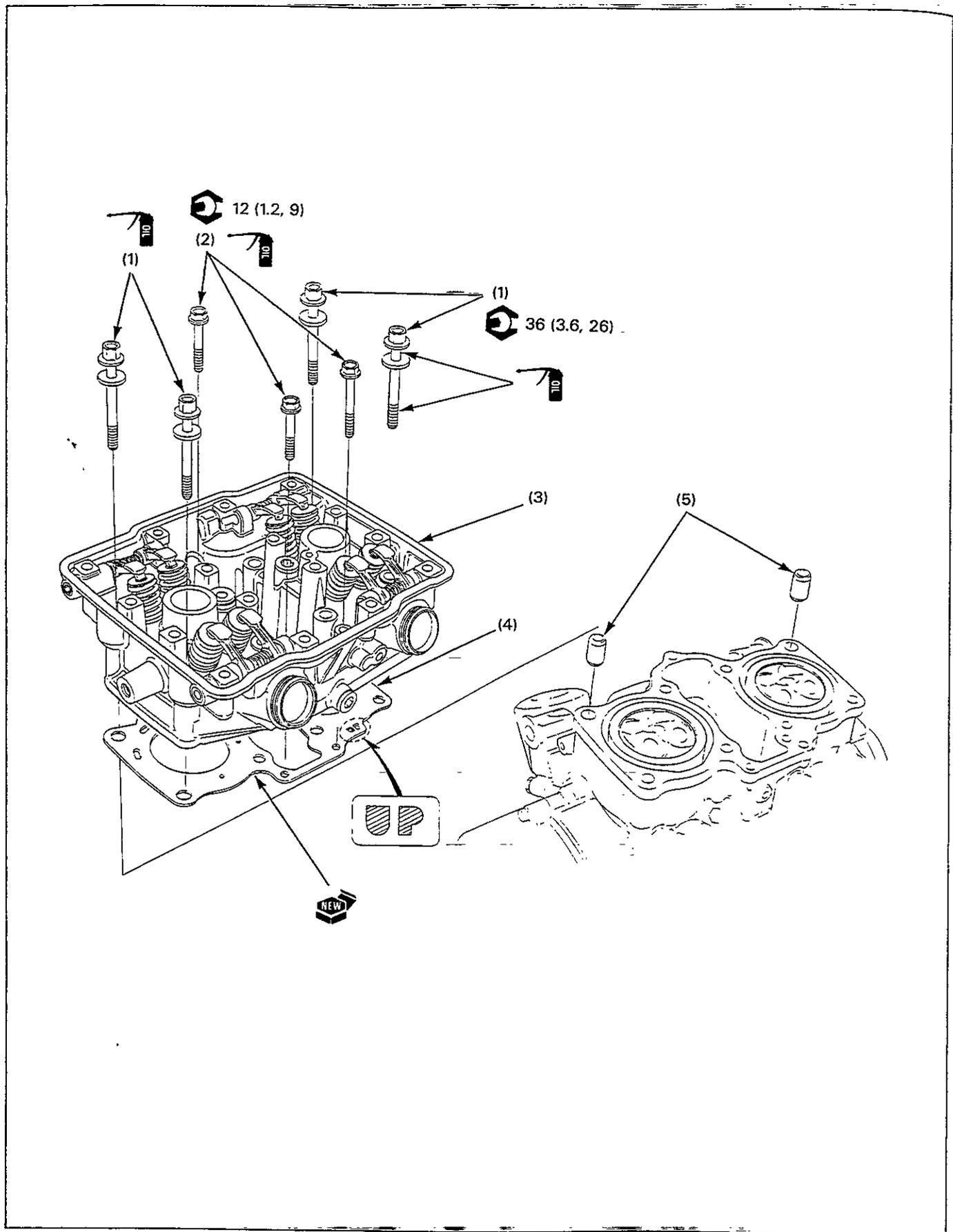
- Service on the front side is described on this page. Perform the rear side service in the same manner.
- Take care not to drop any part into the hole in the cam gear case.
- The cam gear case is stamped with the front and rear I.D. marks. Do not confuse the front and rear gear cases when the both are removed.
- When removing the camshaft holders, be sure that the camshaft of one cylinder is at the top dead center of the compression stroke. Loosen the holder bolts on the side of the other cylinder (which camshaft is at the top dead center of the exhaust stroke) equally in 2 or 3 steps, then loosen the remaining holder bolts in the same manner. Remove the holders as straight as possible.
- Each camshaft is stamped with the I.D. mark; F for the front cylinder and R for the rear cylinder. Also each camshaft is marked with IN or EX respectively.

## Requisite Service

- Radiator removal (page 5-6).
- Water pipe.
- Carburetor removal (page 6-8).
- Spark plug removal.

Procedure		Q'ty	Remarks
<b>Removal Order</b>			
(1)	Carburetor insulator	2	
(2)	Cylinder head cover bolt/washer	4/4	
(3)	Cylinder head cover	1	
(4)	Gasket	1	
(5)	Camshaft holder bolt	16	NOTE <ul style="list-style-type: none"> <li>• Check that the camshaft of one cylinder is at the top dead center of the compression stroke.</li> <li>• Loosen the holder bolts on the side of the other cylinder which camshaft is at the top dead center of the exhaust stroke in 2 or 3 steps equally, then loosen the remaining holder bolts.</li> </ul>
(6)	Oil pipe stopper plate	2	
(7)	Oil pipe	1	
(8)	Camshaft assembly	2	NOTE <ul style="list-style-type: none"> <li>• Check for the cam gear and drive gear engagement.</li> </ul>
(9)	Cam holder dowel pin	8	NOTE <ul style="list-style-type: none"> <li>• The cam holder dowel pins must not necessarily removed.</li> </ul>
(10)	Camshaft holder	4	NOTE <ul style="list-style-type: none"> <li>• Check the mark on the camshaft holder and erase either front (F) or rear (R) mark.</li> </ul>
(11)	Camshaft	2	NOTE <ul style="list-style-type: none"> <li>• Remove by aligning the cam lobe with the long hole in the cam holder.</li> </ul>
(12)	Cam gear case set bolt	1	NOTE <ul style="list-style-type: none"> <li>• With copper washer.</li> </ul>
(13)	Cam gear case mounting bolt	4	NOTE <ul style="list-style-type: none"> <li>• With conical washer. Loosen in 2 or 3 steps equally.</li> </ul>
(14)	Cam gear case	1	NOTE <ul style="list-style-type: none"> <li>• Do not confuse the front and rear when both are removed.</li> </ul>
(15)	Dowel pin (8mm)	2	

# Cylinder Head Removal/Installation



**NOTE**

- Service on the front side is described on this page. Perform the rear side service in the same manner.
- When removing/installing the front engine mounting bolt, be sure to protect the oil pan by attaching it with 2 suitable wood board and support the engine with a jack to prevent load on the bolt.

**CAUTION**

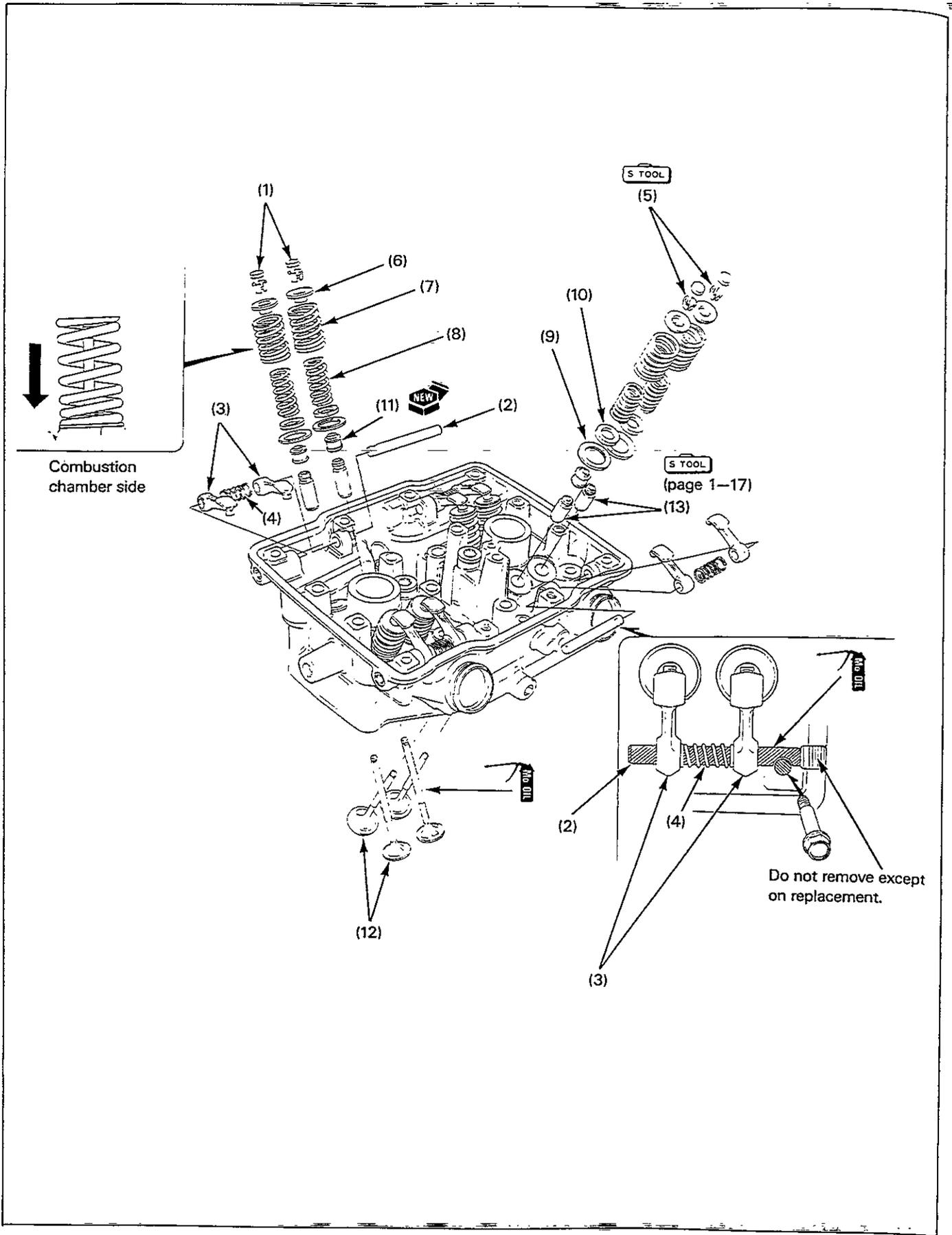
- Apply engine oil to the threads and the seating face of the cylinder head bolt.

**Requisite Service**

- Operations related to the front cylinder:
  - Radiator removal/installation (page 5-6).
  - Thermostat removal/installation (page 5-4).
- Operations related to the both cylinder:
  - Camshaft holder/cam gear case removal (page 8-2).
  - Coolant draining (page 5-3).
  - Exhaust pipe removal/installation (page 2-10).
  - Engine mounting bolt removal.
  - Carburetor removal/installation (page 6-8).

Procedure		Q'ty	Remarks
(1)	<b>Removal Order</b> Cylinder head bold 8 × 84mm	4	Installation is in the reverse order of removal. NOTE • Loosen/tighten the conical washer attached special bolts together with the 6mm bolts in 2 or 3 steps equally.
(2)	Cylinder head bold 6 × 62mm	3	
(3)	Cylinder head assembly	1	
(4)	Gasket	1	NOTE • Install with the "UP" mark facing up.
(5)	Dowel pin	2	

# Cylinder Head Disassembly/Assembly



**CAUTION**

- Before servicing the cylinder head, note and record the shim thickness and combination with the valve to installed the shims in their original position.
- Do not compress the valve springs more than necessary.
- Note the location of each part and reinstall them in their original position.
- When installing the valve springs, install with the narrower coil pitch side toward the combustion chamber.
- Do not remove the rocker arm shaft plug except when it is replaced as it has the tapered threads. When the rocker arm shaft plug is replaced, apply sealing agent to the threads and install.

**NOTE**

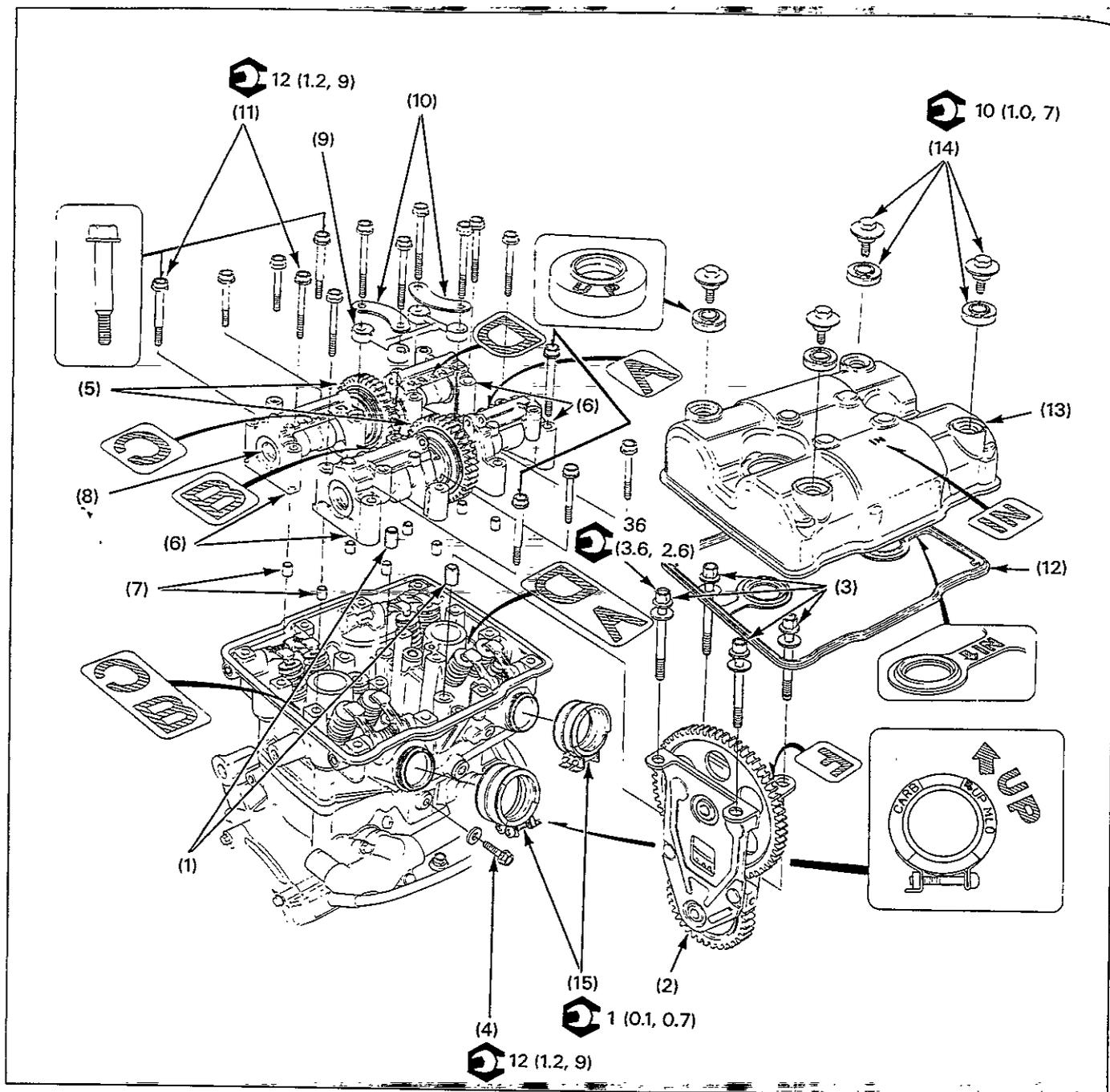
- Servicing on the front bank is described on this page. Perform the rear bank service in the same manner.

**Requisite Service**

- Cylinder head removal/installation (page 8-4).

	Procedure	Q'ty	Remarks
	<b>Disassembly Order</b>		Assemble is in the reverse order of disassembly.
(1)	Shim	8	NOTE • Note the location and thickness of the shims.
(2)	Rocker arm shaft	4	NOTE • The rocker arm shaft can be easily removed by pressing the spring with the two rocker arms and moving the shaft inward. When installing the rocker arm shaft, align the groove in the rocker arm shafts with the recess groove of the camshaft holder bolts.
(3)	Rocker arm	8	NOTE • Check for missing spring.
(4)	Thrust spring	4	
(5)	Valve cotter	16	
(6)	Valve retainer	8	
(7)	Outer spring	8	NOTE • Install them with the narrow pitch end facing down.
(8)	Inner spring	8	
(9)	Outer spring seat	8	NOTE
(10)	Inner spring seat	8	• Install flush. There should be no step between the spring seats.
(11)	Stem seal	8	
(12)	Valve IN/EX	8	
(13)	Valve guide	8	

## Camshaft, Cam Gear Case Installation



## NOTE

- The front cylinder service is described on this page. Perform the rear cylinder service in the same manner.
- Check that the shim is installed on each valve retainer securely. Take care not to drop any part into the hole in the cam gear case.
- When installing the cam shaft holders, check that the camshaft of one cylinder is at the top dead center of the compression stroke. Loosely tighten the holder bolts on the side of the other cylinder which camshaft is at the top dead center of the exhaust stroke in 2 or 3 steps equally, then tighten the remaining holder bolts (page 8-11).
- The camshaft are marked with F for front cylinder and R for rear cylinder. Each camshaft is also marked with IN or EX respectively (page 8-11).

## Requisite Service

- Radiator installation (page 5-6).
- Water pipe installation.
- Carburetor Installation (page 6-8).
- Spark plug installation.

Procedure		Q'ty	Remarks
<b>Installation Order</b>			
(1)	Dowel pin (8mm)	2	NOTE • Push the dowel pins fully and install.
(2)	Cam gear case	1	NOTE • Check the flange for F (for front) or R (for rear) mark and install accordingly with the set bolt installation hole toward the carburetor (page 8-10).
(3)	Cam gear case mounting bolt	4	NOTE • Loosely tighten, check for proper engagement of the second gear and the crankshaft timing gear, and push the cam gear case as much as it goes.
(4)	Cam gear case set bolt	1	NOTE • With copper washer. Loosely tighten. Tighten the cam gear mounting bolts of the dowel pin side first, then the remaining mounting bolts diagonally. Tighten the set bolt (page 8-10).
(5)	Camshaft	2	NOTE • Install by aligning the cam lobe with the long hole in the cam holder.
(6)	Camshaft holder	4	NOTE • Check the mark on the camshaft holder and assemble with the camshaft accordingly.
(7)	Camshaft holder dowel pin	8	
(8)	Camshaft assembly	2	NOTE • Check the timing mark on the starter clutch. Check the engagement of the cam gear and the drive gear and install by aligning the edge mark with the scribe line on the holder.
(9)	Oil pipe	1	
(10)	Oil pipe stopper plate	2	
(11)	Camshaft holder bolt	16	NOTE • Check that the camshaft of one cylinder is at the top dead center of the compression strokes. Loosely tighten the holder bolts on the side of the other cylinder which camshaft is at the top dead center of the exhaust stroke in 2 or 3 steps equally, then tighten the remaining holder bolts. The outer rows of the camshaft holder bolts tightened on the cylinder head are the stepped bolts.
(12)	Gasket	1	NOTE • Align the in mark with the mark on the cover and attach by using the recommended adhesive agent (page 3-10).
(13)	Cylinder head cover	1	NOTE • Install with the IN mark toward the carburetor
(14)	Cylinder head cover washer/bolt	4	NOTE • Install the washer with the "UP" mark toward out.
(15)	Carburetor insulator	2	NOTE • Install with the "CARB" mark toward the carburetor and the "UP" mark toward up.

## Cam Gear Case Installation

**NOTE**

- The cam gear case is marked with F or R on the flange. Install the gear case marked F on the front cylinder and the case marked R on the rear cylinder.
- When the identification mark is not clear, the gear case can be identified by the sub gear of the second gear. With the sub gear toward you:
  - for front cylinder: the sub gear is off to the left side from the main gear.
  - for rear cylinder: the sub gear is off to the right side from the main gear.

Push the gear case dowel pins fully into the cylinder head.

**NOTE**

- The second gear and the crankshaft timing gear do not engage properly when the dowel pins are not pushed into the full.

Check the I.D. mark on the gear case and install the case on the designate cylinder head.

Check for the proper engagement of the timing gear and the seconds gear in the following procedures.

Lightly move the third gear back and forth with the gear case lightly pushed down. The engagement is correct if the flange of the gear case is pushed by the timing gear and raised off the cylinder head slightly.

Remove the gear case and reinstall it if necessary.

Tighten the four gear case mounting bolts fully with your fingers.

Install and loosely tighten the gear case set bolt and the copper washer.

**NOTE**

- When tightening the set bolt, take care not to damage the gear case threads and the bolt threads.

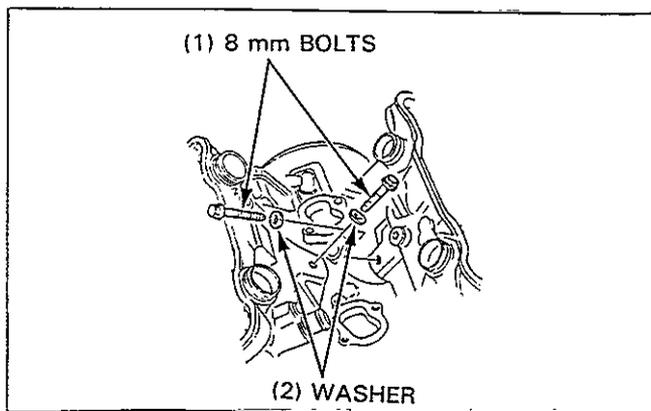
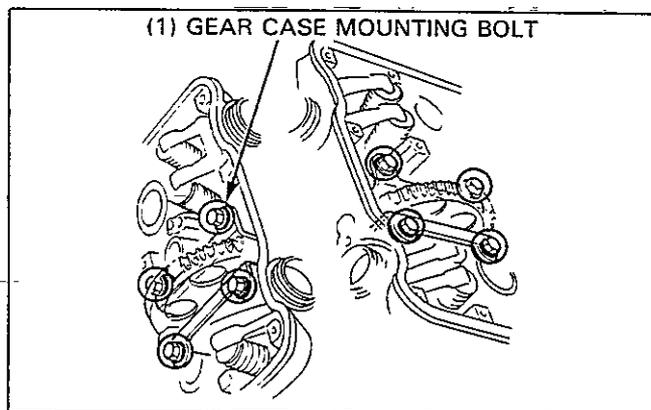
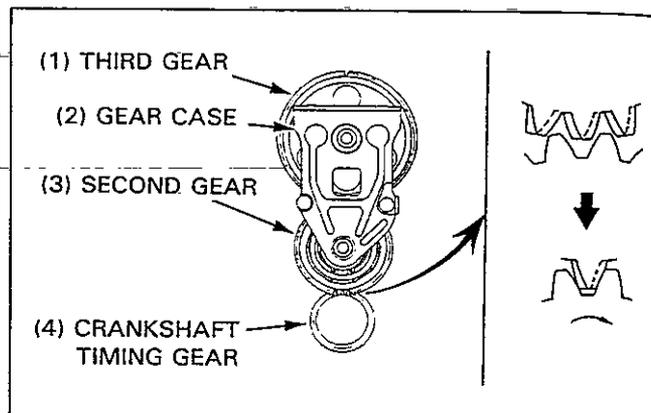
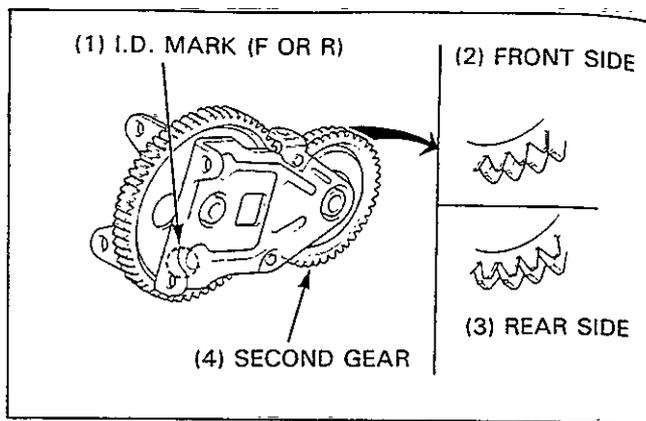
Tighten the gear case mounting bolts of the dowel pin side to the specified torque.

**TORQUE: 36 N·m (3.6 kg-m, 26 ft-lb)**

Then tighten the remaining mounting bolts.

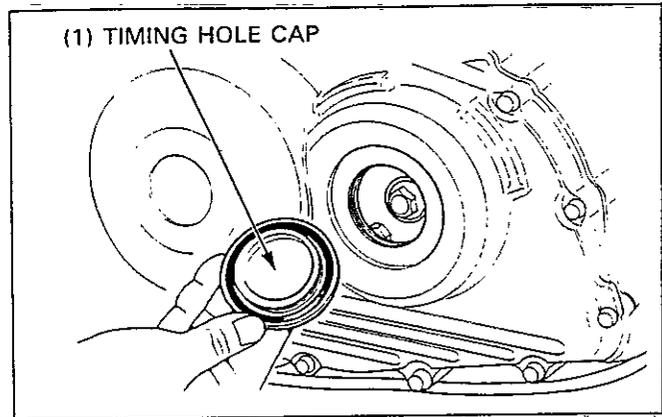
Tighten the gear case set bolt.

**TORQUE: 12 N·m (1.2 kg-m, 9 ft-lb)**



## Camshaft Installation

Remove the lower fairing (page 2-4).  
Remove the timing hole cap.

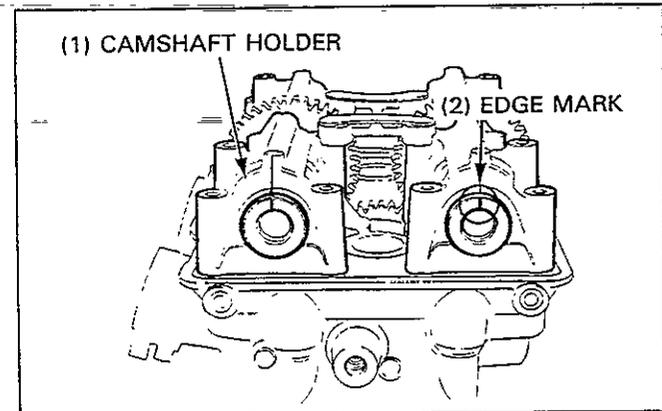


When both front and rear cylinders are disassembled:

### CAUTION

- Install all the camshafts with the edge mark toward the right crankcase cover.

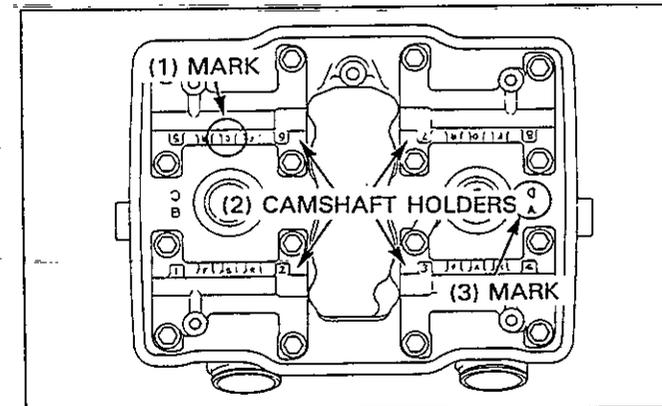
Apply molybdenum disulfide solvent to the sliding surface of the camshaft, camshaft holder, and the rocker arm.



Refer to the marks on the camshaft holders and the cylinder head and note each camshaft holder installation position.

### CAUTION

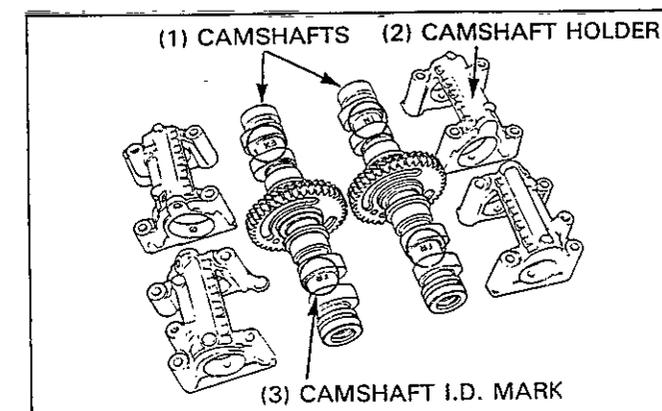
- The camshaft holders make up the oil passage. Be sure to install them in the correct positions as instructed with the marks.



Check the I.D. marks of each bank's camshaft and assemble the camshafts with the respective camshaft holders.

### I.D. MARKS:

- RR: Rear bank
- FR: Front bank
- IN: Intake
- EX: Exhaust

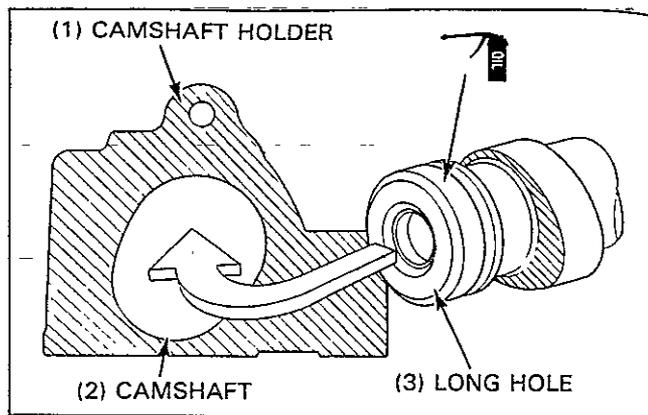


## Cylinder Head/Valves

Align the cam lobe with the long hole in the camshaft holder and insert the camshaft into the camshaft holder.

### CAUTION

- Apply molybdenum disulfide solution to the cam lobe, camshaft, and the camshaft holder journal and insert the camshaft with care not to damage them.

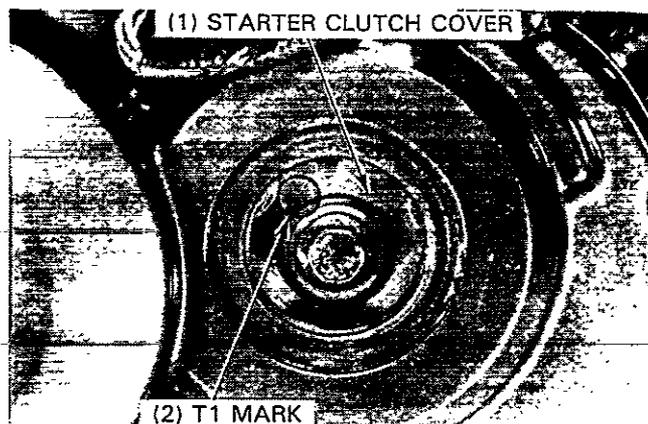


[Rear bank side installation]

Rotate the crankshaft clockwise and align the starter clutch T1 mark (scribe line) with the cutout (alignment mark) in the right crankcase cover. (The No.1 cylinder should be at the top dead center of the compression stroke.)

### CAUTION

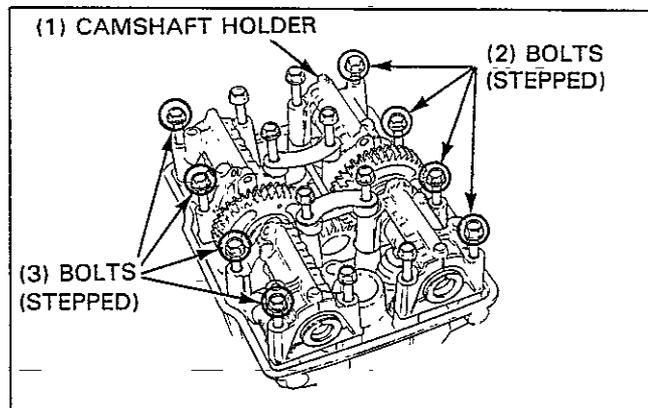
- Be sure to install the camshaft holder of the No.3 cylinder first, as it is at the top dead center of the exhaust stroke.



Install the assembled intake side and exhaust side camshaft holders on the cylinder head with the camshaft edge marks facing up and aligned with the scribe line on the holders.

### CAUTION

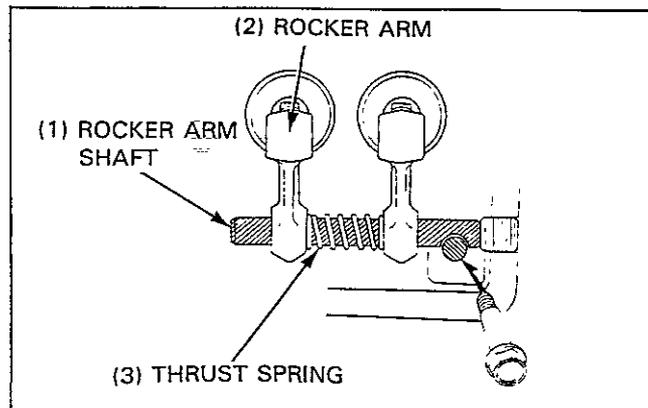
- Be sure each shim is installed properly.
- Check for proper engagement of the cam gear and the camshaft side driven gear, and install with care not to let the edge marks out of the alignment with the scribe lines.
- Do not strike to install the camshaft holder.



Set the oil pipe and the pipe plate between the camshaft holders and loosely tighten all the camshaft holder bolts.

### CAUTION

- Before loosely tightening the camshaft holder bolts, be sure that the bolt holes at the cylinder head corners align with the recess holes for fixing the rocker arm shafts.
- After confirming the alignment of the recess holes and the bolt holes, insert a 6 mm pin into the holes to ease the rear bank side installation.
- Do not remove the sealing plug.



Tighten the eight No.3 side camshaft holder bolts (IN and EX sides) until the camshaft holders closely set on the cylinder head.

**CAUTION**

- The camshafts on the No.3 cylinder are so close that they get "overlapped". Tighten the eight holder bolts (No.3 side only) in 2 or 3 steps equally.
- Tighten the stepped bolts at the corners of the cylinder head.

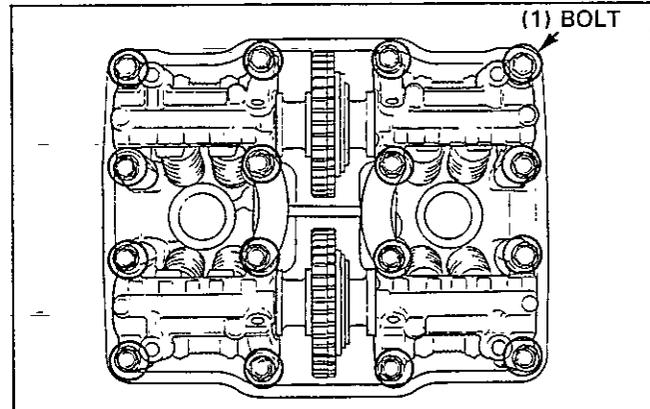
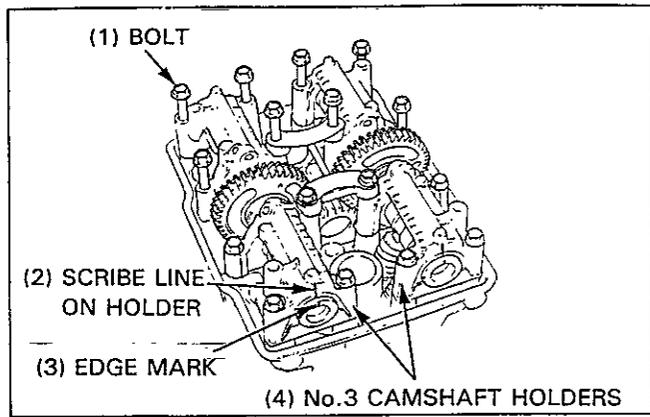
Recheck that the both camshaft edge marks align with the scribe lines on the camshaft holders.

Tighten all the camshaft holder bolts in 2 or 3 steps diagonally.  
**TORQUE: 12 N.m (1.2 kg-m, 9 ft-lb)**

**CAUTION**

- The No.1 cylinder is at the top dead center of the compression stroke. Tighten the No.3 cylinder's camshaft holder bolts first until the No.3 camshaft holders closely set on the cylinder head, then tighten the remaining bolts in 2 or 3 steps equally.

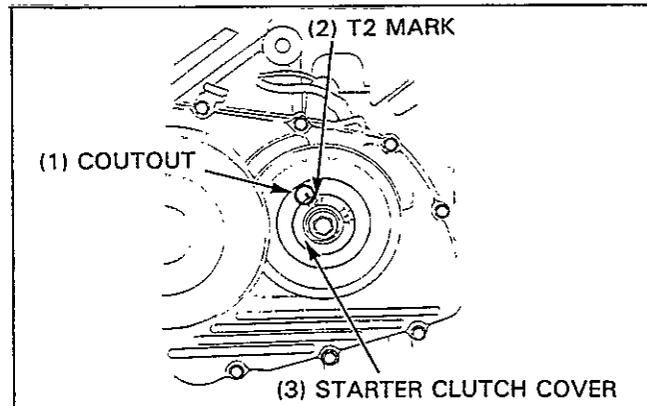
After the installation, slowly turn the crankshaft 2 or 3 revolutions clockwise and adjust the shims to fit.  
 Valve clearance adjustment: see page 3-7.



[Front bank side installation]

Turn the crankshaft clockwise and align the starter clutch T1 mark (scribe line) with the cutout (alignment mark) in the right crankcase cover. Be sure that the camshaft edge mark facing up and aligning with the scribe line on the camshaft holder. If it not, align by turning the crankshaft on emore clockwise revolution. (The No.1 cylinder should be at the top dead center of the compression stroke.)

Turn the crankshaft further 90 degrees clockwise and align the starter clutch T2 mark (scribe line) with the cutout (alignment mark) in the right crankcase cover.

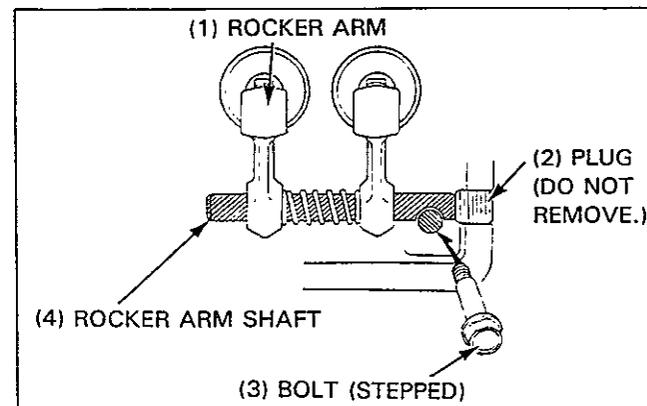


Be sure that the camshaft edge mark is facing up and aligning with the scribe line on the camshaft holder. (The No.4 cylinder should be at the top dead center of the compression stroke.) Now install the camshaft in the follwoing procedures.

Set the oil pipe and the pipe plate between the camshaft holders and tighten all the camshaft holder bolts.

**CAUTION**

- Before loosely tightening the camshaft holder bolts, be sure that the bolt holes at the cylinder head corners align with the recess holes for fixing the rocker arm shafts, before loosely tightening the camshaft holder bolts. Do not remove the sealing plug.

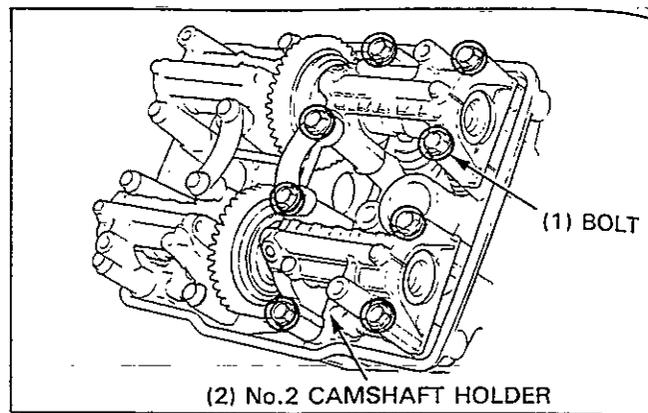


## Cylinder Head/Valves

Tighten the eight camshaft holder bolts of both No.2 cylinder camshafts (IN and EX sides) until the camshaft holders closely set on the cylinder head, as did on the rear bank side.

### CAUTION

- Be sure each shim is installed properly.
- Check for proper engagement of the cam gear and the camshaft side driven gear, and install with care not to let the edge marks out of the alignment with the scribe lines.
- Do not strike to install the camshaft holder.

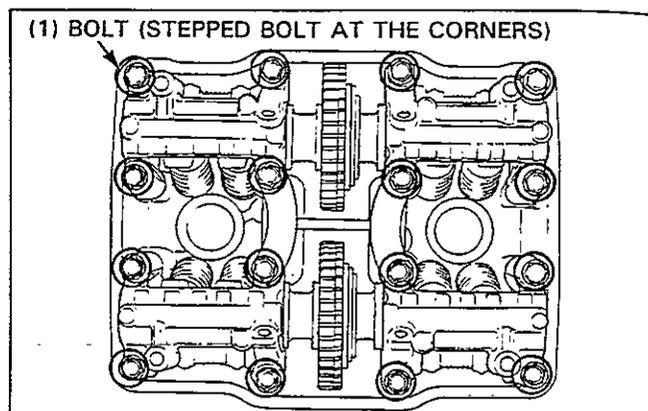


Tighten the all bolts including the camshaft holder bolts of the No.4 cylinder side in 2 or 3 steps.

**TORQUE: 12 N·m (1.2 kg-m, 9 ft-lb)**

### CAUTION

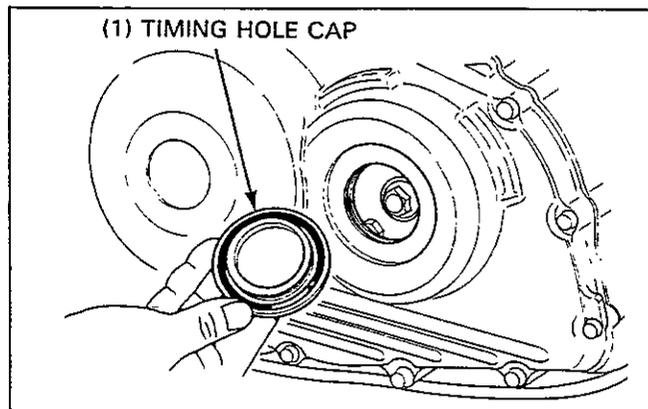
- No.4 cylinder is at the top dead center of the compression stroke. Be sure to tighten the No.2 cylinder's camshaft holder bolts first until the camshaft holders closely set on the cylinder head, then tighten the remaining bolts in 2 or 3 steps equally.



Valve clearance adjustment: see page 3-7.

Head cover installation: see page 3-10.

Apply the molybdenum disulfide solution to the timing hole cap O-ring and install the cap.

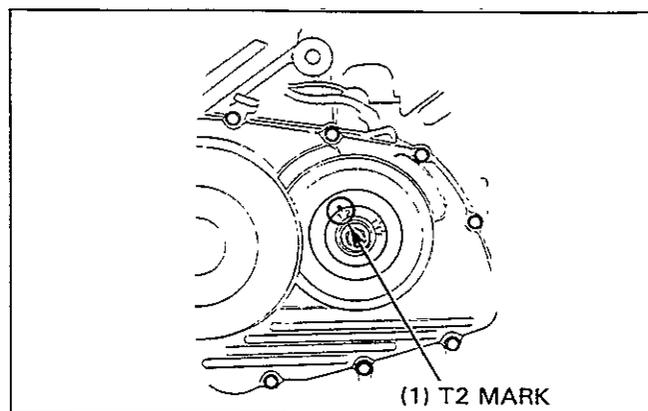


[When the front side is disassembled]

Remove the rear cylinder head cover and check that the No. 1 cylinder is at the top dead center of the compression stroke (page 3-7).

Turn the crankshaft 90 degrees clockwise from the timing mark T1 position and align the starter clutch T2 mark (scribe line) with the cutout (alignment mark) in the right crankcase cover. (The No.4 cylinder should be at the top dead center of the compression stroke.)

Now install the front camshaft.



[When the rear side is disassembled]

Remove the front cylinder head cover and be sure that the No.4 cylinder is at the top dead center of the compression stroke. (The camshaft edge mark should face up at the T2 position.) (Page 3-7)

Turn the crankshaft clockwise 630 degrees (one revolution and 270 degrees) from the timing mark T2 position and align the starter clutch T1 mark (scribe line) with the cutout (alignment mark) on the right crankcase cover. (The No.1 cylinder should be at the top dead center of the compression stroke.)

Now install the rear camshaft.

(1) Relationship between the top dead center marks and cylinders

Timing mark (starter clutch)	Camshaft edge mark	Cylinder at top dead center
T1	Toward up	# 1
	Toward down	# 3
T2	Toward up	# 4
	Toward down	# 2

# 9. Clutch

Service Information	9-1	Clutch Removal	9-4
Troubleshooting	9-1	Clutch Installation	9-6
Right Crankcase Cover Removal/Installation	9-2		

## Service Information

- Clutch maintenance can be done with the engine in the frame.
- Clean any gasket off the crankcase cover-crankcase mating surface.
- Do not damage the cover-case mating surface.
- Never allow foreign materials to get into the engine.
- If the transmission require servicing, remove the engine and separate the crankcase (Section 10).

## Troubleshooting

Most of the clutch malfunction result from the improper clutch free play. Check the clutch free play and adjust, if necessary, before disassembling the clutch.

### Clutch is Slippery When Accelerating.

- Too small clutch lever free play
- Worn clutch disc
- Deteriorated diaphragm spring
- Excessive engine oil

### Clutch Operation is not Stabilized.

- Worn clutch outer groove

### Gear is Hard to Engage.

- Clutch misadjusted

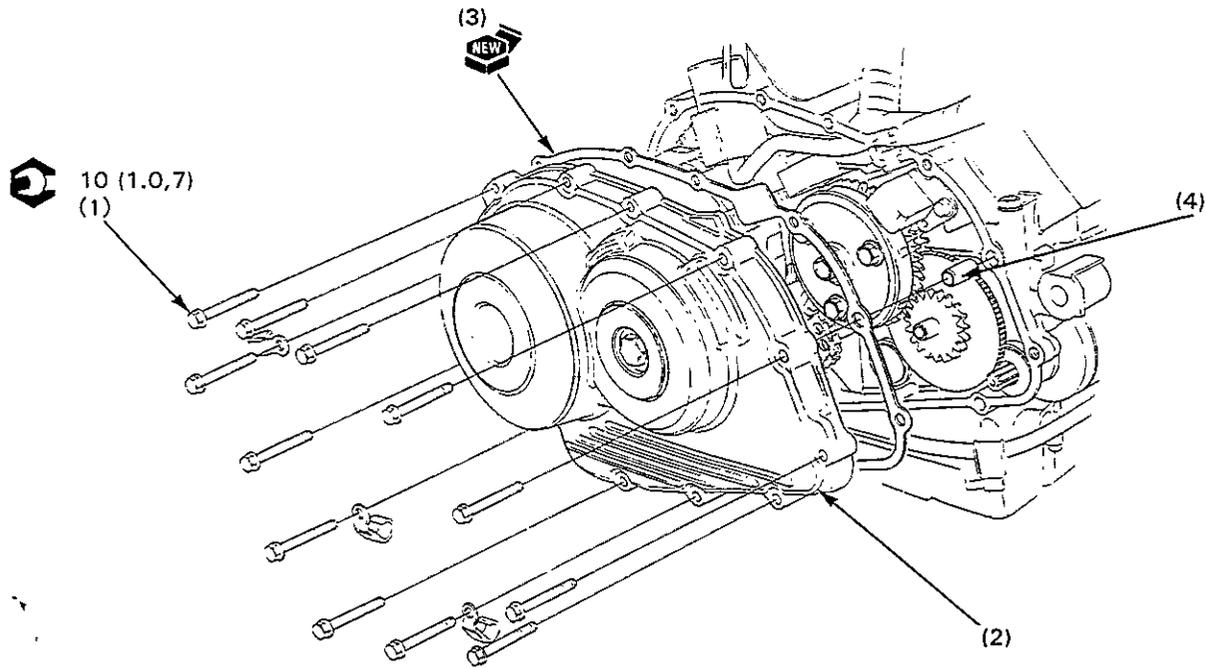
### Clutch Lever is Heavy.

- Poor clutch cable operation due to damage or rust
- Damaged clutch lifter mechanism
- Damaged clutch lifter plate bearing
- Clutch cable not routed properly
- Bent clutch lifter arm

### Clutch is Hard to Disengage or the Motorcycle Moves with the Clutch Disengaged.

- Excessive clutch lever free play
- Bent clutch plate
- Loose clutch lock nut
- Excessive engine oil or excessive oil viscosity
- Clutch cable not routed properly

## Right Crankcase Cover Removal/Installation



### Requisite Service

- Engine oil draining (drain bolt location: page 3-3, step: section 2 of the Common Service Manual).
- Lower fairing removal/Installation (page 2-4).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		Installation is in the reverse order of removal.
1) Right crankcase cover bolt	12	
2) Right crankcase cover	1	
3) Gasket	1	
4) Dowel pin	2	

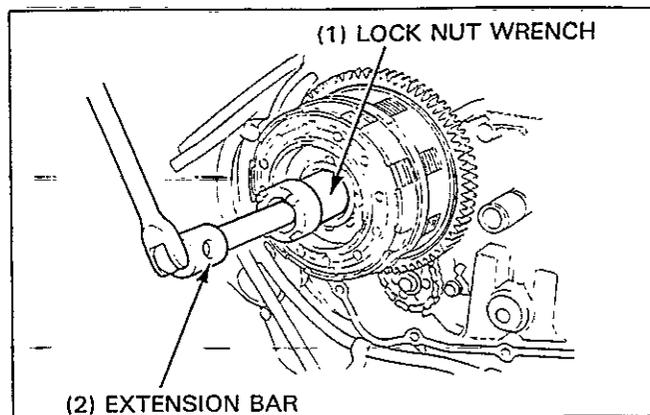
### Clutch lock Nut Removal

Straighten the locking tabs of the lock nut with care not to damage the main shaft.

#### NOTE

- With engine mounted: move the shift lever to the 6th speed, operate the rear brake, and loosen the lock nut.  
With engine dismounted: move the shift lever to the 6th speed, hold the drive sprocket with a universal holder, and loosen the lock nut.

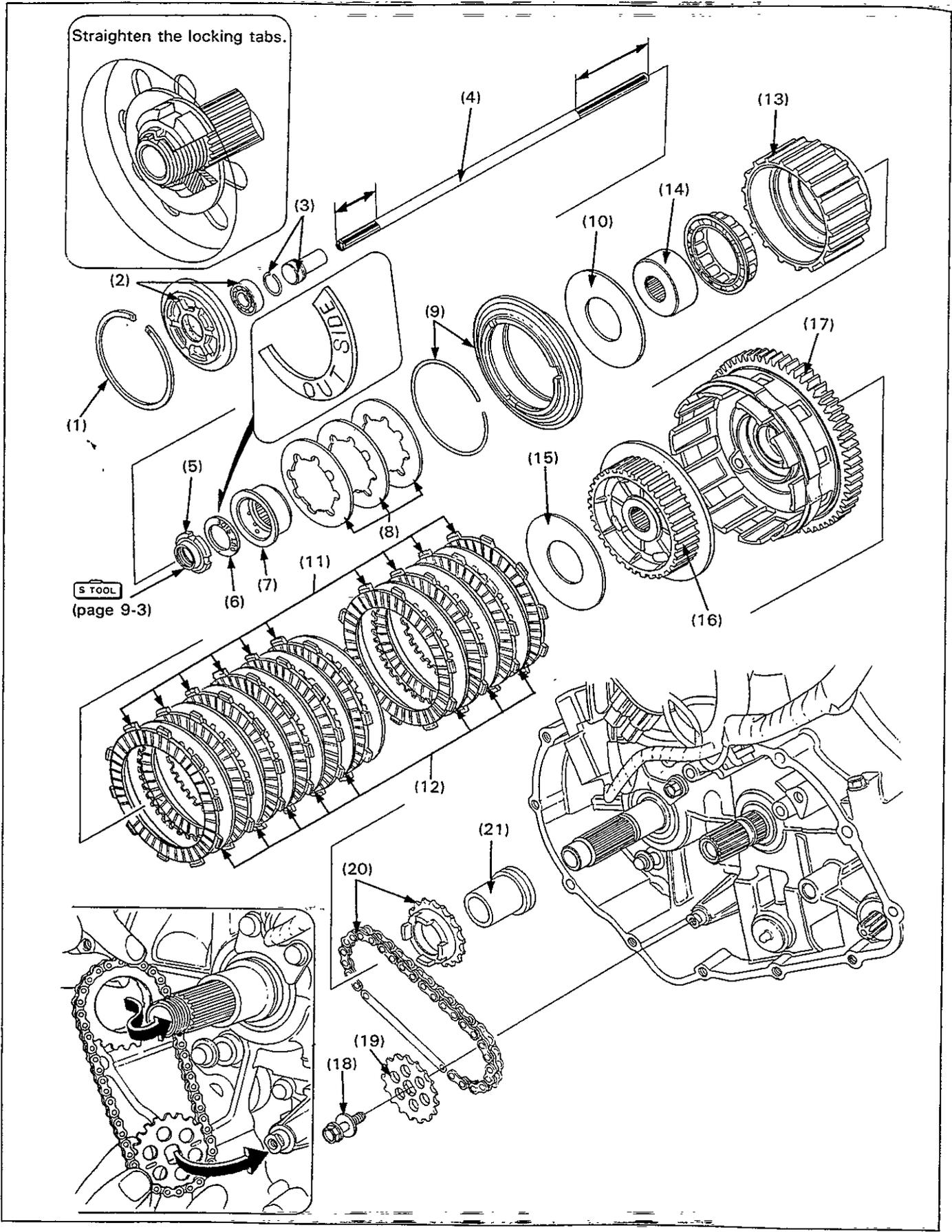
Loosen the lock nut by using the lock nut wrench.



#### 5 TOOL

LOCK NUT WRENCH, 26 x 30 mm 07716-0020203  
EXTENSION BAR 07716-0020500

# Clutch Removal



## NOTE

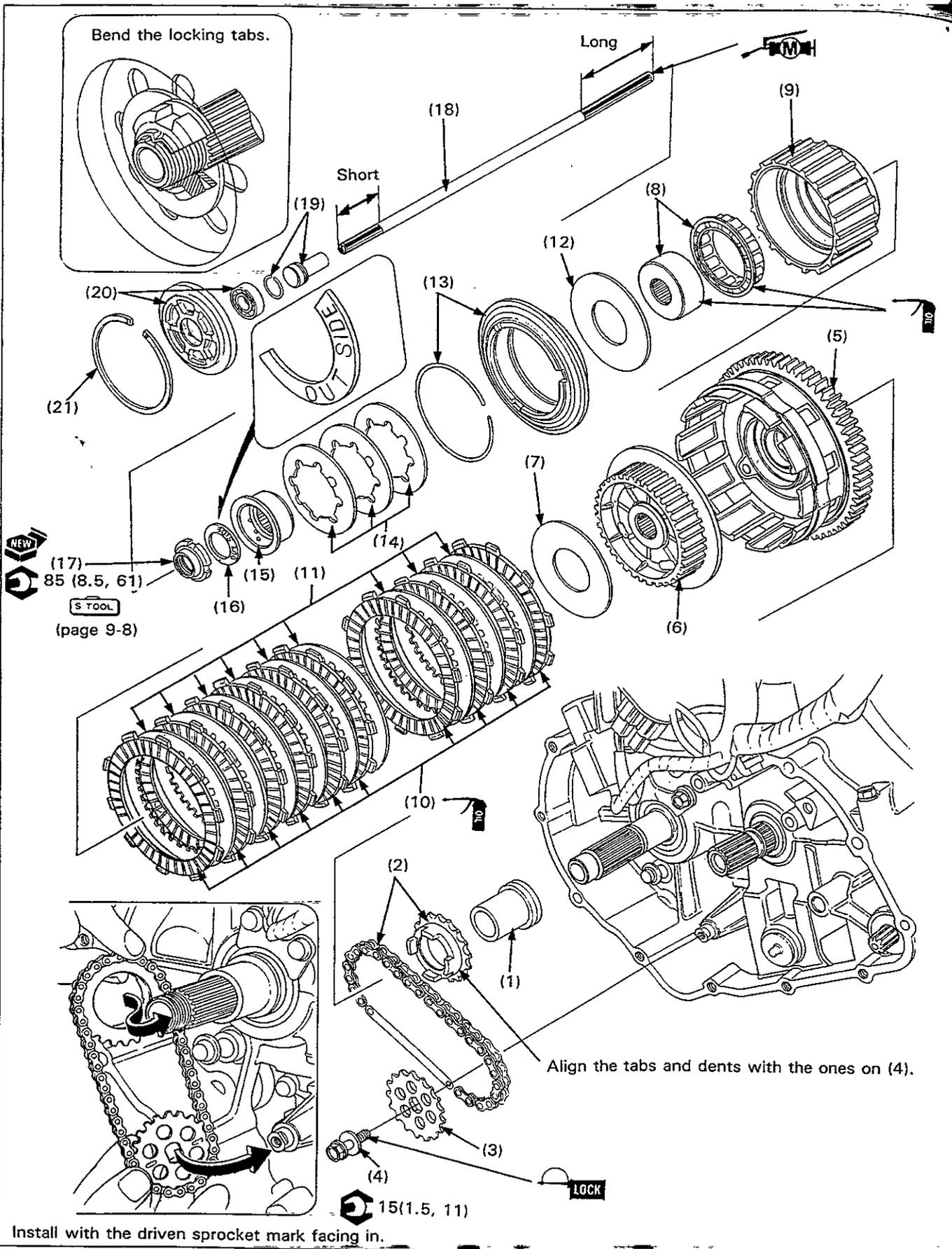
- To loosen the clutch center lock nut, straighten the locking tabs with care not to damage them, then; Move the shift lever to the 6th speed and operate the rear brake. When the engine is dismounted from the frame, move the shift lever to the 6th speed and hold the drive sprocket with a universal holder or equivalent.
- Loosen the oil pump driven sprocket bolt with the clutch assembly installed before removing the bolt. Note that the bolt threads are coated with the thread locking agent.
- Note the connection and installation direction of the lifter rod once it is removed. Special alignment is required at the left lifter cam connecting section (page 10-2).

## Requisite Service

- Right crankcase cover removal/installation (page 9-2).
- Starter clutch removal (page 17-2).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		
(1) Snap ring	1	NOTE • When removing the oil pump driven sprocket bolt, loosen it first with the clutch outer installed.
(2) Clutch lifter plate	1	NOTE • Remove the bearing only on replacement.
(3) Lifter guide	1	NOTE • Remove the stopper ring only on replacement.
(4) Lifter rod	1	NOTE • Do not depress the clutch lever with the rod removed.
(5) Clutch center lock nut	1	NOTE • Straighten the locking tabs first (page 9-3)
(6) Lock washer	1	
(7) Clutch spring set plate	1	
(8) Diaphragm spring	3	NOTE • Replace the three springs as a set.
(9) Pressure plate	1	NOTE • Remove the stopper ring only on replacement.
(10) Thrust washer	1	
(11) Clutch disc	10	NOTE • Disc contact surface of the two end plates is black.
(12) Clutch plate	9	
(13) Clutch center B	1	
(14) One-way clutch assembly	1	NOTE • Do not disassemble unnecessarily.
(15) Thrust washer	1	
(16) Clutch center A	1	
(17) Clutch outer	1	
(18) Oil pump driven sprocket bolt	1	
(19) Oil pump driven sprocket	1	
(20) Oil pump drive chain/sprocket	1/1	NOTE • Remove the oil pump drive chain and sprocket together.
(21) Clutch outer guide	1	

# Clutch Installation



## NOTE

- Tighten the clutch center lock nut as follows.  
Move the shift lever to the 6th speed, operate the rear brake, and tighten the clutch center lock nut.  
When the engine is dismantled from the frame, move the shift lever to the 6th speed and hold the drive sprocket with a universal holder or equivalent.
- Tighten the oil pump driven sprocket bolt with the clutch assembly installed. Apply the thread locking agent to the bolt 5.5 to 7.5 mm from the tip.
- The disc contact surface of the two clutch end discs are different in material (black). Do not interchange them.
- Install the lifter rod with the long iron ends toward left.

## Requisite Service

- Right crankcase installation (page 9-2).
- Starter clutch installation (page 17-4).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		
(1) Clutch outer guide	1	
(2) Oil pump drive chain/sprocket	1/1	
(3) Oil pump driven sprocket	1	NOTE • Install with a scribe line on the gear toward in and tighten with a bolt.
(4) Oil pump driven sprocket bolt	1	
(5) Clutch outer	1	NOTE • Engage with the drive sprocket and install.
(6) Clutch center A	1	NOTE • Take care not to damage the main shaft spline.
(7) Thrust washer	1	
(8) One-way clutch assembly	1	NOTE • Coat the sprag roller and inner with clean engine oil and assemble with the clutch center B with the roller flange toward the case cover.
(9) Clutch center B	1	
(10) Clutch disc	10	NOTE • Contact surface of the both end plates is black. Coat the discs with clean engine oil and assemble with the clutch plates alternately.
(11) Clutch plate	9	
(12) Thrust washer	1	
(13) Pressure plate	1	
(14) Diaphragm spring	3	NOTE • Install with the projected side toward out.
(15) Clutch spring set plate	1	NOTE • Set the thrust washer on the stepped portion at the bottom of the set plate (page 9-8).
(16) Lock washer	1	NOTE • Install with the OUTSIDE mark facing out.
(17) Lock nut	1	CAUTION • Check that the drive sprocket and the clutch outer are properly engaged, then bend the locking tabs with care not to damage the threads.
(18) Lifter rod	1	NOTE • Install with the long iron ends toward left. Apply molybdenum disulfide grease to the left end. Alignment with the lifter cam: see page 10-2.
(19) Lifter guide	1	NOTE • Assemble with the lifter plate bearing.
(20) Lifter plate/bearing	1	
(21) Snap ring	1	

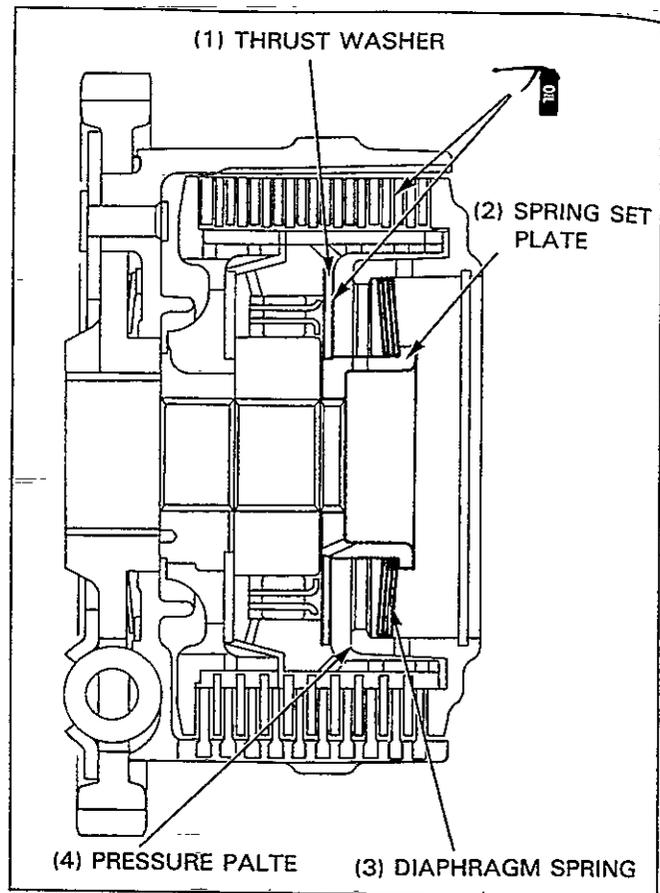
## Clutch

### Clutch Diaphragm Spring Installation

When installing the clutch, install the three diaphragm springs on the pressure plate with the projected side toward the lock nut, then assemble with the spring set plate. Be sure that the thrust washer is securely set on the stepped section at the bottom of the set plate.

#### CAUTION

- Replace the three diaphragm springs as a set.
- Note that the thrust washer is set in the correct position of the set plate. Otherwise, the diaphragm spring and the lock nut cannot be set properly.
- Coat the thrust washer with clean engine oil to ease installation.



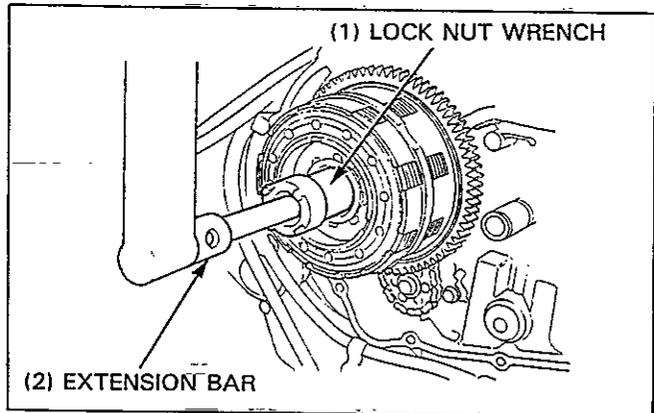
### Clutch Lock Nut Installation

Assemble the clutch (page 9-6).

#### NOTE

- With engine mounted: move the shift lever to the 6th speed, operate the rear brake, and tighten the clutch lock nut.
- With engine dismounted: Move the shift lever to the 6th speed, hold the drive sprocket with a universal holder or equivalent, and tighten the clutch lock nut.

Tighten the lock nut by using the lock nut wrench.



LOCK NUT WRENCH, 26 x 30 mm 07716-0020203  
EXTENSION BAR 07716-0020500

Bent the locking tabs of the lock nut.

#### NOTE

- Take care not to damage the main shaft.

# 10. Gearshift Linkage

Service Information	10-1	Gearshift Linkage, Shift Drum Removal	10-4
Troubleshooting	10-1	Gearshift Linkage, Shift Drum Installation	10-6
Drive Sprocket Cover Removal/Installation	10-2		

## Service Information

- The gear shift linkage (including the shift drum, shift fork, and the shift fork shaft) can be serviced with the engine mounted on the frame.
- Take care not to let dust, dirt, and any other foreign materials enter the engine.
- Separate the crankcase when the transmission service is required.

## Troubleshooting

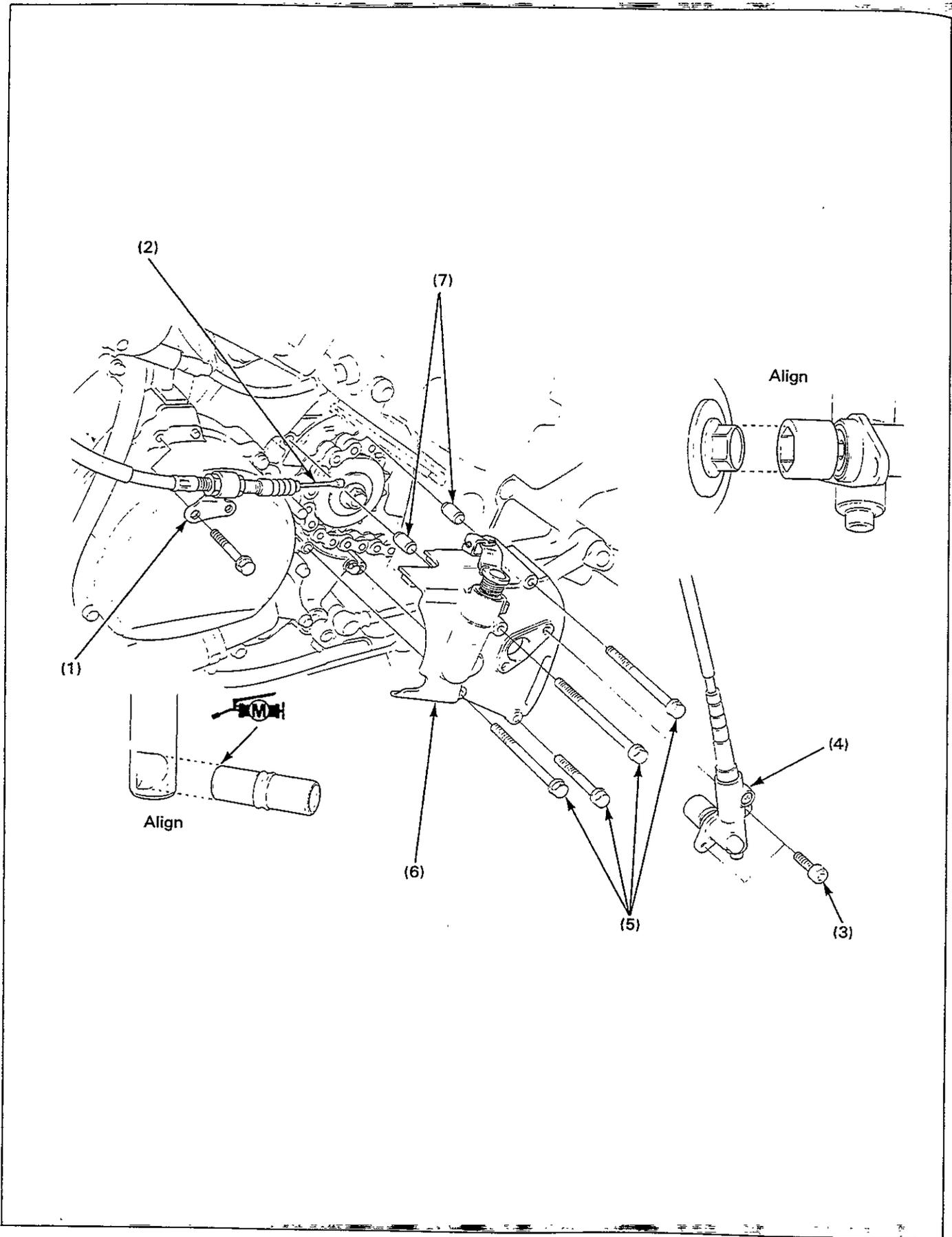
### Gear Slips Out of Engagement.

- Worn gear dog
- Bent shift shaft
- Damaged stopper arm
- Bent or damaged shift fork
- worn shift drum groove

### Gear is Hard to Engage.

- Bent shift fork
- Damaged shift drum cam groove
- Bent gear shift spindle claw

# Drive Sprocket Cover Removal/Installation

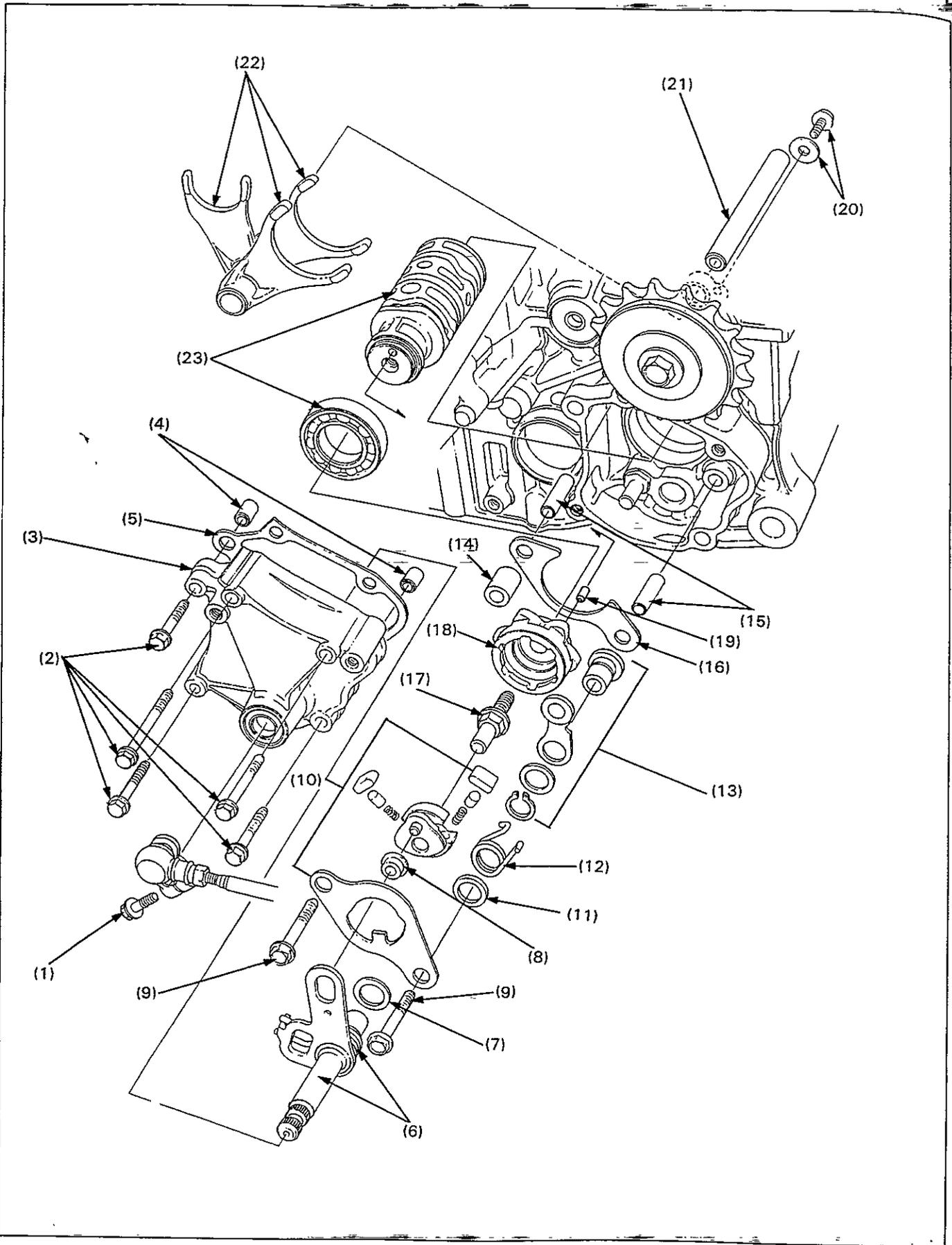


## Requisite Service

- Lower fairing removal/installation (page 2-4).

Procedure		Q'ty	Remarks
<b>Removal Order</b>			
(1)	Clutch cable holder	1	
(2)	Clutch cable	1	NOTE • Disconnect from the lifter arm.
(3)	Speedometer gear box bolt	2	
(4)	Speedometer gear box	1	NOTE • Remove the gear box.
(5)	Drive sprocket cover bolt	4	
(6)	Drive sprocket cover	1	
(7)	Dowel pin	2	
<b>Installation Order</b>			
(7)	Dowel pin	2	
(6)	Drive sprocket cover	1	NOTE • Turn the lifter arm counterclockwise and connect the cam and lifter rod by engaging their projections and dents. Apply molybdenum disulfide grease to the lifter rod end.
(5)	Drive sprocket cover bolt	4	
(4)	Speedometer gear box	1	NOTE • Connect the gear box side joint to the sprocket bolt.
(3)	Speedometer gear box bolt	2	NOTE • Install with care not to disconnect the joint.
(2)	Clutch cable	1	NOTE • Connect to the lifter arm.
(1)	Clutch cable holder	1	NOTE • Install by aligning the hole with the stopper pin.

# Gearshift Linkage, Shift Drum Removal



NOTE

- The shift fork, shift fork shaft, and the shift drum can be removed, installed, and/or disassembled with the engine mounted on the frame.
- The water pump mounting bolts must be removed to service the gearshift linkage. However, it can be serviced without disconnecting the cooling system hose(s).
- Remove/install the clutch assembly and the oil pan to remove/install the shift fork, fork shaft, and shift drum.

Requisite service

- Lower fairing removal (page 2-4).
- Drive sprocket cover removal (page 10-2).
- Clutch removal (page 9-4).
- Water pump removal (page 5-5).
- Oil pan removal (page 4-4).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		
Gearshift Linkage		
(1) Gearshift spindle joint bolt/gearshift spindle joint	1/1	
(2) Gearshift linkage cover bolt	5	
(3) Gearshift linkage cover	1	NOTE • Pull out straight with care not to damage the dust seal.
(4) Dowel pin	2	
(5) Gasket	1	
(6) Gear shift spindle/spring	1/1	NOTE • Do not remove the spring except on replacement.
(7) Thrust washer	1	
(8) Shifter collar	1	
(9) Bolt	2	
(10) Guide plate/drum shifter assembly	1	NOTE • Remove slowly with care not to let the plunger and spring scatter around from the shifter body.
(11) Thrust washer	1	
(12) Stopper arm spring	1	
(13) Stopper arm assembly	1	NOTE • Snap ring, washer, arm, and collar: Do not disassemble unnecessarily.
(14) Spacer collar	1	
(15) Dowel pin	2	
(16) Shift drum set plate	1	
(17) Shift drum center bolt	1	NOTE • The threads are coated with the thread locking agent.
(18) shift drum center	1	
(19) Shift drum pin	1	
(20) Shift Drum Bolt/stopper washer	1	NOTE • The bolt threads are coated with the thread locking agent.
(21) Shift fork shaft	1	NOTE • Push out to the right side.
(22) Shift fork	3	
(23) Bearing/Shift drum	1/1	NOTE • Pull out to the left side.



## NOTE

- When installing the water pump, check the water pump shaft and oil pump shaft connection.

## Requisite Service

- Oil pan installation (page 4-4).
- Drive sprocket cover installation (page 10-2).
- Water pump installation (page 5-5).
- Clutch installation (page 9-6).
- Lower fairing installation (page 2-4).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		
(1) Shift drum/bearing	1/1	
(2) Shift fork	3	NOTE • Install the left shift fork on the C6 gear, center shift fork on the M3/M4 gear, and the right shift fork on the C5 gear respectively with the marks facing right (page 11-4).
(3) Shift fork shaft	1	NOTE • Apply engine oil and push in from the right side.
(4) Stopper washer/bolt	1/1	
(5) Gearshift Linkage Shift drum pin	1	NOTE • Install the shift drum pin on the shift drum.
(6) Shift drum center	1	<b>CAUTION</b> • Install by aligning the shift drum pin with the longhole in the drum center.
(7) Shift drum center bolt	1	
(8) Doel pin	2	
(9) Shift drum set plate	1	
(10) Spacer collar	1	
(11) Stopper arm assembly/spring	1/1	NOTE • Loosely tighten the two set bolts and install the roller on the drum center with the spring hook set on the arm and the reerse side set on the crankcase. Remove the set bolts.
(12) Thrust washer	1	
(13) Guide plate/drum shifter assembly	1/1	NOTE • Assemble the shifter body, plunger, spring, and reatched pawl with the shifter plate. Pushing the pawl with your fingers, install the assembled plate on the shift drum center.
(14) Bolt	2	
(15) Shift collar	1	
(16) Thrust washer	1	
(17) Gearshift spindle/spring	1/1	NOTE • Install by aligning the long hole with the shifter collar and the two return springs with the stud pins on the case.
(18) Gasket	1	
(19) Dowel pin	1	
(20) Gearshift linkage cover	1	NOTE • Install with care not to damage the dust seal.
(21) Gearshift linkage cover bolt	5	
(22) Gearshift spindle joint/gearshift spindle joint bolt	1	NOTE • Align the punch mark with the one on the shift arm and install on the spindle.

# 11. Crankshaft/Piston/Transmission

Service Information	11-1	Countershaft Disassembly/Assembly	11-6
Trouble shooting	11-1	Piston Disassembly/Assembly	11-8
Crankcase Separation	11-2	Bearing Selection	11-10
Shift Fork Installation	11-4	Crankcase Assembly	11-12
Mainshaft Disassembly/Assembly	11-5		

## Service Information

- Identify the connecting rods and the connecting rod bearing caps and store them neatly whenever they are removed. Do not confuse them as improperly installed connecting rods and bearing caps result in lack of oil clearance and eventually crankshaft seizure.
- The piston, connecting rod, crankshaft, cylinder, and/or the transmission services must be made by separating the crankcase after the engine is removed (see section 7).
- When the crankcase is separated, take care not to drop any foreign materials in the oil orifice.
- Do not damage the cylinder wall and the outer surface of the piston.
- Store the piston, piston ring, piston pin, piston pin clip, and the connecting rods for each cylinder so that they can be reinstalled in their original position.
- Select the bearings by the color code numbers. Use the code table to select the replacement bearings.
- After replacing the bearings, check the oil clearance by using the plastigauge.
- Apply molybdenum disulfide oil to the main journal bearing and the crank pin bearing on reassembly (page 1-16).
- Remove the carbon deposits and sludge from the cylinder top before removing the piston and the connecting rod.
- Check the crankcase breather pipe for smoke when the engine is hard to start or poor operation at low speed.
- When there is smoke from the crankcase breather pipe, it might indicate broken or seized piston ring.

11

## Troubleshooting

### Cylinder Compression is Too Low, or Engine is Hard to Start.

- Blown out cylinder head gasket
- Worn, stuck, or broken piston ring
- Worn or damaged cylinder or piston
- Bent valve, or bent and deteriorated valve seat

### Cylinder Compression is Too High, or Engine Overheats or Knocks.

- Carbon deposits on the cylinder head and/or piston

### Piston Sounds.

- Worn cylinder, piston, and/or piston ring
- Worn piston pin hole and piston pin
- Worn connecting rod small end

### Smokes from Muffler

- Worn, stuck, or broken piston ring
- Weak valve stem seal

### Gear is Hard to Engage.

- Clutch is misadjusted (excessive free play).
- Bent shift fork
- Bent shift fork shaft
- Damaged gear shift spindle
- Damaged shift drum guide groove
- Damaged shift drum guide pin

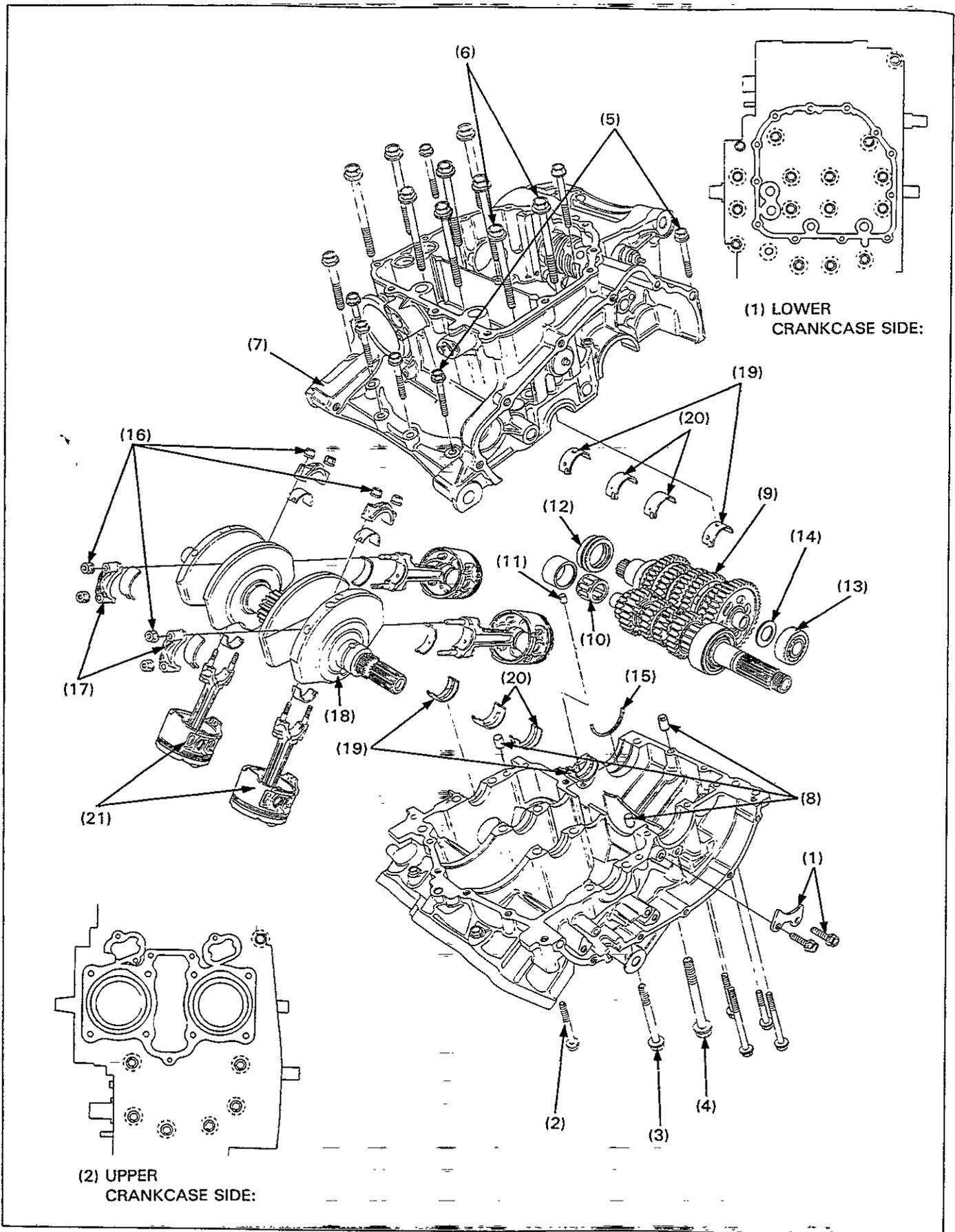
### Gear Slips Out of Engagement.

- Worn gear dowel
- Bent shift fork shaft
- Damaged shift drum stopper
- Worn shift drum guide
- Worn shift fork groove of gear

### Abnormal Engine Noise

- Worn connecting rod large end bearing
- Bent connecting rod
- Worn crankshaft main bearing
- Worn transmission gear

# Crankcase Separation



**CAUTION**

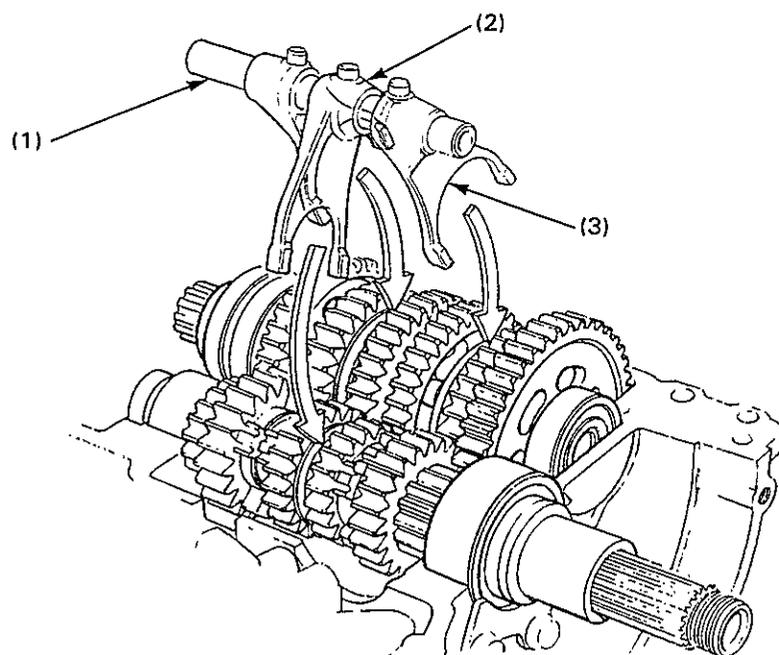
- Select and replace the main bearing by using the selection table to make it a good match with the crankshaft main journal (page 11-10).
- Select and replace the connecting rod bearing by using the selection table to make it a good match with the crankshaft (page 11-10).
- Note the location of each part to reinstall them in their original position.
- The gear shift linkage such as the shift fork and fork shaft can be removed after separating the crankshaft.
- If the crankcase cannot be separated by lighting tapping on the upper case, check whether the crankcase halves are still tightened with a bolt.

**Requisite Service**

- Engine removal (page 7-2).
- Primary drive gear removal (page 17-4).
- Water pump removal (page 5-5).
- Starter motor removal (page 17-7).
- Oil filter removal.
- Cylinder head removal (page 8-4).
- Gearshift linkage removal (page 10-4).
- Oil pump removal (page 4-4).
- Alternator removal (page 15-8).

Procedure		Q'ty	Remarks
<b>Removal Order</b> Upper Case Side			
(1)	Mainshaft bearing set plate	1	NOTE • Loosen the bolt in a crisscross pattern 2 or 3 steps.
(2)	6 mm bolt	5	
(3)	8 mm bolt	1	
(4)	10 mm bolt	1	
Lower Case Side			
(5)	6 mm bolt	7	NOTE • Loosen the bolt in a crisscross pattern 2 or 3 steps.
(6)	8 mm bolt	10	
(7)	Lower crankcae	1	NOTE • Set the crankcase with the upper case toward down. Lift the lower case to separate the upper and lower halves.
(8)	Dowel pin	3	
(9)	Transmission assembly	1	
(10)	Mainshaft bearing	1	
(11)	Bearing cap stop pin	1	
(12)	Countershaft oil seal	1	
(13)	Countershaft bearing	1	
(14)	Thrust washer	1	
(15)	Bearing stopper ring	1	
(16)	Connecting rod bearing cap nut	8	
(17)	Bearing cap	4	NOTE • Do not remove the connecting rod caps with force but pull them out straight. Remove the bearing.
(18)	Crankshaft	1	NOTE • Remove with care not to damage the crankshaft journal.
(19)	Side main bearing	4	NOTE • Remove from the upper and lower cases and record the installation location.
(20)	Center main bearing	4	
(21)	Connecting rod/piston	1/1	NOTE • Remove to the cylinder head side. Piston removal/ installation: page 11-8

## Shift Fork Installation



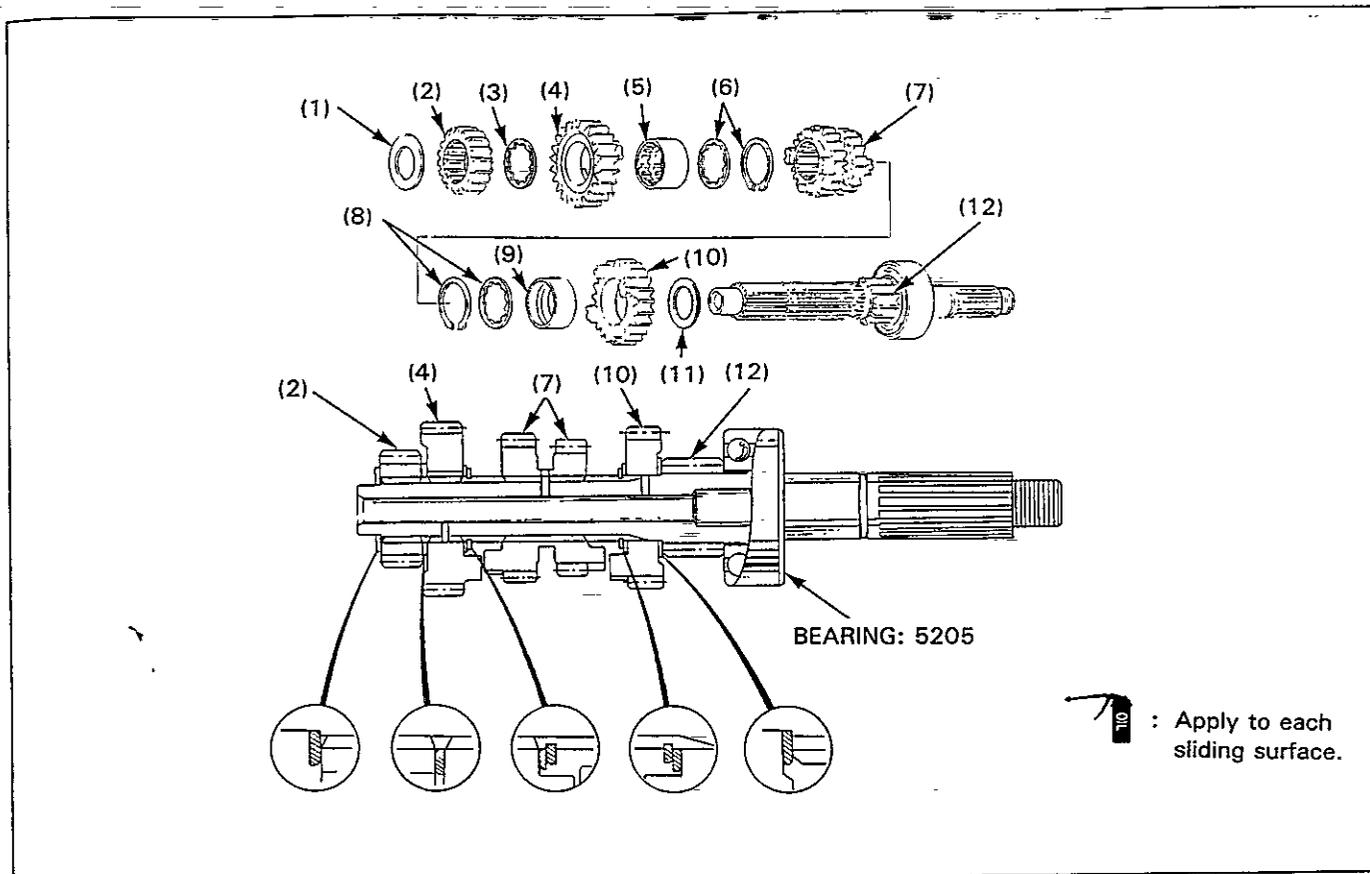
 : Apply to each sliding surface.

### Requisite Service

- Crankcase separation (page 11-2).

Procedure		Q'ty	Remarks
	<b>Installation Order</b>		
(1)	Left shift fork	1	NOTE • Install on the shift fork shaft with each mark (R,C, and L) toward the clutch.
(2)	Center shift fork	1	
(3)	Right shift fork	1	

# Mainshaft Disassembly/Assembly

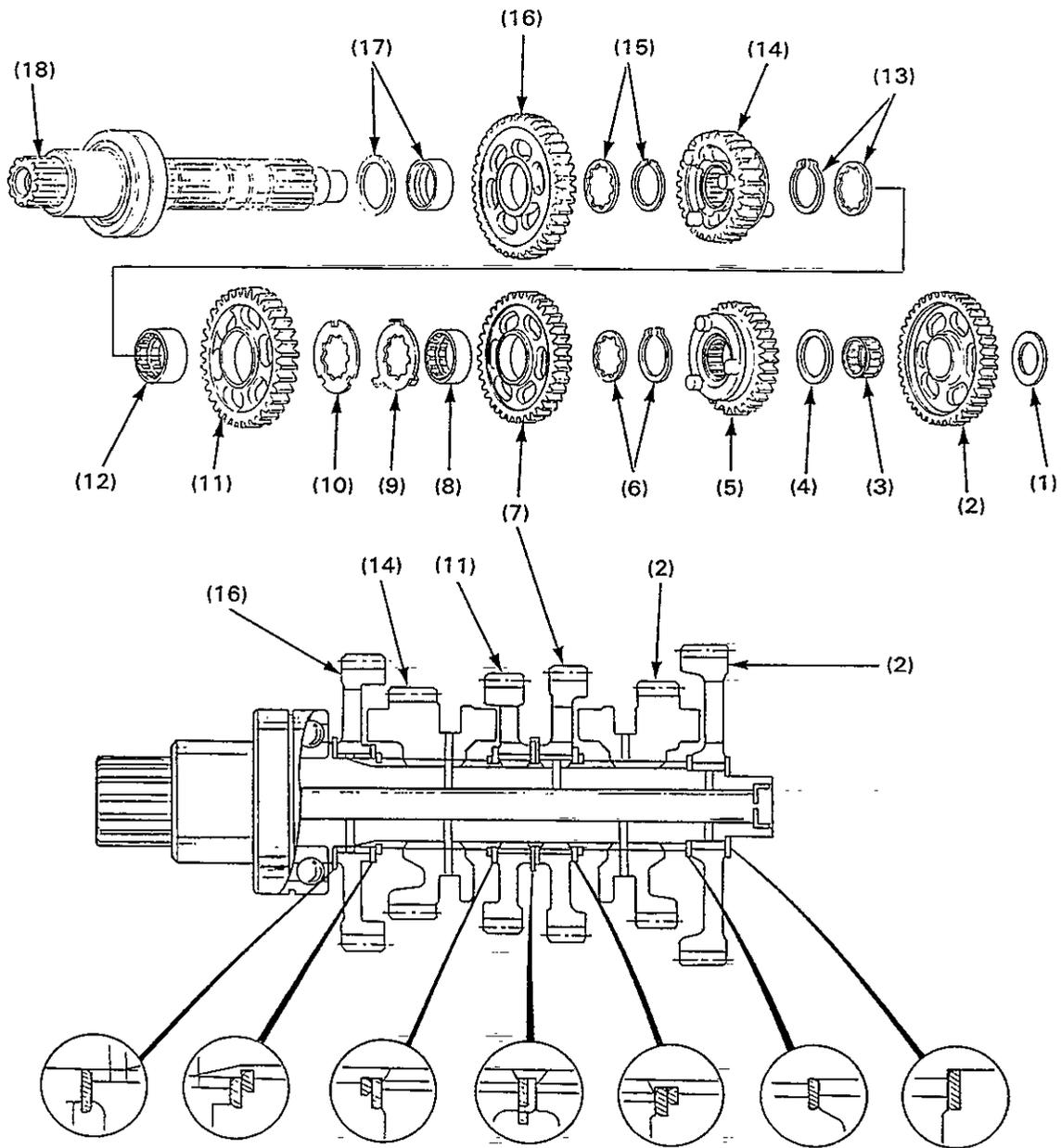


## Requisite Service

- Crankcase separation (page 11-2).

Procedure	Q'ty	Remarks
<b>Removal Order</b>		Assembly is in the reverse order of disassembly.
(1) Thrust washer	1	
(2) M2 gear (18T)	1	
(3) Thrust washer	1	
(4) M6 gear (22T)	1	
(5) Spline bushing	1	
(6) Thrust washer/snap ring	1/1	
(7) M4/M3 gear (22T/20T)	1	
(8) Snap ring/thrust washer	1/1	
(9) M5 bushing	1	
(10) M5 gear (23T)	1	
(11) Thrust washer	1	
(12) Mainshaft M1 gear (14T)	1	

# Countershaft Disassembly/Assembly



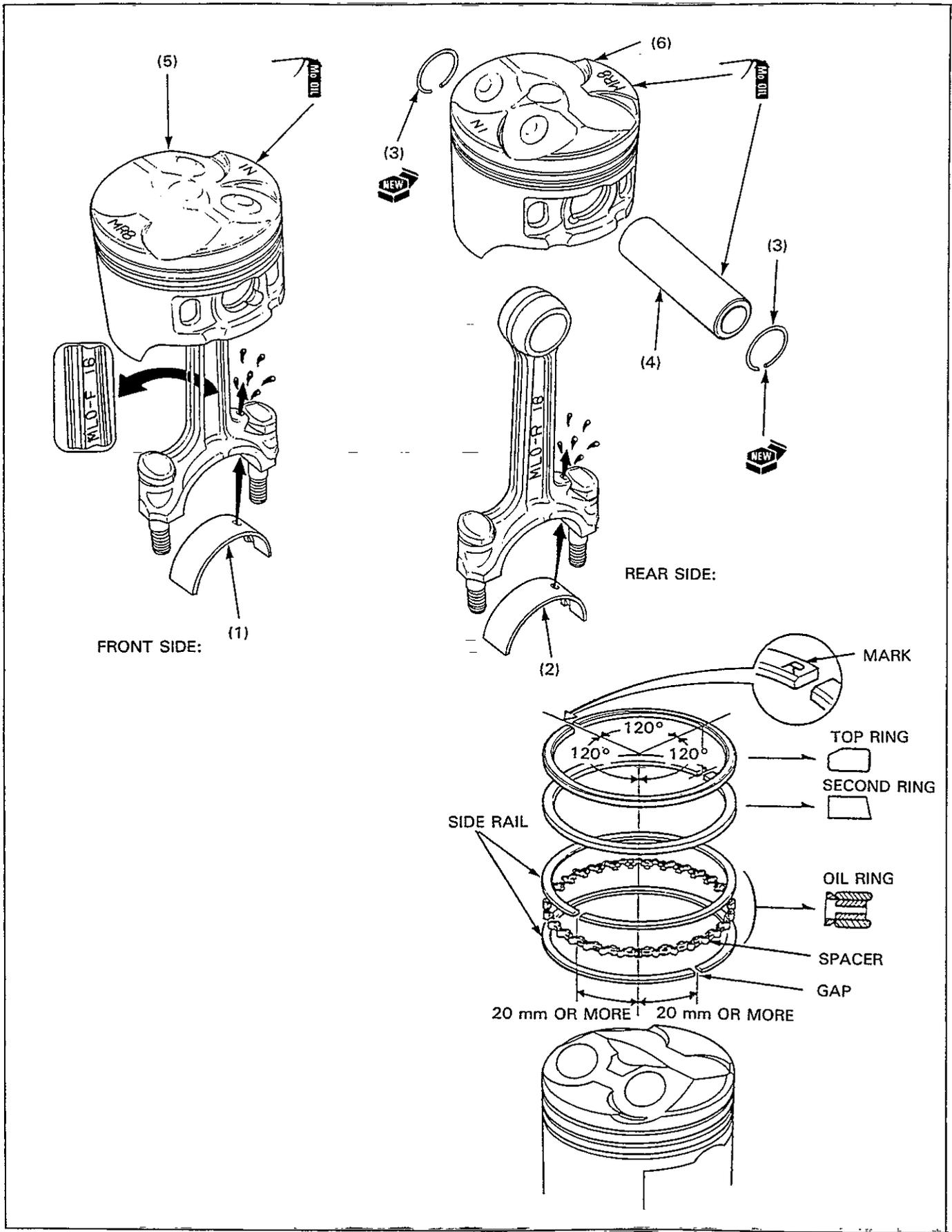
 : Apply to each sliding surface.

## Requisite Service

- Crankcase separation (page 11-2).

Procedure		Q'ty	Remarks
	<b>Disassembly Order</b>		Assembly is in the reverse order of disassembly.
(1)	Thrust washer	1	
(2)	C1 gear (41T)	1	
(3)	Needle bearing	1	
(4)	Thrust washer	1	
(5)	C5 gear (33T)	1	
(6)	snap ring/thrust washer	1/1	
(7)	C3 gear (36T)	1	
(8)	Spline bushing	1	
(9)	Lock washer	1	NOTE
			• When assembly, insert the tang of the washer into the lock washer groove securely.
(10)	Spline washer	1	
(11)	C4 gear (35T)	1	
(12)	Spline bushing	1	
(13)	Thrust washer/snap ring	1/1	
(14)	C6 gear (29T)	1	
(15)	Snap ring/thrust washer	1/1	
(16)	C2 gear (39T)	1	
(17)	C2 gear bushing/thrust washer	1/1	
(18)	Countershaft	1	

# Piston Disassembly/Assembly



**CAUTION**

- Take care not to damage the pistons.
- Classify and store the parts for each cylinder.
- Number of Q'ty listed in the table indicates the numbers that are shown in the drawing.
- Before assembling the piston pin with the connecting rod, apply molybdenum disulfide oil to the sliding surfaces.
- Select the appropriate connecting rod and/or bearings by using the selection table to make a good match. Also select the connecting rods of the most appropriate weight by using the table (page 11-10).

**Requisite Service**

- Crankcase separation (page 11-2).

Procedure		Q'ty	Remarks
(1)	<b>Disassembly Order</b> Front connecting rod bearing	1	Assembly is in the reverse order of disassembly. NOTE • Note the color codes of the connecting rod bearing and the connecting rod cap and store.
(2)	Rear connecting rod bearing	1	NOTE • Note the color codes of the connecting rod bearing and the connecting rod cap and store.
(3)	Piston pin clip	4	NOTE • Do not lose.
(4)	Piston pin	1	
(5)	Front piston assembly	1	NOTE
(6)	Rear piston assembly	1	• Do not remove the piston ring except on replacement.
(6)	<b>Assembly Order</b> Rear piston assembly	1	NOTE • Check the connecting rod I.D. mark. Install with the IN mark toward the carburetor and the connecting rod oil jet port toward the other side.
(5)	Front piston assembly	1	NOTE • Check the connecting rod I.D. mark. Install with the IN mark and the connecting rod oil jet port toward the carburetor.
(4)	Piston pin	4	
(3)	Piston pin clip	4	
(2)	Rear connecting rod bearing	1	NOTE • Install with the oil passage hole aligned with the connecting rod hole.
(1)	Front connecting rod bearing	1	NOTE • Connecting rod bearing selection: see page 11-10.

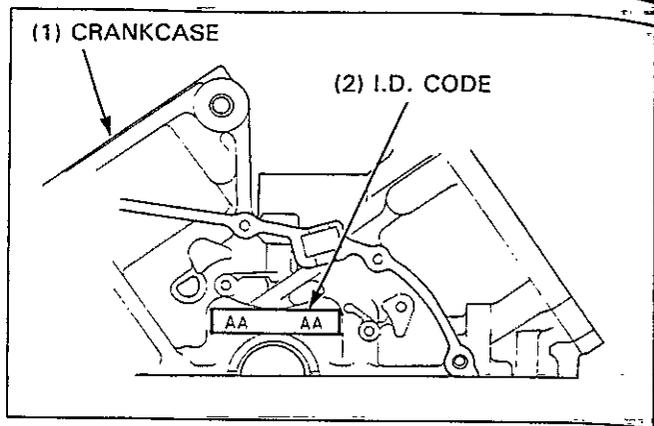
# Bearing Selection

## Main Bearing

Record the crankcase I.D. code.

**NOTE**

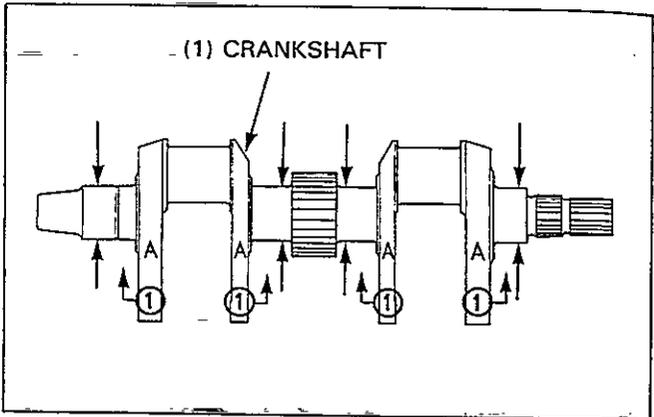
- A or B stamped on the No.4 journal of the upper crankcase is the I.D. code of the journal. The code letters, from left to right, indicate each journal I.D. respectively. (Refer to the drawing to the right.)



Record the crankshaft main journal O.D. code (or measure the main journal O.D.).

**NOTE**

- 1 or 2 stamped on the crank weight is the main journal O.D. code. (Refer to the drawing to the right.)

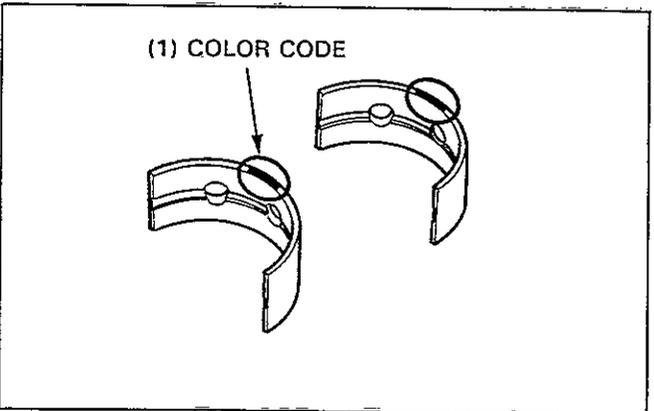


Determine the bearing I.D. code by referring to the case I.D. code and the main journal code.

		Main journal O.D. code	
		1	2
		29.994–30.002mm (1.1809–1.1812in)	30.002–30.010mm (1.1812–1.1815in)
Case I.D. code	A	33.000–33.008mm (1.2992–1.2995in)	C (Yellow)
	B	33.008–33.016mm (1.2995–1.2998in)	B (Green)
			A (Brown)

- A (Brown): 1.498–1.502 mm (0.0590–0.0591 in)
- B (Green): 1.494–1.498 mm (0.0588–0.0590 in)
- C (Yellow): 1.490–1.494 mm (0.0587–0.0588 in)

Thickness of the bearing metal can be identified by the color code.

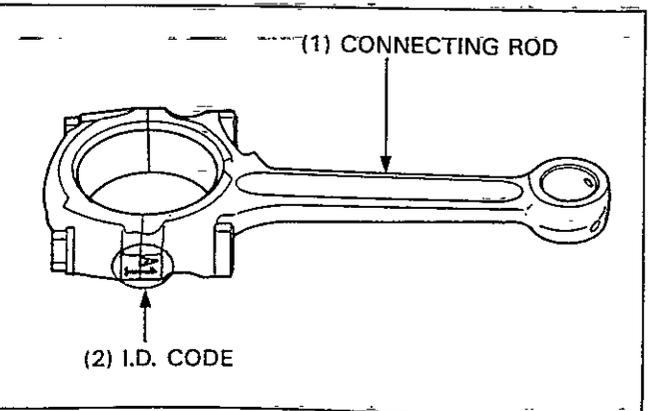


## Connecting Rod Bearing

Record the connecting rod I.D. code number.

**NOTE**

- 1 or 2 stamped on the connecting rod is the connecting rod I.D. code number. (Refer to the drawing to the right.)



Record the crank pin O.D. code number (or measure the crank pin O.D.).

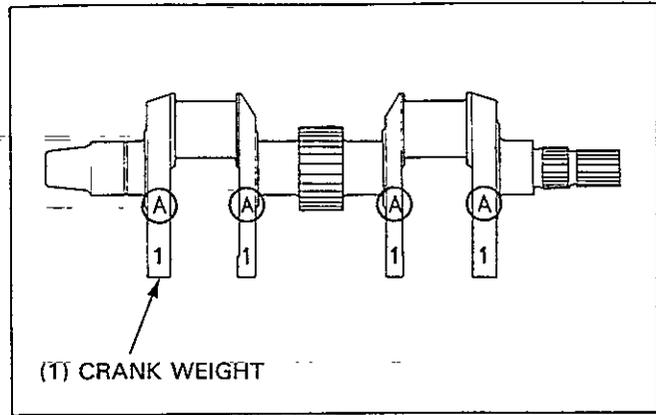
**NOTE**

A or B stamped on the crank weight is the crank pin O.D. code. (Refer to the drawing to the right.)

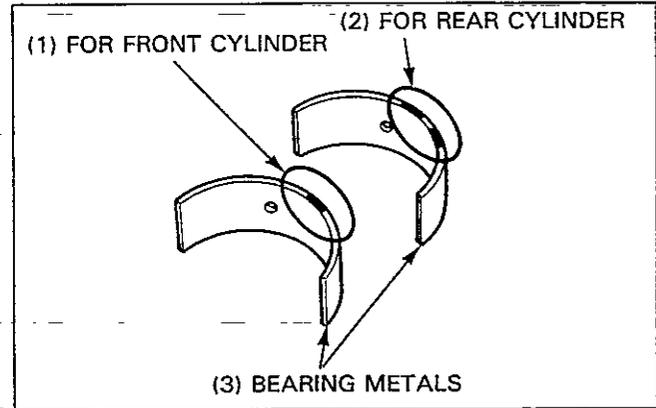
Select the appropriate bearing metal by referring to the crank pin O.D. code letter and the connecting rod I.D. code number.

**NOTE**

- There are two types of the connecting rod bearings: one for the front cylinder (marked with the one I.D. paint) and the other for the rear cylinder (marked with the two I.D. paints). Do not confuse.



		Connecting rod I.D. code			
		1		2	
		33.000–33.008mm (1.2992–1.2995in)		33.008–33.016mm (1.2995–1.2998in)	
		Front	Rear	Front	Rear
Crank pin O.D. code	A	29.992–30.000mm (1.1303–1.1811in) C (Yellow)	C (Yellow, Yellow)	B (Green)	B (Green, Green)
	B	29.984–29.992mm (1.1805–1.1808in) B (Green)	B (Green, Green)	A (Brown)	A (Brown, Brown)



**Selective bearing metals:**

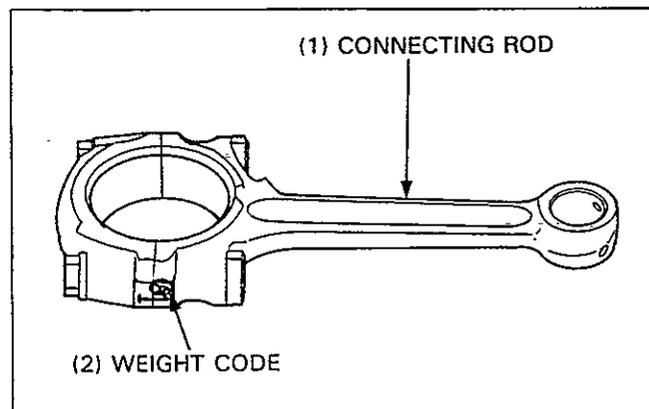
- A (Brown) (Brown, Brown): 1.494 - 1.498 mm (0.0588 - 0.0590 in)
- B (Green) (Green, Green): 1.490 - 1.494 mm (0.0587 - 0.0588 in)
- C (Yellow) (Yellow, Yellow): 1.486 - 1.490 mm (0.0585 - 0.0587 in)

**Connecting Rod Weight Selection**

The connecting rods are stamped with the mark A, B, or C which indicates the weight of the rod.

When replacing the connecting rod, refer to the selection table and select the connecting rod of the appropriate weight.

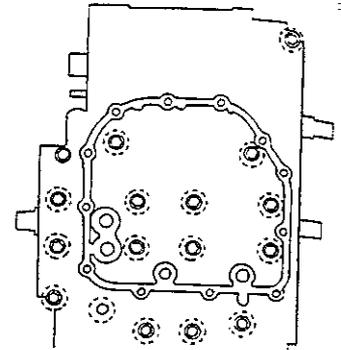
Weight code of the connecting rod which is to be replaced	Weight code of the remaining connecting rod on the same crank pin	Weight code of the new connecting rod
A	B	A, B or C
	C	A or B
B	A	B or C
	B	A, B, or C
C	C	A or B
	A	B or C
	B	A, B, or C



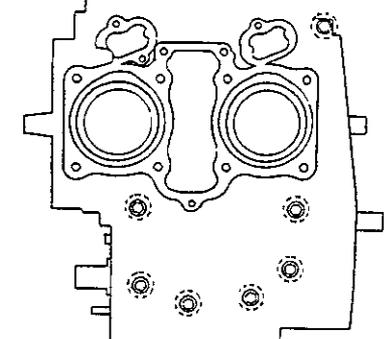
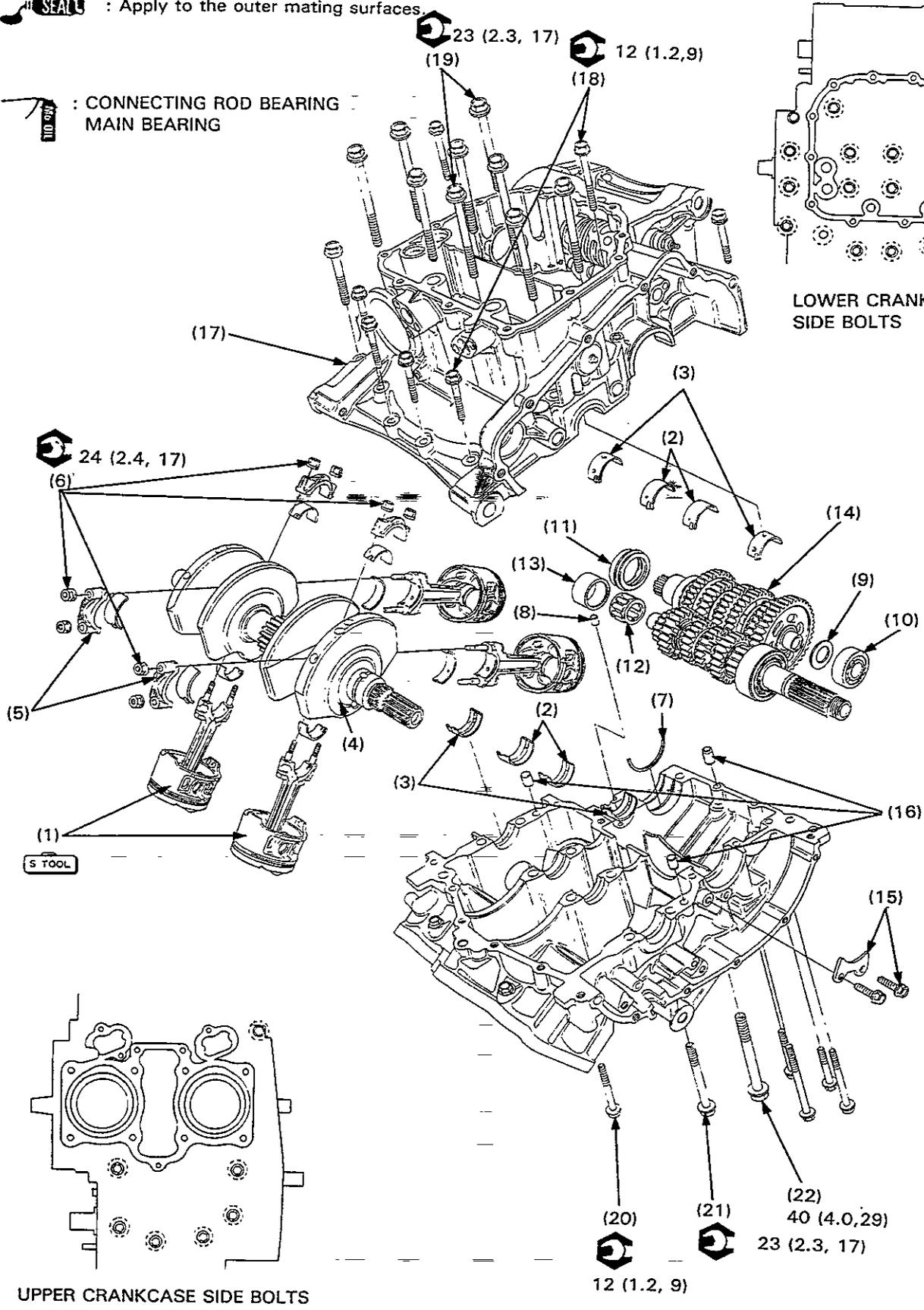
# Crankcase Assembly

 **SEALS** : Apply to the outer mating surfaces

 : CONNECTING ROD BEARING  
MAIN BEARING



LOWER CRANKCASE  
SIDE BOLTS



UPPER CRANKCASE SIDE BOLTS

12 (1.2, 9)

23 (2.3, 17)

22  
40 (4.0, 29)

**CAUTION**

- Select and replace the main bearing by using the selection table to make it a good match with the crankshaft main journal (page 11-10).
- Select and replace the connecting rod bearing by using the selection table to make it a good match with the crankshaft (page 11-10).
- Clean the crankcase mating surfaces and apply the sealant to the outer mating surface of the crankcase halves with care not to get the sealant on and around the main bearing. Assemble the crankcase halves.
- Assemble the crankcase halves with the upper case toward down. If the upper and lower cases are not assembled properly, check the transmission assembly for proper installation.

**Requisite Service**

- Alternator installation (page 15-8).
- Oil pump installation (page 4-4).
- Primary drive gear installation (page 17-4).
- Clutch installation (page 9-6).
- Water pump installation (page 5-5).
- Oil filter installation,
- Coolant filling.
- Starter motor installation (page 17-7).
- Gearshift linkage installation (page 10-6).
- Starter clutch installation (page 17-4).
- Cylinder head installation (page 8-4).
- Engine installation (page 7-4).
- Engine oil filling.

Procedure		Q'ty	Remarks
<b>Assembly Order</b>			
<b>Lower Case Side</b>			
(1)	Connecting rod/piston	4/4	NOTE • Install from the cylinder head side.
(2)	Center main bearing	4	
(3)	Side main bearing	4	
(4)	Crankshaft	1	NOTE • Take care not to damage the journal.
(5)	Bearing cap	4	
(6)	Cap nut	8	
(7)	Bearing stopper ring	1	
(8)	Bearing cap stop pin	1	
(9)	Thrust washer	1	
(10)	Countershaft bearing	1	
(11)	Countershaft oil seal	1	
(12)	Mainshaft bearing	1	
(13)	Needle bearing cap	1	
(14)	Transmission assembly	1	NOTE • Align the countershaft bearing groove with the stopper ring, and the hole in the mainshaft bearing cap with the stop pin.
(15)	Mainshaft bearing set plate	1	
(16)	Dowel pin	1	
(17)	Lower crankcase	1	NOTE • Apply sealant to the mating surfaces with care not to get it on and around the main bearing.
(18)	6 mm bolt	7	NOTE • Tighten the bolt in a crisscross pattern 2 or 3 steps. • Tighten at the lower side first, then raise the engine to tighten at the upper side.
(19)	8 mm bolt	10	
<b>Upper Case Side</b>			
(20)	6 mm bolt	5	NOTE • Tighten the bolt in a crisscross pattern 2 or 3 steps.
(21)	8 mm bolt	1	
(22)	10 mm bolt	1	