



CHAPTER 4. ENGINE OVERHAUL

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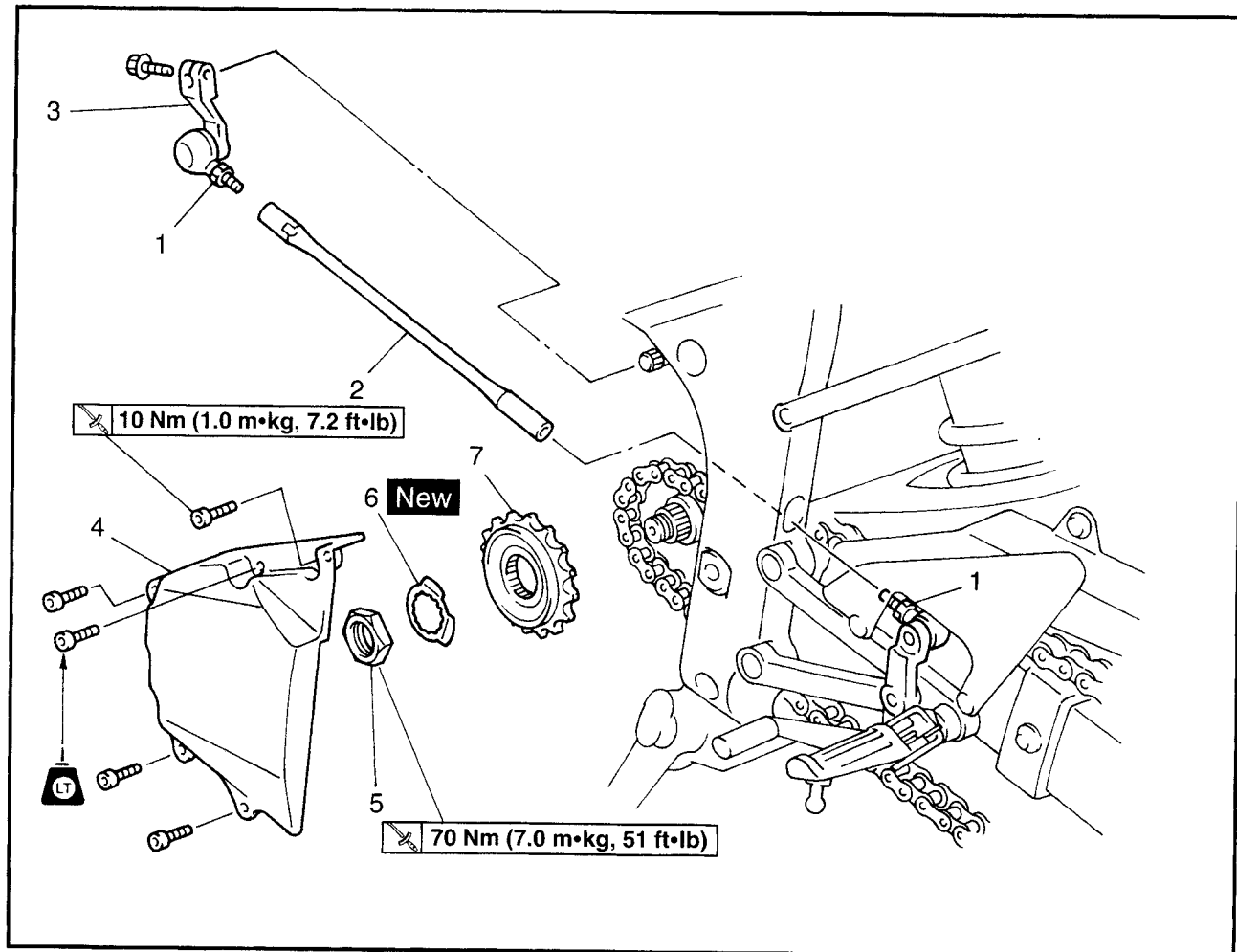
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EAS00190

ENGINE OVERHAUL

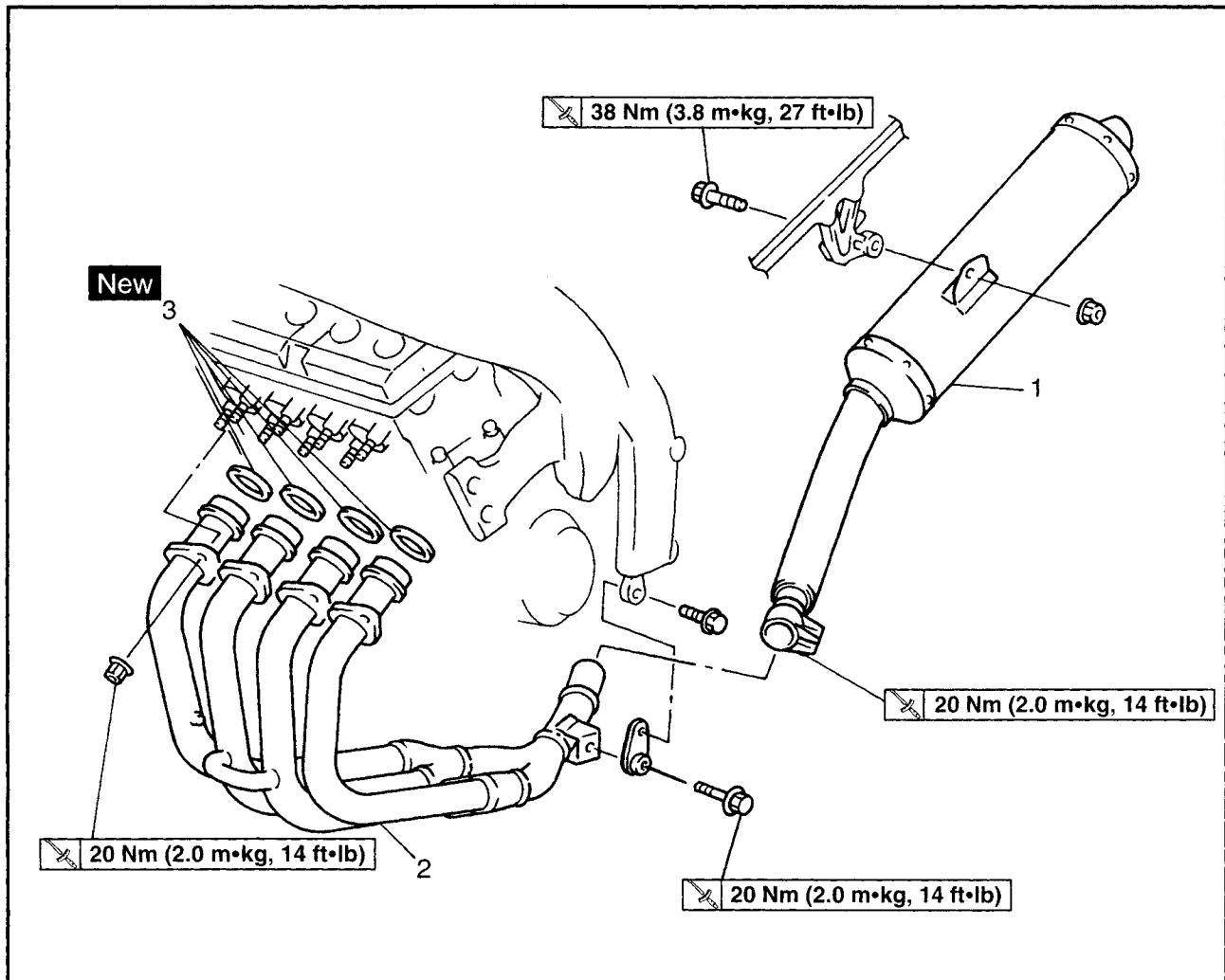
ENGINE DRIVE SPROCKET



Order	Job/Part	Q'ty	Remarks
	Removing the drive sprocket		
	Reserve tank	2	Remove the parts in the order listed. Refer to "CHANGING THE COOLANT"
1	Locknut	1	
2	Shift rod	1	
3	Shift arm	1	
4	Drive sprocket cover	1	
5	Nut	1	
6	Lock washer	1	
7	Drive sprocket	1	For installation reverse the remove procedure.



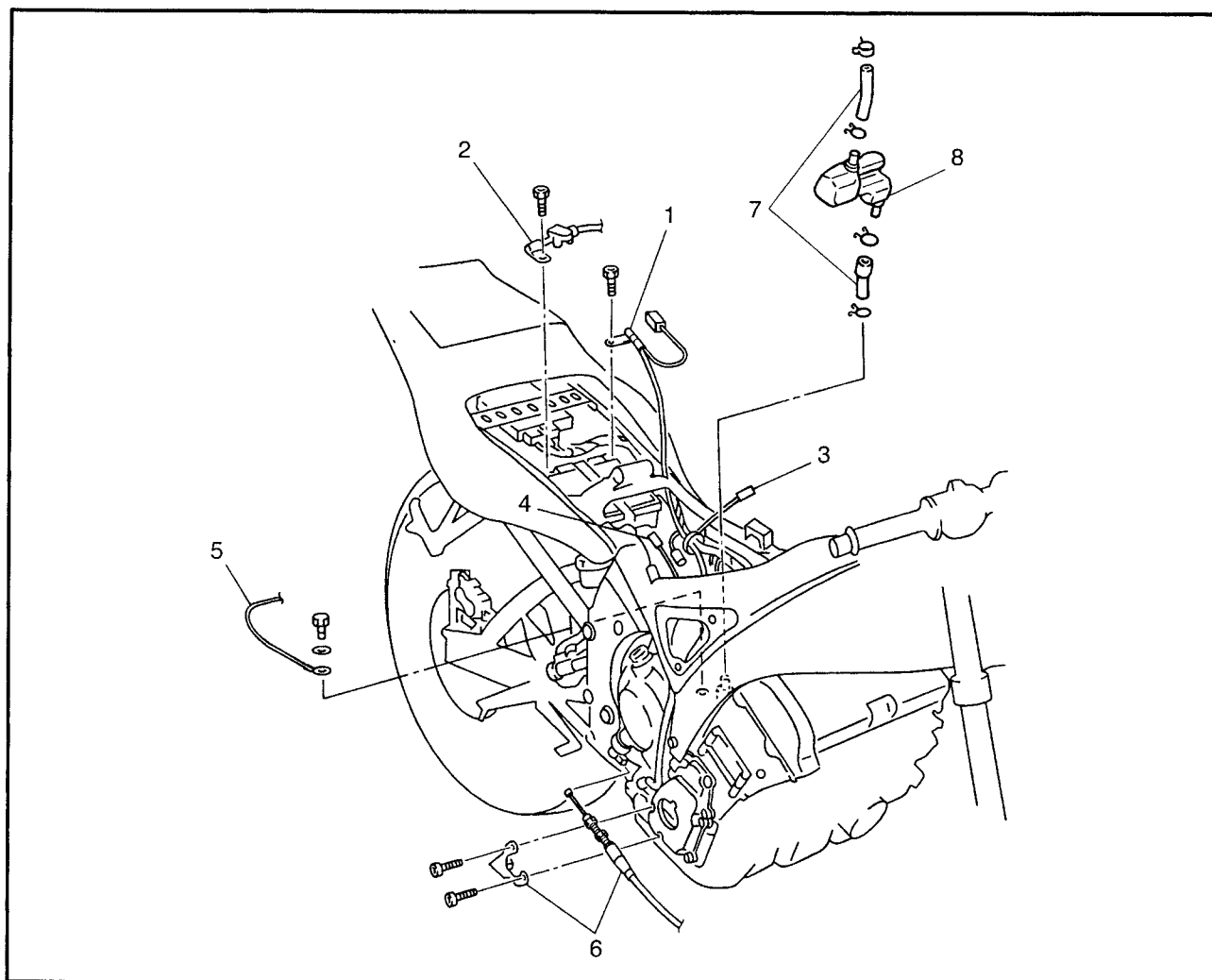
EXHAUST ASSEMBLY



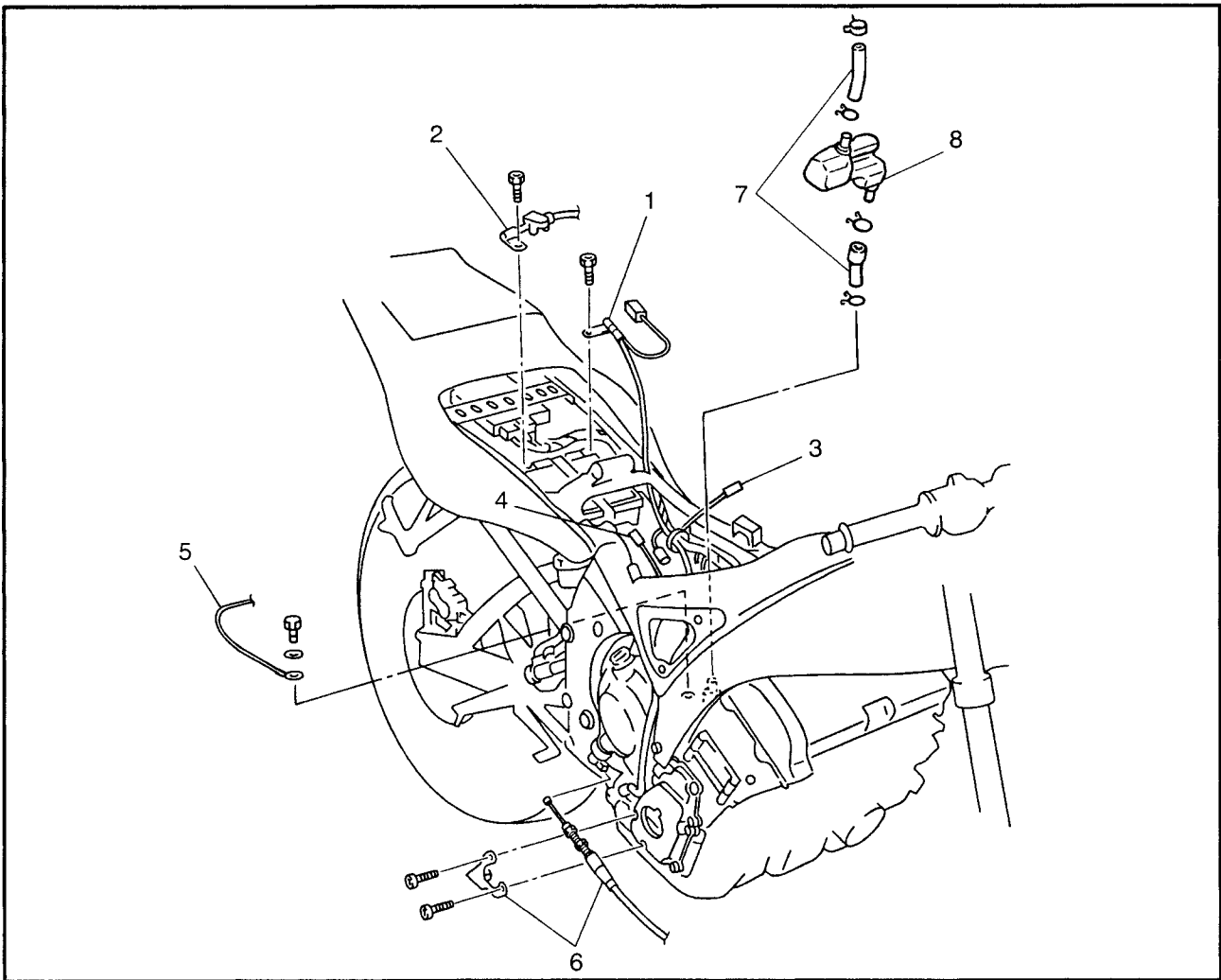
Order	Job/Part	Q'ty	Remarks
	Removing the exhaust assembly Bottom cowl and side cowlings Coolant		Remove the parts in the order listed. Refer to "COWLINGS" in chapter 3 Drain. Refer to "CHANGING THE COOLANT" in chapter 3. Refer to "RADIATOR" in chapter 5.
1	Radiator assembly	1	
2	Muffler	1	
3	Exhaust pipe assembly	1	
	Exhaust pipe gasket	4	
			For installation reverse the removal procedure.




LEADS AND HOSES



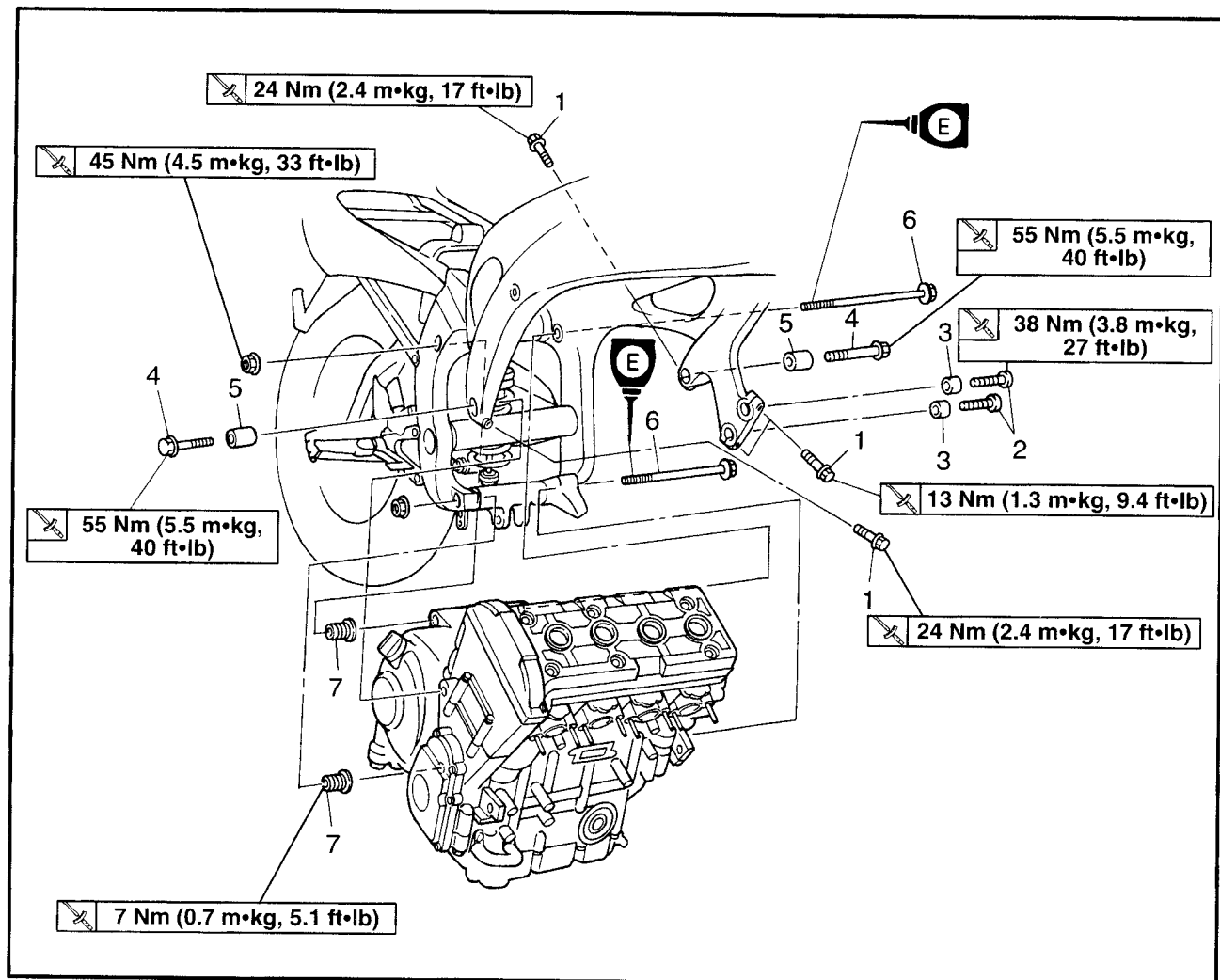
Order	Job/Part	Q'ty	Remarks
	Disconnecting the leads and hoses		
	Fuel tank		Disconnect the parts in the order listed.
	Air filter case		Refer to "FUEL TANK" in chapter 3.
	Carburetor assembly and joints		Refer to "AIR FILTER CASE AND IGNITION COILS" in chapter 3.
	Engine oil and oil filter cartridge		Refer to "CARBURETORS" in chapter 6.
	Oil cooler		Drain.
			Refer to "CHANGING THE ENGINE OIL" in chapter 3.
			Refer to "OIL COOLER" in chapter 5.



Order	Job/Part	Q'ty	Remarks
1	Battery negative lead	1	CAUTION:  _____ First, disconnect the negative lead, then the positive lead. _____ For connecting reverse the disconnecting procedure.
2	Battery positive lead	1	
3	Stator coil assembly coupler	1	
4	Pickup coil coupler	1	
5	Engine earth	1	
6	Clutch wire and holder	1	
7	Crankcase breather hose	1	
8	Separator	1	



ENGINE



Order	Job/Part	Q'ty	Remarks
	Removing the engine		Remove The Parts In The Order Listed. NOTE: _____ Place a suitable stand under the frame and engine.
1	Pinch bolts	4	Refer to "INSTALLING THE ENGINE".
2	Button head bolts	2	
3	Collars	2	
4	Front mounting bolts	2	
5	Collars	2	
6	Rear mounting bolts	2	
7	Engine mounting adjust bolts	2	
			NOTE: _____ Use the point shaft wrench to loosen the engine mounting adjust bolt.
			For Installation, Reverse The Removal Procedure.



EAS00192

INSTALLING THE ENGINE

1. Install:

- engine mounting adjust bolts ①
- rear mounting bolts ②
- self-locking nuts ③
- collars ④
- front mounting bolts ⑤
- collars ⑥
- button head bolts ⑦
- pinch bolts ⑧

NOTE:

- Lubricate the rear mounting bolt threads with lithium soap base grease.
- Do not fully tighten the nuts and bolts.

2. Tighten:

- self-locking nut 45 Nm (4.5 m•kg, 33 ft•lb)
- front mounting bolts 55 Nm (5.5 m•kg, 40 ft•lb)
- button head bolt 38 Nm (3.8 m•kg, 27 ft•lb)
- pinch bolt M8 24 Nm (2.4 m•kg, 17 ft•lb)
- M6 13 Nm (1.3 m•kg, 9.4 ft•lb)
- engine adjusting bolts

NOTE:

Use the pivot shaft wrench ① to tighten the engine mounting adjust bolt to finger tightness.



Pivot shaft wrench
90890-01471

3. Install:

- drive sprocket 70 Nm (7.0 m•kg, 51 ft•lb)

4. Install:

- drive sprocket cover 10 Nm (1.0 m•kg, 7.2 ft•lb)

NOTE:

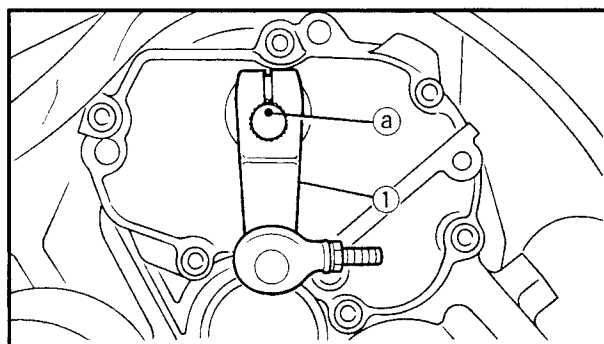
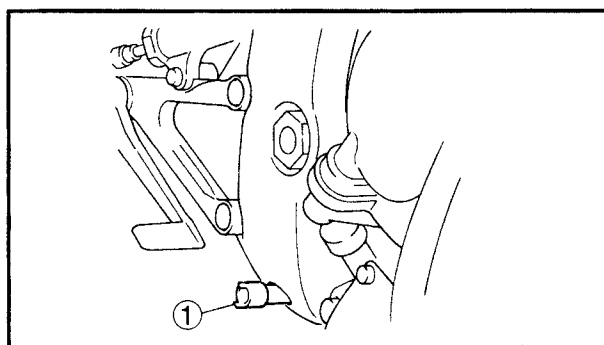
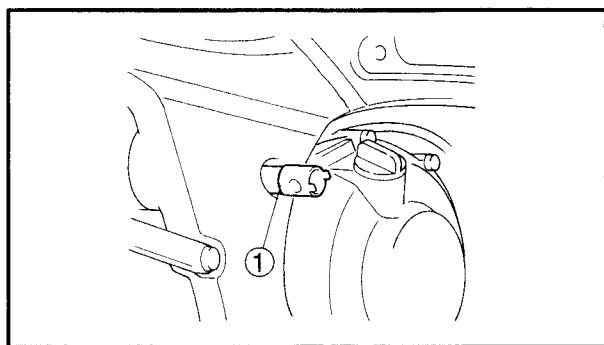
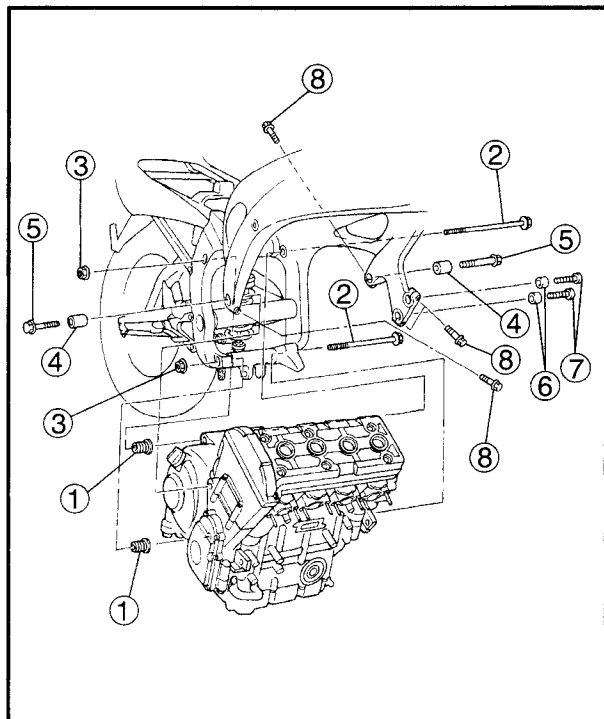
Refer to "CABLE ROUTING" in chapter 2.

5. Install:

- shift arm ① 10 Nm (1.0 m•kg, 7.2 ft•lb)

NOTE:

Align the punch mark ② in the shift shaft with the slot in the shift arm.

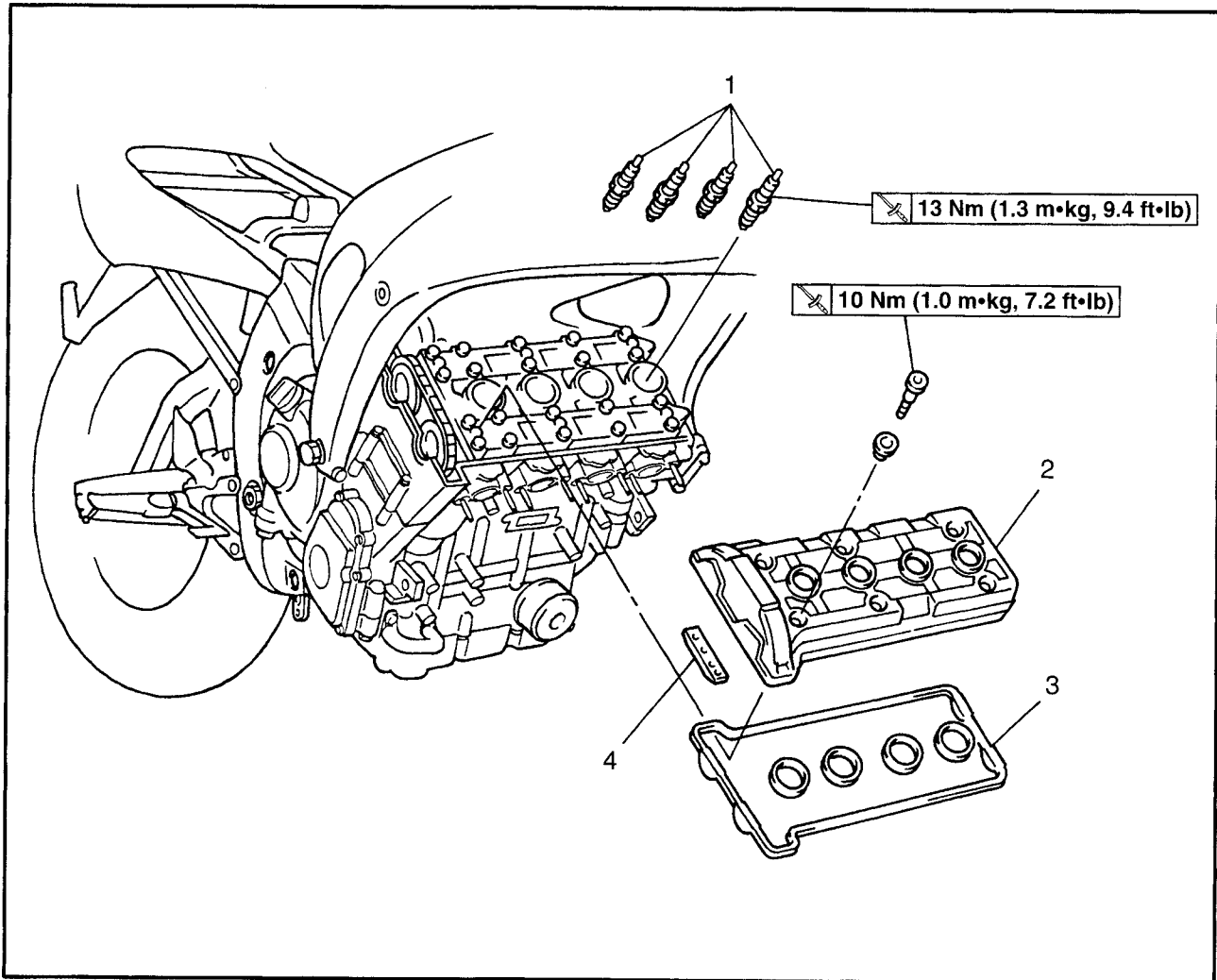




EAS00194

CAMSHAFTS

CYLINDER HEAD COVER

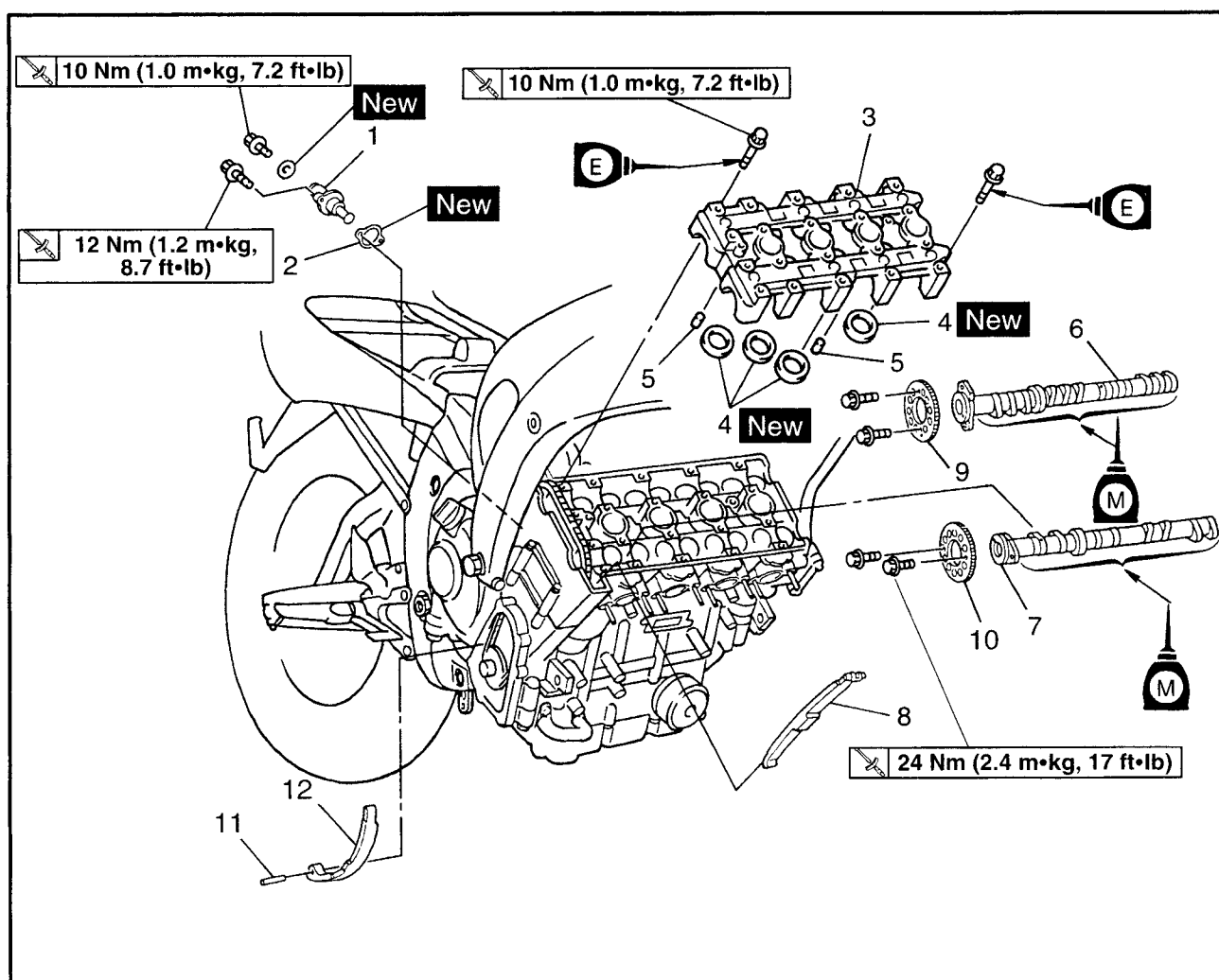


Order	Job/Part	Q'ty	Remarks
	Removing the cylinder head cover		
	Carburetor assembly		Remove the parts in the order listed.
	Radiator assembly		Refer to "CARBURETORS" in chapter 6.
1	Spark plugs	4	Refer to "RADIATOR" in chapter 5.
2	Cylinder head cover	1	
3	Cylinder head cover gasket	1	
4	Timing chain guide (top side)	1	
			For installation reverse the removal procedure.

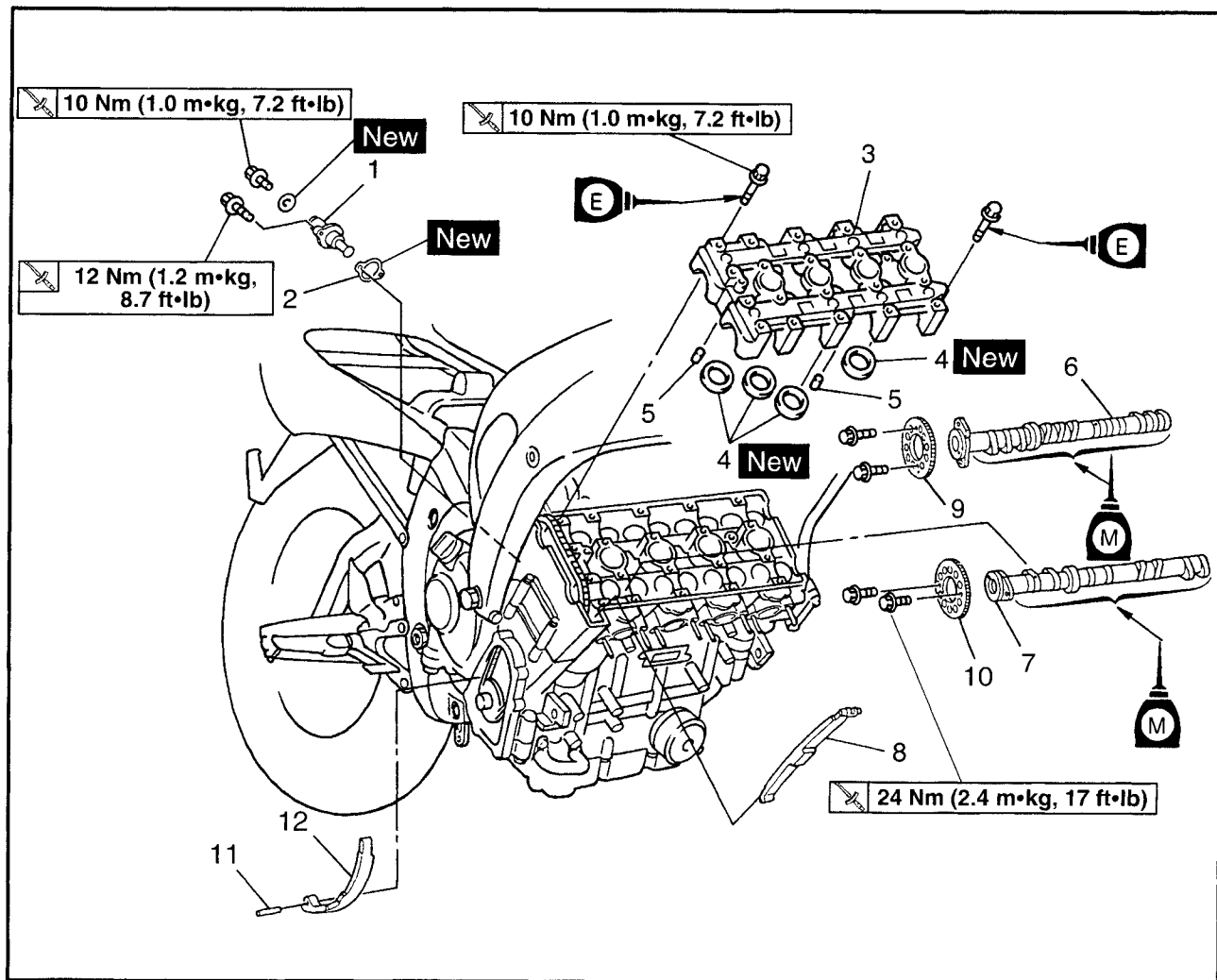


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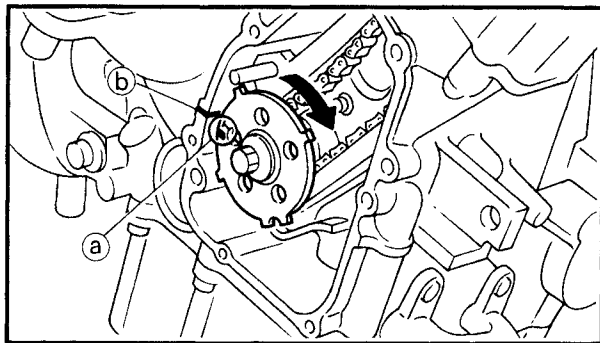
CAMSHAFTS



Order	Job/Part	Q'ty	Remarks
	Removing the camshafts		
	Pickup coil rotor cover		Remove the parts in the order listed. Refer to "PICKUP COIL AND PICK UP COIL COVER".
1	Timing chain tensioner	1	Refer to "REMOVING/INSTALLING THE CAMSHAFTS". NOTE: During removal, the dowel pins may still be connected to the camshaft cap.
2	Timing chain tensioner gasket	1	
3	Camshaft cap	1	
4	Camshaft cap gasket	4	
5	Dowel pin	2	
6	Intake camshaft	1	Refer to "REMOVING/INSTALLING THE CAMSHAFT".
7	Exhaust camshaft	1	
8	Timing chain guide (exhaust side)	1	



Order	Job/Part	Q'ty	Remarks
9	Intake camshaft sprocket	1	Refer to "INSTALLING THE CAMSHAFTS".
10	Exhaust camshaft sprocket	1	
11	Pin	1	
12	Timing chain guide (intake side)	1	
			For installation reverse the removal procedure.



EAS00198

REMOVING THE CAMSHAFTS

1. Align:

- TDC mark on the pickup coil rotor (with the crankcase mating surface)

a. Turn the crankshaft clockwise.

- b. When piston #1 is at TDC on the compression stroke, align the mark (a) on the pickup coil rotor with the crankcase mating surface (b).

NOTE:

TDC on the compression stroke can be found when the camshaft lobes are turned away from each other.

2. Remove:

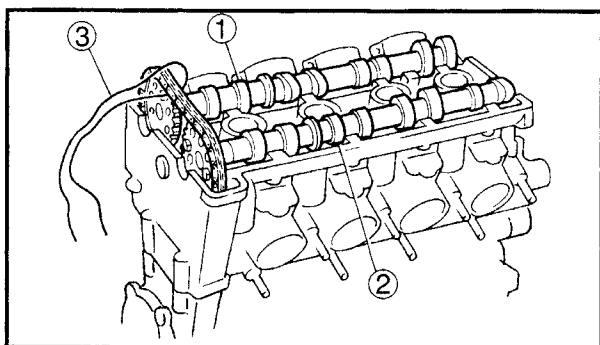
- timing chain tensioner

3. Remove:

- camshaft cap
- dowel pins

CAUTION:

To prevent damage to the cylinder head, camshafts or camshaft cap, loosen the camshaft cap bolts in stages and in a crisscross pattern, working from the outside in.



4. Remove:

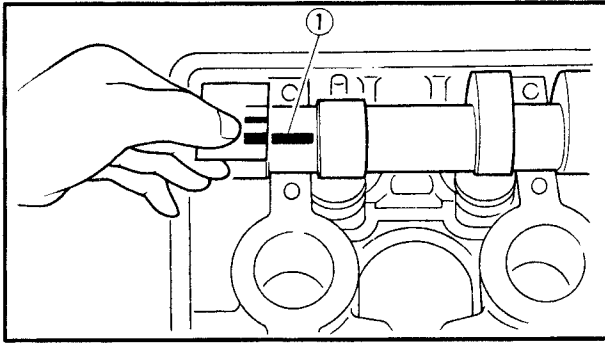
- intake camshaft (1)
- exhaust camshaft (2)

NOTE:

To prevent the timing chain from falling into the crankcase, fasten it with a wire (3).

5. Remove:

- timing chain guide (exhaust side)



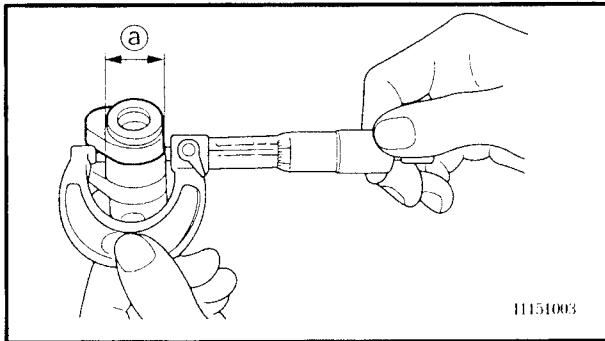
NOTE:

- Tighten the camshaft cap bolts in stages and in a crisscross pattern, working from the inner caps out.
- Do not turn the camshaft when measuring the camshaft-journal-to-camshaft-cap clearance with the Plastigauge®.



Camshaft cap bolt
10 Nm (1.0 m•kg, 7.2 ft•lb)

- d. Remove the camshaft caps and then measure the width of the Plastigauge® ①.



5. Measure:

- camshaft journal diameter (a)
 Out of specification → Replace the camshaft.
 Within specification → Replace the cylinder head and the camshaft caps as a set.



Camshaft journal diameter
22.967 ~ 22.980 mm
(0.9042 ~ 0.9047 in)

EAS00208


CHECKING THE CAMSHAFT SPROCKETS, AND TIMING CHAIN GUIDES

The following procedure applies to all of the camshaft sprockets and timing chain guides.




INSTALLING THE CAMSHAFTS

1. Install:
 - timing chain guide (intake side)
 - timing chain guide (exhaust side)
2. Install:
 - intake camshaft sprocket

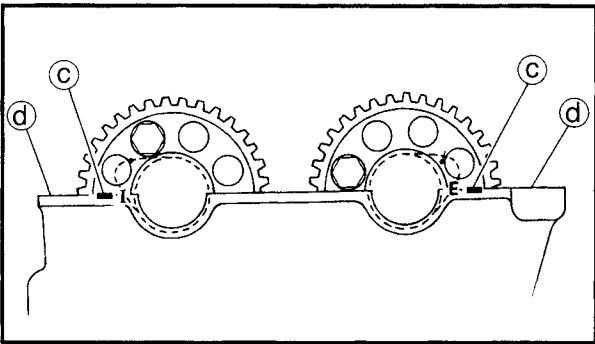
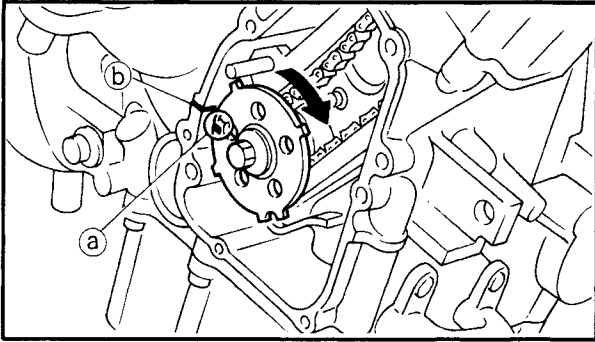
 **24 Nm (2.4 m•kg, 17 ft•lb)**

- exhaust camshaft sprocket

 **24 Nm (2.4 m•kg, 17 ft•lb)**

NOTE:

Cam sprocket timing mark is outside and align the cam sprocket hole to camshaft hole.



3. Install:
 - exhaust camshaft
 - intake camshaft
 - camshaft cap gasket
 - camshaft cap

a. Turn the crankshaft clockwise.

b. When piston #1 is at TDC on the compression stroke, align the (a) mark on the pickup coil rotor with the crankcase mating surface (b).

- c. Install the timing chain onto both camshaft sprockets and then install the camshaft sprockets onto the camshafts.

CAUTION:

Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.

- d. Install the exhaust and intake camshaft cap.



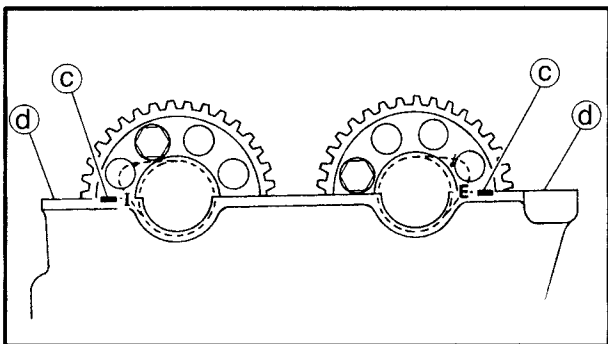
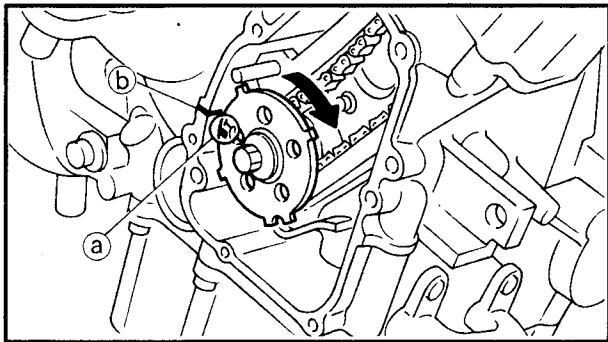
Camshaft cap bolt
10 Nm (1.0 m•kg, 7.2 ft•lb)

NOTE:

Make sure that the camshaft sprocket timing marks [Ⓒ] are aligned with the cylinder head edge [Ⓓ]

Out of alignment → Reinstall.

- e. Remove the wire from the timing chain.



6. Check:

- TDC mark (a)
Make sure that the TDC mark is aligned with the crankcase mating surface (b).
- camshaft sprocket timing mark (c)
Make sure that the camshaft sprocket timing mark is aligned with the cylinder head edge (d)
Out of alignment → Adjust.
Refer to the installation steps above.

7. Measure:

- valve clearance
Out of specification → Adjust.
Refer to "ADJUSTING THE VALVE CLEARANCE" in chapter 3.

8. Install:

- cylinder head cover gasket
- cylinder head cover

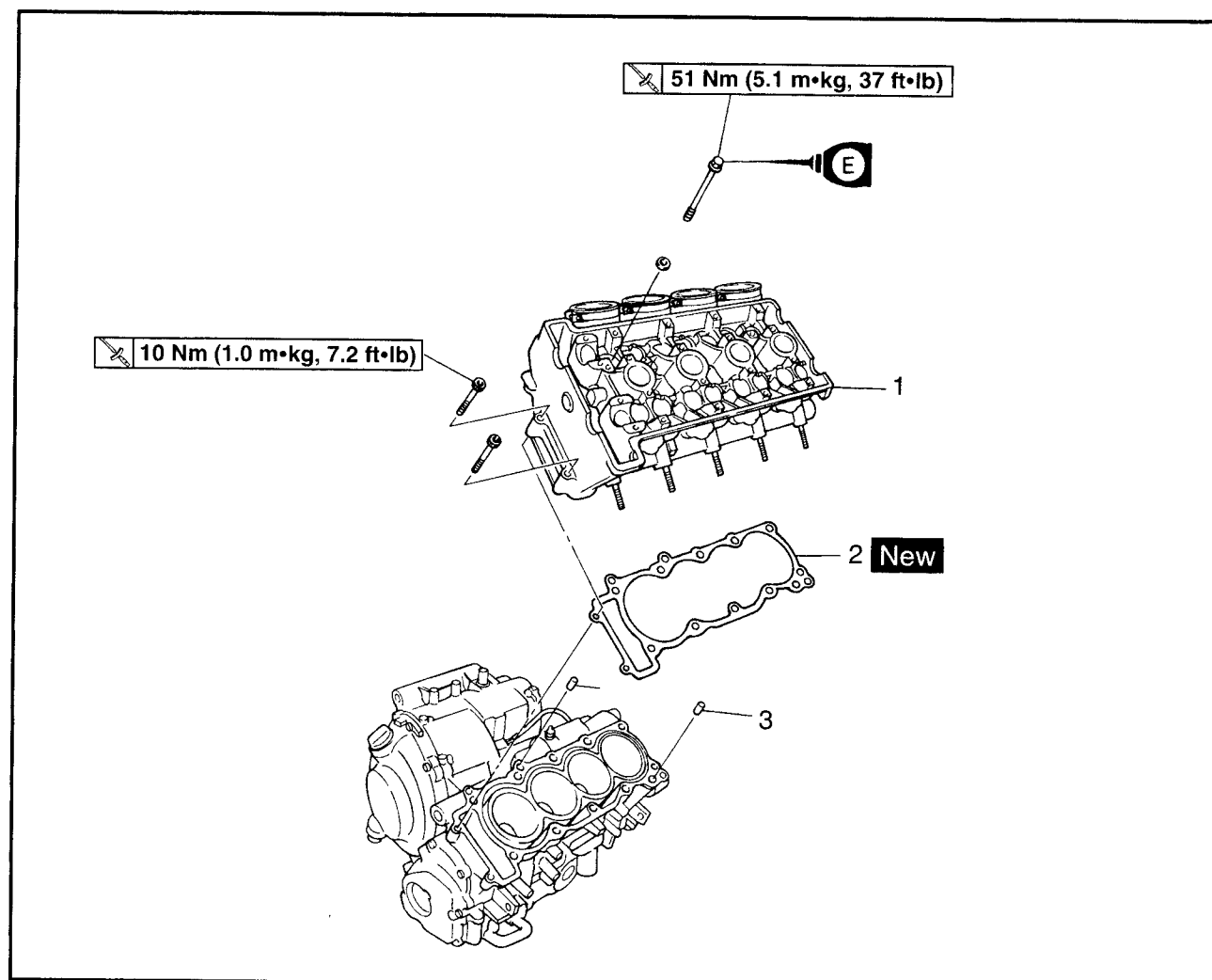
NOTE:

- Apply bond TB1541 onto the mating surfaces of the cylinder head cover and cylinder head cover gasket.
- Apply bond 1215B onto the mating surfaces of the cylinder head cover gasket and cylinder head.
- Tighten the cylinder head cover bolts in stages and in a crisscross pattern.

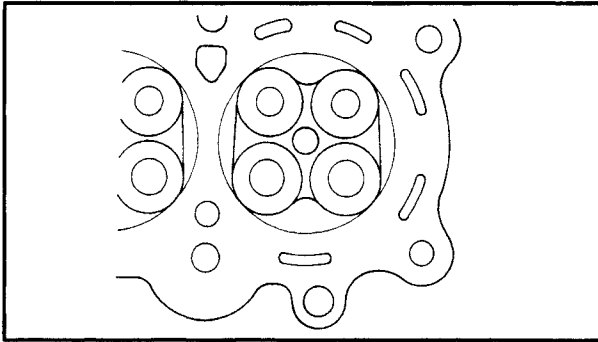
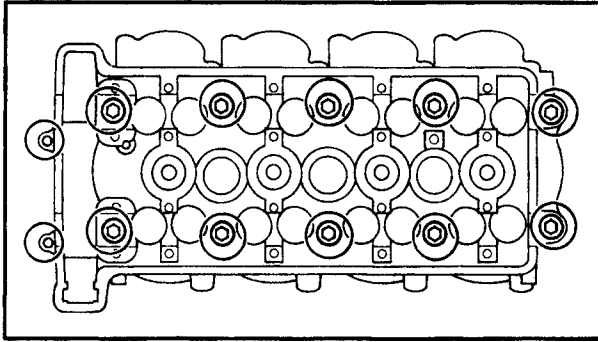


EAS00220

CYLINDER HEAD



Order	Job/Part	Q'ty	Remarks
1	Removing the cylinder head Intake and exhaust camshafts Water hose Temp sensor lead Front mounting bolt Cylinder head	1	Remove the parts in the order listed. Refer to "CAMSHAFTS". Disconnect Disconnect Refer to "ENGINE". Refer to "REMOVING/INSTALLING THE CYLINDER HEAD".
2	Cylinder head gasket	1	
3	Dowel pin	2	For installation reverse the removal procedure.



EAS00223

REMOVING THE CYLINDER HEAD

1. Remove:

- cylinder head bolts
- cylinder head

NOTE:

Loosen each bolt and nut 1/2 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts and nuts are fully loosened, remove them.

EAS00229

CHECKING THE CYLINDER HEAD

1. Eliminate:

- combustion chamber carbon deposits (with a rounded scraper)

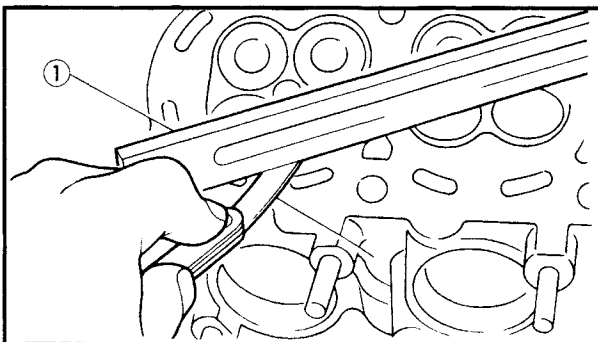
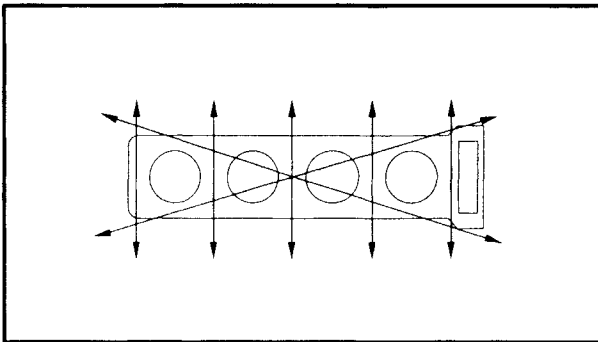
NOTE:

Do not use a sharp instrument to avoid damaging or scratching:

- spark plug bore threads
- valve seats

2. Check:

- cylinder head
Damage/scratches → Replace.
- cylinder head water jacket
Mineral deposits/rust → Eliminate.



3. Measure:

- cylinder head warpage
Out of specification → Resurface the cylinder head.



Max. cylinder head warpage
0.05 mm (0.002 in)

- Place a straightedge ① and a thickness gauge ② across the cylinder head.
- Measure the warpage.
- If the limit is exceeded, resurface the cylinder head as follows.



- d. Place a 400 ~ 600 grit wet sandpaper on the surface plate and resurface the cylinder head using a figure-eight sanding pattern.

NOTE:


To ensure an even surface, rotate the cylinder head several times.




EAS00223

INSTALLING THE CYLINDER HEAD**1. Install:**

- cylinder head gasket
- cylinder head
- cylinder headbolt

(M10)  51 Nm (5.1 m•kg, 37 ft•lb)

(M6)  10 Nm (1.0 m•kg, 7.2 ft•lb)

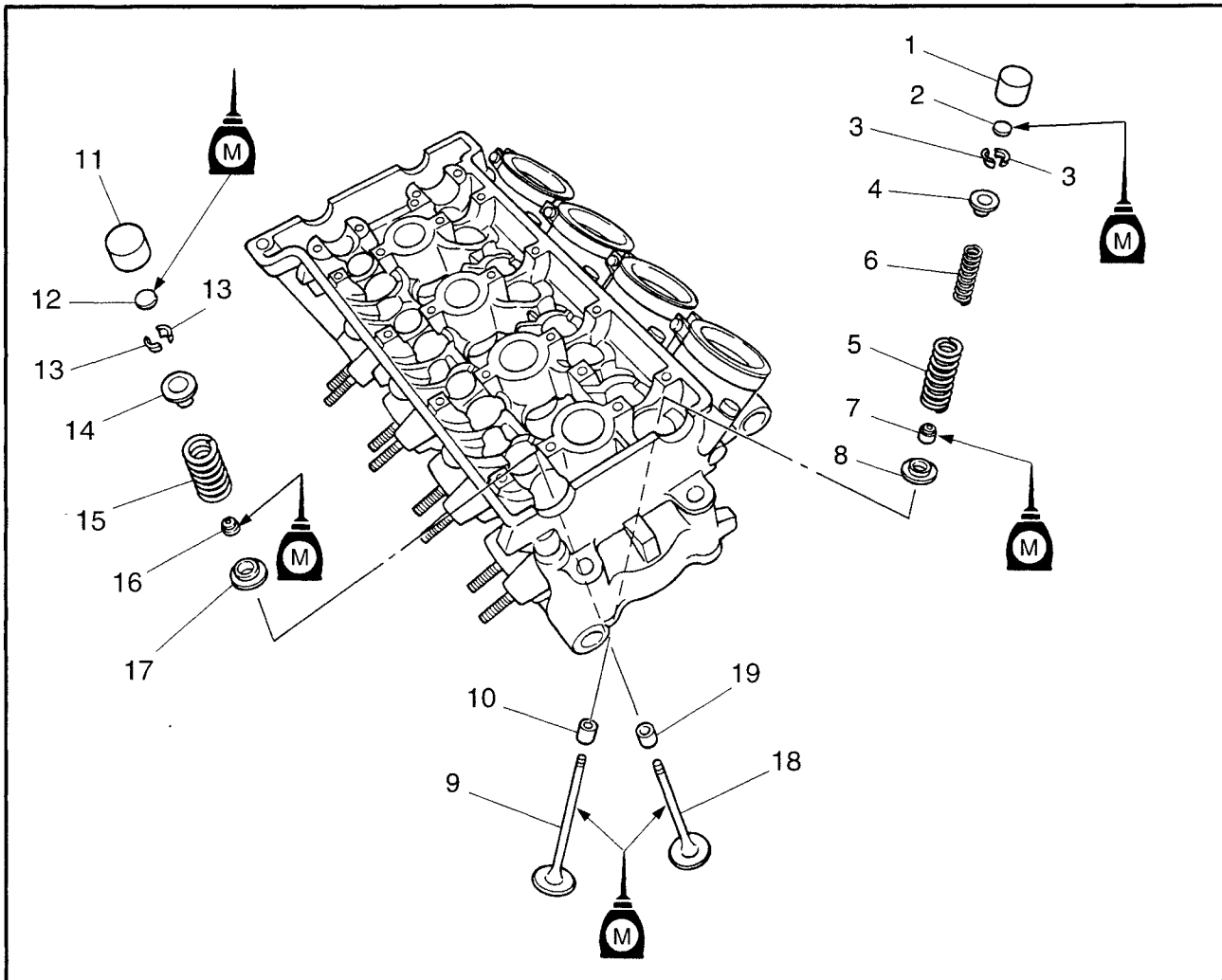
NOTE:

- Lubricate the cylinder head nuts with engine oil.
- Tighten the cylinder head nuts and bolts in two stages and in a crisscross pattern.

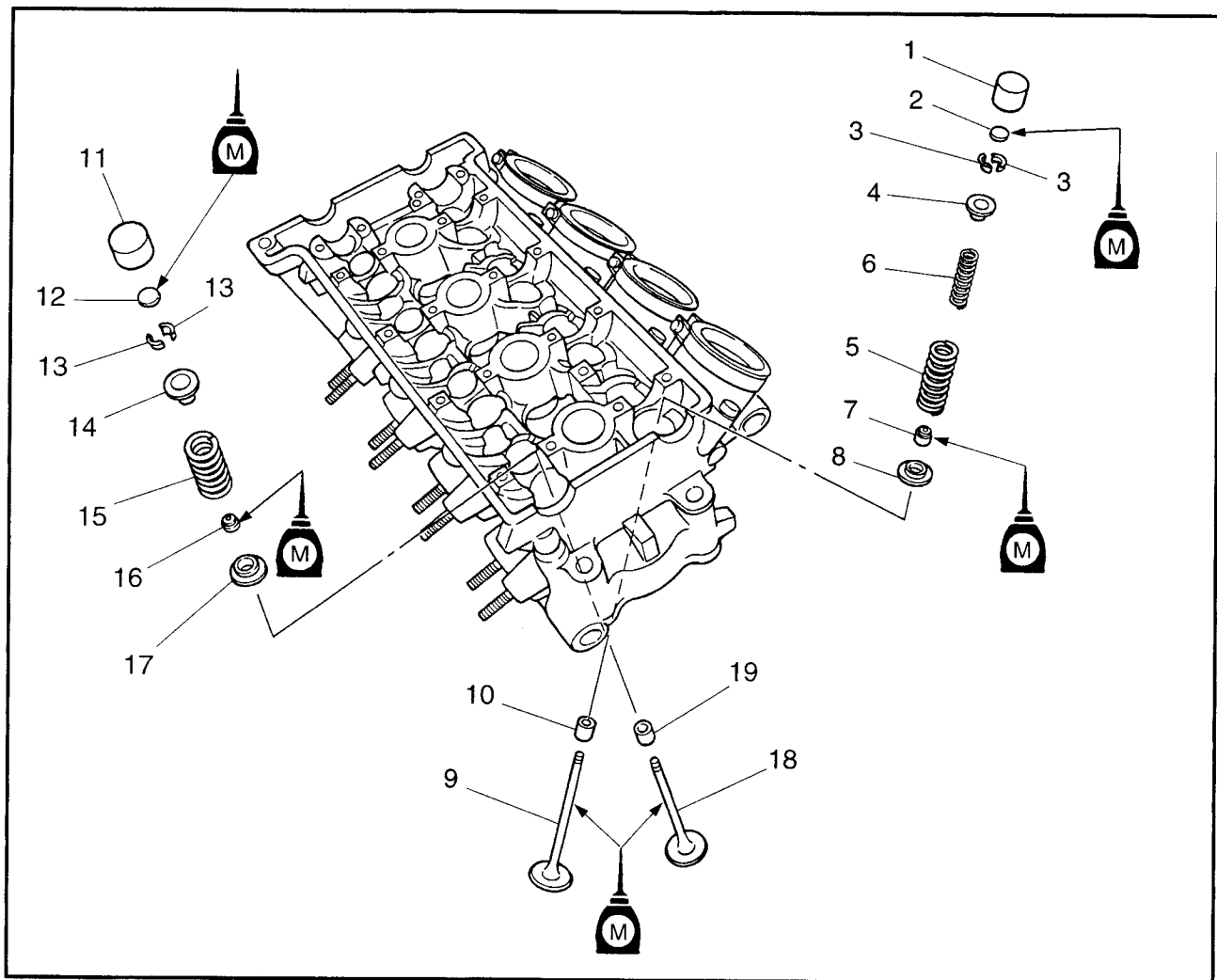


EAS00236

VALVES AND VALVE SPRINGS



Order	Job/Part	Q'ty	Remarks
	Removing the valves and valve springs		
	Cylinder head		Remove the parts in the order listed.
			Refer to "CYLINDER HEAD".
1	Intake valve lifter	8	Refer to "REMOVING/INSTALLING THE VALVES".
2	Intake valve pad	8	
3	Intake valve cotter	16	
4	Intake valve upper spring seat	8	
5	Intake valve spring outer	8	
6	Intake valve spring inner	8	
7	Intake valve oil seal	8	
8	Intake valve lower spring seat	8	
9	Intake valve	8	
10	Intake valve guide	8	



Order	Job/Part	Q'ty	Remarks
11	Exhaust valve lifter	8	Refer to "REMOVING/INSTALLING THE VALVES".
12	Exhaust valve pad	8	
13	Exhaust valve cotter	16	
14	Exhaust valve upper spring seat	8	
15	Exhaust valve spring	8	
16	Exhaust valve oil seal	8	
17	Exhaust valve lower spring seat	8	
18	Exhaust valve	8	For installation, reverse the removal procedure.
19	Exhaust valve guide	8	



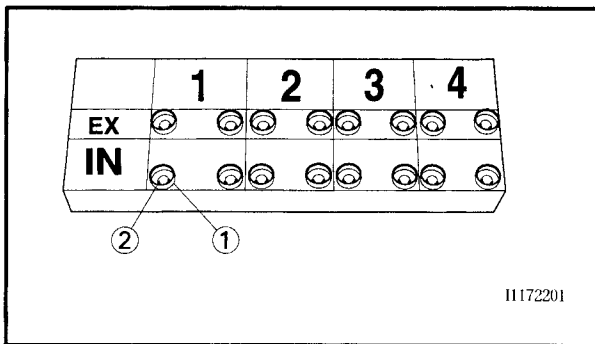
EAS00237

REMOVING THE VALVES

The following procedure applies to all of the valves and related components.

NOTE:

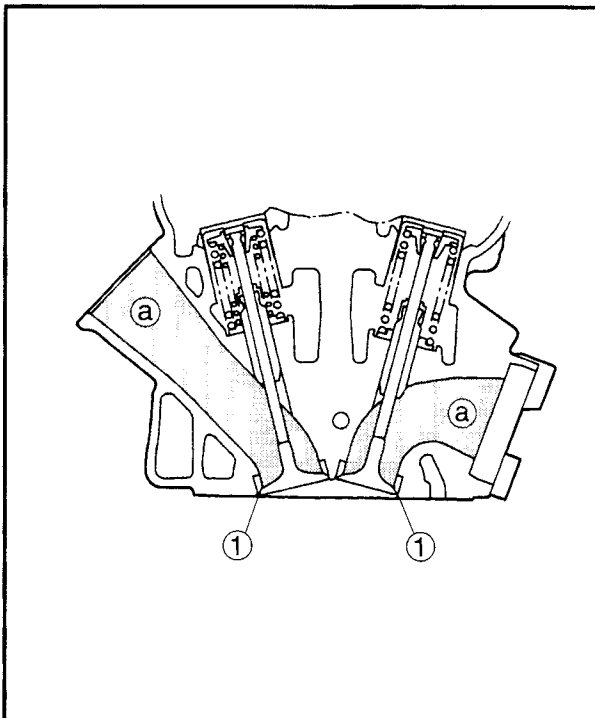
Before removing the internal parts of the cylinder head (e.g., valves, valve springs, valve seats), make sure that the valves properly seal.



1. Remove:
 - valve lifter ①
 - valve pad ②

NOTE:

Make a note of the position of each valve lifter and valve pad so that they can be reinstalled in their original place.

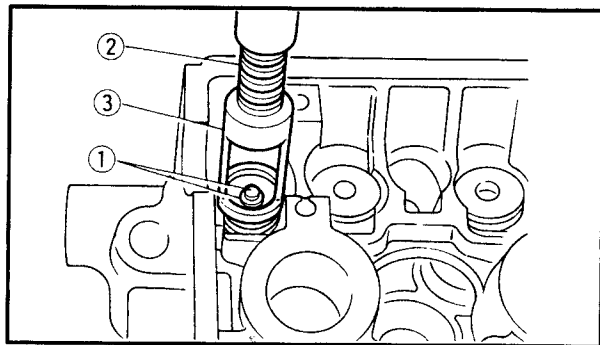


2. Check:
• valve
(for leakage)
Leakage at the valve seat → Check the valve
face, valve seat, and valve seat width.
Refer to “CHECKING THE VALVE SEATS”.

- Pour a clean solvent (a) into the intake and exhaust ports.
- Check that the valves properly seal.

NOTE:

There should be no leakage at the valve seat
①.



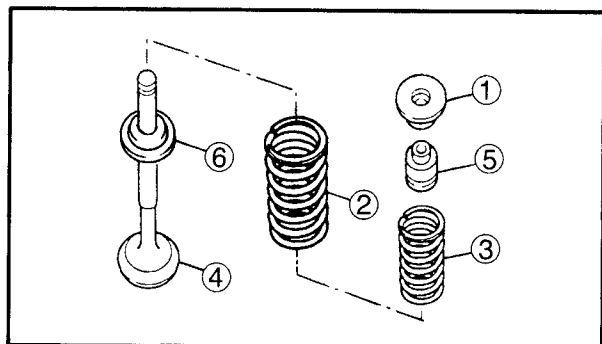
3. Remove:
- valve cotteners ①

NOTE:

Remove the valve cotteners by compressing the valve spring with the valve spring compressor ② and attachment ③.



Valve spring compressor
90890-04019, YM-04019
Attachment
90890-04114, YM-01253-1



4. Remove:
- upper spring seat ①
 - valve spring outer ②
 - valve spring inner (intake only) ③
 - valve ④
 - oil seal ⑤
 - lower spring seat ⑥

NOTE:

Identify the position of each part very carefully so that it can be reinstalled in its original place.

EAS00239

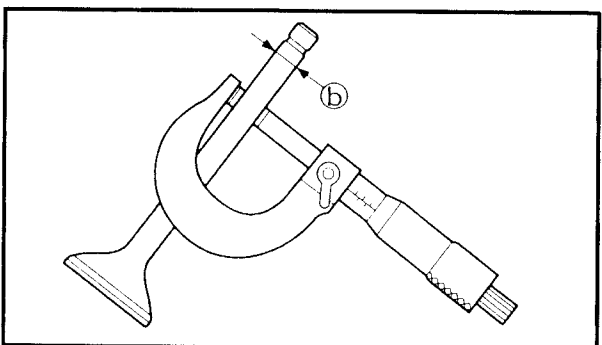
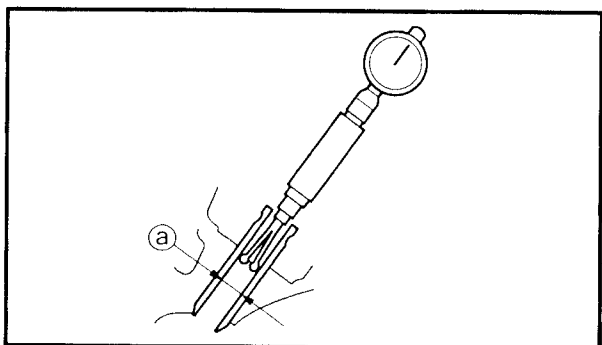
CHECKING THE VALVES AND VALVE GUIDES

The following procedure applies to all of the valves and valve guides.

1. Measure:
- valve-stem-to-valve-guide clearance

Valve-stem-to-valve-guide clearance =
Valve guide inside diameter (a) –
Valve stem diameter (b)

Out of specification → Replace the valve guide.



Valve-stem-to-valve-guide clearance

Intake

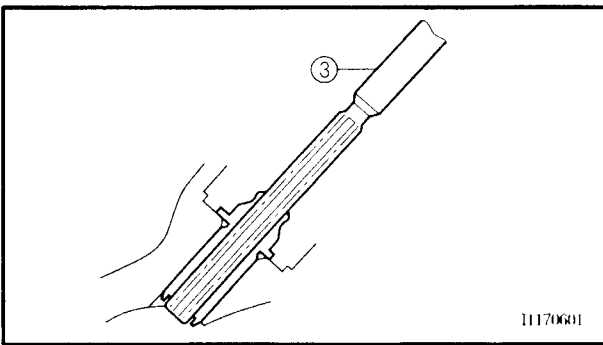
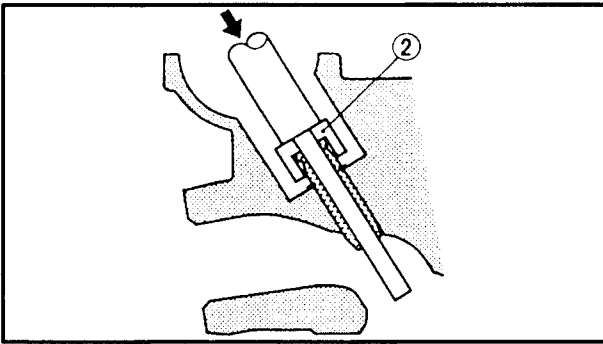
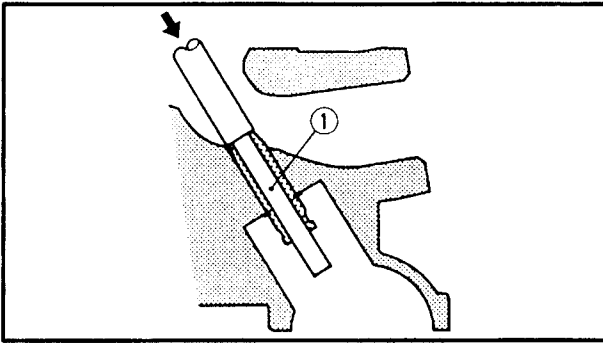
0.010 ~ 0.037 mm
(0.0004 ~ 0.0015 in)

<Limit> : 0.08 mm (0.0031 in)

Exhaust

0.025 ~ 0.052 mm
(0.001 ~ 0.002 in)

<Limit>: 0.1 mm (0.0039 in)



- 2. Replace:
 - valve guide

NOTE:

To ease valve guide removal and installation, and to maintain the correct fit, heat the cylinder head to 100°C (212°F) in an oven.

- Remove the valve guide with a valve guide remover ①.
- Install the new valve guide with the valve guide installer ② and valve guide remover ①.
- After installing the valve guide, bore the valve guide with a valve guide reamer ③ to obtain the proper valve-stem-to-valve-guide clearance.

NOTE:

After replacing the valve guide, reface the valve seat .

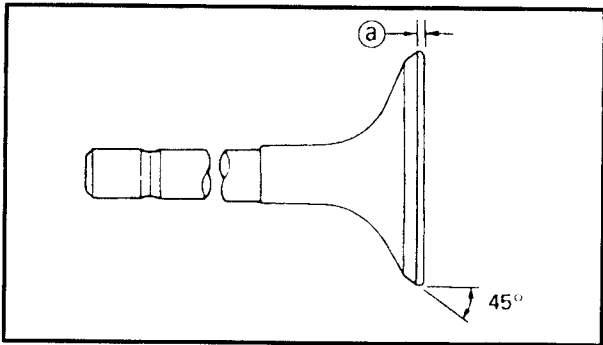


**Valve guide remover
(4.0 mm, 0.16 in)
90890-04111**

**Valve guide installer
(4.0 mm, 0.16 in)
90890-04112**

**Valve guide reamer
(4.0 mm, 0.16 in)
90890-04113**

3. Eliminate:
 - carbon deposits
(from the valve face and valve seat)
4. Check:
 - valve face
Pitting/wear → Grind the valve face.
 - valve stem end
Mushroom shape or diameter larger than the body of the valve stem → Replace the valve.



5. Measure:

- valve margin thickness (a)

Out of specification → Replace the valve.

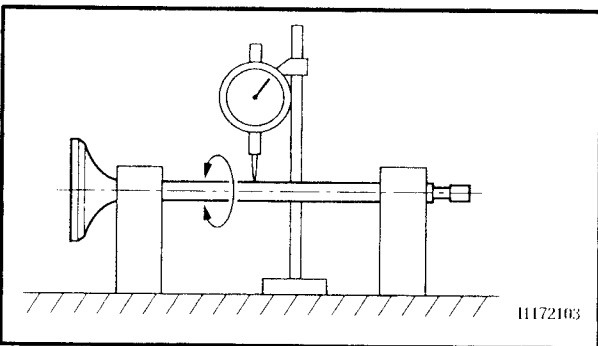


Valve margin thickness

0.6 mm ~ 0.8 mm

(0.0236 ~ 0.0315 in)

<LIMIT>: 0.5 mm (0.02 in)



6. Measure:

- valve stem runout

Out of specification → Replace the valve.

NOTE:

- When installing a new valve, always replace the valve guide.
- If the valve is removed or replaced, always replace the oil seal.



Valve stem runout

0.04 mm (0.0016 in)

EAS00240

CHECKING THE VALVE SEATS

The following procedure applies to all of the valves and valve seats.

1. Eliminate:

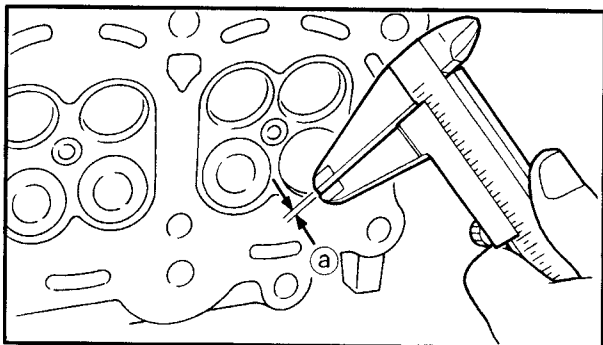
- carbon deposits
(from the valve face and valve seat)

2. Check:

- valve seat
Pitting/wear → Replace the cylinder head.

3. Measure:

- valve seat width (a)
Out of specification → Replace the cylinder head.

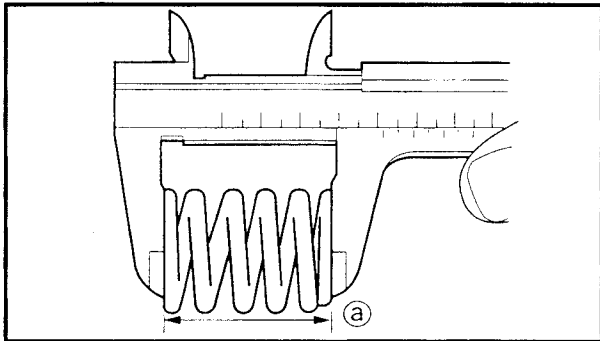
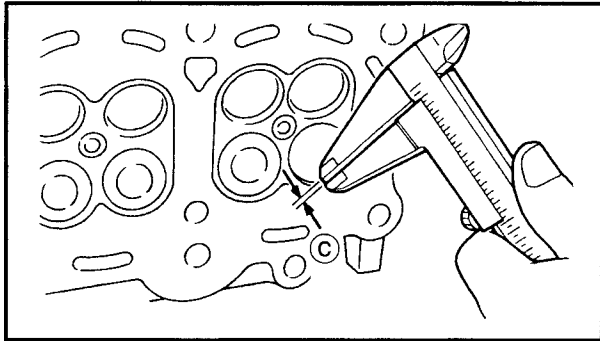
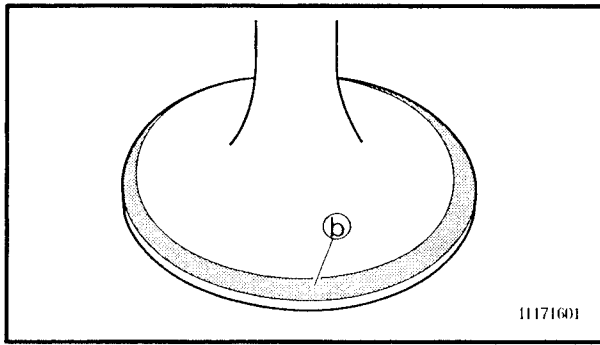


Valve seat width

Intake: 0.9 ~ 1.1 mm

(0.0354 ~ 0.0433 in)

<Limit>: 1.6 mm (0.06 in)



- e. Apply a fine lapping compound to the valve face and repeat the above steps.
- f. After every lapping procedure, be sure to clean off all of the lapping compound from the valve face and valve seat.
- g. Apply Mechanic's blueing dye (Dykem) ⑥ onto the valve face.
- h. Install the valve into the cylinder head.
- i. Press the valve through the valve guide and onto the valve seat to make a clear impression.
- j. Measure the valve seat width ⑦ again. If the valve seat width is out of specification, reface and lap the valve seat.

EAS00241

CHECKING THE VALVE SPRINGS

The following procedure applies to all of the valve springs.

1. Measure:
- valve spring free length (a)
- Out of specification → Replace the valve spring.



Valve spring free length

Intake valve spring (inner)

37.0 mm (1.46 in)

<Limit>: 35mm (1.38 in)

Intake valve spring (outer)

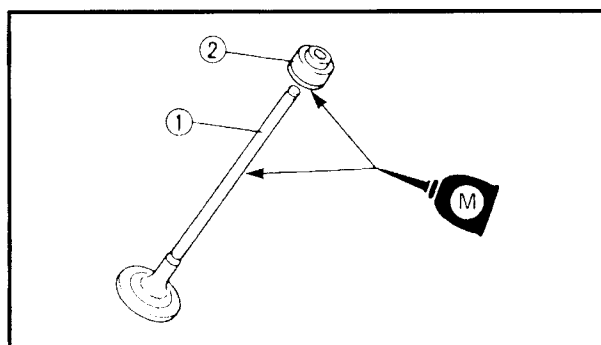
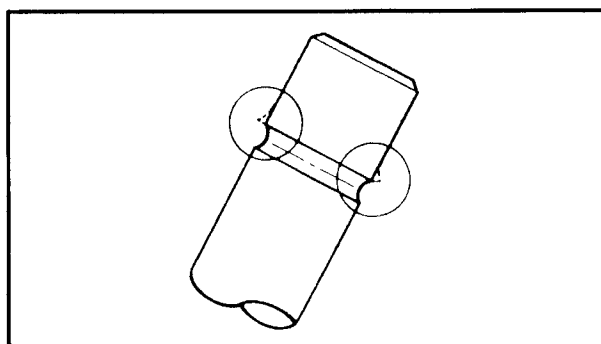
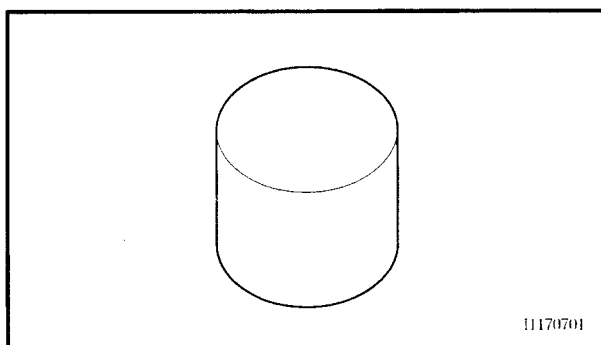
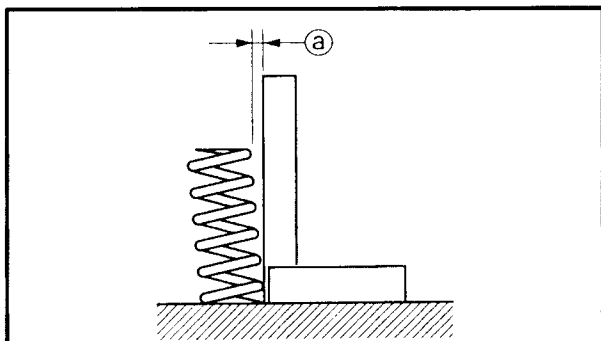
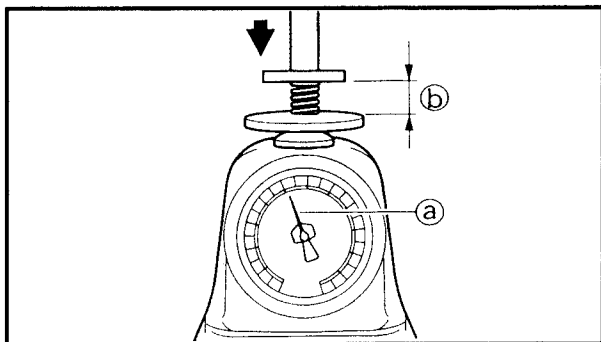
38.4 mm (1.51 in)

<Limit>: 36.5mm (1.44 in)

Exhaust valve spring

41.7 mm (1.64 in)

<Limit>: 39.5mm (1.56 in)



2. Measure:

- compressed spring force (a)

Out of specification → Replace the valve spring.

(b) Installed length



Compressed spring force (installed)

Intake valve spring inner

69 ~ 79 N (15.51 ~ 17.76 lb,
7.04 ~ 8.06 kg) at 30.0 mm
(1.18 in)

Intake valve spring outer

114 ~ 132 N (25.63 ~ 29.67 lb,
11.62 ~ 13.46 kg) at 32.5 mm
(1.28 in)

Exhaust valve spring

160 ~ 184 N (35.97 ~ 41.36 lb,
16.32 ~ 18.76 kg) at 36.1 mm
(1.42 in)

3. Measure:

- valve spring tilt (a)

Out of specification → Replace the valve spring.



Max. Spring tilt

Intake valve spring inner

2.5° / 1.6 mm (0.06 in)

Intake valve spring outer

2.5° / 1.7 mm (0.07 in)

Exhaust valve spring

2.5° / 1.8 mm (0.07 in)

EAS00242

CHECKING THE VALVE LIFTERS

The following procedure applies to all of the valve lifters.

1. Check:

- valve lifter

Damage/scratches → Replace the valve lifters and cylinder head.

EAS00247

INSTALLING THE VALVES

The following procedure applies to all of the valves and related components.

1. Deburr:

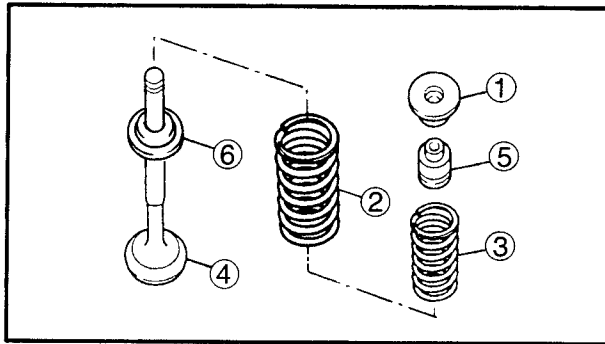
- valve stem end
(with an oil stone)

2. Lubricate:

- valve stem (1)
- oil seal (2)
(with the recommended lubricant)



Recommended lubricant
Molybdenum disulfide oil

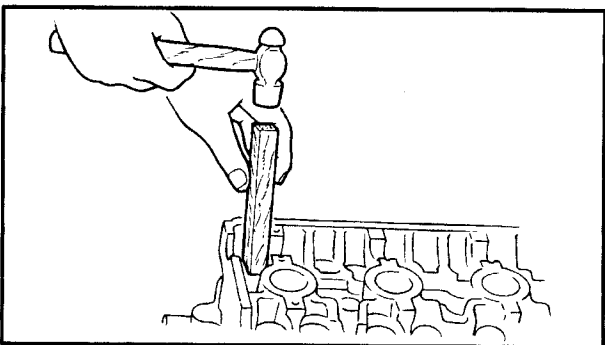
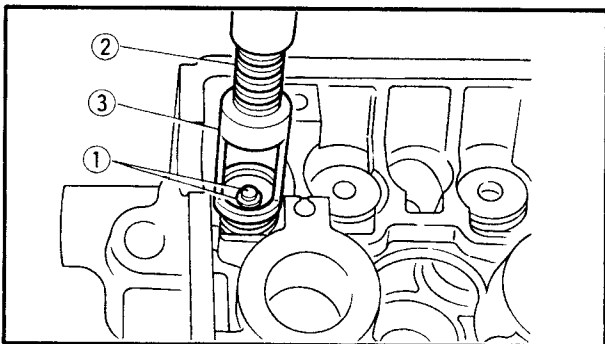
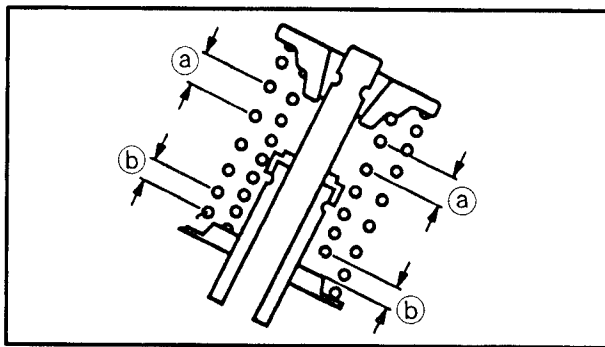


3. Install:
- lower spring seat ⑥
 - oil seal ⑤ **New**
 - valve ④
 - valve spring inner (intake only) ③
 - valve spring outer ②
 - upper spring seat ①
(into the cylinder head)

NOTE:

- Make sure that each valve is installed in its original place. Refer to the following embossed marks.
- Install the valve spring with the larger pitch ② facing up.

② Smaller pitch



4. Install:
- valve cotters ①

NOTE:

Install the valve cotters by compressing the valve spring with the valve spring compressor ② and attachment ③.



Valve spring compressor
90890-04019, YM-04019
Attachment
90890-04114, YM-01253-1

5. To secure the valve cotters ① onto the valve stem, lightly tap the valve tip with a soft-face hammer.

CAUTION:

Hitting the valve tip with excessive force could damage the valve.



6. Lubricate:

- valve pad
(with the recommended lubricant)



Recommended lubricant
Molybdenum disulfide oil

7. Install:

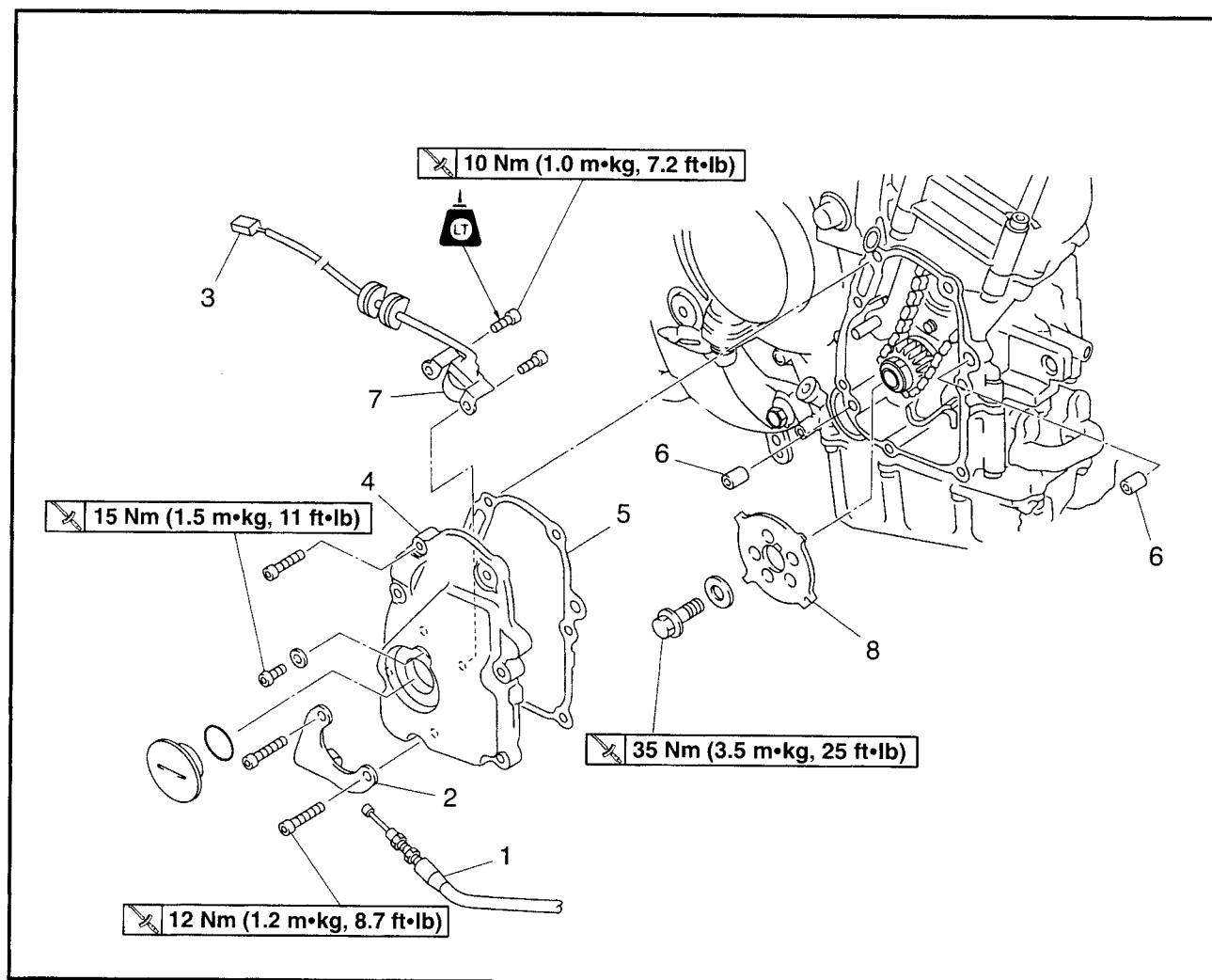
- valve pad
- valve lifter

NOTE:

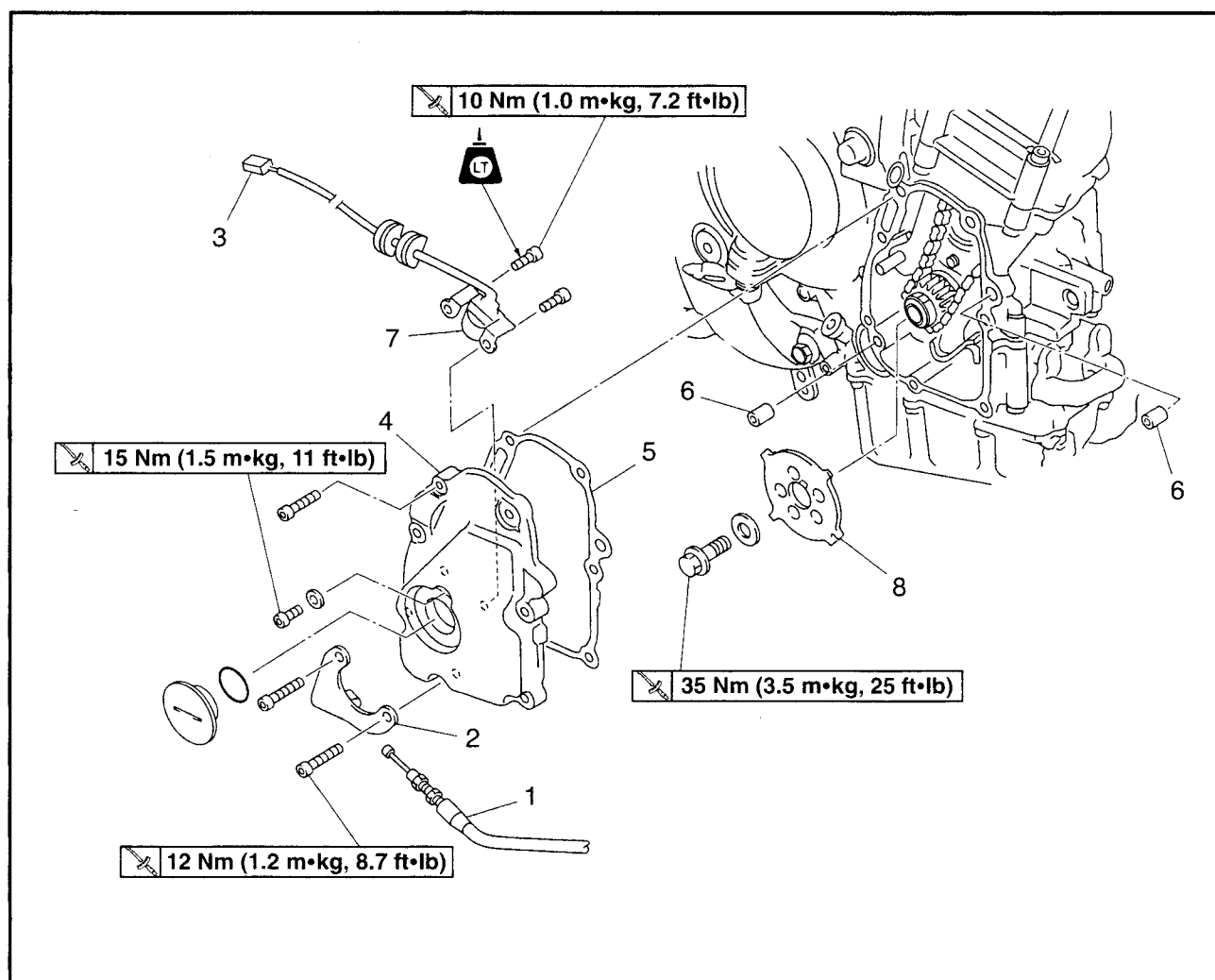
- The valve lifter must move smoothly when rotated with a finger.
- Each valve lifter and valve pad must be reinstalled in its original position.



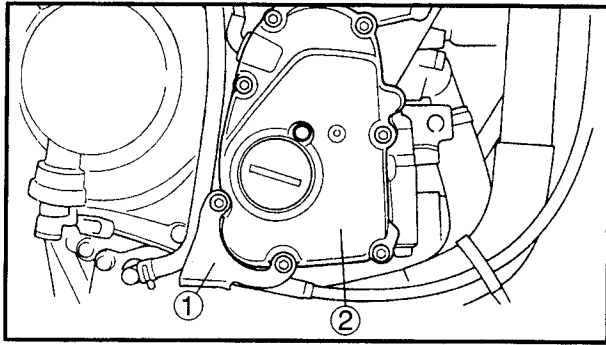
PICKUP COIL AND PICKUP COIL ROTOR



Order	Job/Part	Q'ty	Remarks
	Removing the pickup coil and pickup coil rotor Riders seat and fuel tank Bottom cowl and right side cowl Engine oil Generator cover		Remove the parts in the order listed. Refer to "SEATS" and "FUEL TANK" in chapter 3. Refer to "COWLINGS" in chapter 3. Drain. Refer to "CHANGING THE ENGINE OIL" in chapter 3. Refer to "STARTER CLUTCH AND GENERATOR".



Order	Job/Part	Q'ty	Remarks
1	Clutch cable	1	Disconnect
2	Clutch cable holder	1	
3	Pickup coil coupler	1	
4	Pickup coil cover	1	
5	Pickup coil cover gasket	1	Refer to "REMOVING/INSTALLING THE PICKUP COIL ROTOR".
6	Dowel pin	2	
7	Pickup coil	1	
8	Pickup rotor	1	
			For installation reverse the removal procedure.



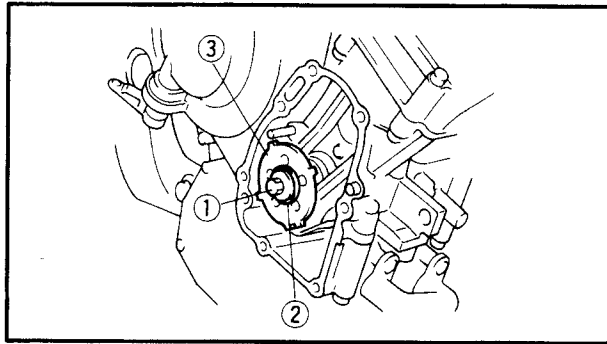
REMOVING THE PICKUP COIL ROTOR

1. Remove:

- clutch cable holder ①
- pickup coil cover ②

NOTE:

Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.

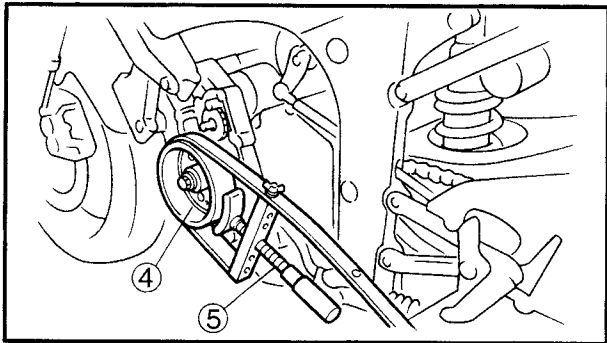


2. Remove:

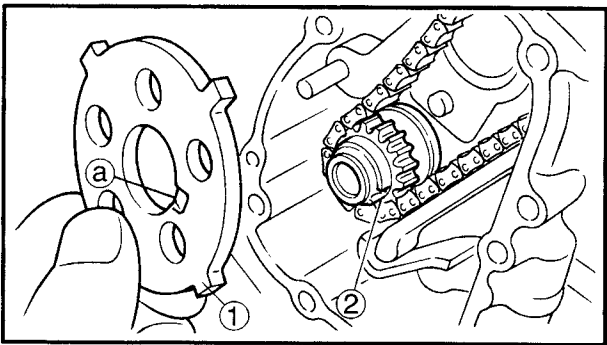
- pickup coil rotor bolt ①
- plain washer ②
- pickup coil rotor ③

NOTE:

While holding the generator rotor ④ with the rotor holding tool ⑤, loosen the pickup coil rotor bolt.



Sheave holder
90890-01701, YS-01880



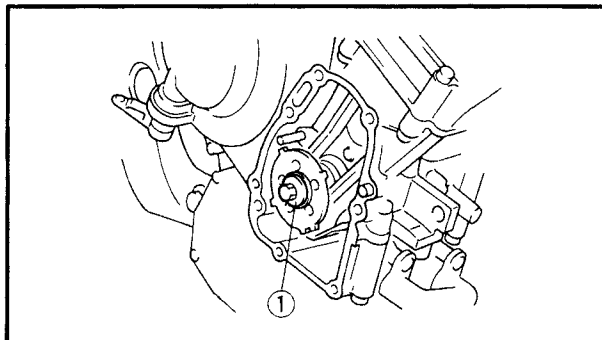
INSTALLING THE PICKUP COIL ROTOR

1. Install:

- pickup coil rotor ①
- plain washer
- pickup coil rotor bolt


NOTE:

When installing the pickup coil rotor, align the pin ② in the crankshaft sprocket with the groove @ in the pickup coil rotor.



2. Tighten:

- pickup coil rotor bolt ①

 35 Nm (3.5 m•kg, 25 ft•lb)

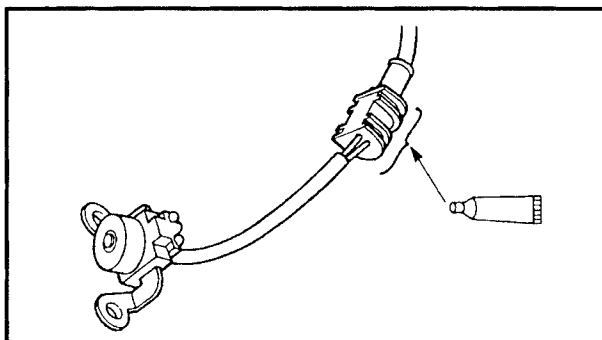
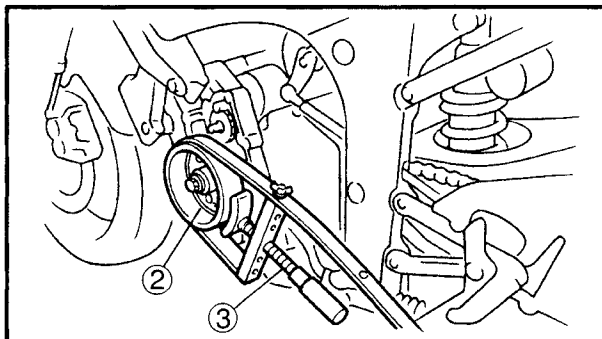
NOTE:

While holding the generator rotor ② with the sheave holder ③, tighten the pickup coil rotor bolt.



Sheave holder

90890-01701, YS-01880



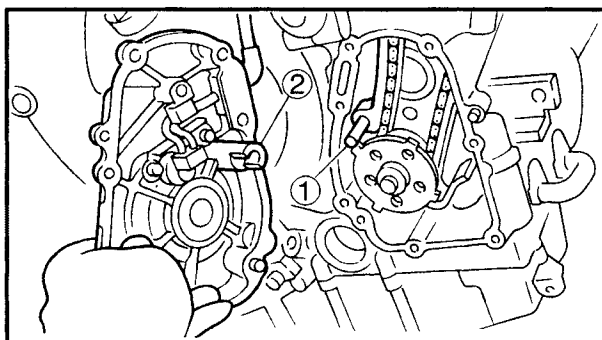
3. Apply:

- sealant
(onto the pickup coil lead grommet)



Yamaha bond No.1215

90890-85505, ACC-1100-15-01



4. Install:

- pickup coil cover
- clutch cable holder

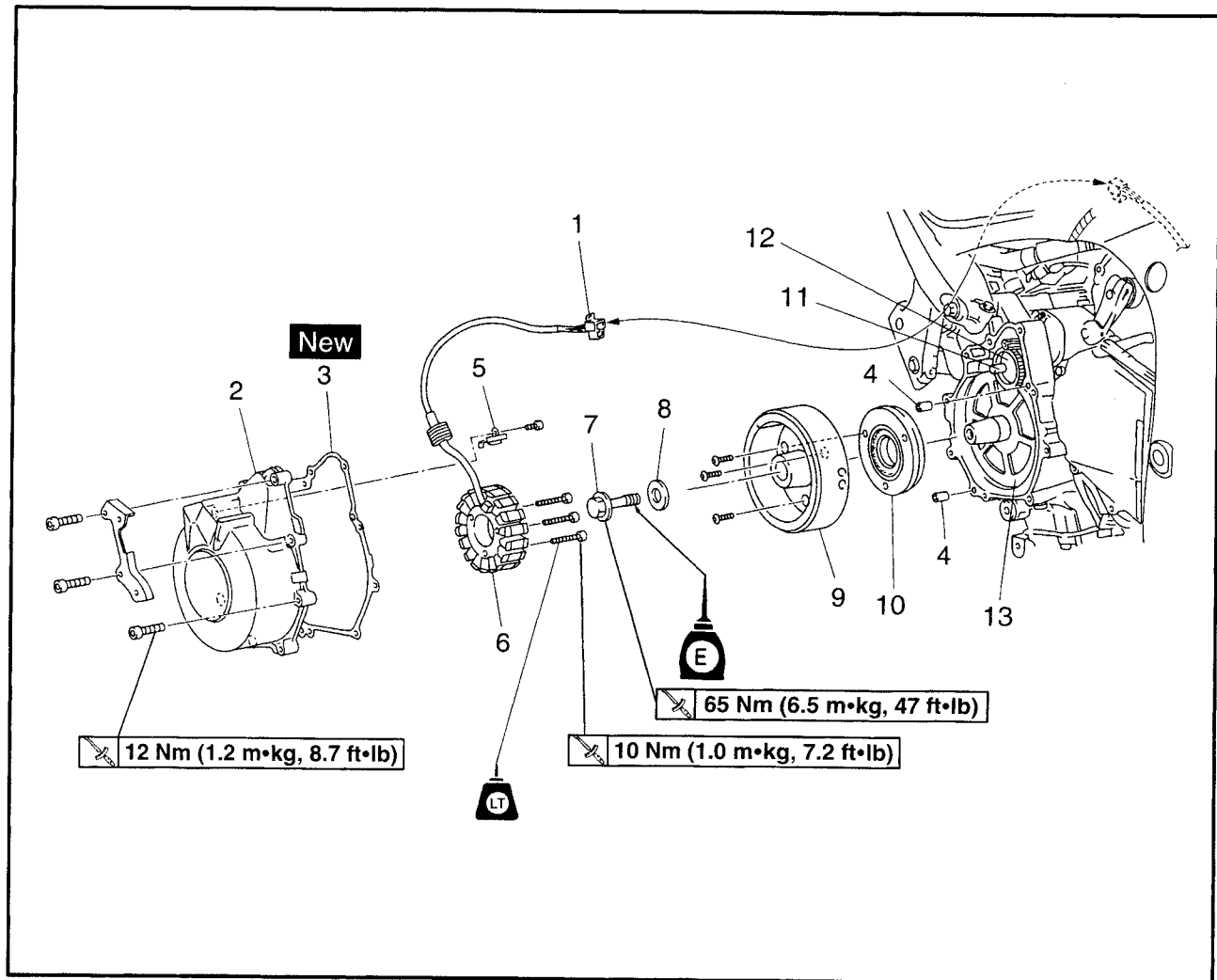
NOTE:

- When installing the pickup coil cover, align the timing chain guide (intake side) pin ① of the with the hole ② in the pickup coil cover.
- Tighten the pickup coil cover bolts in stages and in a crisscross pattern.

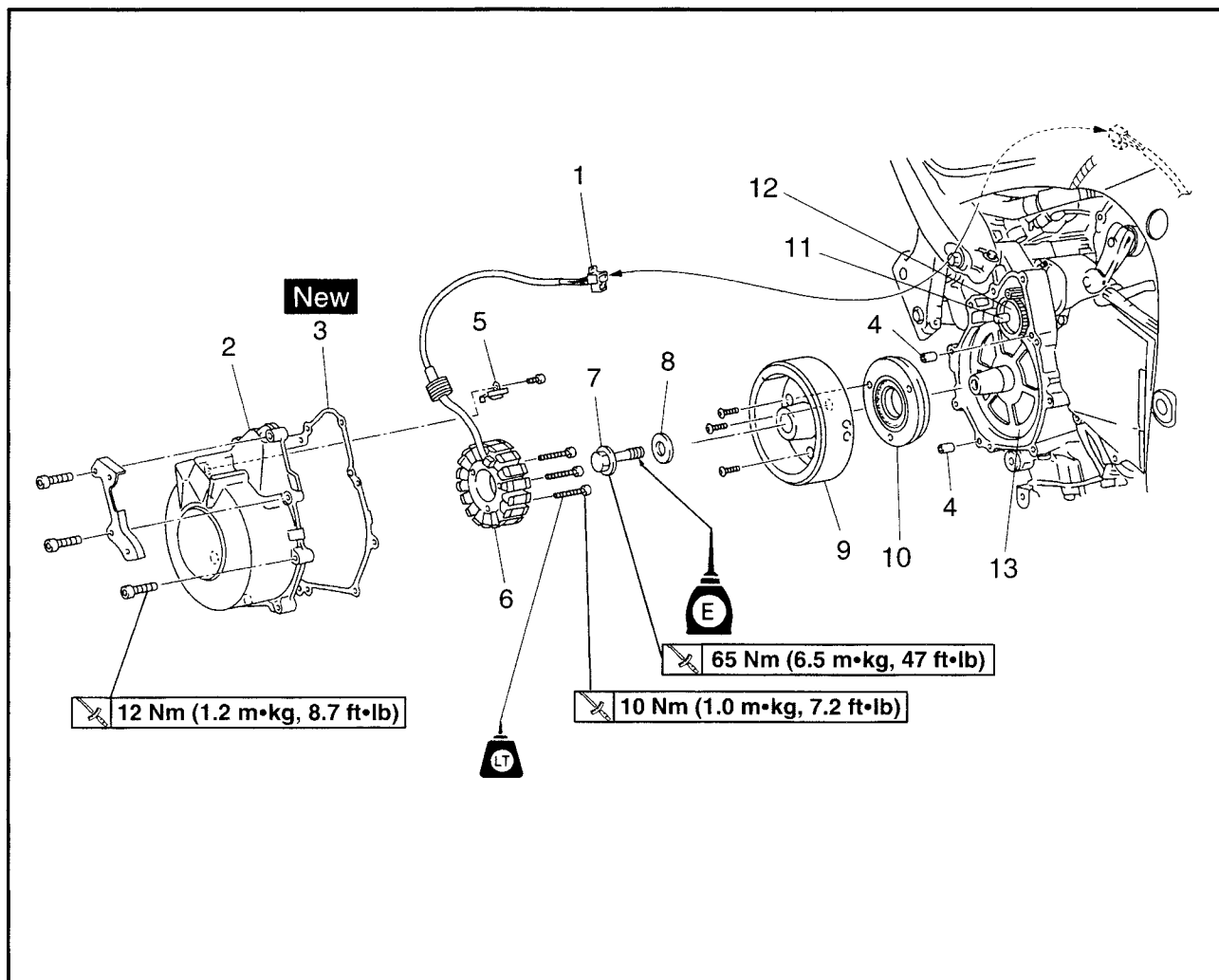


EAS00341

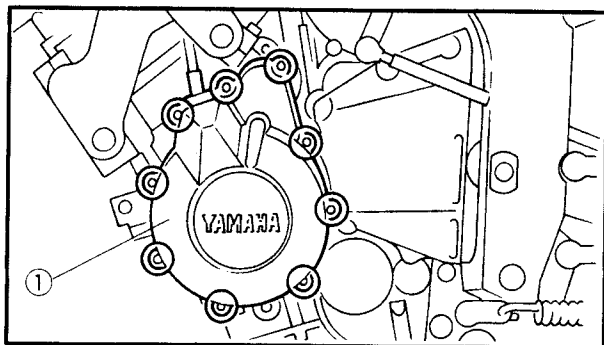
STARTER CLUTCH AND GENERATOR



Order	Job/Part	Q'ty	Remarks
	Removing the starter clutch and generator		Remove the parts in the order listed.
	Riders seat and fuel tank		Refer to "SEATS" and "FUEL TANK" in chapter 3.
	Bottom and left side cowlings		Refer to "COWLINGS" in chapter 3.
	Engine oil		Drain. Refer to "CHANGING THE ENGINE OIL" in chapter 3.
	Coolant reservoir		Drain. Refer to "CHANGING THE COOLANT" in chapter 3.
1	Stator coil assembly coupler	1	Disconnect.
2	Generator cover	1	Refer to "REMOVING/INSTALLING THE GENERATOR".
3	Generator rotor cover gasket	1	
4	Dowel pin	2	
5	Stator coil assembly lead holder	1	
6	Stator coil assembly	1	



Order	Job/Part	Q'ty	Remarks
7	Generator rotor bolt	1	Refer to "REMOVING/INSTALLING THE GENERATOR".
8	Plain washer	1	
9	Generator rotor	1	
10	Starter one-way assy	1	
11	Idler gear shaft	1	
12	Idler gear	1	
13	Starter clutch gear	1	For installation reverse the removal proceduer.



EAS00346

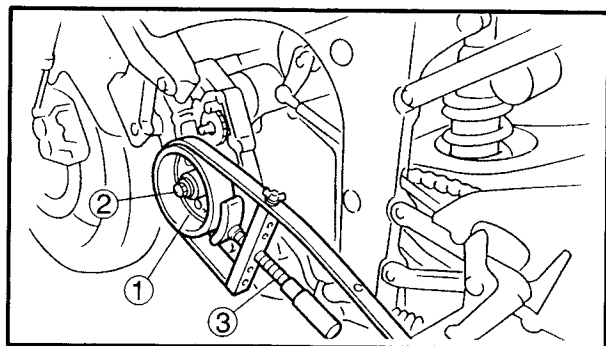
REMOVING THE GENERATOR

1. Remove:

- generator rotor cover ①

NOTE:

Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.



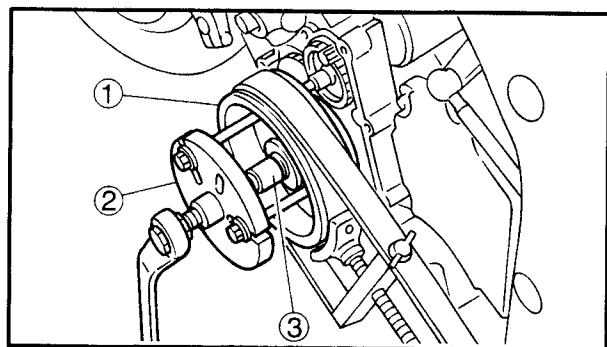
2. Remove:

- generator rotor bolt ①
- Plain washer

NOTE:

While holding the generator rotor ② with the sheave holder ③, loosen the generator rotor bolt.

Do not allow the sheave holder to touch the projection on the generator rotor.

**Sheave holder**

90890-01701, YS-01880

3. Remove:

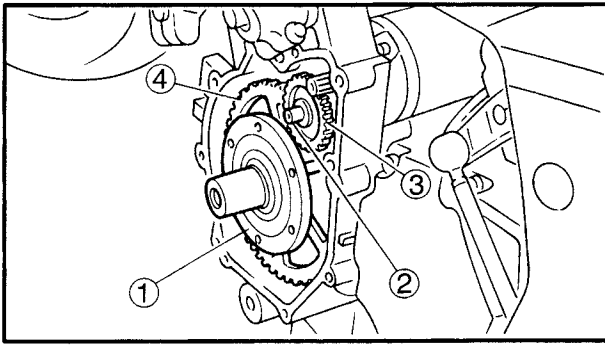
- generator rotor ①
(with the flywheel puller ② and adapter ③)

**Flywheel puller**

90890-01362, YU-33270

Flywheel puller attachment

90890-04089, YM-33282



EAS00345

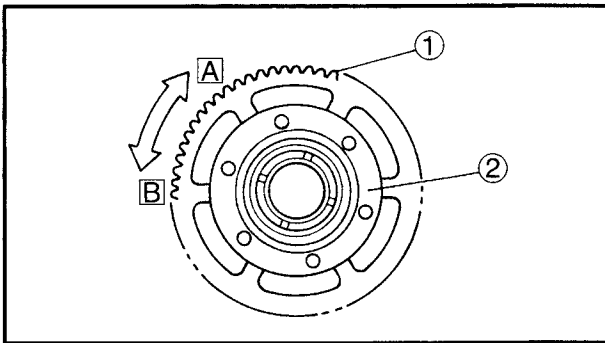
REMOVING THE STARTER CLUTCH

1. Remove:
 - Generator
 - Starter one-way assy ①
 - Idler gear shaft ②
 - Idler gear ③
 - Starter clutch gear ④

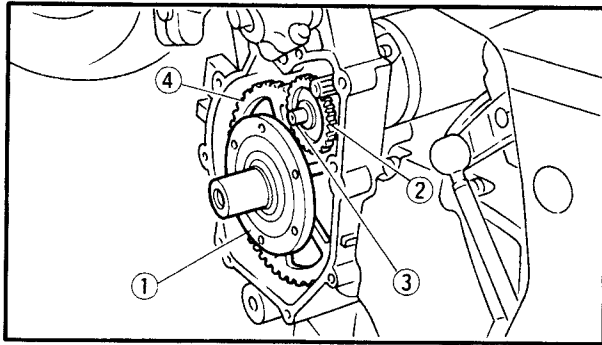
EAS00351

CHECKING THE STARTER CLUTCH

1. Check:
 - Starter one-way assy
Damage/wear → Replace.
2. Check:
 - Idler gear
 - Idler gear shaft
 - starter clutch gear
Pitting/Burrs/chips/roughness/wear → Replace the defective parts.
3. Check:
Starter clutch operation



- Install the starter clutch gear ① onto the starter clutch ② and hold the starter clutch.
- When turning the starter clutch drive gear clockwise **A**, the starter clutch and the starter clutch gear should engage.
If the starter clutch gear and starter clutch do not engage, the starter clutch is faulty and must be replaced.
- When turning the starter clutch drive gear counterclockwise **B**, it should turn freely. If the starter clutch drive gear does not turn freely, the starter clutch is faulty and must be replaced.



EAS00355

INSTALLING THE STARTER CLUTCH

1. Install:
 - starter clutch gear (1)
 - idler gear (2)
 - idler gear shaft (3)
 - starter one-way assy (4)

EAS00354

INSTALLING THE GENERATOR

1. Install:
 - generator rotor (1)
 - washer (2)
 - generator rotor bolt (3)

NOTE:

Clean the tapered portion of the crankshaft and the generator rotor hub with lacquer thinner.

2. Tighten:

- generator rotor bolt (3)

65 Nm (6.5 m•kg, 47 ft•lb)

NOTE:

While holding the generator rotor (2) with the sheave holder (3), tighten the generator rotor bolt.

Do not allow the sheave holder to touch the projection on the generator rotor.



Sheave holder
90890-01701, YS-01880

3. Apply:
 - sealant
(onto the stator coil assembly lead grommet)

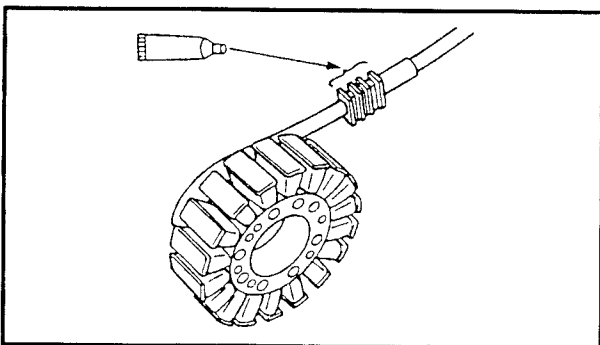


Yamaha bond No.1215
90890-85505, ACC-1100-15-01

4. Install:
 - stator coil
5. Install:
 - generator rotor cover

NOTE:

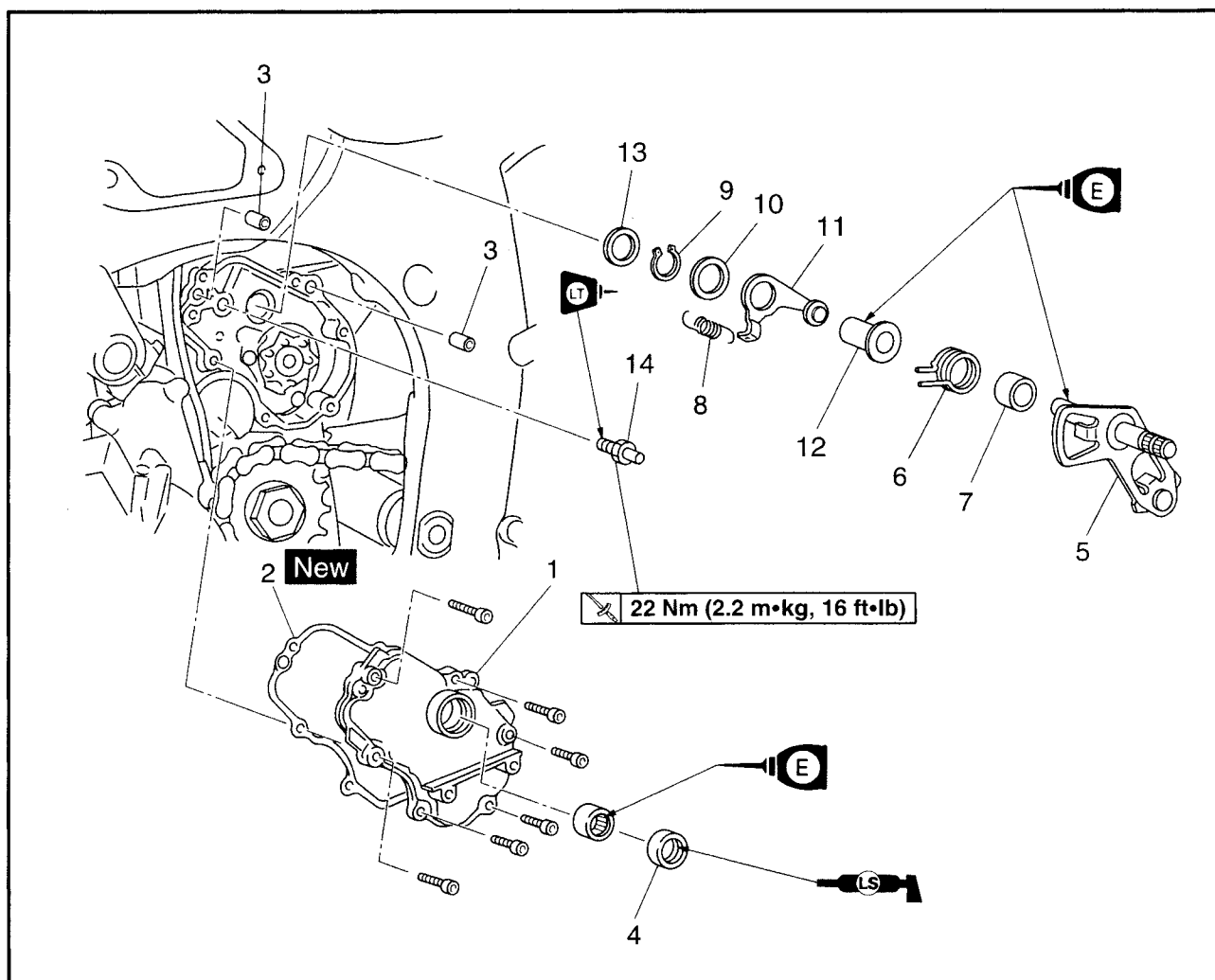
Tighten the generator rotor cover bolts in stages and in a crisscross pattern.



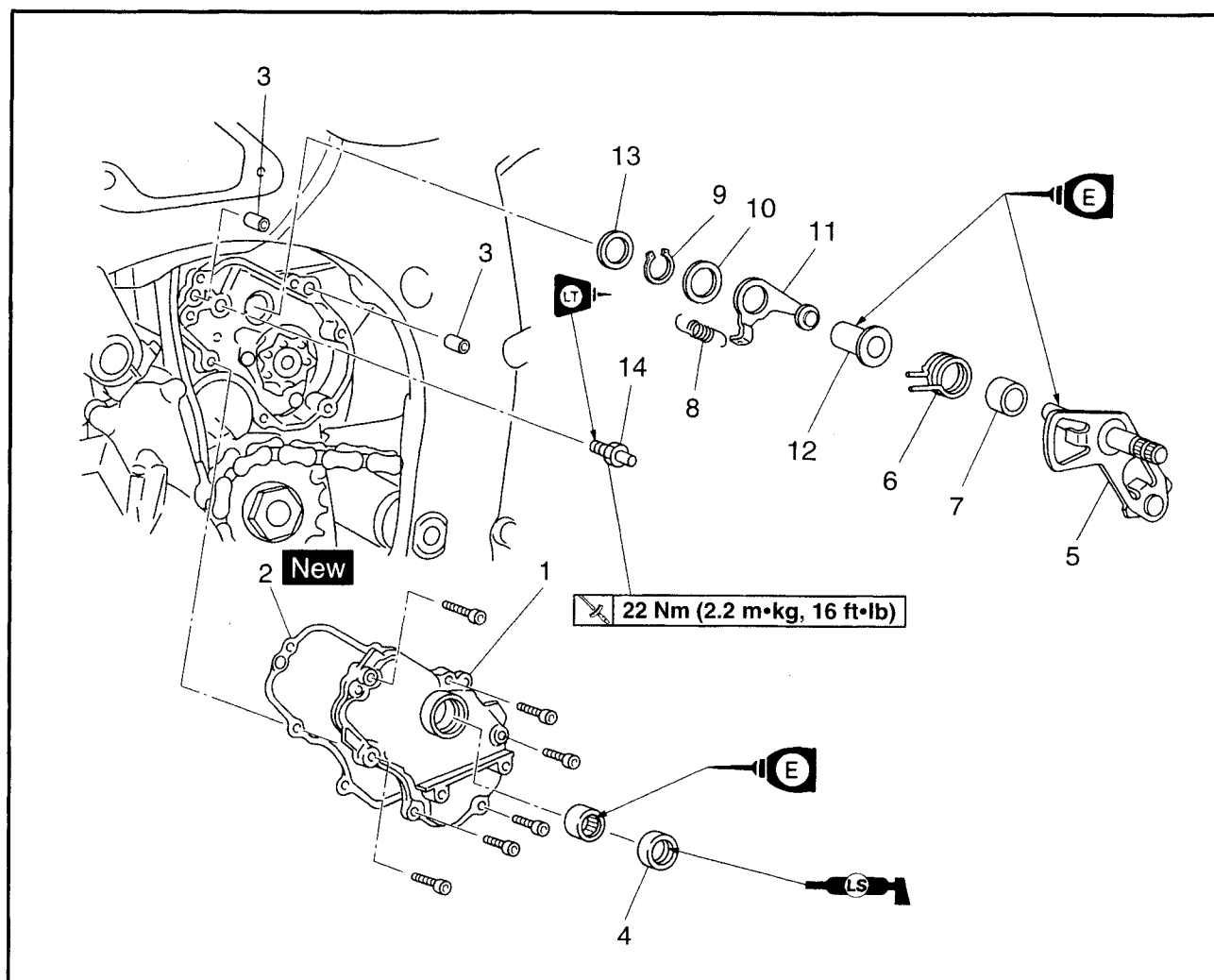


EAS00327

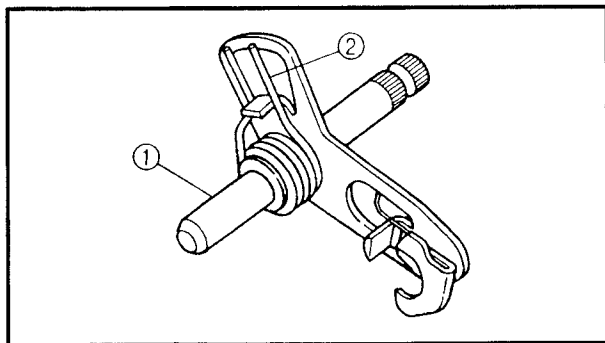
SHIFT SHAFT



Order	Job/Part	Q'ty	Remarks
	Removing the shift shaft		
	Coolant reserver		Remove the parts in the order listed. Drain. Refer to "CHANGING THE COOLANT" in chapter 3. Refer to "ENGINE".
	Drive sprocket cover, sift rod and sift arm.		
1	Shift shaft cover	1	
2	Shift shaft cover gasket	1	
3	Dowel pin	2	
4	Oil seal	1	
5	Sift shaft	1	Refer to "INSTALLING THE SHIFT SHAFT".



Order	Job/Part	Q'ty	Remarks
6	Shift shaft spring	1	Refer to "INSTALLING THE SHIFT SHAFT".
7	Collar	1	
8	Stopper lever spring	1	
9	Circlip	1	
10	Washer	1	
11	Stopper lever	1	
12	Collar	1	
13	Washer	1	
14	Shift shaft spring stopper	1	For installation reverse the removal procedure.

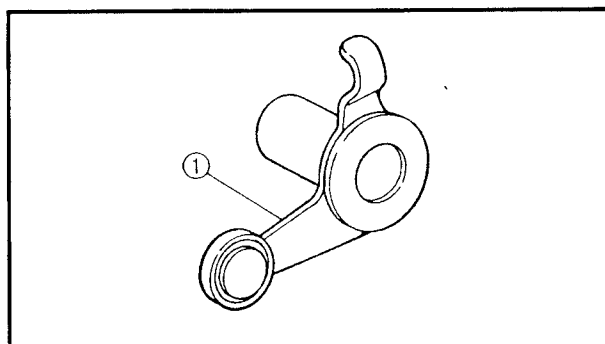


EAS00329

CHECKING THE SHIFT SHAFT

1. Check:

- shift shaft ①
Bends/damage/wear → Replace.
- shift shaft spring ②
Damage/wear → Replace.

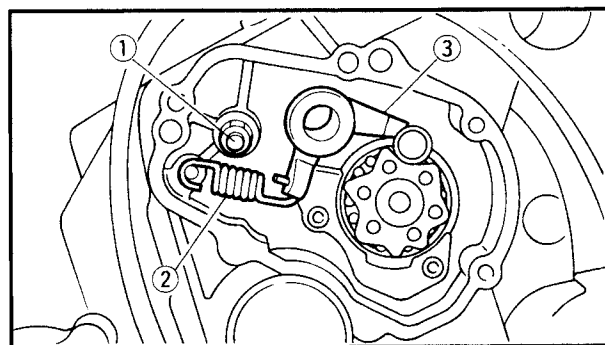


EAS00330

CHECKING THE STOPPER LEVER

1. Check:

- stopper lever ①
Bends/damage → Replace.
Roller turns roughly → Replace the stopper lever.



EAS00334

INSTALLING THE SHIFT SHAFT

1. Install:

- shift shaft spring stopper ①

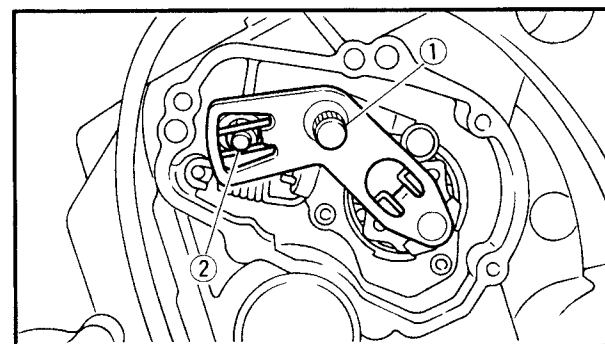


22 Nm (2.2 m•kg, 16 ft•lb)

- stopper lever spring ②
- washer
- stopper lever ③

NOTE:

- Apply LOCTITE® to the threads of the shift shaft spring stopper.
- Hook the ends of the stopper lever spring onto the stopper lever and the crankcase boss.
- Mesh the stopper lever with the shift drum segment assembly.



2. Install:

- shift shaft ①
- collar

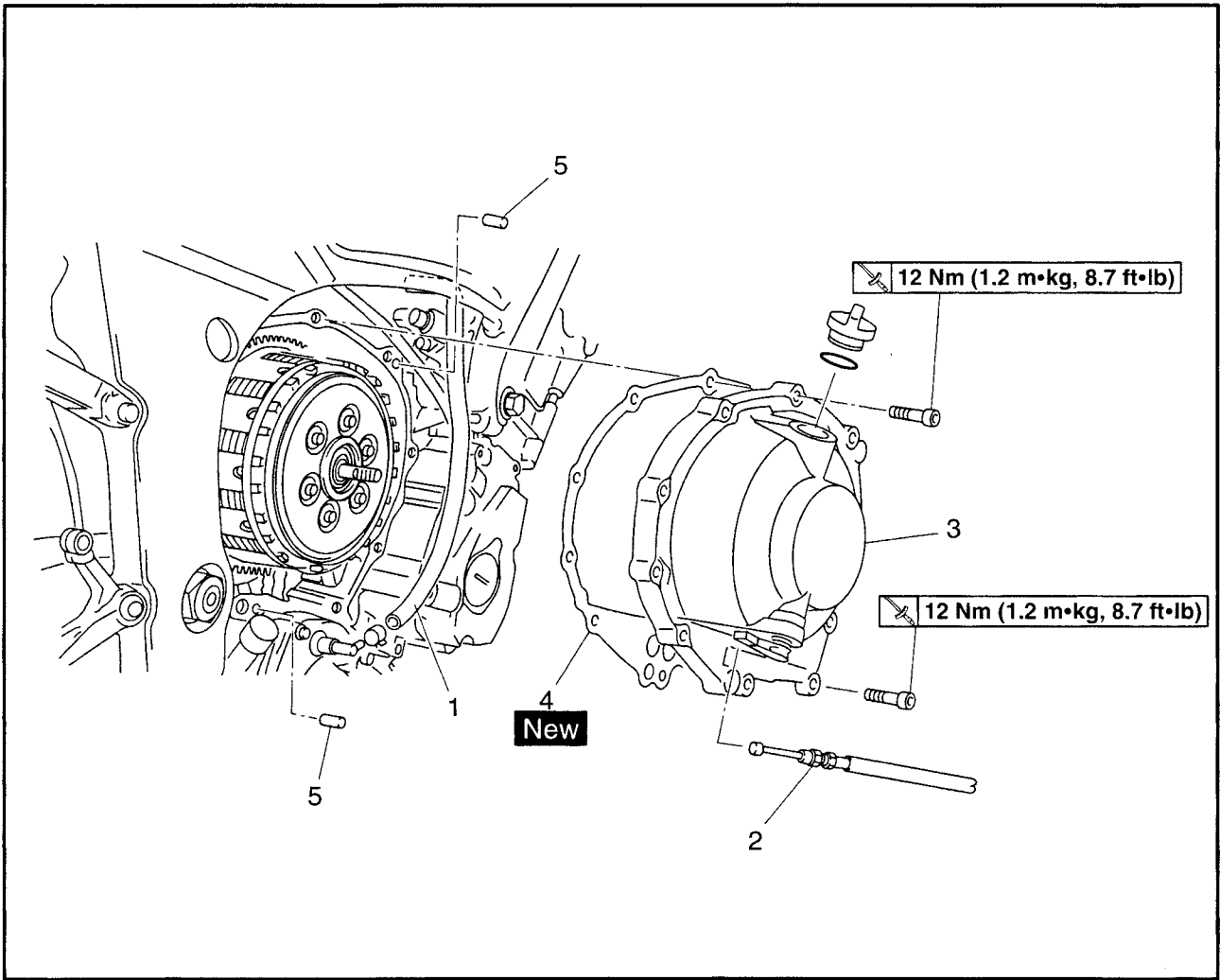
NOTE:

- Lubricate the oil seal lips with lithium soap base grease.
- Install the end of the shift shaft spring onto the shift shaft spring stopper ②

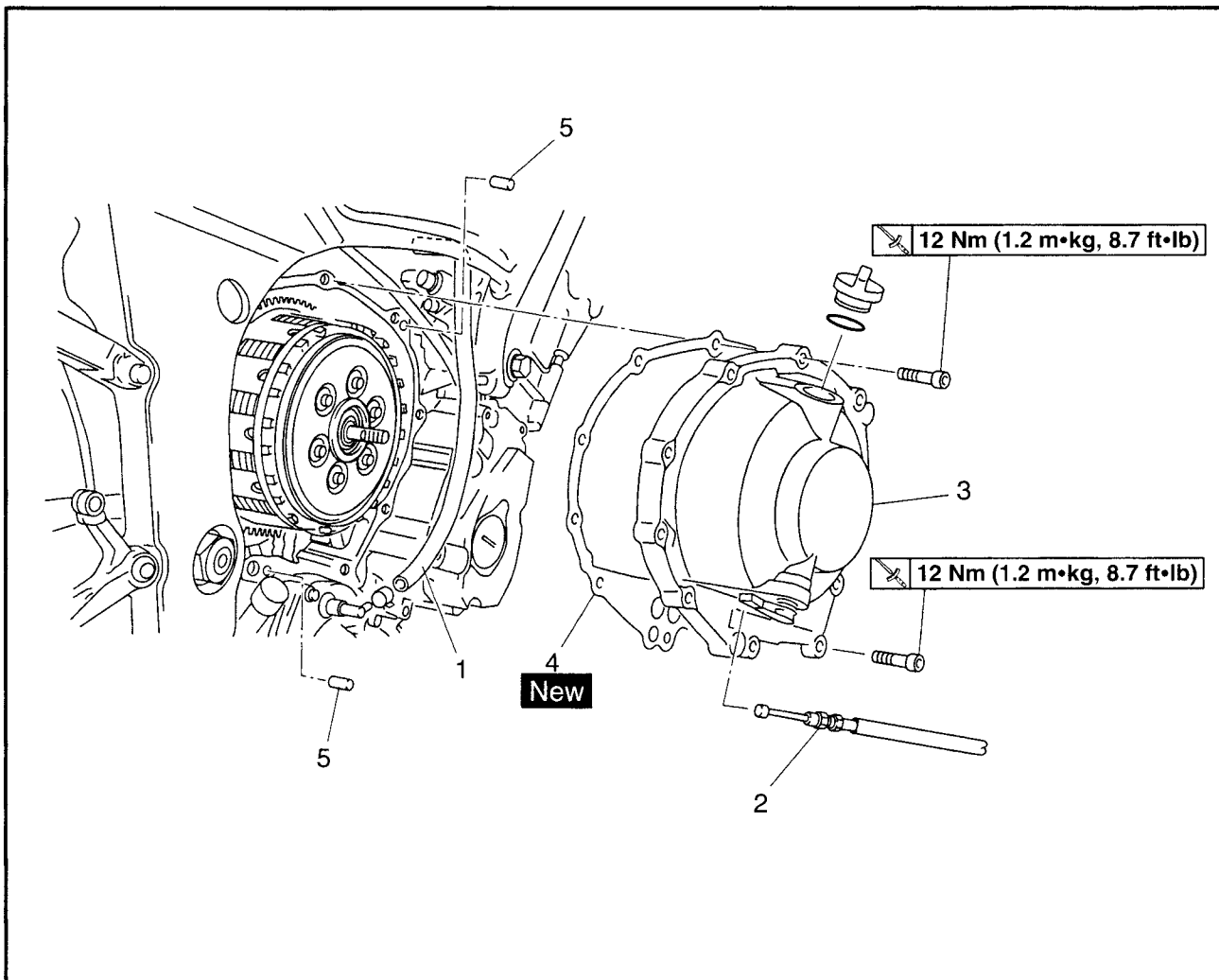


EB405000

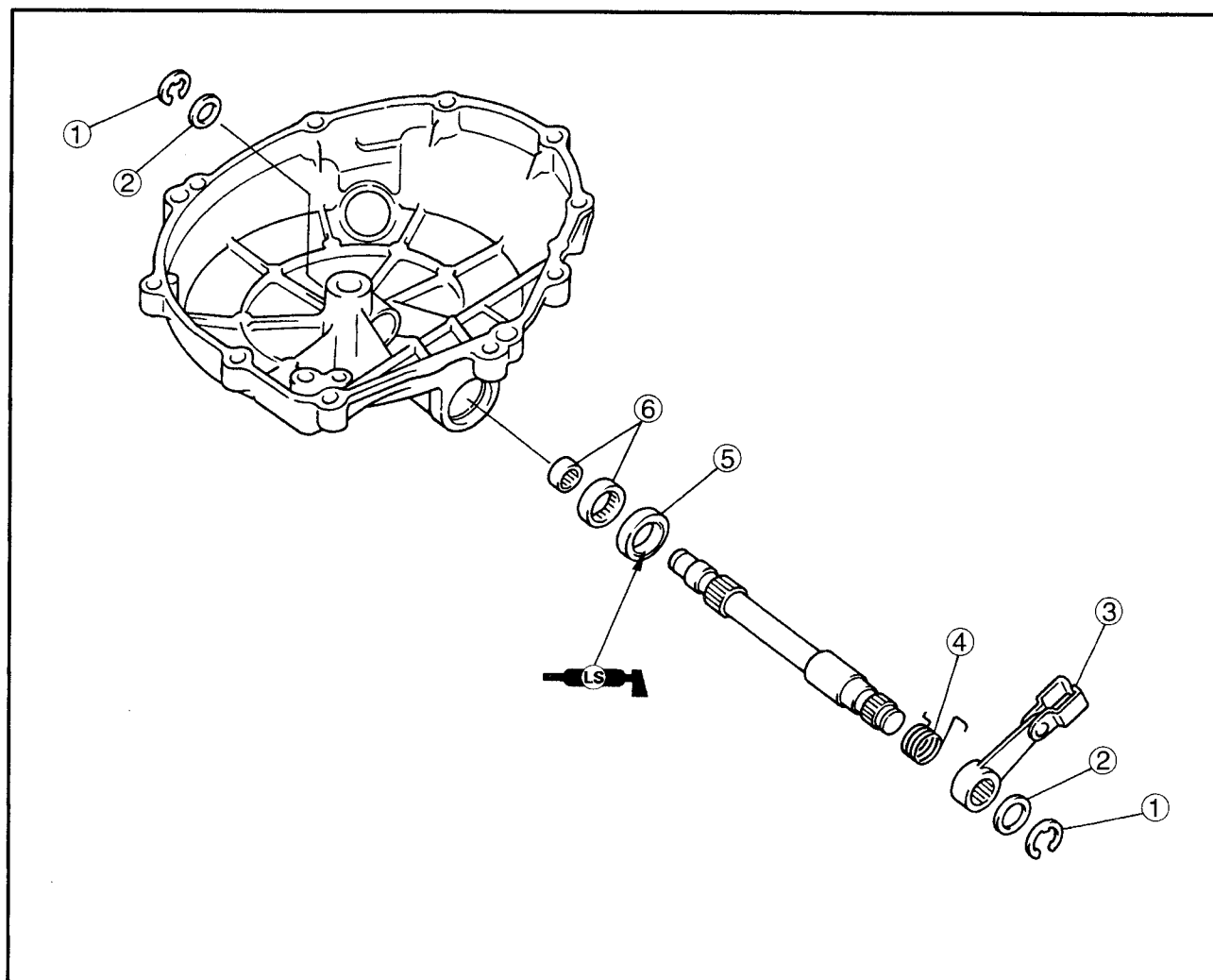
CLUTCH
CLUTCH COVER



Order	Job/Part	Q'ty	Remarks
	Removing the clutch cover Bottom cowing and right side cowing Engine oil Coolant		Remove the parts in the order listed. Refer to "COWLINGS" in chapter 3. Drain. Refer to "CHANGING THE ENGINE OIL" in chapter 3. Drain. Refer to "CHANGING THE COOLANT" in chapter 3.
1	Therm bypass hose	1	
2	Clutch cable	1	



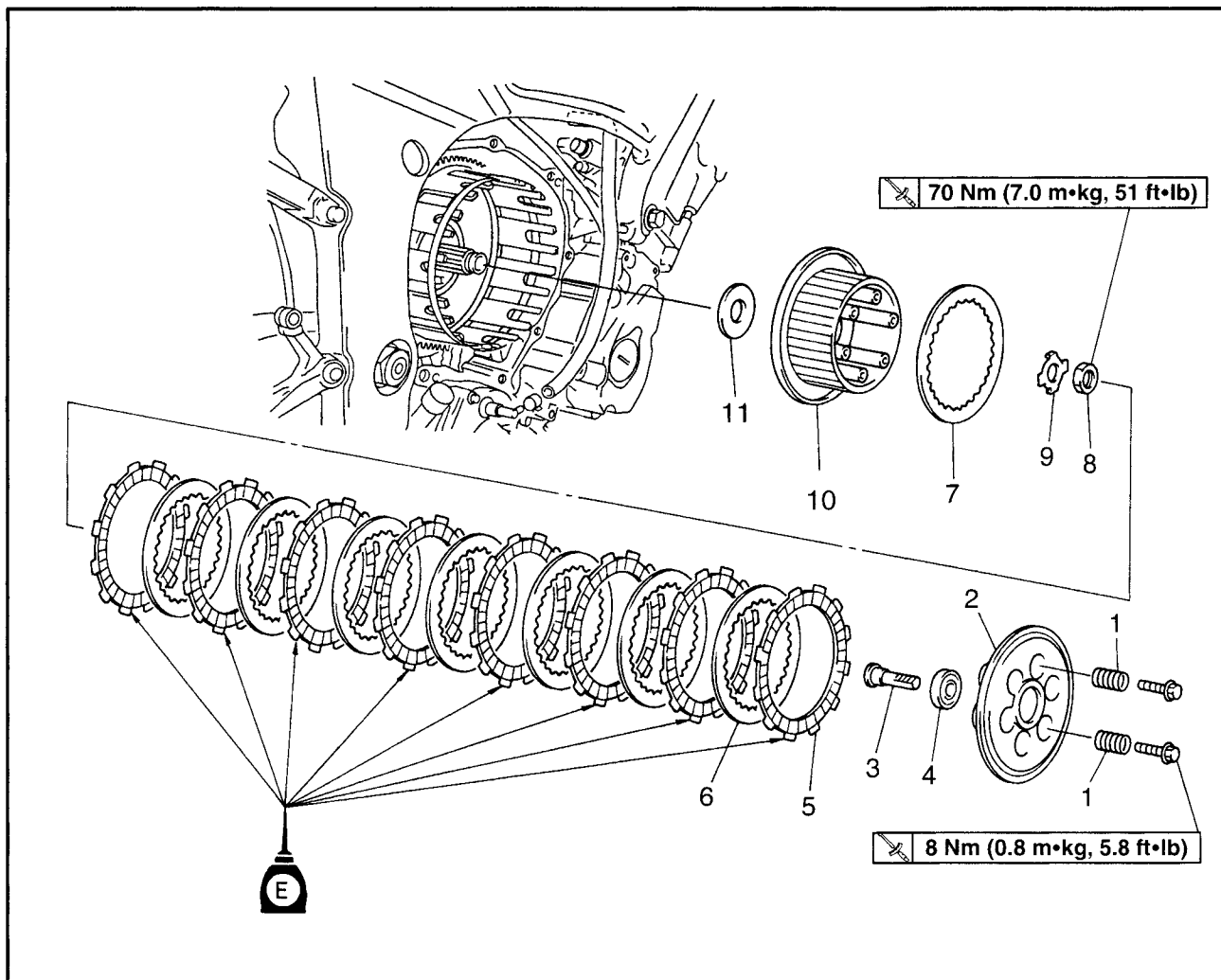
Order	Job/Part	Q'ty	Remarks
3	Clutch cover	1	Refer to "REMOVING/INSTALLING THE CLUTCH". For installation reverse the removal procedure.
4	Clutch cover gasket	1	
5	Dowel pin	2	



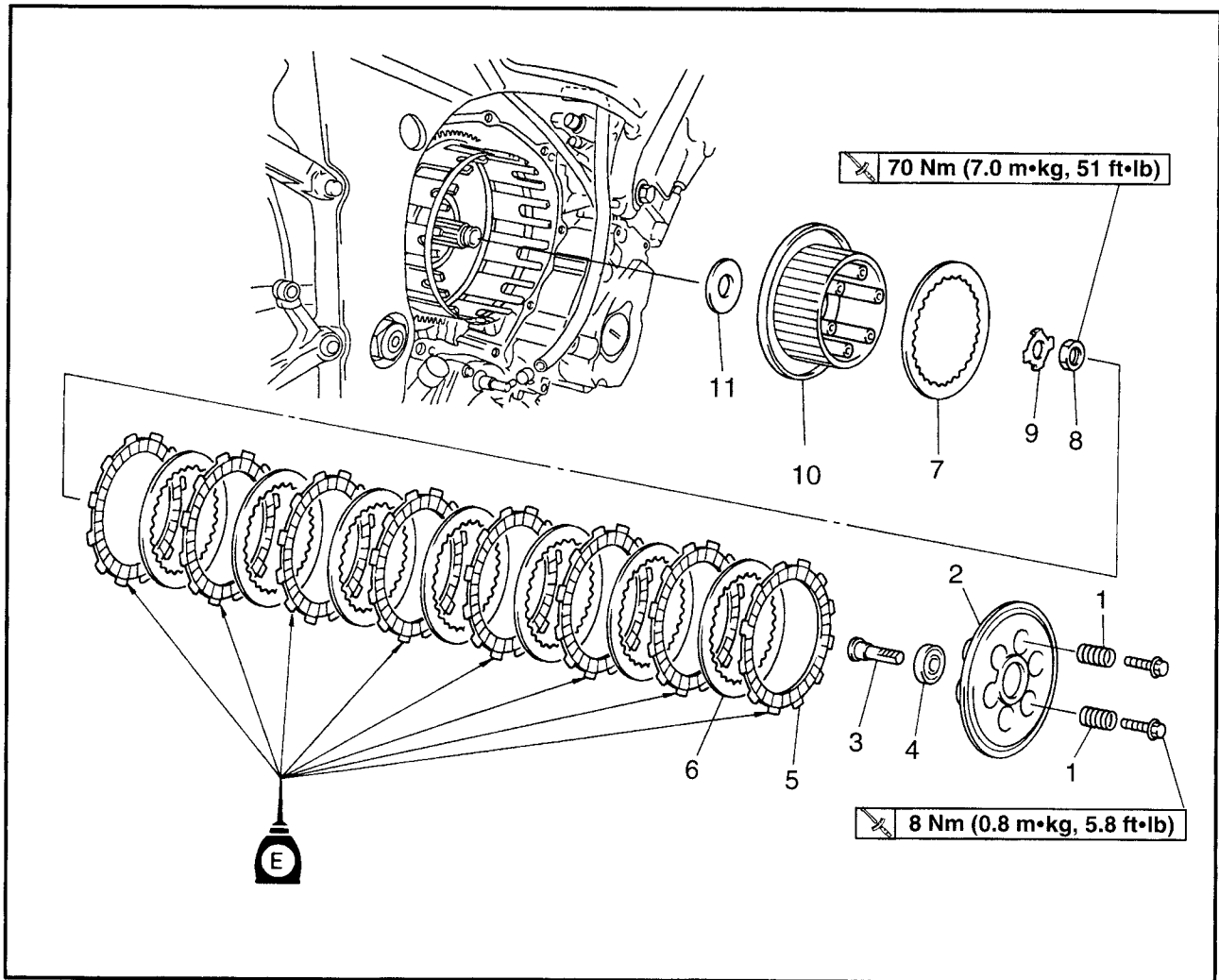
Order	Job/Part	Q'ty	Remarks
	Disassembling the clutch cover assembly		Disassemble the parts in the order listed.
①	Circlip	2	
②	Plain washer	2	
③	Pull lever	1	Refer to "INSTALLING THE CLUTCH".
④	Pull lever spring	1	
⑤	Oil seal	1	
⑥	Bearing	2	For assembly, reverse the disassembly procedure.



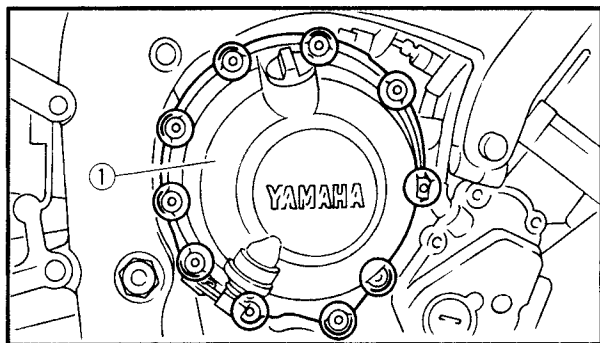
CLUTCH



Order	Job/Part	Q'ty	Remarks
	Removing the clutch		
1	Compression spring	6	Remove the parts in the order listed.
2	Pressure plate	1	
3	Pull rod	1	
4	Bearing	1	Refer to "INSTALLING THE CLUTCH".
5	Friction plate	8	
6	Clutch plate	7	
7	Clutch plate	1	Refer to "REMOVING/INSTALLING THE CLUTCH".
8	Clutch boss nut	1	
9	Lock washer	1	
10	Clutch boss	1	



Order	Job/Part	Q'ty	Remarks
11	Thrust plate	1	For installation, reverse the removal procedure.



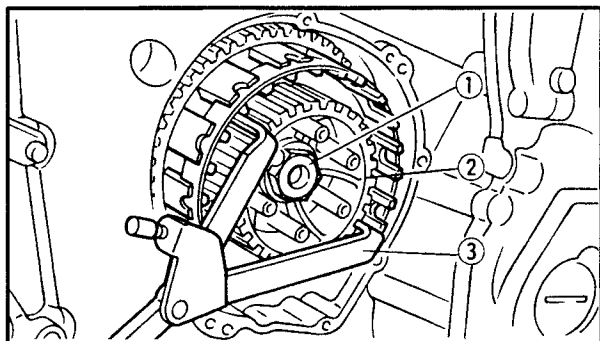
EAS00277

REMOVING THE CLUTCH

1. Remove:
 - clutch cover ①

NOTE:

Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern.
After all of the bolts are fully loosened, remove them.



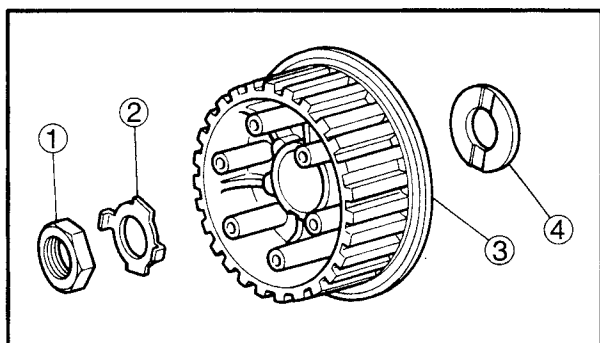
- Pressure plate
 - Friction and clutch plates
2. Straighten the lock washer tab.
 3. Loosen:
 - clutch boss nut ①

NOTE:

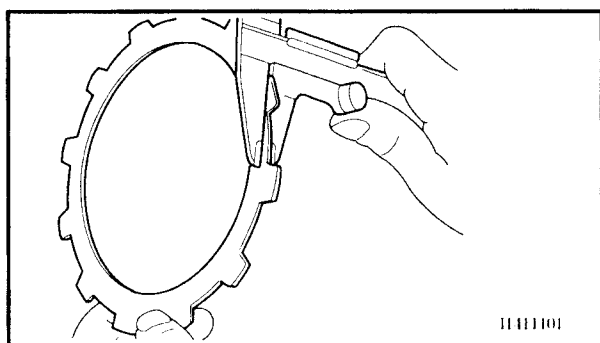
While holding the clutch boss ② with the clutch holding tool ③, loosen the clutch boss nut.



Clutch holding tool
90890-04086, YM-91042



4. Remove:
 - clutch boss nut ①
 - lock washer ②
 - clutch boss ③
 - thrust plate ④



EAS00280

CHECKING THE FRICTION PLATES

The following procedure applies to all of the friction plates.

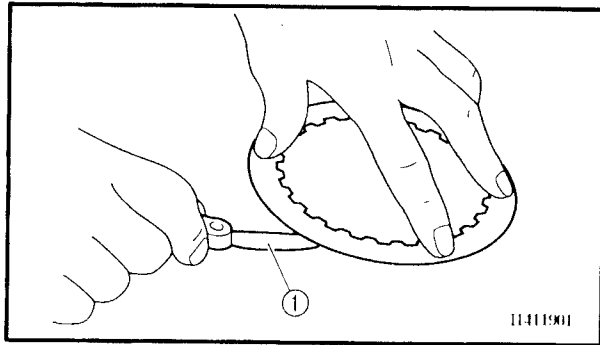
1. Check:
 - friction plate
Damage/wear → Replace the friction plates as a set.
2. Measure:
 - friction plate thickness
Out of specification → Replace the friction plates as a set.

NOTE:

Measure the friction plate at four places.



Friction plate thickness
2.9 ~ 3.1 mm (0.114 ~ 0.122 in)
<Limit>: 2.8 mm (0.11 in)



EAS00281

CHECKING THE CLUTCH PLATES

The following procedure applies to all of the clutch plates.

1. Check:

- clutch plate

Damage → Replace the clutch plates as a set.

2. Measure:

- clutch plate warpage

(with a surface plate and thickness gauge ①)

Out of specification → Replace the clutch plates as a set.



Max. clutch plate warpage
0.1 mm (0.0039 in)

EAS00282

CHECKING THE CLUTCH SPRINGS

The following procedure applies to all of the clutch springs.

1. Check:

- clutch spring

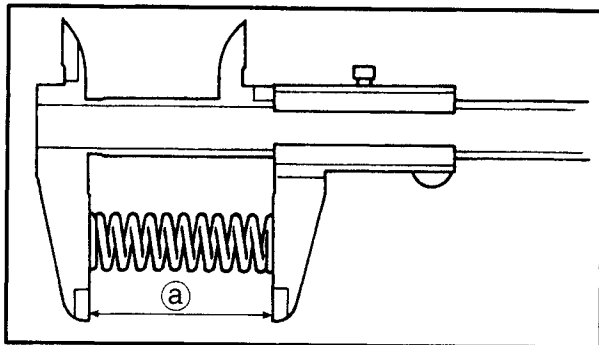
Damage → Replace the clutch springs as a set.

2. Measure:

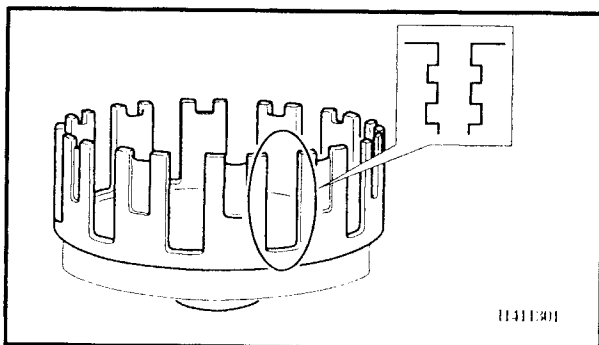
- clutch spring free length ②

Out of specification → Replace the clutch springs as a set.

Clutch spring free length



Clutch spring free length
55 mm (2.17 in)
<Limit>: 54 mm (2.13 in)



EAS00284

CHECKING THE CLUTCH HOUSING

1. Check:

- clutch housing dogs

Damage/pitting/wear → Deburr the clutch housing dogs or replace the clutch housing.

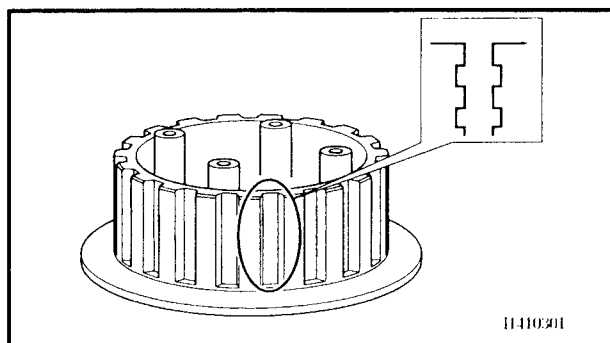
NOTE:

Pitting on the clutch housing dogs will cause erratic clutch operation.

2. Check:

- bearing

Damage/wear → Replace the clutch housing.



EAS00285

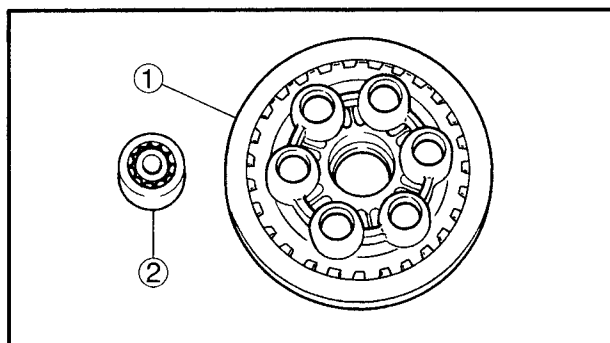
CHECKING THE CLUTCH BOSS

1. Check:

- clutch boss splines
Damage/pitting/wear → Replace the clutch boss.

NOTE:

Pitting on the clutch boss splines will cause erratic clutch operation.

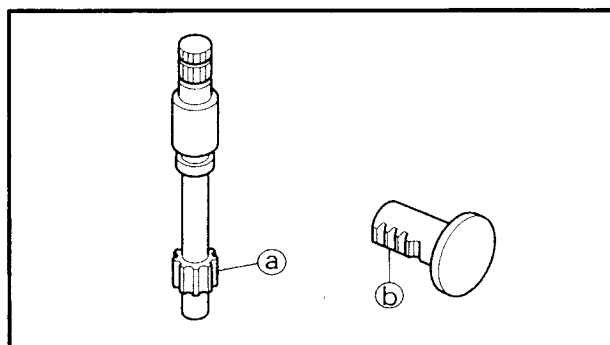


EAS00286

CHECKING THE PRESSURE PLATE

1. Check:

- pressure plate ①
Cracks/damage → Replace.
- bearing ②
Damage/wear → Replace.



EAS00287

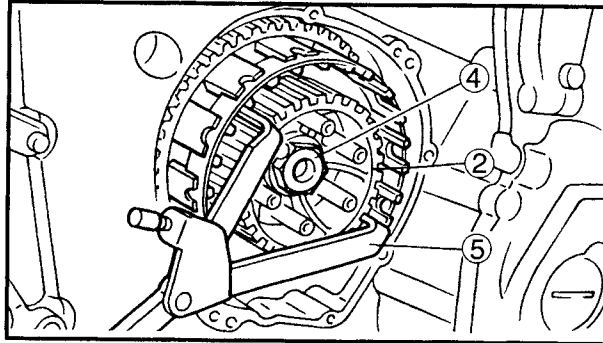
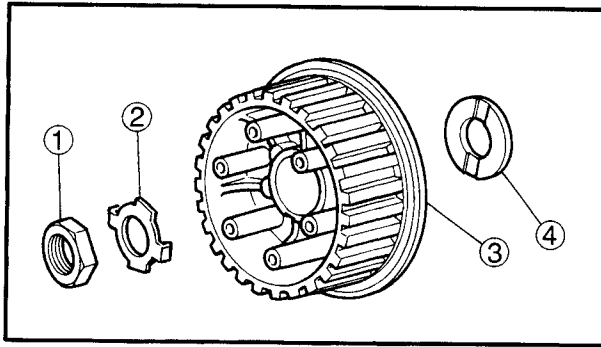
CHECKING THE PULL LEVER SHAFT AND PULL ROD

1. Check:

- pull lever shaft pinion gear teeth (a)
- pull rod teeth (b)
Damage/wear → Replace the pull rod and pull lever shaft as a set.

2. Check:

- pull rod bearing
Damage/wear → Replace.



EAS00296

INSTALLING THE CLUTCH

1. Install:
 - thrust plate ①
 - clutch boss ②
2. Install:
 - lock washer ③ **New**
 - clutch boss nut ④

70 Nm (7.0 m•kg, 51 ft•lb)

NOTE:

While holding the clutch boss ② with the clutch holding tool ⑤, tighten the clutch boss nut.



Clutch holding tool
90890-04086, YM-91042

3. Bend the lock washer tab along a flat side of the nut.
4. Lubricate:
 - friction plates
 - clutch plates
 - (with the recommended lubricant)

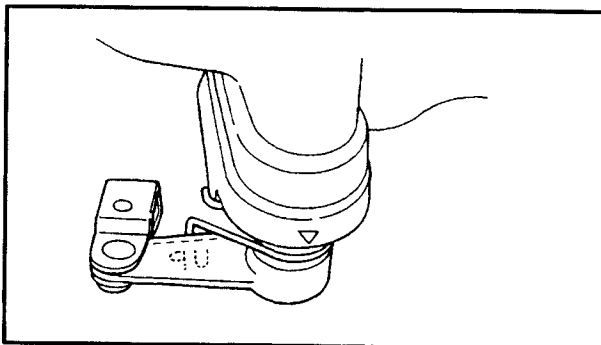
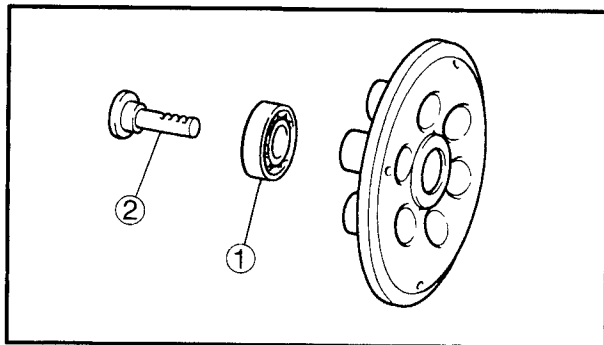


Recommended lubricant
Engine oil

5. Install:
 - friction plates
 - clutch plates

NOTE:

First, install a friction plate and then alternate between a clutch plate and a friction plate.

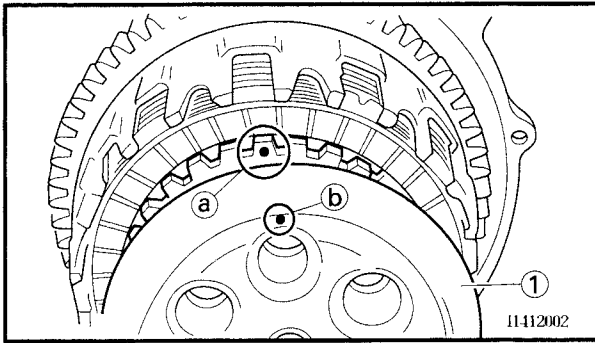
**NOTE:**

Install the pull rod so that the teeth face towards the rear of the motorcycle. Then, install the clutch cover.


Tighten the clutch cover bolts in stages and in a crisscross pattern.

Apply oil onto the bearing.

Apply molybdenum disulfide grease onto the pull rod.



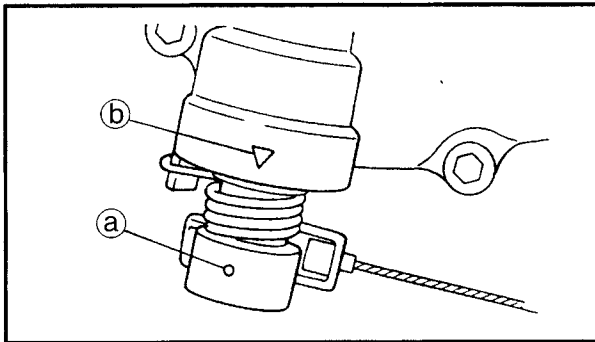
7. Install:
- pressure plate ①
 - clutch springs
 - clutch spring bolts

 8 Nm (0.8 m•kg, 5.8 ft•lb)


NOTE:

Tighten the clutch spring bolts in stages and in a criss cross pattern.

Align the punch mark ⑥ in the pressure plate with the punch mark ⑤ in the clutch boss.



8. Install:
- clutch cover

 12 Nm (1.2 m•kg, 8.7 ft•lb)

NOTE:

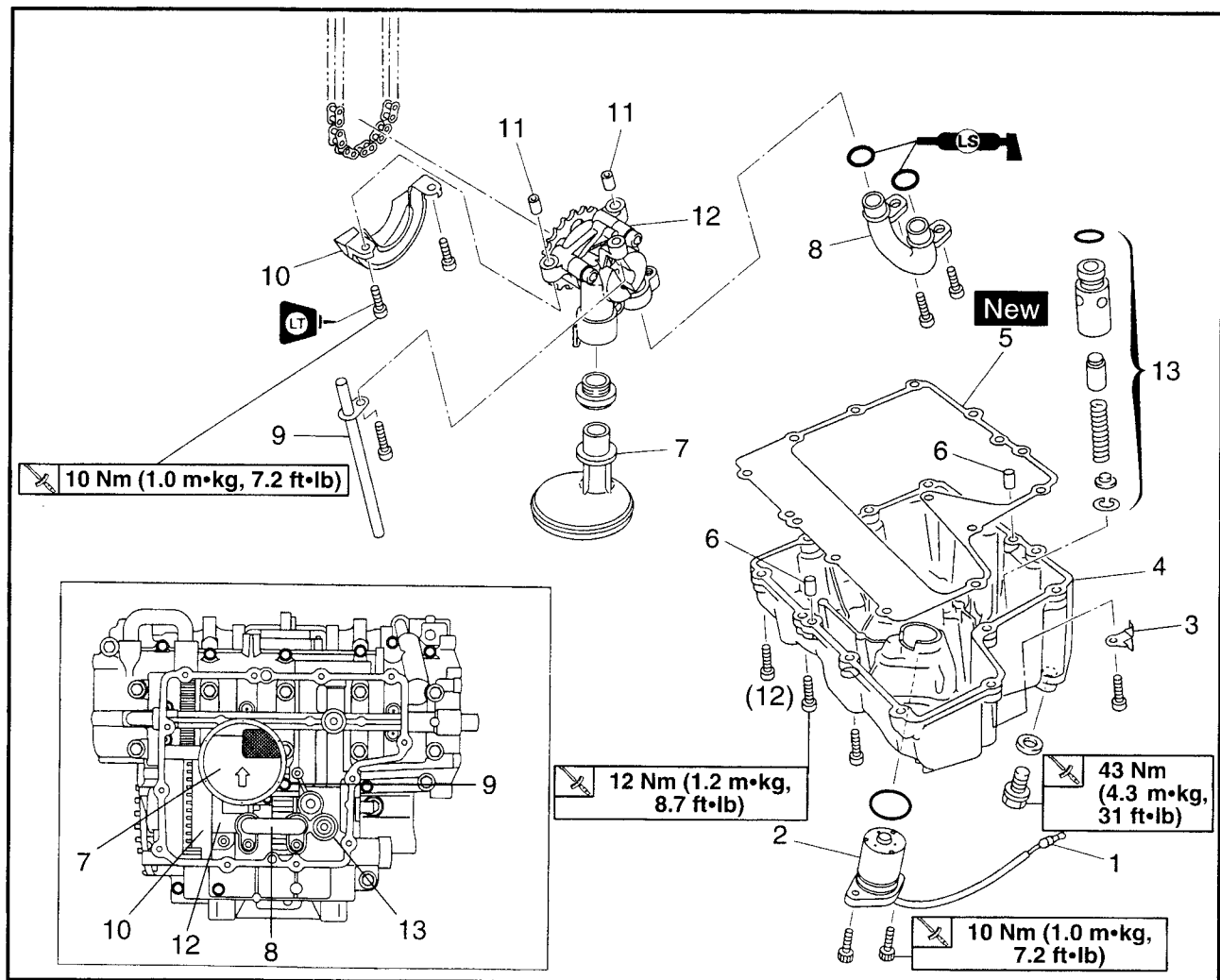
• When installing the clutch cover, push the pull lever and check that the punch mark ⑤ on the pull lever aligns with the mark ⑥ on the clutch cover. Make sure that the pull rod teeth and pull lever shaft pinion gear are engaged.

• Tighten the clutch cover bolts in stages and in a crisscross pattern.

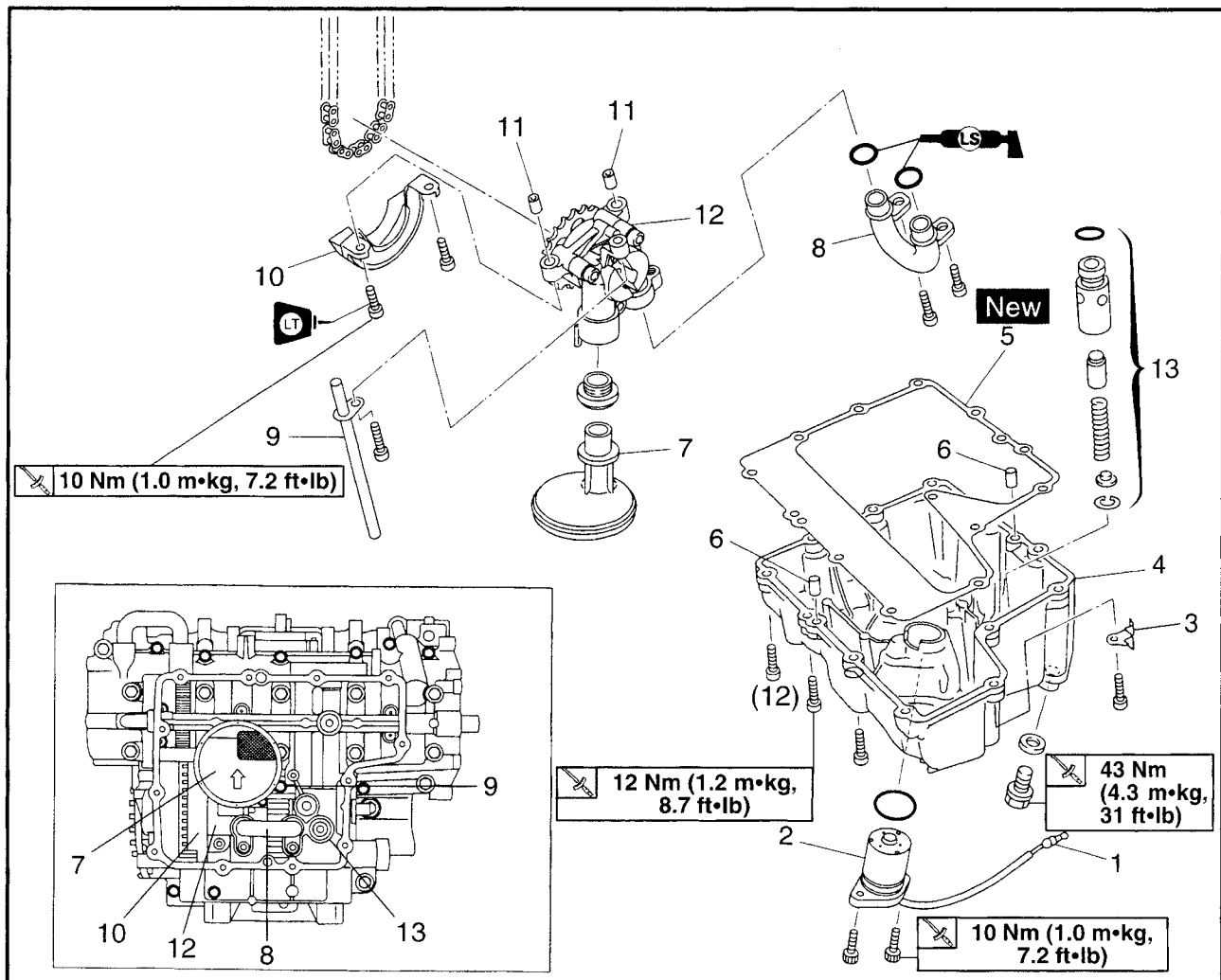


EAS00356

OIL PAN AND OIL PUMP



Order	Job/Part	Q'ty	Remarks
	Removing the oil pan and oil pump		Remove the parts in the order listed.
	Engine oil		Drain.
	Coolant		Refer to "CHANGING THE ENGINE OIL" in chapter 3.
	Radiator assembly and water pump assembly		Drain.
	Exhaust pipe assembly		Refer to "CHANGING THE COOLANT" in chapter 3.
1	Oil level switch coupler	1	Refer to "RADIATOR" and "WATER PUMP" in chapter 5.
2	Oil level switch	1	Refer to "ENGINE".
			Disconnect.

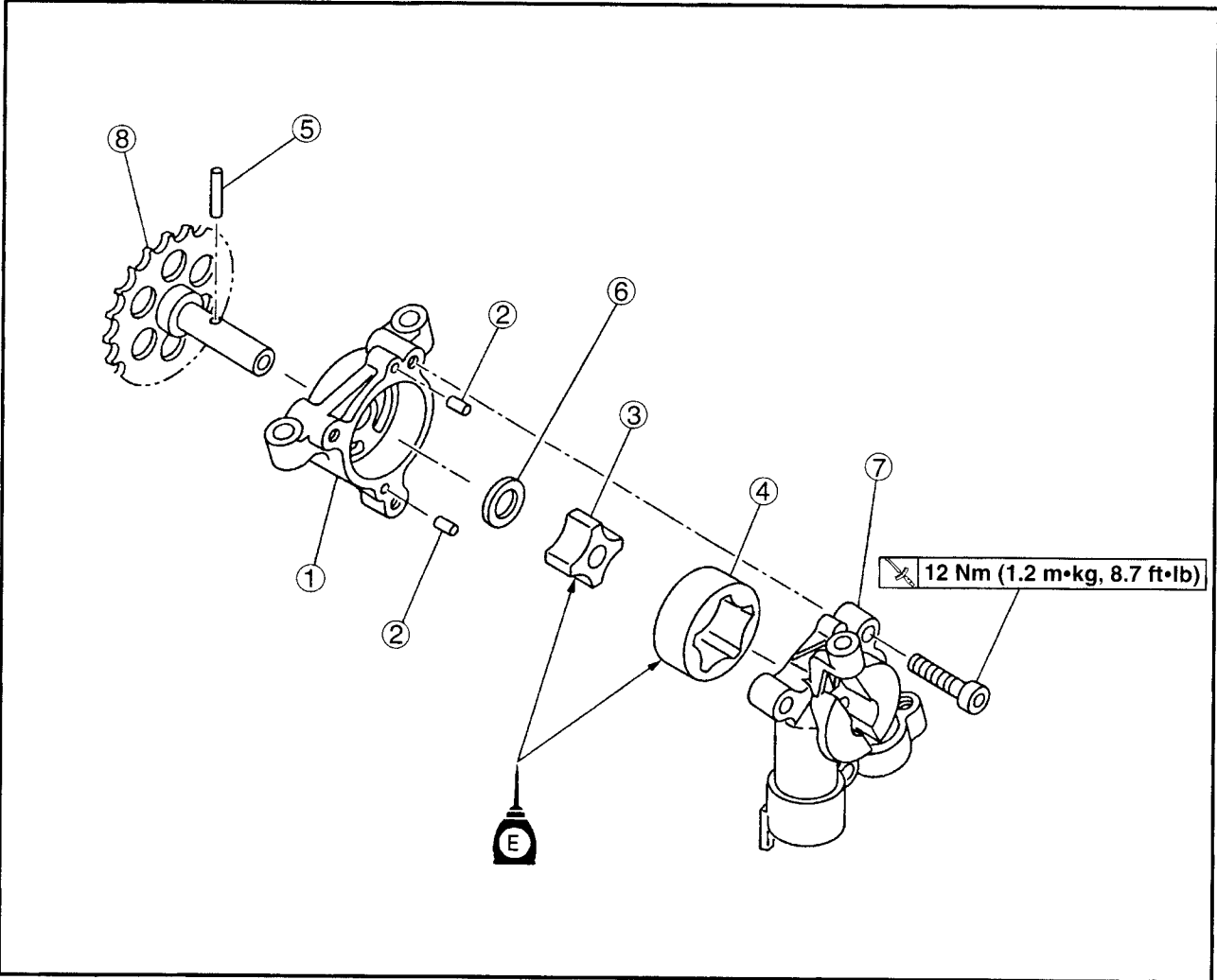


Order	Job/Part	Q'ty	Remarks
3	Oil level switch lead holder	1	Refer to "REMOVEING/INSTALLING THE OIL PAN."
4	Oil pan	1	
5	Oil pan gasket	1	
6	Dowel pin	2	
7	Oil strainer	1	Refer to "INSTALLING THE OIL STRAINER".
8	Oil pipe	1	Refer to "INSTALLING THE OIL PUMP".
9	Oil delivery pipe	1	
10	Gear cover	1	
11	Dowel pin	2	
12	Oil pump assembly	1	For installation, reverse the removal procedure.
13	Relief valve assembly	1	

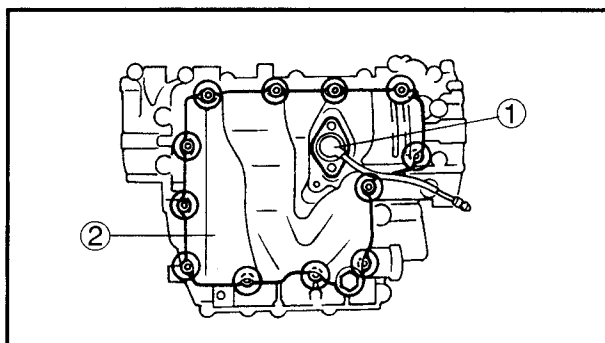


EB411010

OIL PUMP



Order	Job/Part	Q'ty	Remarks
	Disassembling the oil pump assembly		Disassemble the parts in the order listed.
①	Oil pump rotor housing	1	
②	Dowel pin	2	
③	Oil pump inner rotor	1	
④	Oil pump outer rotor	1	
⑤	Dowel pin	1	
⑥	Washer	1	
⑦	Oil pump cover	1	
⑧	Driver gear	1	
			For assembly reverse the disassembly procedure.



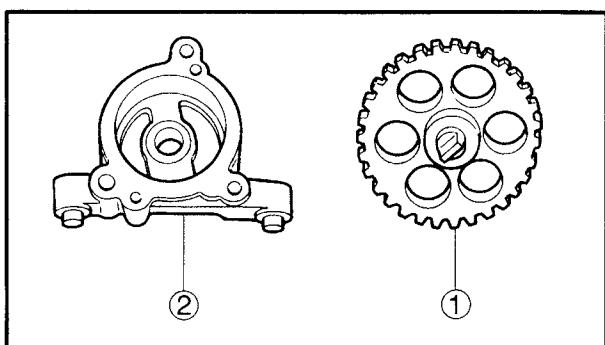
EAS00362

REMOVING THE OIL PAN

1. Remove:
 - oil level switch ①
 - oil pan ②
 - oil pan gasket
 - dowel pins

NOTE:

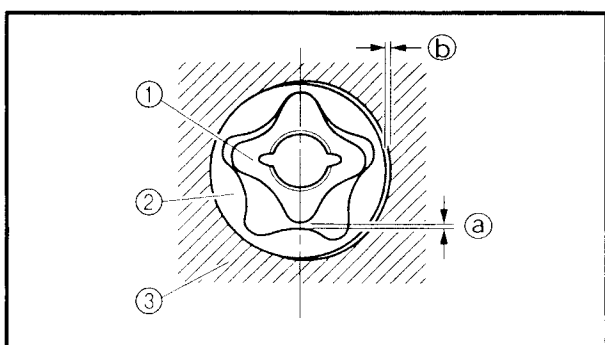
Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern.
After all of the bolts are fully loosened, remove them.



EAS00364

CHECKING THE OIL PUMP

1. Check:
 - oil/pump driven gear ①
 - rotor housing ②
 Cracks/damage/wear → Replace the defective part(-s).



2. Measure:
 - inner-rotor-to-outer-rotor-tip clearance ①
 - outer-rotor-to-oil-pump-cover clearance ②
 Out of specification → Replace the oil pump.

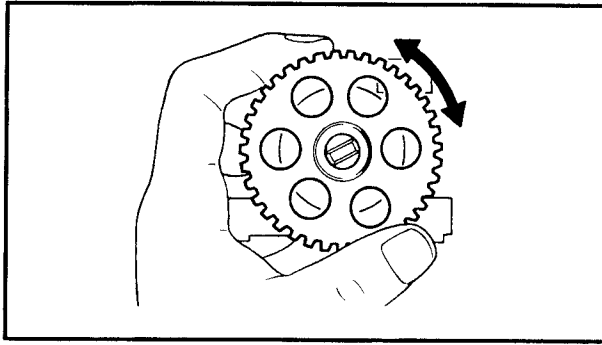
- ① Inner rotor
- ② Outer rotor
- ③ Oil pump cover

**Inner-rotor-to-outer-rotor-tip clearance**

0.03 ~ 0.09 mm
(0.0012 ~ 0.0035 in)
<Limit>: 0.15 mm (0.0059 in)

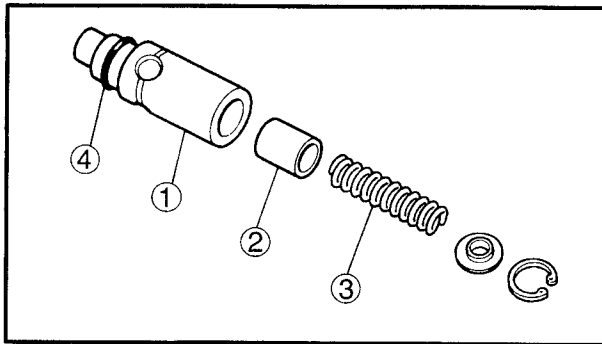
Outer-rotor-to-oil-pump-cover clearance

0.03 ~ 0.08 mm
(0.0012 ~ 0.0031 in)
<Limit>: 0.15 mm (0.0059 in)



3. Check:

- oil pump operation
Unsmooth → Repair or replace the defective part(s).



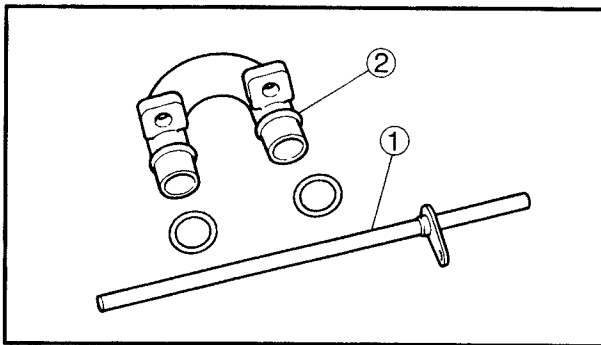
EAS00365

CHECKING THE RELIEF VALVE

1. Check:

- relief valve body ①
- relief valve ②
- spring ③
- O-ring ④

Damage/wear → Replace the defective part(s).



EAS00367

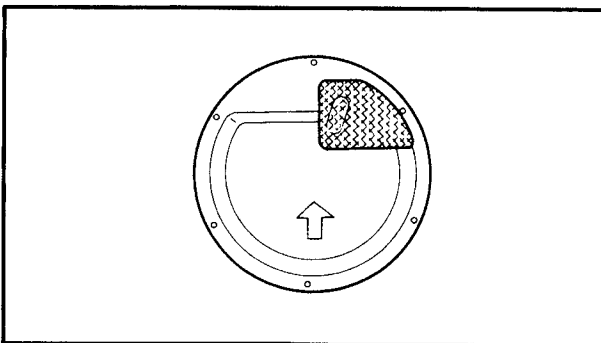
CHECKING THE OIL DELIVERY PIPE AND OIL PIPE

1. Check:

- oil delivery pipe ①
- oil pipe ②

Damage → Replace.

Obstruction → Wash and blow out with compressed air.



EAS00368

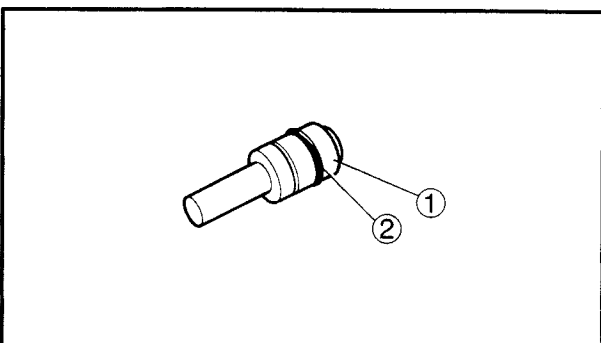
CHECKING THE OIL STRAINER

1. Check:

- oil strainer ①

Damage → Replace.

Contaminants → Clean with engine oil.



EAS00373

CHECKING THE OIL NOZZLES

The following procedure applies to all of the oil nozzles.

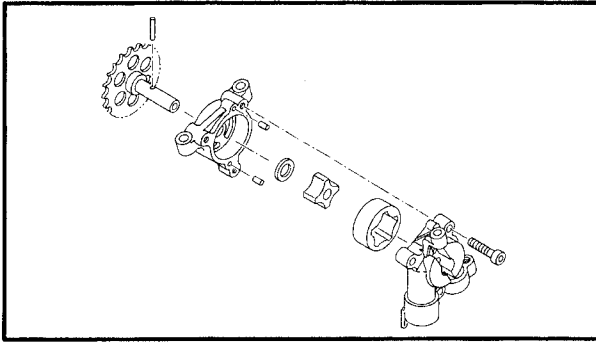
1. Check:

- oil nozzle ①
- O-ring ②

Damage/wear → Replace the oil nozzle.

oil nozzle passage

Obstruction → Blow out with compressed air.



EAS00375

ASSEMBLING THE OIL PUMP

1. Lubricate:
 - inner rotor
 - outer rotor
 - impeller shaft
(with the recommended lubricant)



Recommended lubricant
Engine oil

2. Check:
 - oil pump operation
 Refer to "CHECKING THE OIL PUMP".

EAS00376

INSTALLING THE OIL PUMP

1. Install:
 - oil pump ①  **12 Nm (1.2 m•kg, 8.7 ft•lb)**

NOTE:

Install the oil pump assembly drive chain onto the oil pump assembly driven sprocket.

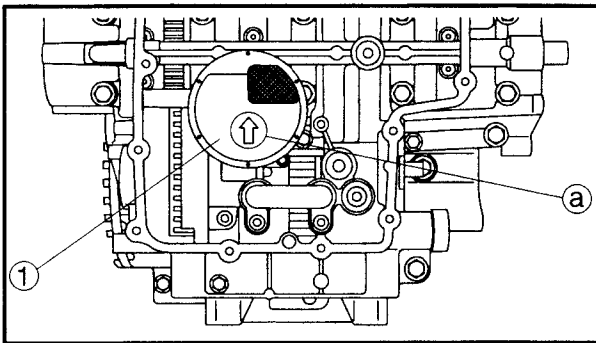
EAS00378

INSTALLING THE OIL STRAINER

1. Install:
 - oil strainer ①




NOTE:

The arrow ① on the oil strainer housing must point towards the front of the engine.



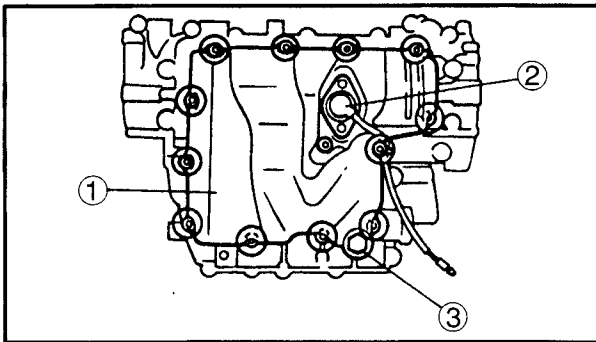
EAS00380

INSTALLING THE OIL PAN

1. Install:
 - dowel pins
 - oil pan gasket **New**
 - oil pan ①  **12 Nm (1.2 m•kg, 8.7 ft•lb)**
 - oil level switch ②  **10 Nm (1.0 m•kg, 7.2 ft•lb)**
 - engine oil drain bolt ③  **43 Nm (4.3 m•kg, 31 ft•lb)**

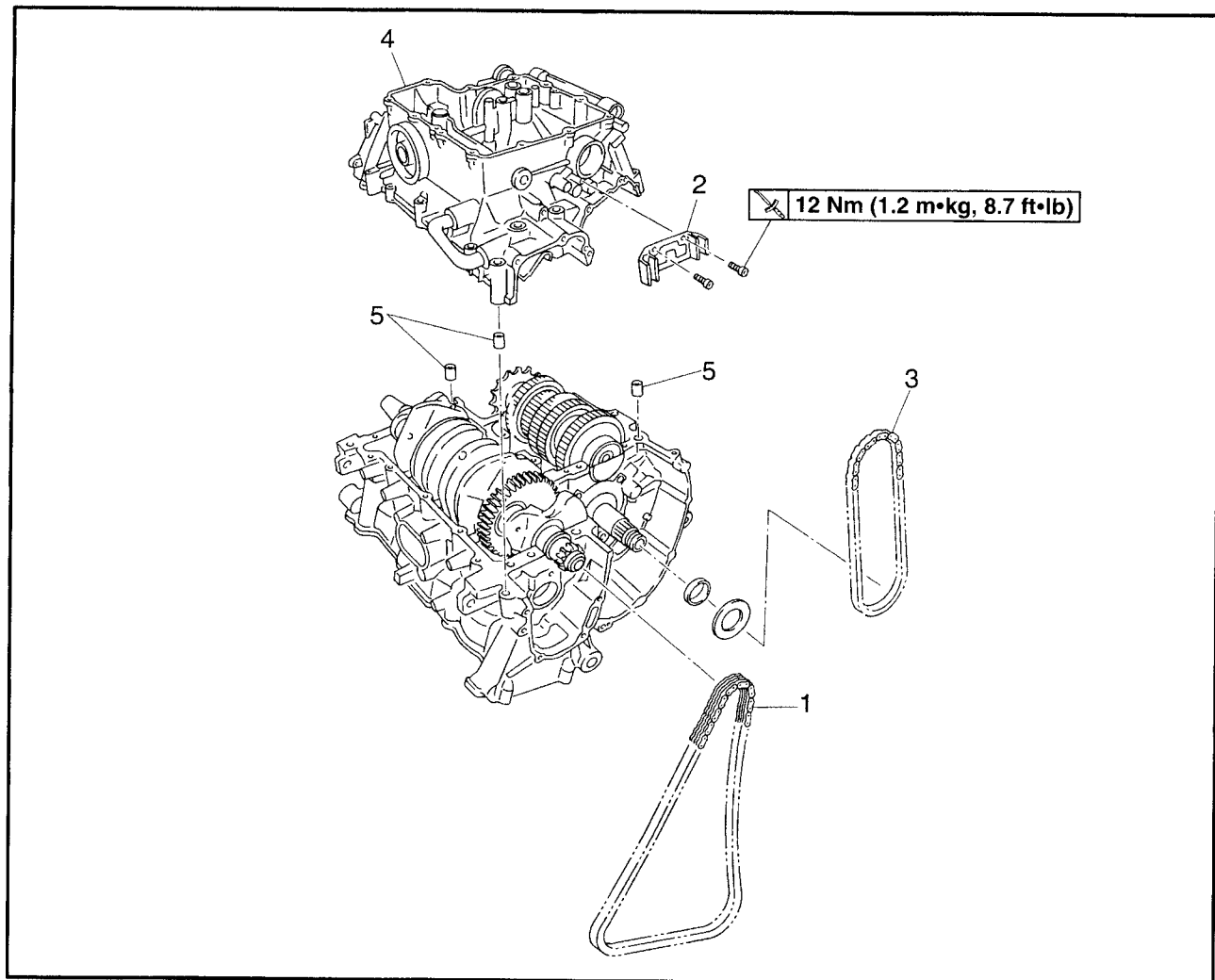
NOTE:

- Tighten the oil pan bolts in stages and in a crisscross pattern.
- Lubricate the oil level switch O-ring with lithium soap base grease.

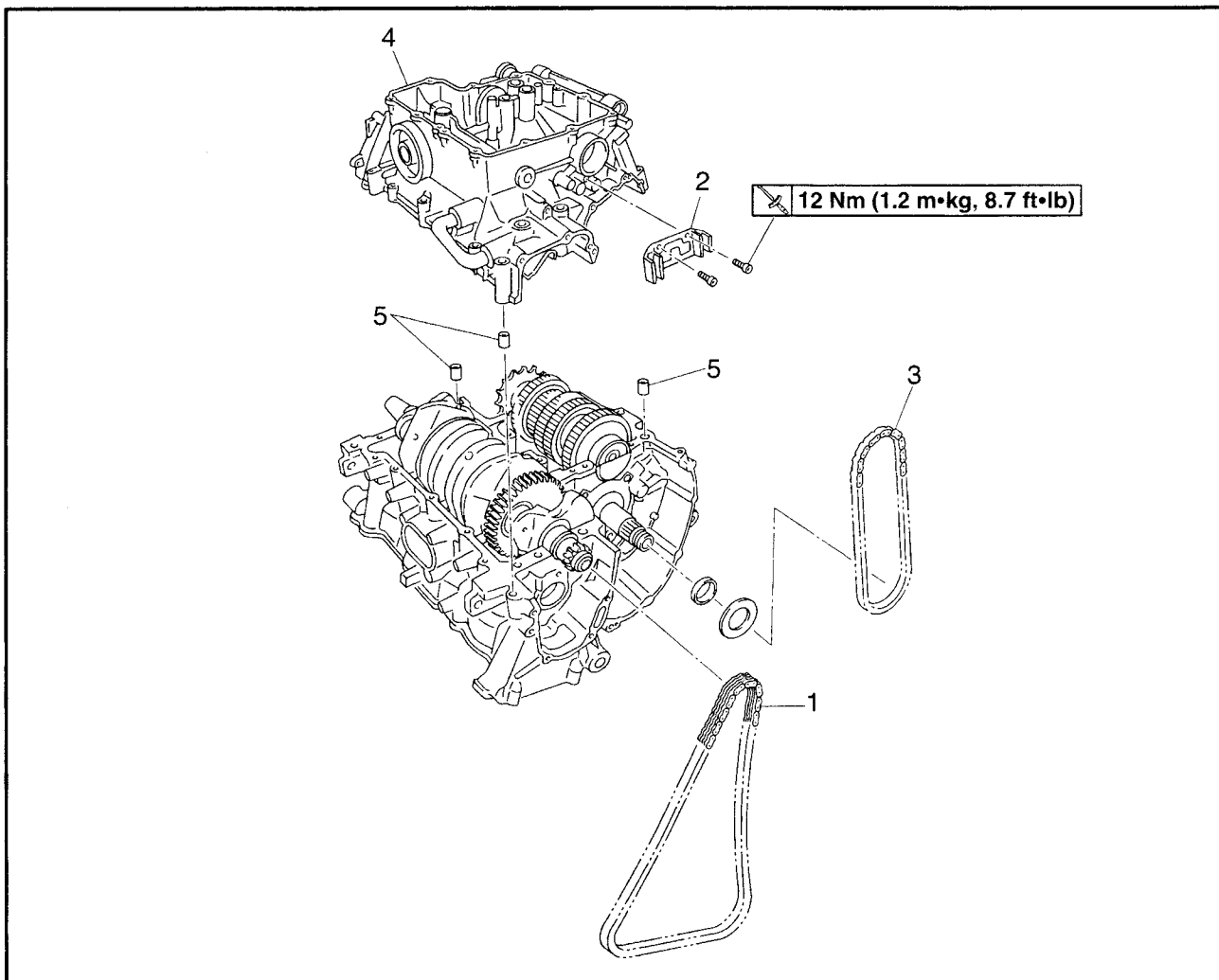




CRANKCASE



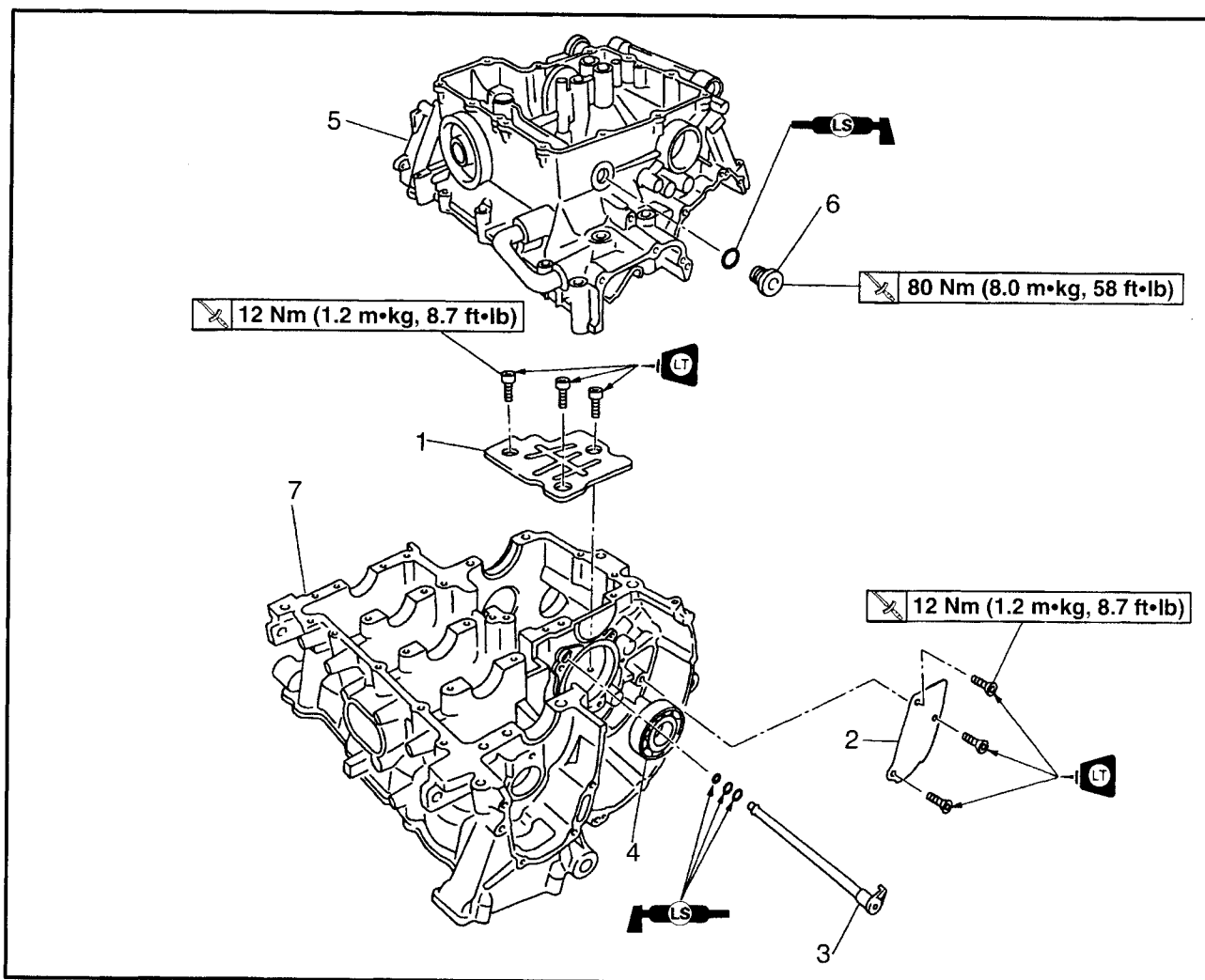
Order	Job/Part	Q'ty	Remarks
	Separating the crankcase		
	Engine		Remove the parts in the order listed.
	Cylinder head		Refer to "ENGINE".
	Starter clutch and generator		Refer to "CYLINDER HEAD".
			Refer to "STARTER CLUTCH AND GENERATOR".
	Shift shaft		Refer to "SHIFT SHAFT".
	Pickup coil and pickup rotor		Refer to "PICKUP COIL AND PICKUP ROTOR".
	Clutch assembly		Refer to "CLUTCH".
	Water pump assembly		Refer to "WATER PUMP" in chapter 5.
	Oil pan and oil pump		Refer to "OIL PAN AND OIL PUMP".



Order	Job/Part	Q'ty	Remarks
1	Timing chain	1	Refer to "DISASSEMBLY/ASSEMBLY THE CRANKCASE".
2	Oil pump drive chain guide	1	
3	Oil pump drive chain	1	
4	Lower crankcase	1	
5	Dowel pin	3	For installation, reverse the removal procedure.



OIL BAFFLE PLATES AND OIL FILTER BOLT



Order	Job/Part	Q'ty	Remarks
	Removing the oil baffle plates and oil filter bolt		Remove the parts in the order listed.
	Transmission		Refer to "TRANSMISSION".
1	Oil baffle plate	1	
2	Oil baffle plate	1	
3	Oil delivery pipe	1	
4	Bearing	1	
5	Lower crankcase	1	
6	Oil filter bolt	1	
7	Upper crankcase	1	
			For installation, reverse the removal procedure.



EAS00384

DISASSEMBLING THE CRANKCASE

1. Place the engine upside down.

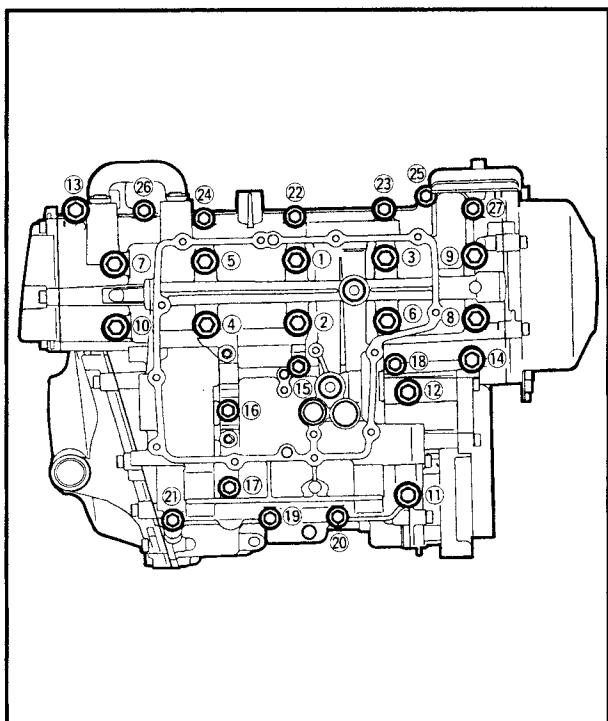
NOTE:

- Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.
- Loosen the bolts in decreasing numerical order (refer to the numbers in the illustration).
- The numbers embossed on the crankcase indicate the crankcase tightening sequence.

2. Remove:
crankcase bolts
3. Remove:
• lower crankcase

CAUTION:

Tap on one side of the crankcase with a soft-face hammer. Tap only on reinforced portions of the crankcase, not on the crankcase mating surfaces. Work slowly and carefully and make sure that the crankcase halves separate evenly.



M8 × 85 mm bolts: ① ~ ⑦ ⑩
 M8 × 115 mm bolts: ⑧ ⑨
 M8 × 65 mm bolt: ⑪ ⑫
 M6 × 65 mm bolts: ⑬ ⑭ ⑰ ⑳
 M6 × 55 mm bolts: ⑮ ㉒ ~ ㉔
 M6 × 45 mm bolt: ⑯ ㉑ ~ ㉓
 M6 × 75 mm bolt: ⑱

4. Remove:
• dowel pins



EAS00399

CHECKING THE CRANKCASE

1. Thoroughly wash the crankcase halves in a mild solvent.
2. Thoroughly clean all the gasket surfaces and crankcase mating surfaces.
3. Check:
 - upper crankcase
 - lower crankcase
 - Cracks/damage → Replace.
 - oil delivery passages
 - Obstruction → Blow out with compressed air.

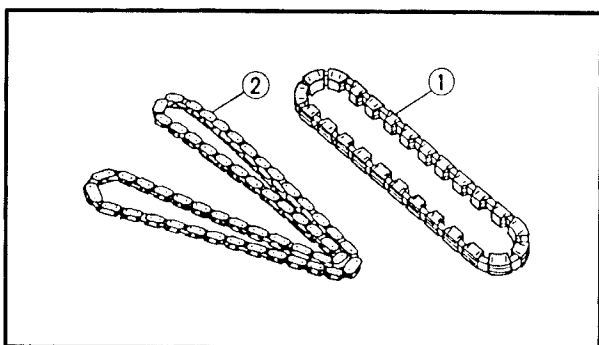
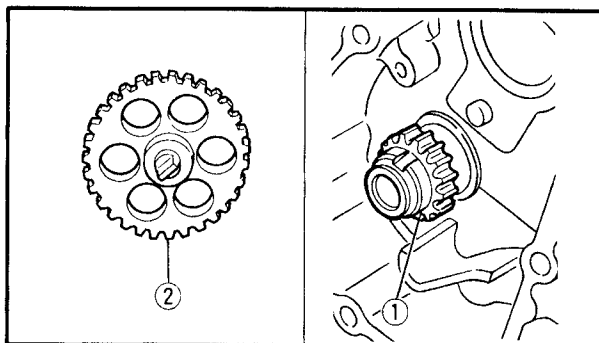
EAS00401

CHECKING THE BEARINGS AND OIL SEALS

1. Check:
 - bearings
 - Clean and lubricate the bearings, then rotate the inner race with your finger.
 - Rough movement → Replace.
2. Check:
 - oil seals
 - Damage/wear → Replace.

CHECKING THE SPROCKETS AND CHAINS

1. Check:
 - crankshaft sprocket ①
 - oil/water pump assembly drive sprocket ②
 - Cracks/damage/wear → Replace the defective part(-s).



2. Check:
 - timing chain ①
 - Damage/stiffness → Replace the timing chain and crankshaft sprocket as a set.
 - oil/water pump assembly drive chain ②
 - Damage/stiffness → Replace the oil/water pump assembly drive chain and oil/water pump assembly drive sprocket as a set.

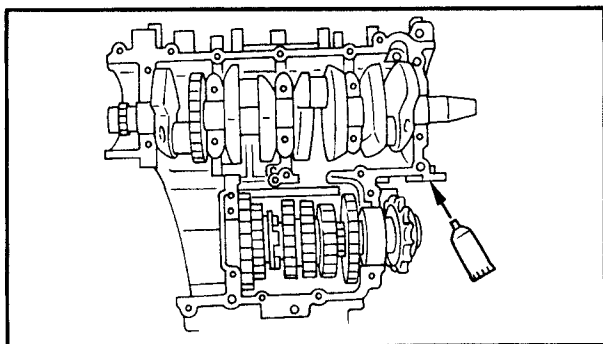


EAS00415

ASSEMBLING THE CRANKCASE

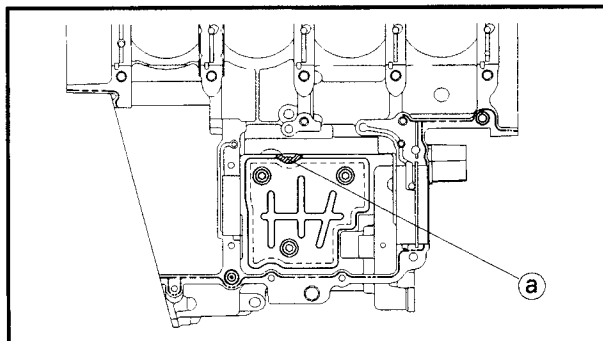
1. Lubricate:

- crankshaft journal bearings
(with the recommended lubricant)

**Recommended lubricant**
Engine oil

2. Apply:

- sealant
(onto the crankcase mating surfaces and the groove (a) of the oil baffle plate)

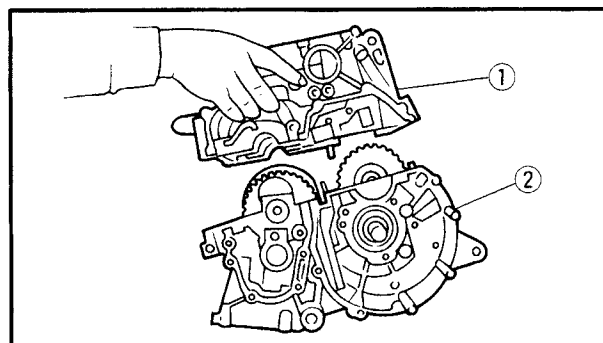
**Yamaha bond No. 1215**
90890-85505, ACC-1100-15-01**NOTE:**

Do not allow any sealant to come into contact with the oil gallery or crankshaft journal bearings. Do not apply sealant to within 2 ~ 3 mm of the crankshaft journal bearings.

3. Install:

- dowel pin

4. Set the shift drum assembly and transmission gears in the neutral position.

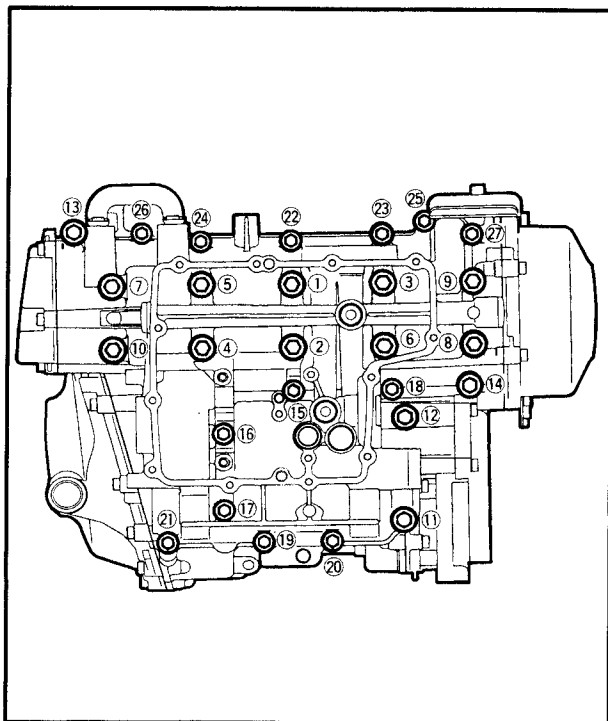


5. Install:

- lower crankcase (1)
(onto the upper crankcase (2))

CAUTION:

Before tightening the crankcase bolts, make sure that the transmission gears shift correctly when the shift drum assembly is turned by hand.



6. Install:

- crankcase bolts

NOTE:

- Lubricate the bolt threads with engine oil.
- Install a washer on bolts ① ~ ⑩.
- Install a gasket on bolt ②①.
- Not lubricate seal bolts ⑬ ⑭
- Tighten the bolts in the tightening sequence cast on the crankcase.

M8 × 85 mm bolts: ① ~ ⑦ ⑩

M8 × 115 mm bolts: ⑧ ⑨

M8 × 65 mm bolt: ⑪ ⑫

M6 × 65 mm bolts: ⑬ ⑭ ⑰ ⑳

M6 × 55 mm bolts: ⑮ ⑯ ~ ⑳

M6 × 45 mm bolts: ⑰ ⑱ ~ ㉑

M6 × 75 mm bolts: ⑲



Bolt ⑮ ~ ㉑

12 Nm (1.2 m•kg, 8.7 ft•lb)

Bolt ⑬ ~ ⑭

14 Nm (1.4 m•kg, 10 ft•lb)

Bolt ① ~ ⑫

24 Nm (2.4 m•kg, 17 ft•lb)

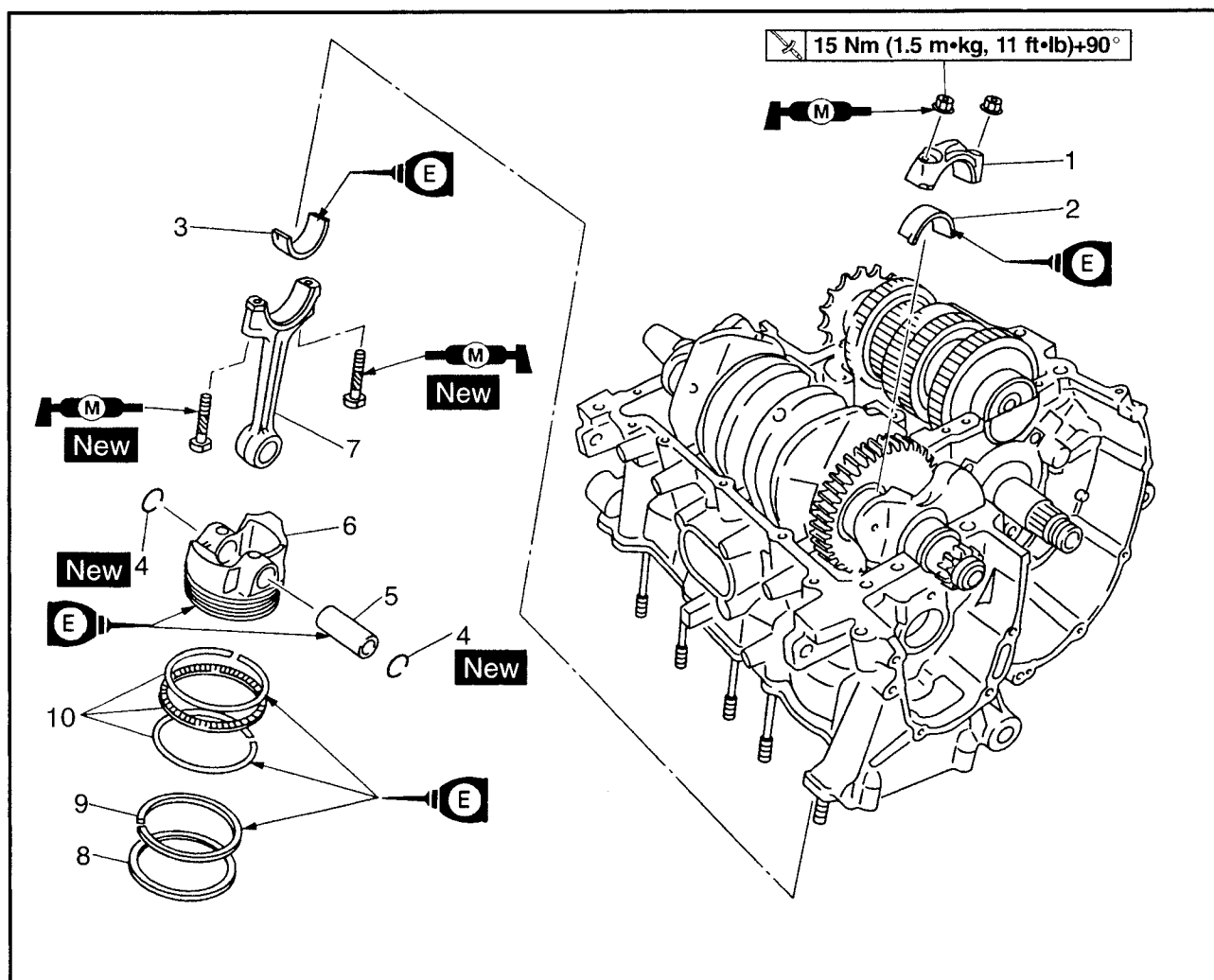
⚠ WARNING

Always use new copper washers.

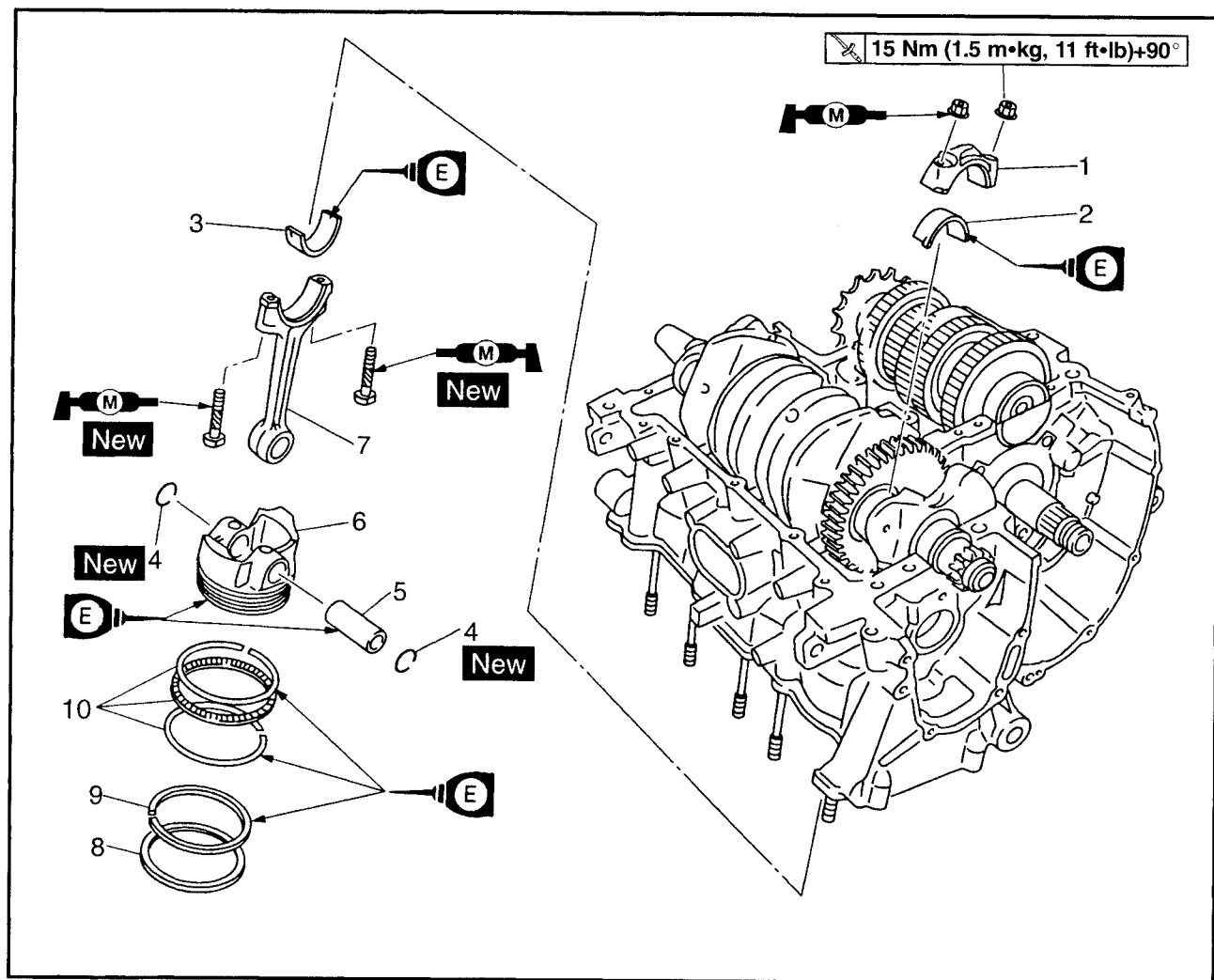


EAS00252

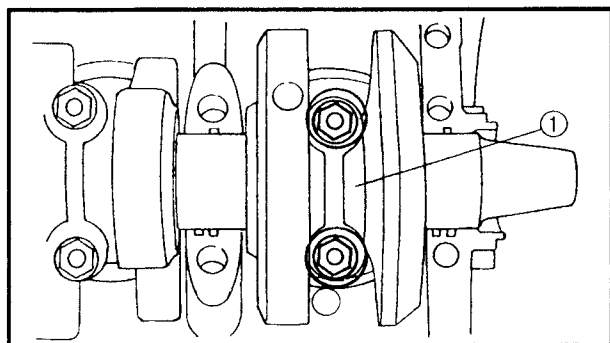
CONNECTING RODS AND PISTONS



Order	Job/Part	Q'ty	Remarks
	Removing the connecting rods and pistons		
	Lower crankcase		Remove the parts in the order listed.
			Separate.
			Refer to "CRANKCASE".
1	Connecting rod cap	4	Refer to "REMOVING/INSTALLING THE CONNECTING RODS AND PISTONS".
2	Big end lower bearing	4	
3	Big end upper bearing	4	
4	Piston pin clip	8	
5	Piston pin	4	
6	Piston	4	
7	Connecting rod	4	



Order	Job/Part	Q'ty	Remarks
8	Top ring	4	Refer to "REMOVING/INSTALLING THE CONNECTING RODS AND PISTONS". For installation, reverse the removal procedure.
9	2nd ring	4	
10	Oil ring	4	



EAS00393

REMOVING THE CONNECTING RODS AND PISTONS

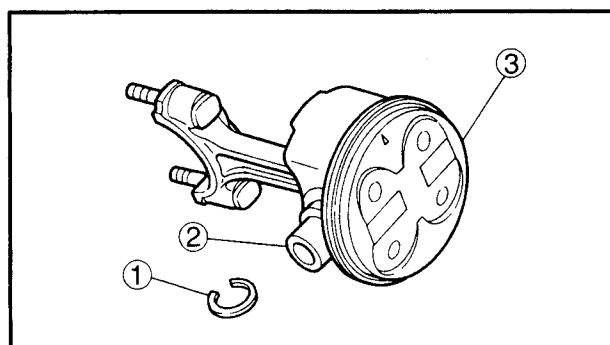
The following procedure applies to all of the connecting rods and pistons.

1. Remove:

- connecting rod cap ①
- big end bearings

NOTE:

Identify the position of each big end bearing so that it can be reinstalled in its original place.



2. Remove:

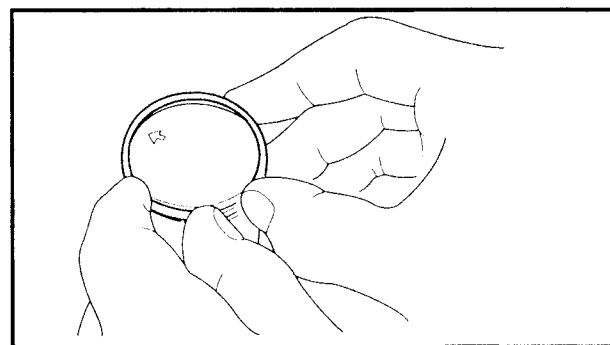
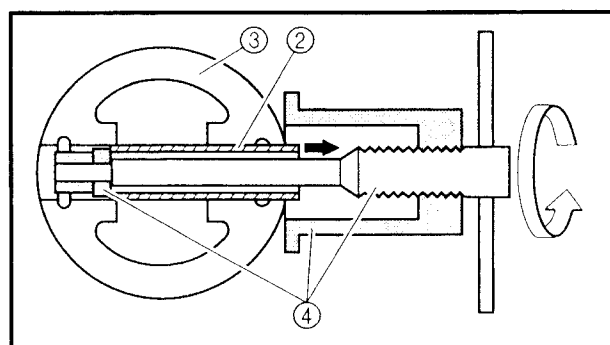
- piston pin clips ①
- piston pin ②
- piston ③
- connecting rod

CAUTION:

Do not use a hammer to drive the piston pin out.

NOTE:

- For reference during installation, put identification marks on the piston crown.
- Before removing the piston pin, deburr the piston pin clip groove and the piston pin bore area in the piston. If both areas are deburred and the piston pin is still difficult to remove, remove it with the piston pin puller ④.



Piston pin puller
90890-01304, YU-01304

3. Remove:

- top ring
- 2nd ring
- oil ring

NOTE:

To remove a piston ring, open the end gap with your fingers and lift the other side of the ring over the piston crown.



EAS00262

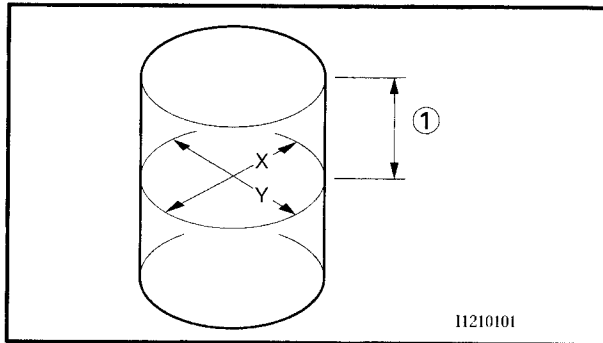
CHECKING THE CYLINDER AND PISTONS

The following procedure applies to all of the cylinders and pistons.

1. Check:

- piston wall
- cylinder wall

Vertical scratches → Replace the crankcases, and the piston and piston rings as a set.



2. Measure:

- piston-to-cylinder clearance

a. Measure cylinder bore "C" with the cylinder bore gauge.

NOTE:

Measure cylinder bore "C" by taking side-to-side and front-to-back measurements of the cylinder. Then, find the average of the measurements.

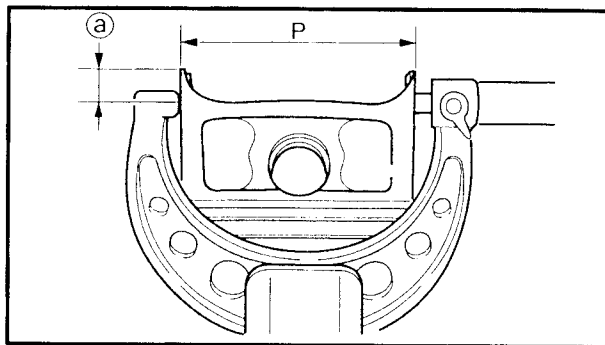


Cylinder bore gauge
90890-03017, YU-03017

Cylinder bore "C"	65.50 ~ 65.51 mm (25.787 ~ 25.791 in)
Max. taper "T"	0.05 mm (0.002 in)
Out of round "R"	0.05 mm (0.002 in)

b. If out of specification, replace the crankcases, and the piston and piston rings as a set.

c. Measure piston skirt diameter "P" with the micrometer.



Micrometer
90890-03008, YU-03008

② 4 mm from the bottom edge of the piston

	Piston size "P"
Standard	65.460 ~ 65.475 mm (2.5772 ~ 2.5778 in)

d. If out of specification, replace the piston and piston rings as a set.



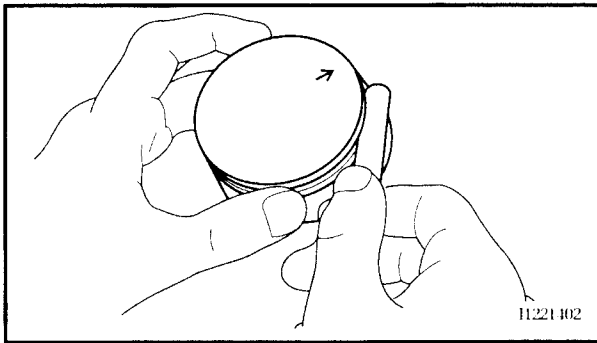
- e. Calculate the piston-to-cylinder clearance with the following formula.

**Piston-to-cylinder clearance =
Cylinder bore “C” –
Piston skirt diameter “P”**



Piston-to-cylinder clearance
0.025 ~ 0.050 mm
(0.001 ~ 0.002 in)
<Limit>: 0.07 mm (0.0028 in)

- f. If out of specification, replace the crankcases, and the pistons and piston rings as a set.



EAS00263

CHECKING THE PISTON RINGS

1. Measure:
 - piston ring side clearance
Out of specification → Replace the piston and piston rings as a set.

NOTE: _____

Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.



Piston ring side clearance

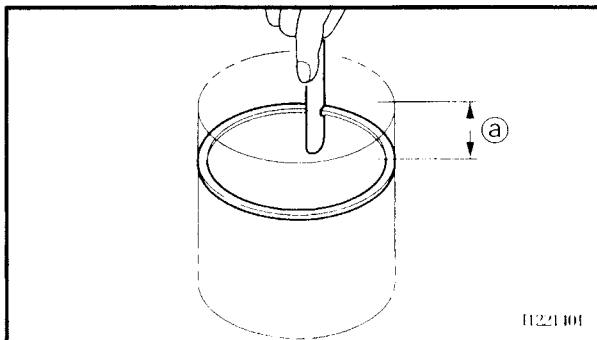
Top ring
0.030 ~ 0.065 mm
(0.0012 ~ 0.0026 in)
<Limit>: 0.115 mm (0.005 in)

2nd ring
0.020 ~ 0.055 mm
(0.0008 ~ 0.0022 in)
<Limit>: 0.115 mm (0.005 in)

2. Install:
 - piston ring
(into the cylinder)

NOTE: _____

Level the piston ring in the cylinder with the piston crown.



Ⓐ 5 mm (0.20 in)



3. Measure:

- piston ring end gap

Out of specification → Replace the piston ring.

NOTE:

The oil ring expander spacer's end gap cannot be measured. If the oil ring rail's gap is excessive, replace all three piston rings.

**Piston ring end gap****Top ring**

0.15 ~ 0.25 mm

(0.006 ~ 0.009 in)

<Limit>: 0.50 mm (0.02 in)

2nd ring

0.40 ~ 0.50 mm

(0.016 ~ 0.02 in)

<Limit>: 0.85 mm (0.033 in)

Oil ring

0.10 ~ 0.35 mm

(0.004 ~ 0.014 in)

ABS00266

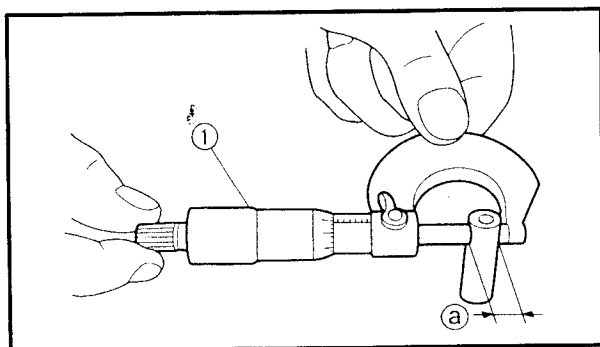
CHECKING THE PISTON PINS

The following procedure applies to all of the piston pins.

1. Check:

- piston pin

Blue discoloration/grooves → Replace the piston pin and then check the lubrication system.



2. Measure:

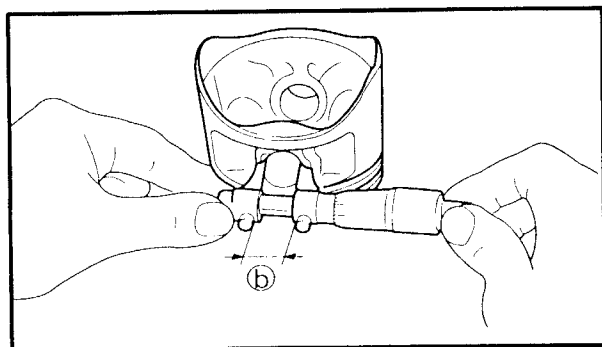
- piston pin outside diameter (a)

Out of specification → Replace the piston pin.

**Piston pin outside diameter**

15.991 ~ 16.000 mm

(0.6296 ~ 0.6299 in)



3. Measure:

- piston pin bore diameter (in the piston)

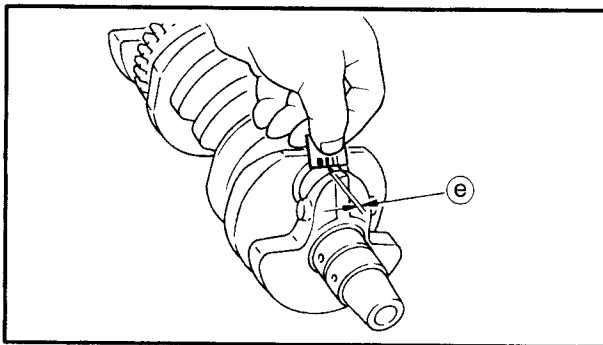
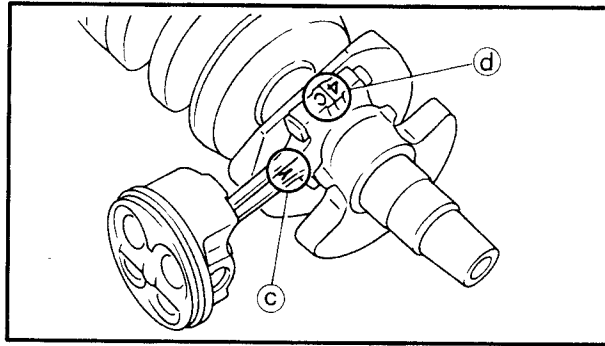
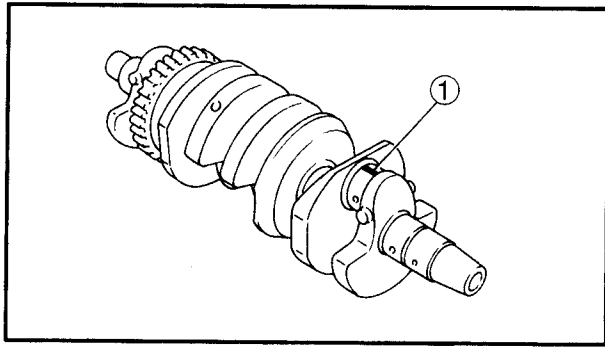
Out of specification → Replace the piston pin.

**Piston pin bore diameter
(in the piston)**

16.002 ~ 16.013 mm

(0.6300 ~ 0.6304 in)





- c. Put a piece of Plastigauge® ① on the crankshaft pin.
- d. Assemble the connecting rod halves.

NOTE:

- Do not move the connecting rod or crankshaft until the clearance measurement has been completed.
- Lubricate the bolt threads and nut seats with molybdenum disulfide grease.
- Make sure that the “Y” mark (C) on the connecting rod faces towards the left side of the crankshaft.
- Make sure that the characters (d) on both the connecting rod and connecting rod cap are aligned.

- e. Tighten the connecting rod nuts.

CAUTION:

- When tightening the connecting rod nuts, be sure to use an F-type torque wrench.
- After tightening the connecting rod nut to the specified torque, turn the connecting rod nut another $+90^{\circ}$.

Refer to "INSTALLING THE PISTONS AND CONNECTING RODS".

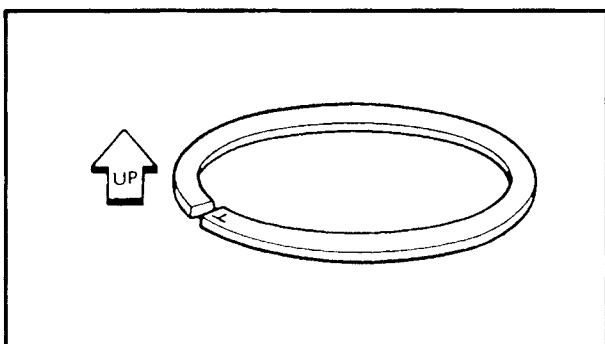
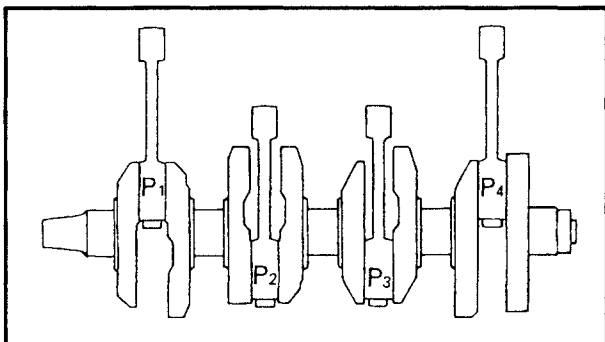
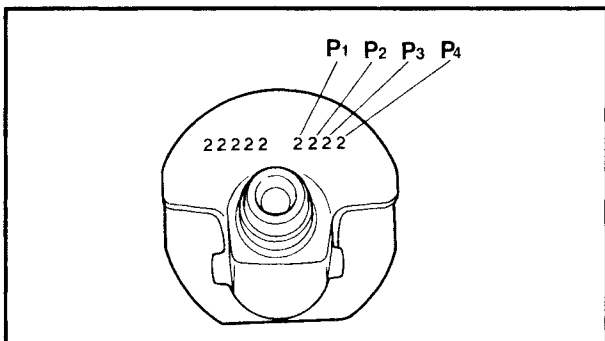
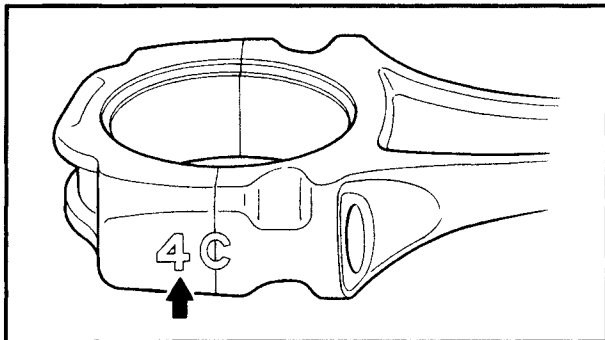


Connecting rod nut

15 Nm (1.5 m•kg, 11 ft•lb) + 90°

- f. Remove the connecting rod and big end bearings.
Refer to “REMOVING THE CONNECTING RODS AND PISTONS”.
- g. Measure the compressed Plastigauge® width ⑤ on the crankshaft pin.
If the crankshaft-pin-to-big-end-bearing clearance is out of specification, select replacement big end bearings.

[illegible]



2. Select:

- big end bearings ("P₁" ~ "P₄")

NOTE:

- The numbers stamped into the crankshaft web and the numbers on the connecting rods are used to determine the replacement big end bearing sizes.
- "P₁" ~ "P₄" refer to the bearings shown in the crankshaft illustration.

For example, if the connecting rod "P₁" and the crankshaft web "P₁" numbers are "5" and "1" respectively, then the bearing size for "P₁" is:

$$\text{"P}_1 \text{ (connecting rod) - "P}_1 \text{ (crankshaft) = } 5 - 1 = 4$$

BIG END BEARING COLOR CODE

1	blue
2	black
3	brown
4	green

EAS00271

INSTALLING THE PISTONS AND CONNECTING RODS

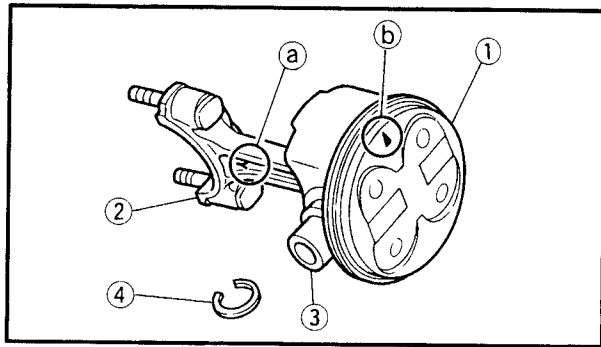
The following procedure applies to all of the pistons and cylinders.

1. Install:

- top ring
- 2nd ring
- oil ring

NOTE:

Be sure to install the piston rings so that the manufacturer's marks or numbers face up.

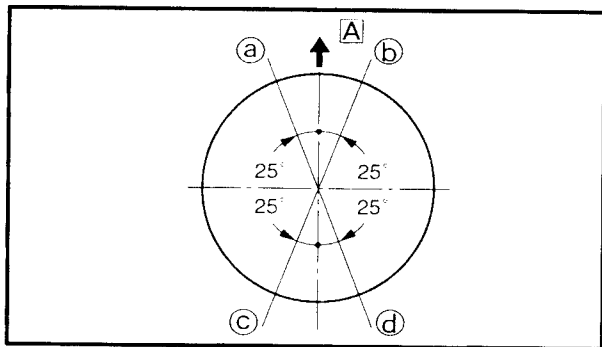


2. Install:

- piston ①
(onto the respective connecting rod ②)
- piston pin ③
- piston pin clip ④ **New**

NOTE:

- Apply engine oil onto the piston pin.
- Make sure that the "Y" mark (a) on the connecting rod faces left when the arrow mark (b) on the piston is pointing up. Refer to the illustration.
- Reinstall each piston into its original cylinder (numbering order starting from the left: #1 to #4).




3. Offset:

- piston ring end gaps

- (a) Top ring
- (b) Lower oil ring rail
- (c) Upper oil ring rail
- (d) 2nd ring
- (A) Intake side


4. Lubricate:

- piston
- piston rings
- cylinder
(with the recommended lubricant)

	Recommended lubricant Engine oil
---	---

5. Lubricate:

- bolt threads
- nut seats
(with the recommended lubricant)

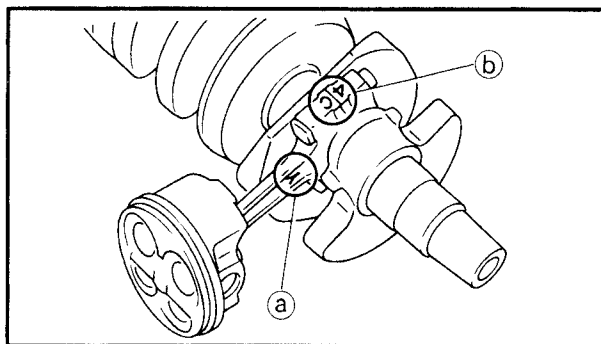
	Recommended lubricant Molybdenum disulfide grease
---	--



6. Lubricate:
- crankshaft pins
 - big end bearings
 - connecting rod big end inner surface (with the recommended lubricant)



Recommended lubricant
Engine oil




7. Install:
 - big end bearings
 - connecting rod assembly
(into the cylinder and onto the crankshaft pin).
 - connecting rod cap
(onto the connecting rod)

NOTE:

- Align the projections on the big end bearings with the notches in the connecting rods and connecting rod caps.
- Be sure to reinstall each big end bearing in its original place.
- While compressing the piston rings with one hand, install the connecting rod assembly into the cylinder with the other hand.
- Make sure that the “Y” marks (a) on the connecting rods face towards the left side of the crankshaft.
- Make sure that the characters (b) on both the connecting rod and connecting rod cap are aligned.

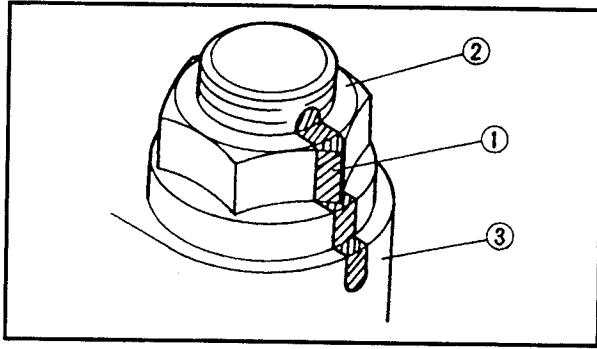
8. Align:
 - bolt heads
(with the connecting rod caps)
9. Tighten:
 - connecting rod nuts

	15 Nm (1.5 m•kg, 11 ft•lb)+90°
---	--------------------------------

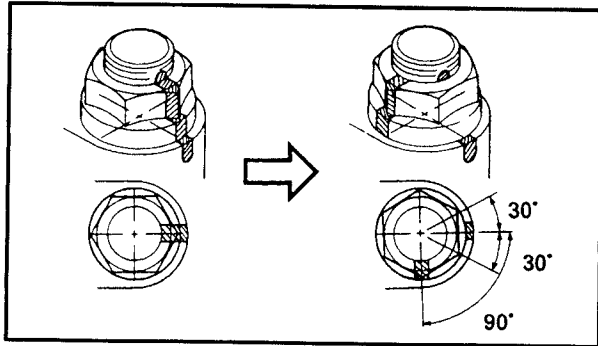
- a. Replace the connecting rod bolts and nuts with new ones.

CAUTION:

Tighten the connecting rod bolts using the plastic-region tightening angle method. Always install new bolts and nuts.



- b. Clean the connecting rod bolts and nuts.
- c. Tighten the connecting rod nuts.
- d. Put a mark ① on the corner of the connecting rod nut ② and the connecting rod ③.



- e. Tighten the nut further to reach the specified angle (90°).

⚠ WARNING

When the nut is tightened more than the specified angle, do not loosen the nut and then retighten it.

Replace the bolt with a new one and perform the procedure again.

CAUTION:

- Do not use a torque wrench to tighten the nut to the specified angle.
- Tighten the nut until it is at the specified angles.

NOTE:

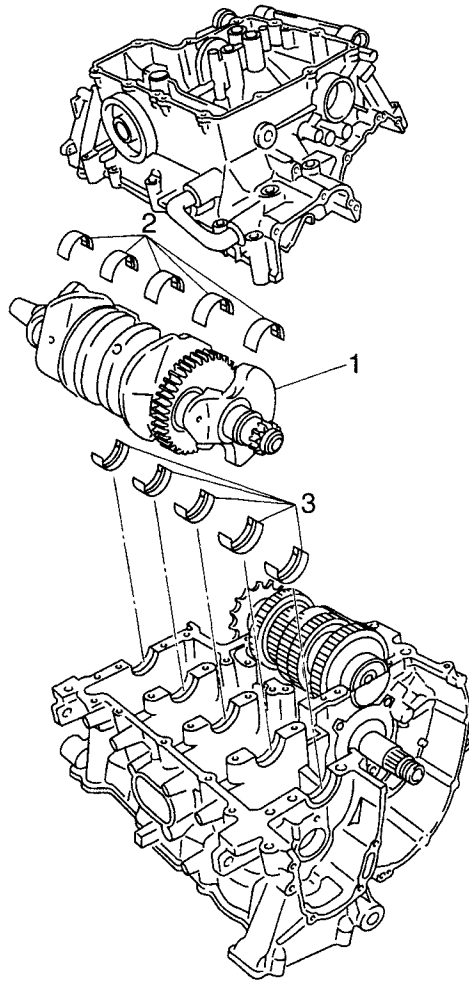
When using a hexagonal nut, note that the angle from one corner to another is 60°.



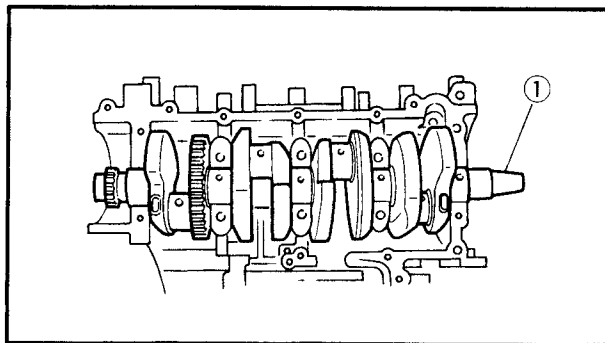


EAS00381

CRANKSHAFT



Order	Job/Part	Q'ty	Remarks
	Removing the crankshaft		
	Crankcase lower		Remove the parts in the order listed. Separate. Refer to "CRANKCASE".
	Connecting rods and pistons		Refer to "CONNECTING RODS AND PISTONS".
1	Crankshaft	1	Refer to "REMOVING/INSTALLING THE CRANKSHAFT".
2	Crankshaft journal lower bearing	5	
3	Crankshaft journal upper bearing	5	
			For installation, reverse the removal procedure.



EAS00387

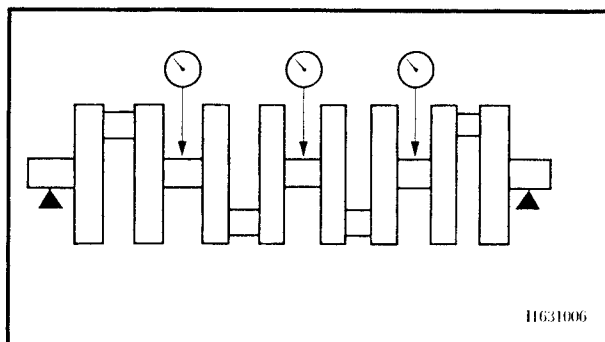
REMOVING THE CRANKSHAFT

1. Remove:

- crankshaft ①
- crankshaft journal upper bearings (from the upper / lower crankcase)

NOTE:

Identify the position of each crankshaft journal upper bearing so that it can be reinstalled in its original place.



EAS00397

CHECKING THE CRANKSHAFT

1. Measure:

- crankshaft runout
Out of specification → Replace the crankshaft.



Max. crankshaft runout
0.03 mm (0.0012 in)

2. Check:

- crankshaft journal surfaces
- crankshaft pin surfaces
- bearing surfaces
Scratches/wear → Replace the crankshaft.

CHECKING THE CRANKSHAFT JOURNAL BEARINGS

1. Measure:

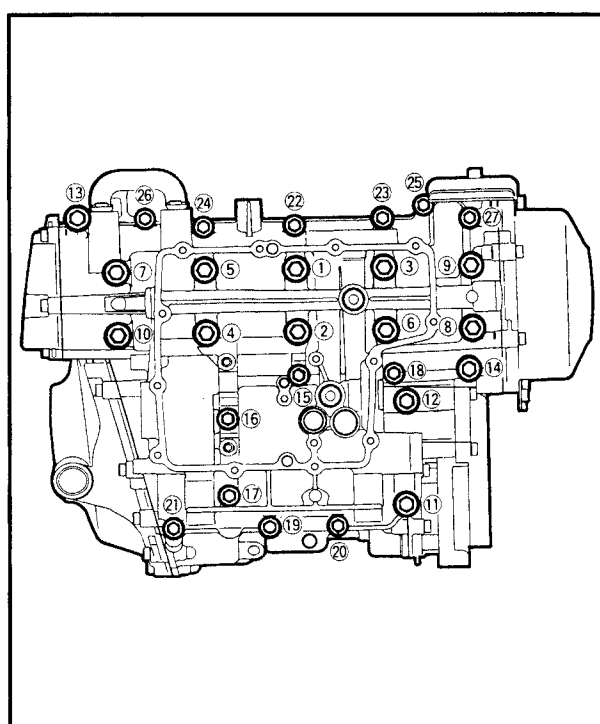
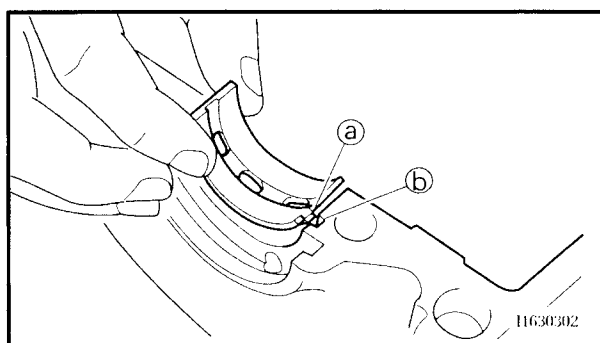
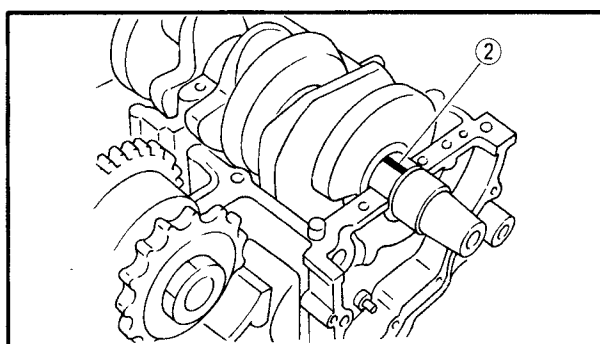
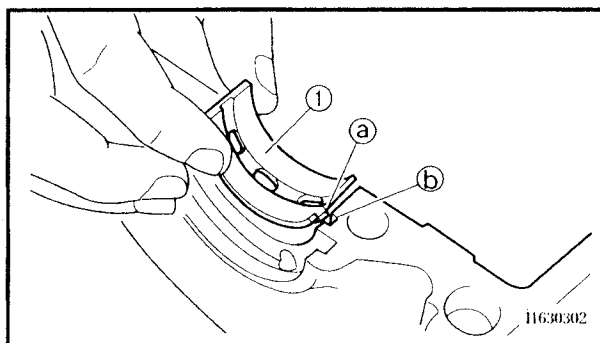
- crankshaft-journal-to-crankshaft-journal-bearing clearance
Out of specification → Replace the crankshaft journal bearings.



Crankshaft-journal-to-crankshaft-journal-bearing clearance
0.034 ~ 0.058 mm
(0.0013 ~ 0.0023 in)

CAUTION:

Do not interchange the crankshaft journal bearings. To obtain the correct crankshaft-journal-to-crankshaft-journal-bearing clearance and prevent engine damage, the crankshaft journal bearings must be installed in their original positions.



- a. Clean the crankshaft journal bearings, crankshaft journals, and bearing portions of the crankcase.
- b. Place the upper crankcase upside down on a bench.
- c. Install the crankshaft journal upper bearings ① and the crankshaft into the upper crankcase.

NOTE:

Align the projections (a) on the crankshaft journal upper bearings with the notches (b) in the upper crankcase.

- d. Put a piece of Plastigauge® (2) on each crankshaft journal.

NOTE:

Do not put the Plastigauge® over the oil hole in the crankshaft journal.

- e. Install the crankshaft journal lower bearings into the lower crankcase and assemble the crankcase.

NOTE:

- Align the projections (a) on the crankshaft journal lower bearings with the notches (b) in the lower crankcase.
- Do not move the crankshaft until the clearance measurement has been completed.

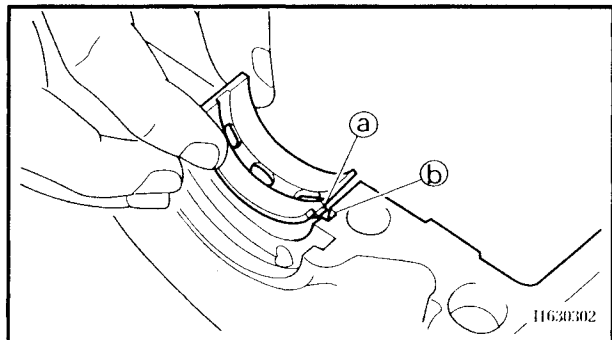
- f. Tighten the bolts to specification in the tightening sequence cast on the crankcase.



- Bolt ⑮ ~ ⑳**
12 Nm (1.2 m•kg, 8.7 ft•lb)
- Bolt ⑬ ⑭**
14 Nm (1.4 m•kg, 10 ft•lb)
- Bolt ① ~ ⑫**
24 Nm (2.4 m•kg, 17 ft•lb)

NOTE:

Lubricate the crankcase bolt threads with engine oil.



EAS00407

INSTALLING THE CRANKSHAFT

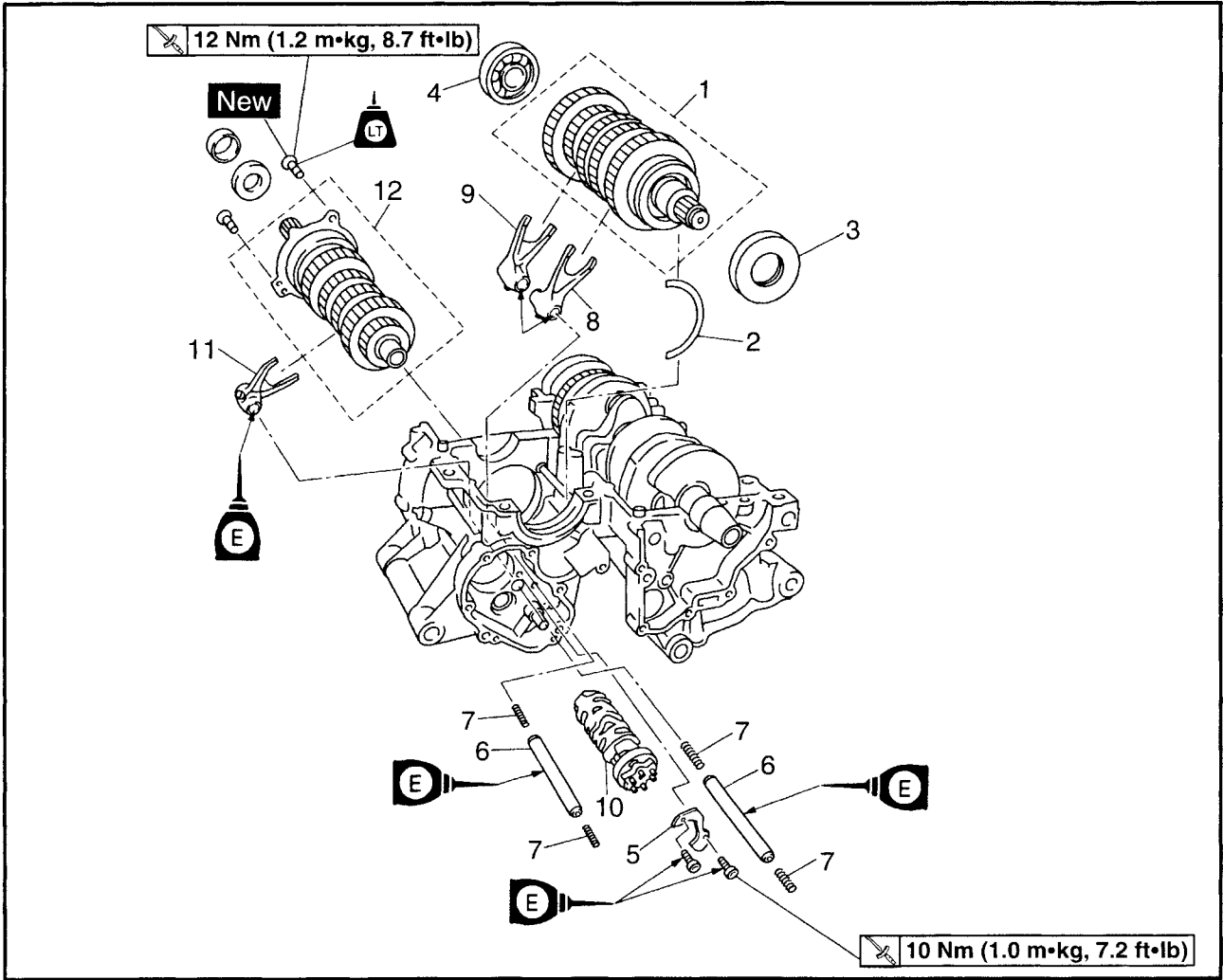
1. Install:

- crankshaft journal upper bearings
(into the upper / lower crankcase)

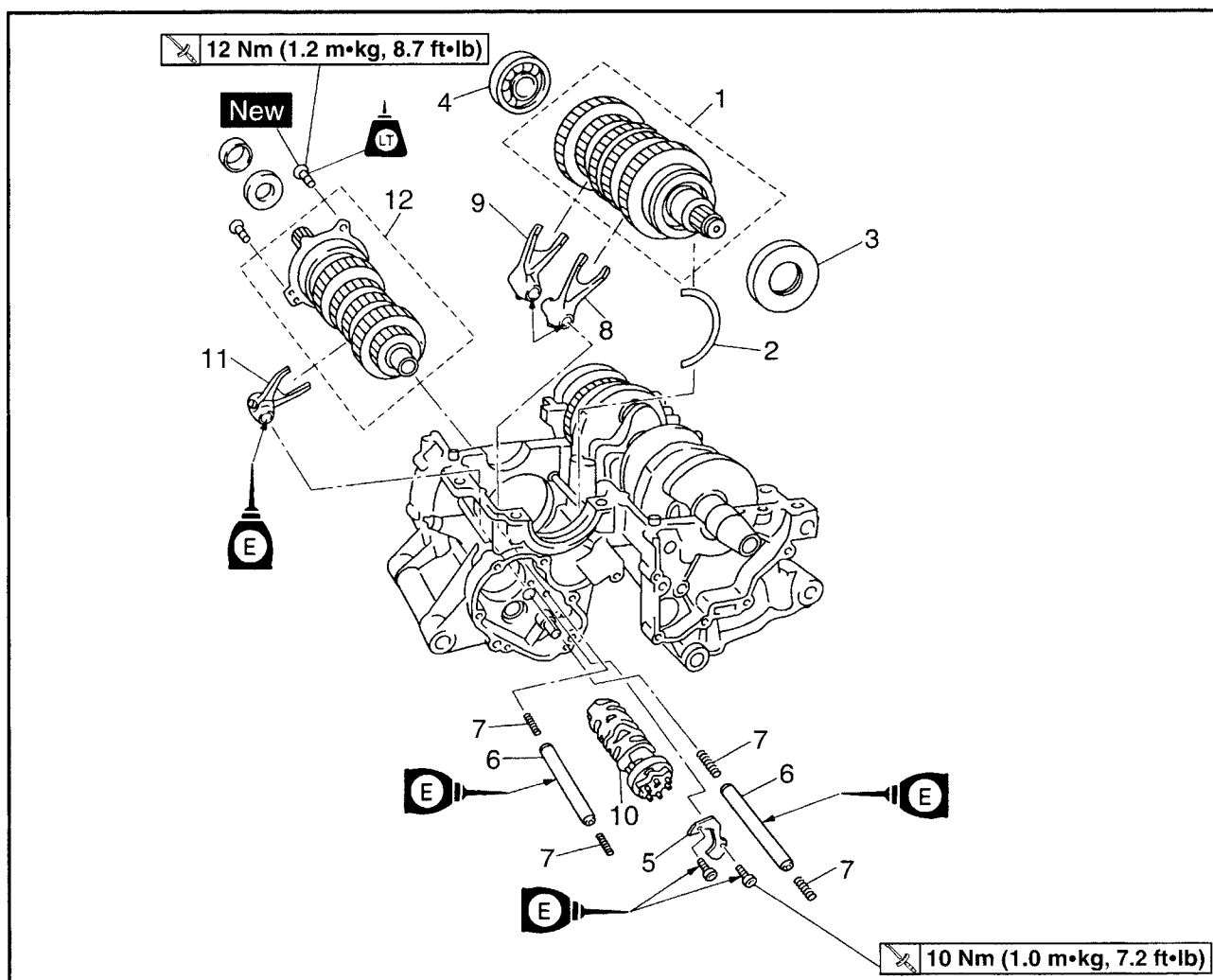
NOTE:

- Align the projections (a) on the crankshaft journal upper bearings with the notches (b) in the upper crankcase.
- Be sure to install each crankshaft journal upper bearing in its original place.

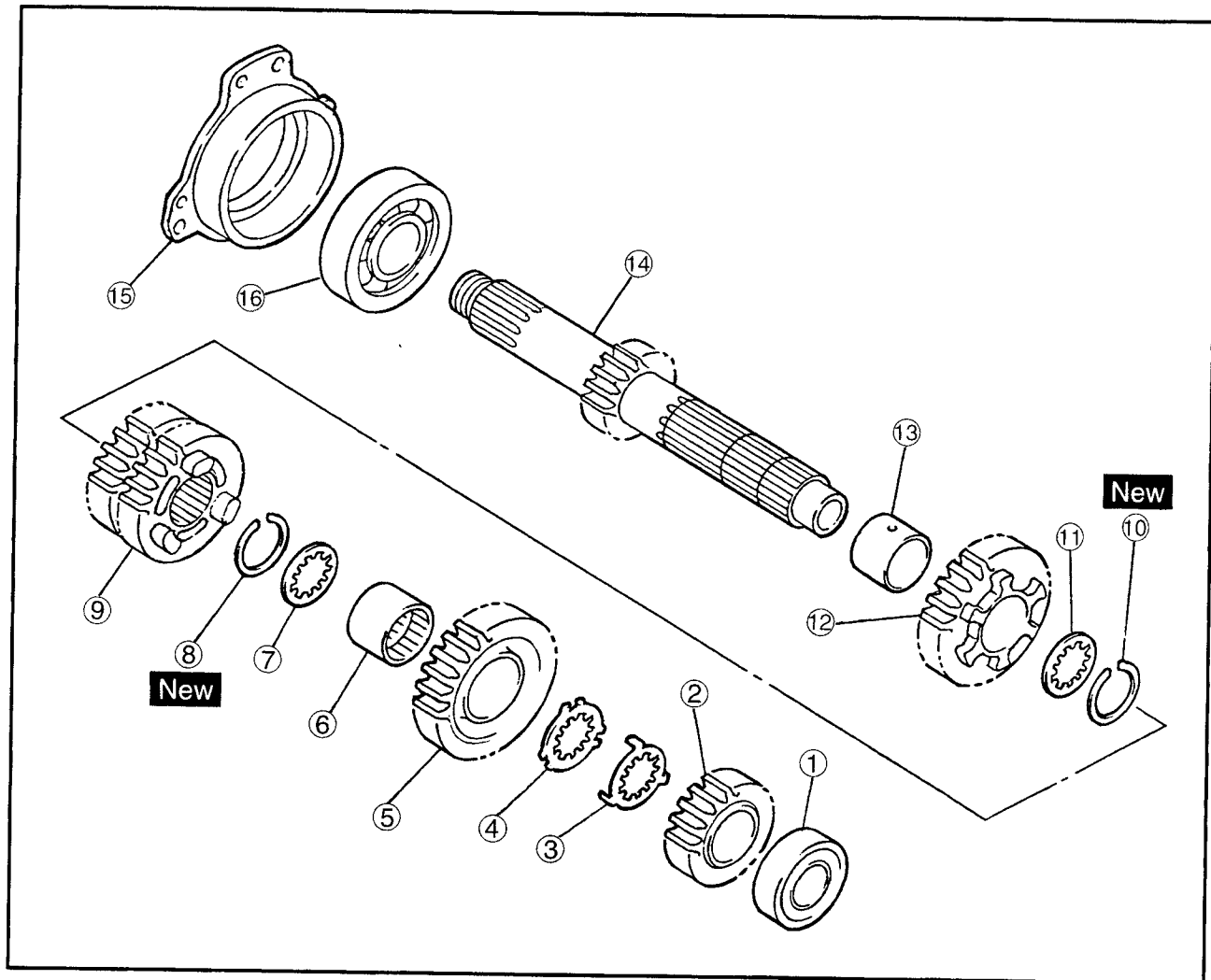
EAS00419
TRANSMISSION



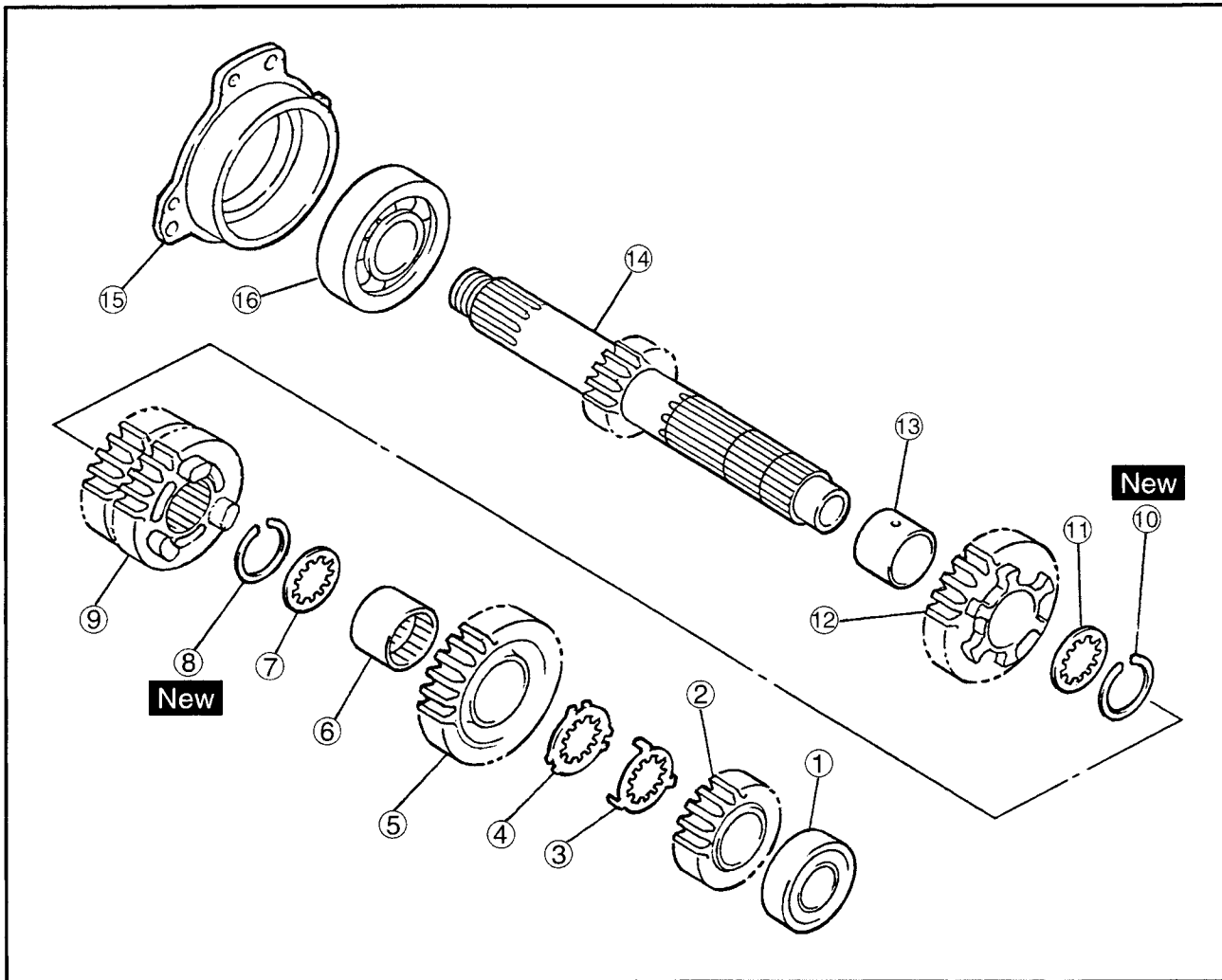
Order	Job/Part	Q'ty	Remarks
	Removing the transmission		
	Crankcase lower		Remove the parts in the order listed. Separate. Refer to "CRANKCASE".
	Shift shaft and stopper lever		Refer to "SHIFT SHAFT".
1	Drive axle assembly	1	
2	Circlip	1	
3	Oil seal	1	
4	Bearing	1	
5	Shift bar stopper	1	
6	Shift fork guide bar	2	



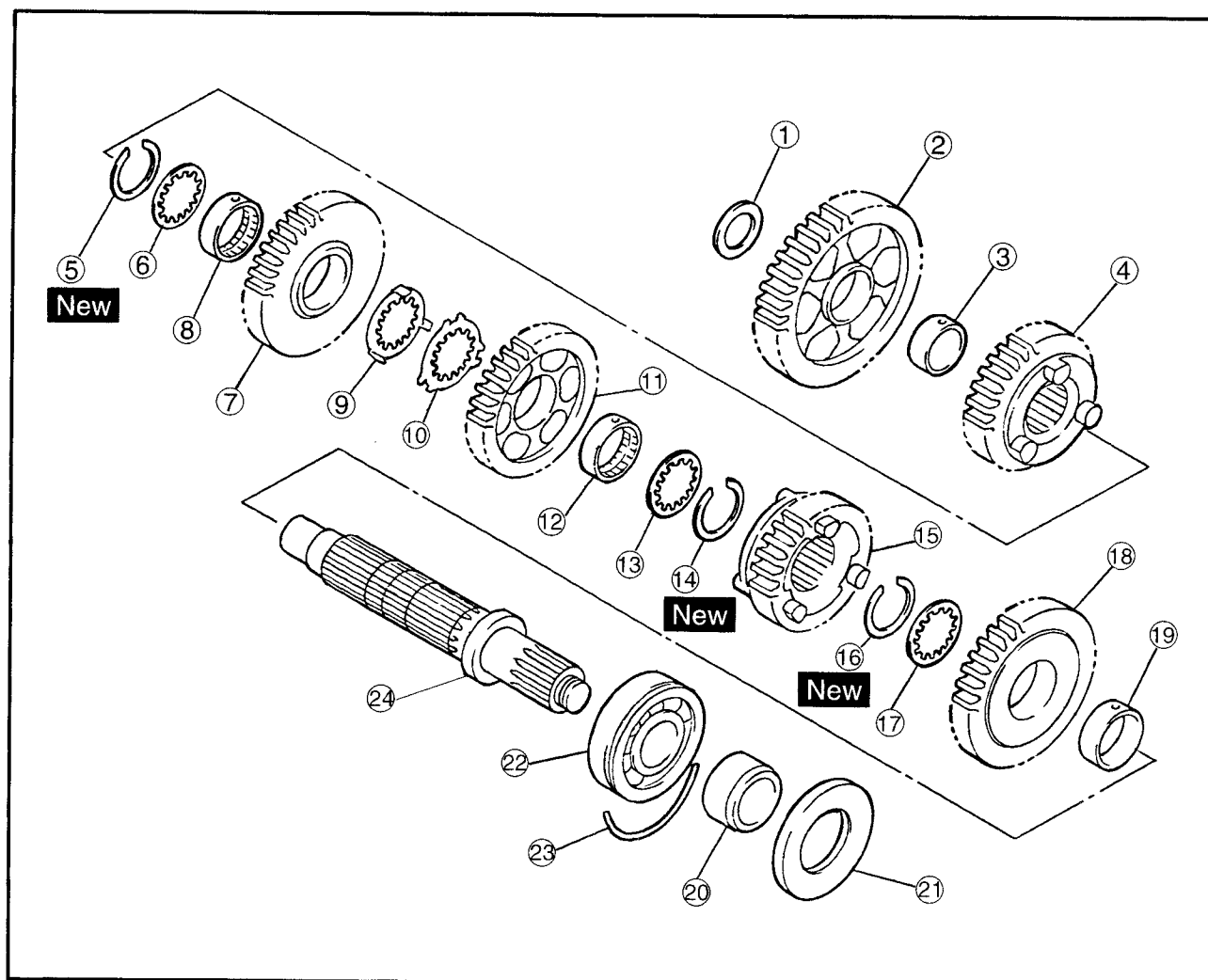
Order	Job/Part	Q'ty	Remarks
7	Spring	4	Refer to "INSTALLING THE TRANSMISSION". Refer to "REMOVING THE TRANSMISSION".
8	Shift fork "L"	1	
9	Shift fork "R"	1	
10	Shift drum assembly	1	
11	Shift fork "C"	1	
12	Main axle assembly	1	For installation, reverse the removal procedure.



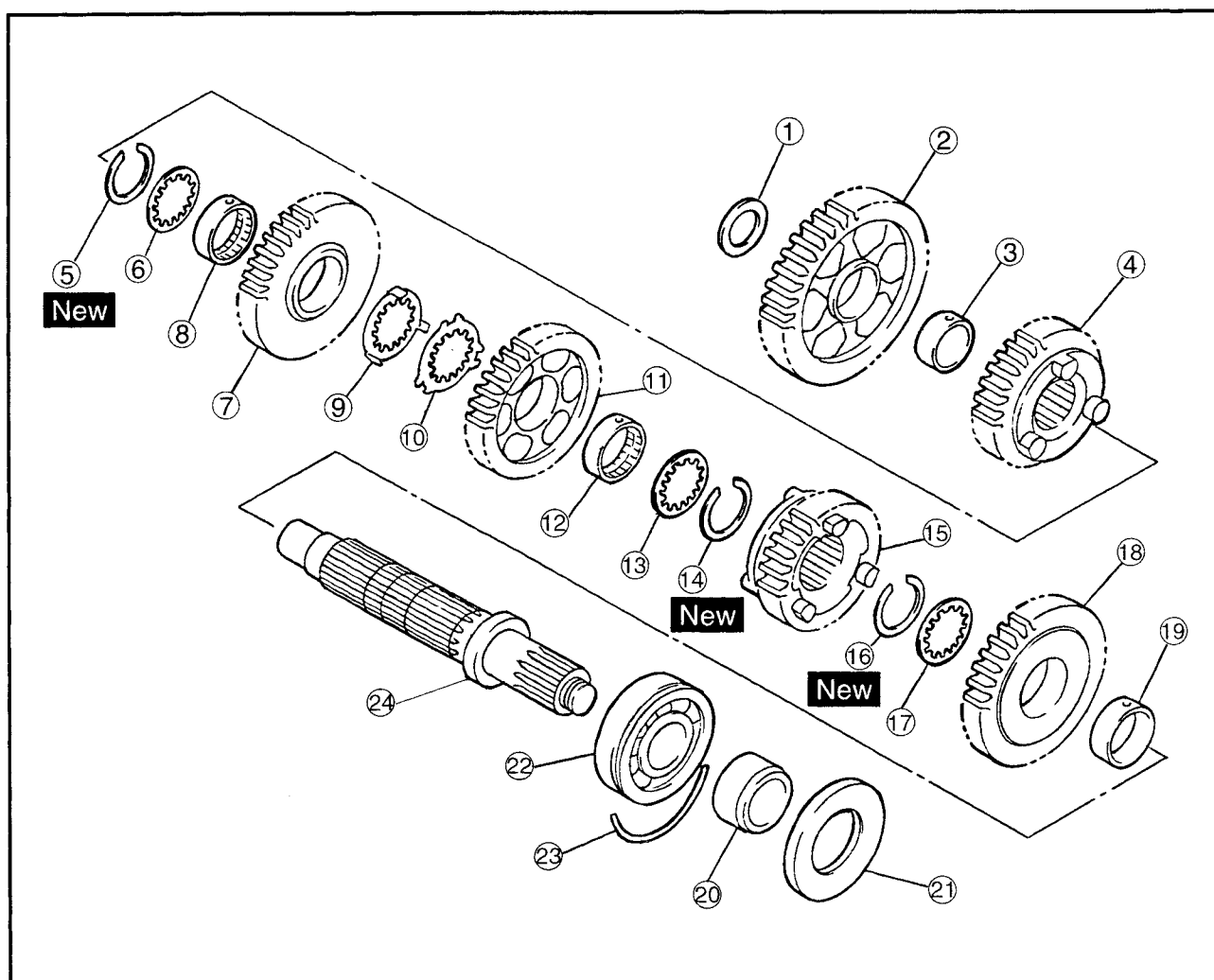
Order	Job/Part	Q'ty	Remarks
	Disassembling the main axle assembly		Remove the parts in the order listed.
①	Bearing	1	
②	2nd pinion gear	1	
③	Toothed lock washer	1	
④	Toothed lock washer retainer	1	
⑤	6th pinion gear	1	
⑥	Collar	1	
⑦	Washer	1	
⑧	Circlip	1	
⑨	3rd pinion gear	1	
⑩	Circlip	1	



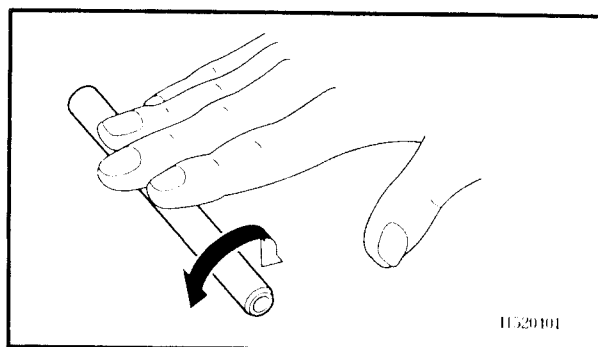
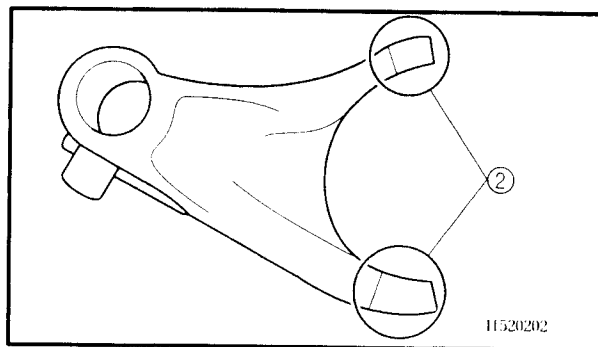
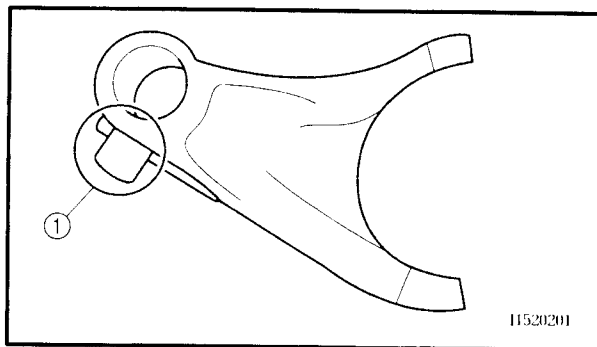
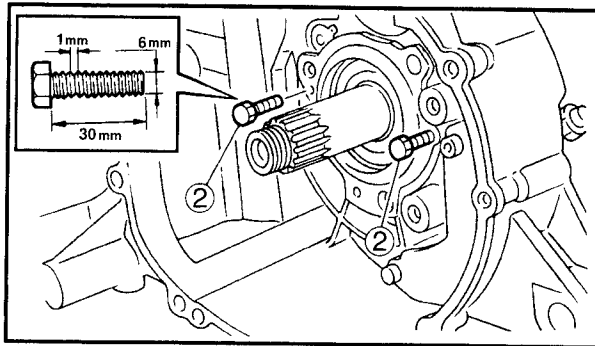
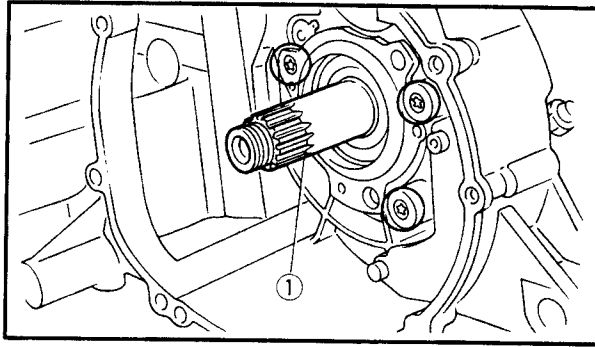
Order	Job/Part	Q'ty	Remarks
⑪	Washer	1	For installation, reverse the removal procedure.
⑫	5th pinion gear	1	
⑬	Collar	1	
⑭	Main axle	1	
⑮	Bearing housing	1	
⑯	Bearing	1	



Order	Job/Part	Q'ty	Remarks
	Disassembling the drive axle assembly		Remove the parts in the order listed.
①	Washer	1	
②	1st wheel gear	1	
③	Collar	1	
④	5th wheel gear	1	
⑤	Circlip	1	
⑥	Washer	1	
⑦	3rd wheel gear	1	
⑧	Collar	1	
⑨	Toothed lock washer	1	
⑩	Toothed lock washer retainer	1	
⑪	4th wheel gear	1	



Order	Job/Part	Q'ty	Remarks
⑫	Collar	1	For installation, reverse the removal procedure.
⑬	Washer	1	
⑭	Circrip	1	
⑮	6th wheel gear	1	
⑯	Circrip	1	
⑰	washer	1	
⑱	2nd wheel gear	1	
⑲	Collar	1	
⑳	Collar	1	
㉑	Oil seal	1	
㉒	Bearing	1	
㉓	Circrip	1	
㉔	Drive axle	1	



EAS00420

REMOVING THE TRANSMISSION

1. Remove:
 - drive axle assembly
2. Remove:
 - main axle assembly ①
(with the Torx® wrench T30)

- a. Insert two bolts ② of the proper size, as shown in the illustration, into the main axle assembly bearing housing.
- b. Tighten the bolts until they contact the crankcase surface.
- c. Continue tightening the bolts until the main axle assembly comes free from the upper crankcase.

EAS00421

CHECKING THE SHIFT FORKS

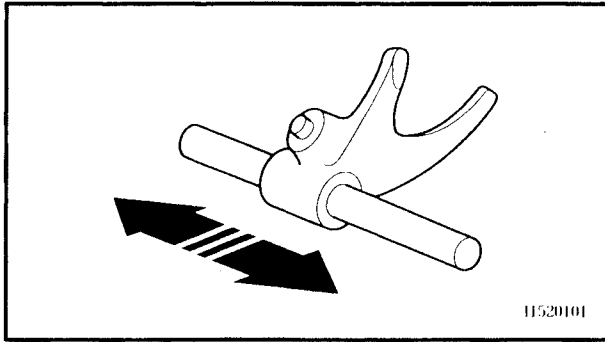
The following procedure applies to all of the shift forks.

1. Check:
 - shift fork cam follower ①
 - shift fork pawl ②Bends/damage/scoring/wear → Replace the shift fork.

2. Check:
- shift fork guide bar
Roll the shift fork guide bar on a flat surface.
Bends → Replace.

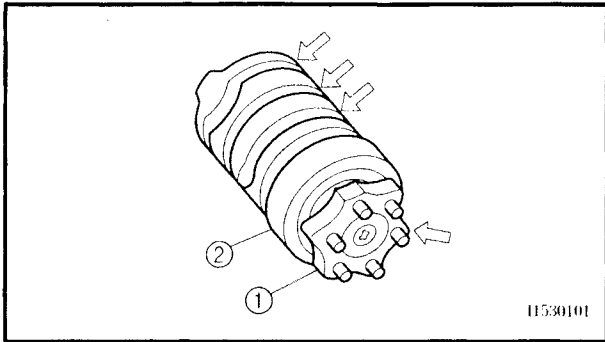
⚠ WARNING

Do not attempt to straighten a bent shift fork guide bar.



3. Check:

- shift fork movement
(along the shift fork guide bar)
Rough movement → Replace the shift fork(-s) and shift fork guide bar as a set.



EAS00422

CHECKING THE SHIFT DRUM ASSEMBLY

1. Check:

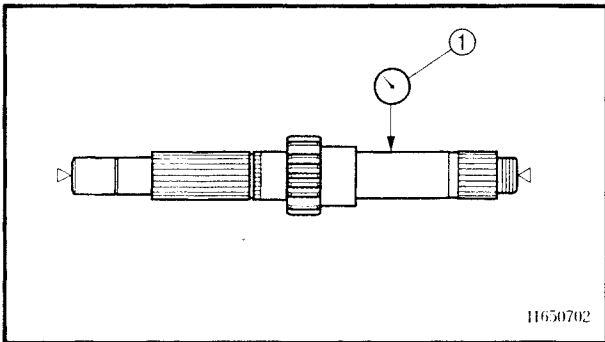
- shift drum grooves
Damage/scratches/wear → Replace the shift drum assembly.
- shift drum segment ①
Damage/wear → Replace the shift drum assembly.
- shift drum bearing ②
Damage/pitting → Replace the shift drum assembly.

EAS00425

CHECKING THE TRANSMISSION

1. Measure:

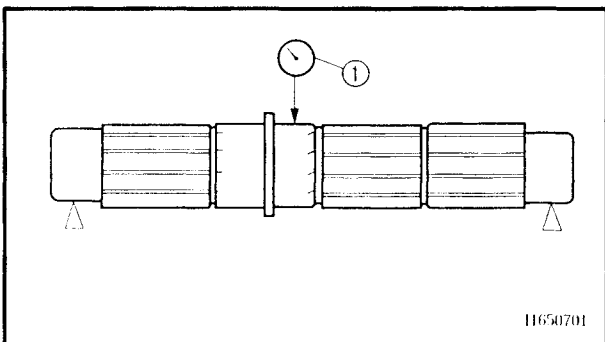
- main axle runout
(with a centering device and dial gauge ①)
Out of specification → Replace the main axle.



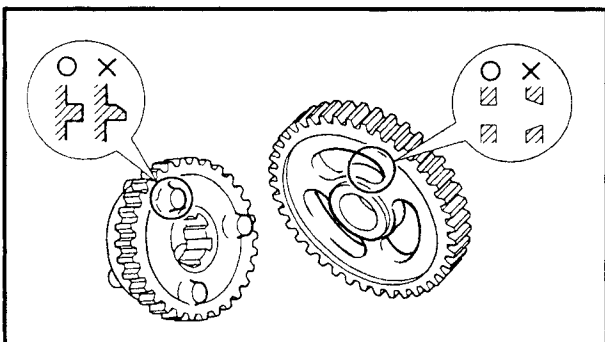
Max. main axle runout
0.02 mm (0.0008 in)

2. Measure:

- drive axle runout
(with a centering device and dial gauge ①)
Out of specification → Replace the drive axle.



Max. drive axle runout
0.02 mm (0.0008 in)



3. Check:

- transmission gears
Blue discoloration/pitting/wear → Replace the defective gear(-s).
- transmission gear dogs
Cracks/damage/rounded edges → Replace the defective gear(-s).



4. Check:
 - transmission gear engagement
(each pinion gear to its respective wheel gear)
Incorrect → Reassemble the transmission axle assemblies.
5. Check:
 - transmission gear movement
Rough movement → Replace the defective part(-s).
6. Check:
 - circlips
Bends/damage/looseness → Replace.

INSTALLING THE TRANSMISSION

1. Install:
 - main axle assembly
 - shift fork "C"
 - shift drum assembly
 - shift fork "R"
 - shift fork "L"
 - springs
 - shift fork guide bars
 - drive axle assembly

NOTE:

- Carefully position the shift forks so that they are installed correctly into the transmission gears.
- Install shift fork "C" into the groove in the 3rd and 4th pinion gear on the main axle.
- Install shift fork "L" into the groove in the 6th wheel gear and shift fork "R" into the groove in the 5th wheel gear on the drive axle.
- Make sure that the drive axle bearing circlip is inserted into the grooves in the upper crankcase.

2. Check:
 - transmission
Rough movement → Repair.

NOTE:

Oil each gear, shaft, and bearing thoroughly.