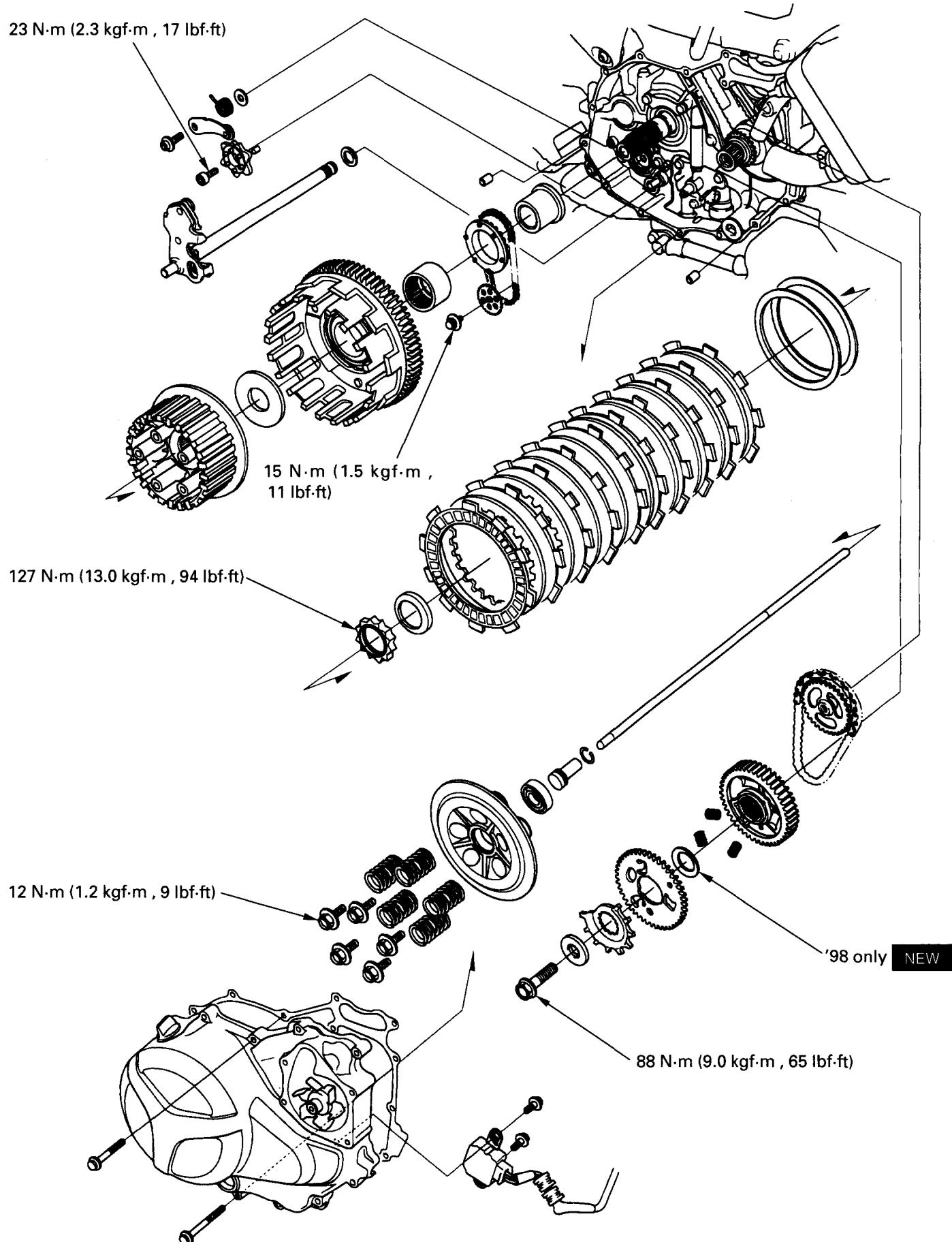
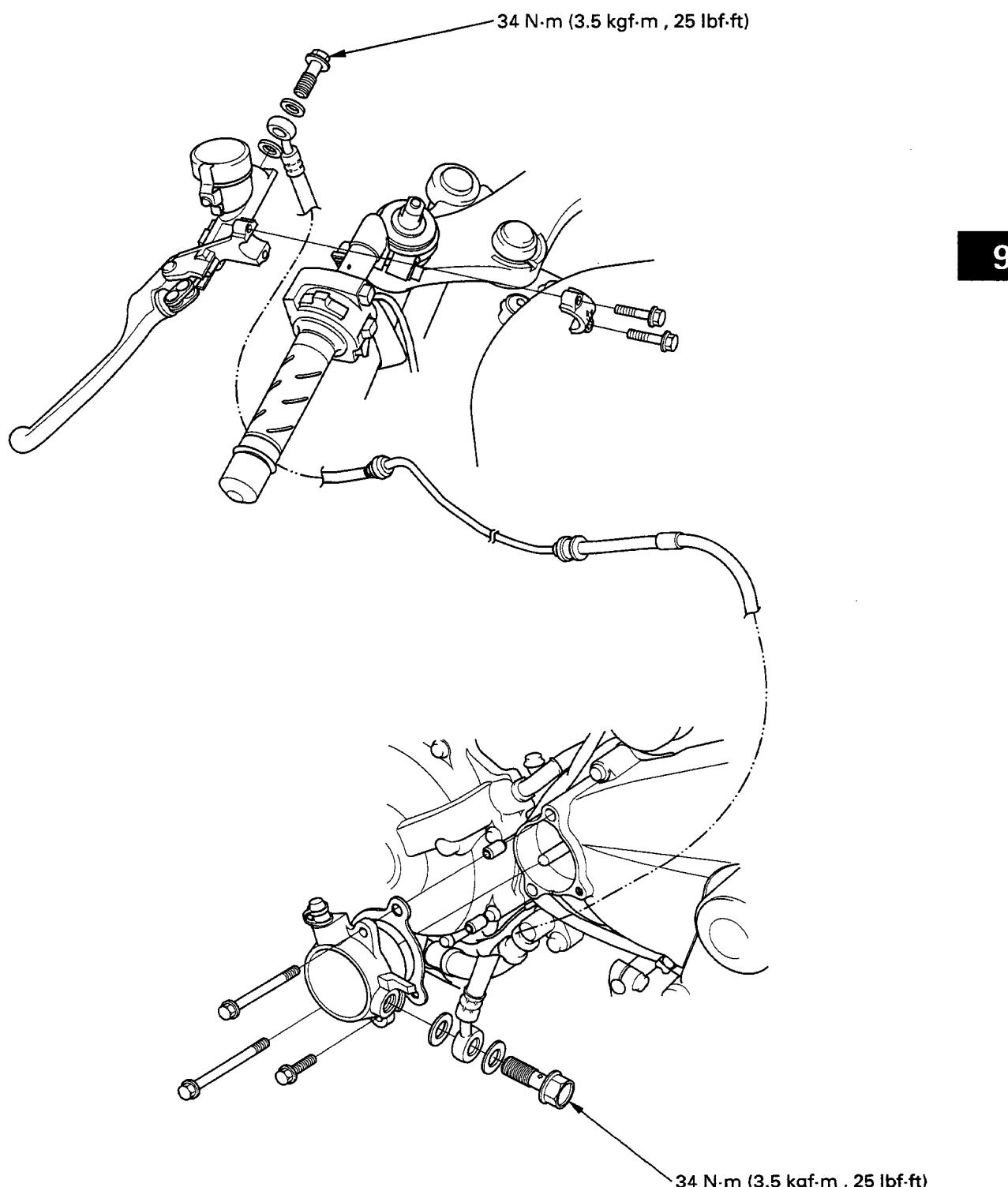


CLUTCH/GEARSHIFT LINKAGE



9. CLUTCH/GEARSHIFT LINKAGE

SERVICE INFORMATION	9-2	CLUTCH SLAVE CYLINDER	9-10
TROUBLESHOOTING	9-3	CLUTCH	9-12
CLUTCH FLUID REPLACEMENT/ AIR BLEEDING	9-4	GEARSHIFT LINKAGE	9-20
CLUTCH MASTER CYLINDER	9-5	PRIMARY DRIVE GEAR	9-22



SERVICE INFORMATION**GENERAL**

- The clutch system can be serviced with the engine in the frame.
- DOT 4 brake fluid is used for the hydraulic clutch and is referred to as clutch fluid in this section. Do not use other types of fluid as they are not compatible.
- Spilled clutch (brake) fluid will severely damage the plastic parts and painted surfaces. It is also harmful to some rubber parts. Be careful whenever you remove the reservoir cap; make sure the reservoir is horizontal first.
- Never allow contaminants (dirt, water, etc.) to get into an open reservoir.
- Once the hydraulic system has been opened, the system must be bled.
- Always use fresh DOT 4 brake fluid from a sealed container when servicing the system. Do not mix different types of fluid as they may not be compatible.
- Engine oil viscosity and level and the use of oil additives have an effect on clutch disengagement. Oil additives of any kind are specifically not recommended. When the clutch does not disengage or the motorcycle creeps with the clutch disengaged, inspect the engine oil viscosity and level before servicing the clutch system.

SPECIFICATIONS

Unit: mm (in)

ITEM	STANDARD	SERVICE LIMIT
Specified clutch fluid	DOT 4 brake fluid	—
Clutch master cylinder	Cylinder I.D. 14.000 – 14.043 (0.5512 – 0.5529) Piston O.D. 13.957 – 13.984 (0.5495 – 0.5506)	14.055 (0.5533) 13.945 (0.5490)
Clutch	Spring free length 49.6 (1.95) Disc thickness 3.72 – 3.88 (0.146 – 0.153) Plate warpage	46.6 (1.83) 3.5 (0.14) 0.30 (0.012)
Clutch outer guide	I.D. 28.000 – 28.021 (1.1024 – 1.1032) O.D. 34.975 – 34.991 (1.3770 – 1.3776)	28.031 (1.1036) 34.965 (1.3766)
Mainshaft O.D. at clutch outer guide	27.980 – 27.993 (1.1016 – 1.1021)	27.970 (1.1012)

TORQUE VALUES

Clutch slave cylinder bleed valve	9 N·m (0.9 kgf·m , 6.5 lbf·ft)	
Clutch fluid reservoir cap stopper plate screw	1 N·m (0.12 kgf·m , 0.9 lbf·ft)	
Clutch fluid reservoir mounting screw	1 N·m (0.15 kgf·m , 1.1 lbf·ft)	Apply locking agent to the threads
Clutch lever pivot nut	6 N·m (0.6 kgf·m , 4.3 lbf·ft)	
Clutch hose oil bolt	34 N·m (3.5 kgf·m , 25 lbf·ft)	
Clutch bolt	12 N·m (1.2 kgf·m , 9 lbf·ft)	
Clutch center lock nut	127 N·m (13.0 kgf·m , 94 lbf·ft)	Apply oil to the threads and seating surface and stake
Oil pump driven sprocket bolt	15 N·m (1.5 kgf·m , 11 lbf·ft)	Apply locking agent to the threads
Gearshift cam bolt	23 N·m (2.3 kgf·m , 17 lbf·ft)	Apply locking agent to the threads
Primary drive gear bolt	88 N·m (9.0 kgf·m , 65 lbf·ft)	Apply oil to the threads and seating surface

TOOLS

Snap ring pliers	07914-3230001
Clutch center holder	07724-0050002
Driver	07749-0010000
Attachment, 32 × 35 mm	07746-0010100
Pilot, 17 mm	07746-0040400
Attachment, 37 × 40 mm	07746-0010200
Attachment, 42 × 47 mm	07746-0010300
Gear holder	07724-0010100

TROUBLESHOOTING

Clutch lever too hard

- Sticking piston (s)
- Clogged hydraulic system

Clutch slips

- Sticking piston (s)
- Clogged hydraulic system
- Discs worn
- Weak clutch spring

Clutch will not disengage or motorcycle creeps with clutch disengaged

- Air in hydraulic system
- Low clutch fluid level
- Sticking piston (s)
- Leaking hydraulic system
- Warped plates
- Oil level too high, improper oil viscosity or oil additive used.

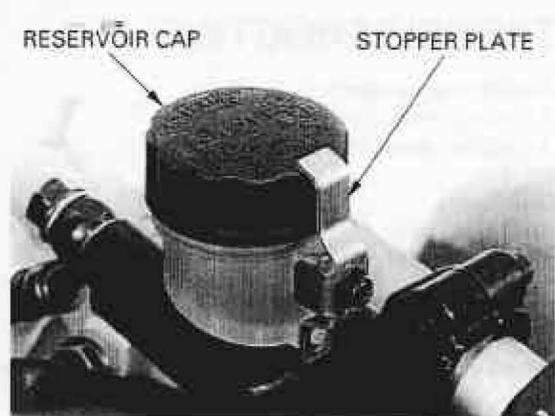
CLUTCH FLUID REPLACEMENT/AIR BLEEDING

CAUTION:

- *Do not allow foreign material to enter the system when filling the reservoir.*
- *Avoid spilling fluid on painted, plastic or rubber parts. Place a rag over these parts whenever the system is serviced.*

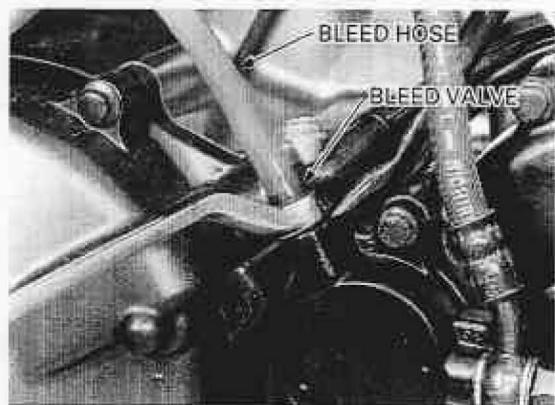
CLUTCH FLUID DRAINING

Turn the handlebar to the right until the reservoir is level, and remove the stopper plate, reservoir cap, set plate and diaphragm.



Connect a bleed hose to the clutch slave cylinder bleed valve.

Loosen the bleed valve and pump the clutch lever until no more fluid flows out of the bleed valve.



CLUTCH FLUID FILLING/BLEEDING

Fill the reservoir with DOT 4 brake fluid from a sealed container.

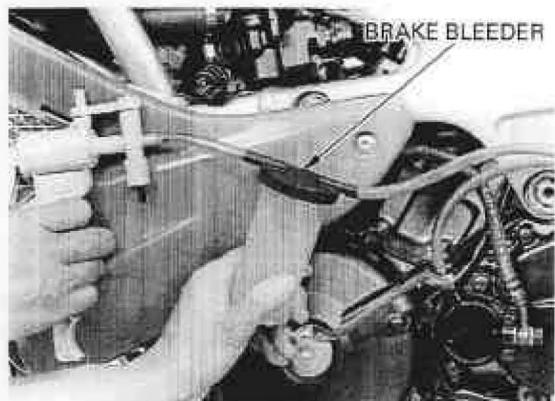
CAUTION:

- *Use only DOT 4 brake fluid from a sealed container.*
- *Do not mix different types of fluid. They are not compatible.*

Connect a commercially available brake bleeder to the bleed valve.

Loosen the bleed valve and pump the brake bleeder.

Add brake fluid when the fluid level in the reservoir is low.

**NOTE:**

- Check the fluid level often while bleeding the clutch to prevent air from being pumped into the system.
- When using a brake bleeding tool, follow the manufacturer's operating instructions.

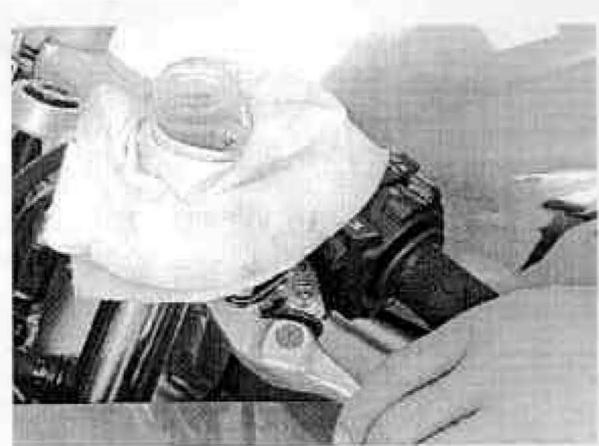
Repeat the above procedures until new fluid appears coming out of the bleed valve and air bubbles do not appear in the plastic hose.

NOTE:

If air is entering the bleeder from around the bleed valve threads, seal the threads with teflon tape.

If a brake bleeder is not available, use the following procedure:

Pump up the system pressure with the clutch lever until the lever resistance is felt.



Connect a bleed hose to the bleed valve and bleed the system as follows:

1. Squeeze the clutch lever, open the bleed valve 1/2 turn and then close it.

NOTE:

Do not release the clutch lever until the bleed valve has been closed.

2. Release the clutch lever slowly and wait several seconds after it reaches the end of its travel.

Repeat the steps 1 and 2 until air bubbles do not appear in the bleed hose.

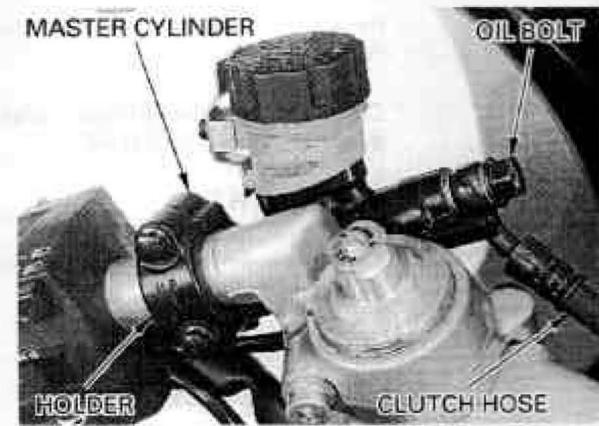
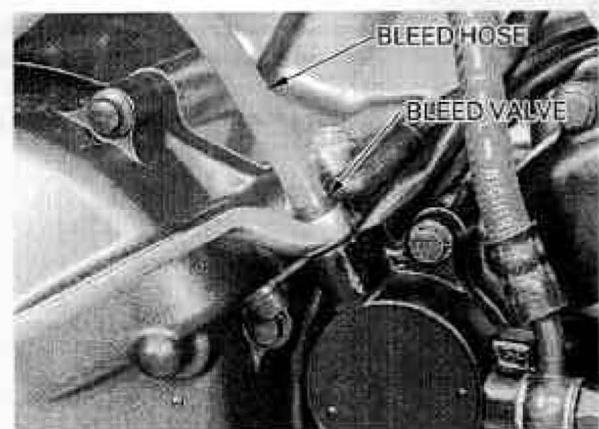
Tighten the bleed valve

TORQUE: 9 N·m (0.9 kgf·m, 6.5 lbf·ft)

Fill the reservoir to the upper level mark with DOT 4 brake fluid from a sealed container.

Install the diaphragm, set plate, reservoir cap and stopper plate, and tighten the stopper plate screw.

TORQUE: 1 N·m (0.12 kgf·m, 0.9 lbf·ft)



CLUTCH MASTER CYLINDER

CAUTION:

- **Avoid spilling clutch fluid on painted, plastic, or rubber parts. Place a rag over these parts whenever the system is serviced.**
- **When removing the oil bolt, cover the end of the hose to prevent contamination.**

DISASSEMBLY

Drain the clutch fluid from the hydraulic system (page 9-4).

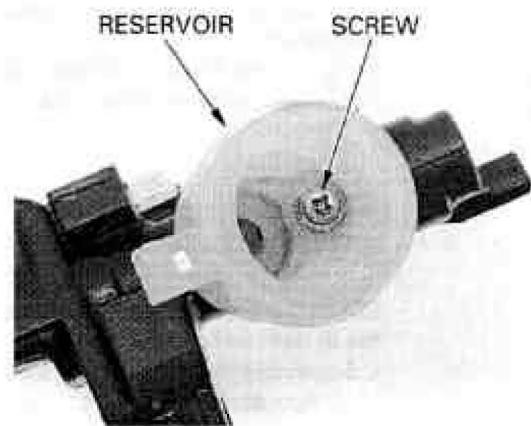
Disconnect the clutch switch connectors.

Disconnect the clutch hose from the master cylinder by removing the oil bolt and sealing washers.

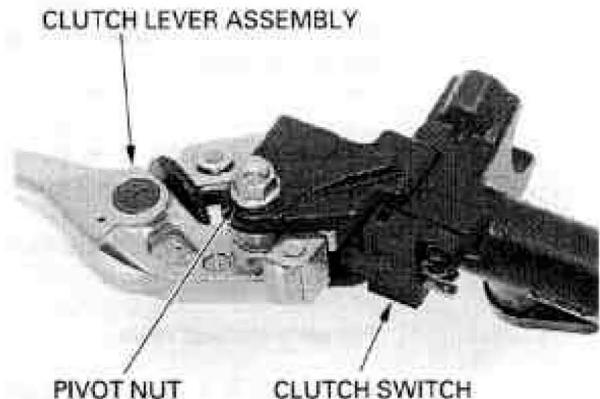
Remove the master cylinder holder bolts, holder and the master cylinder.

CLUTCH/GEARSHIFT LINKAGE

Remove the screw, fluid reservoir and O-rings from the master cylinder.



Remove the screw and clutch switch.
Remove the pivot nut, bolt and clutch lever assembly.
Remove the push rod and piston boot.

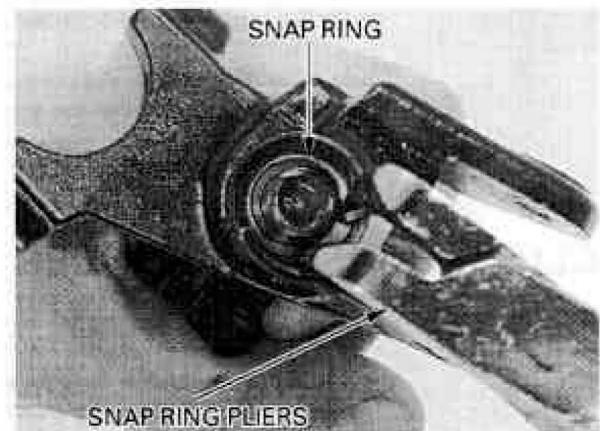


Remove the snap ring with the special tool.

TOOL:

Snap ring pliers

07914-3230001



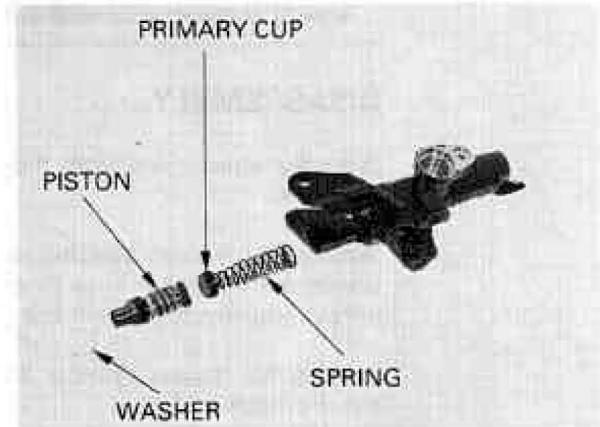
Remove the washer, master piston, primary cup and spring.

Clean the master cylinder, reservoir and master piston in clean clutch fluid.

INSPECTION

Check the piston cups for wear, deterioration or damage.

Check the spring for damage.



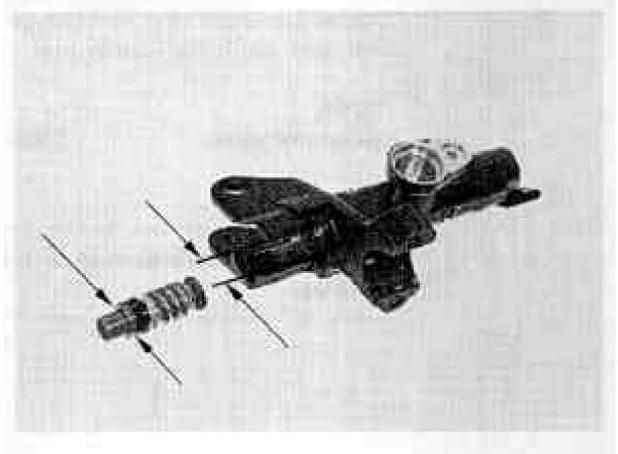
Check the master cylinder and piston for scoring or damage.

Measure the master cylinder I.D.

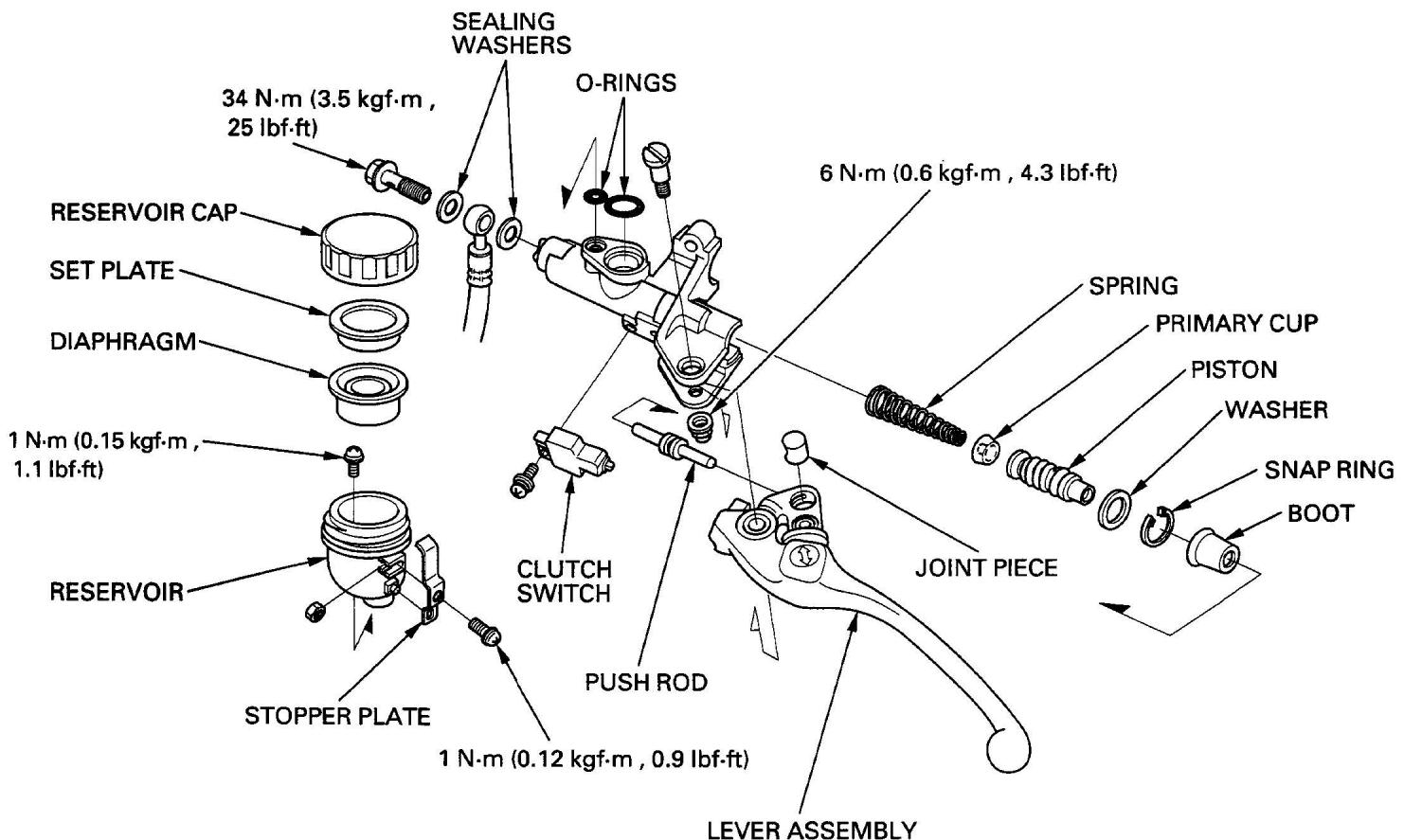
SERVICE LIMIT: 14.055 mm (0.5533 in)

Measure the master piston O.D.

SERVICE LIMIT: 13.945 mm (0.5490 in)



ASSEMBLY



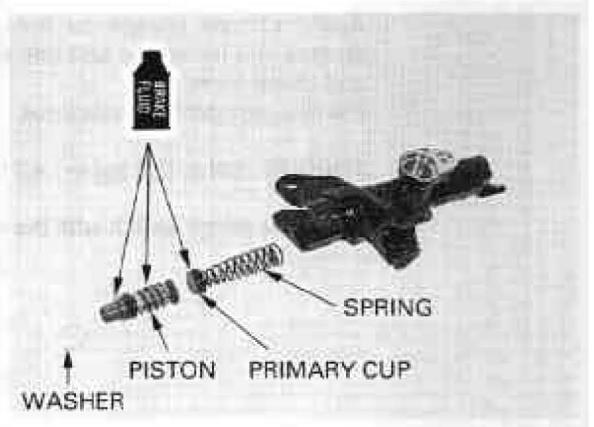
Coat the master piston and piston cups with clean clutch fluid.

Install the spring onto the primary cup.

Install the spring, primary cup, master piston and washer into the master cylinder.

CAUTION:

Do not allow the piston cup lips to turn inside out.



CLUTCH/GEARSHIFT LINKAGE

Install the snap ring into the groove in the master cylinder, using the special tool.

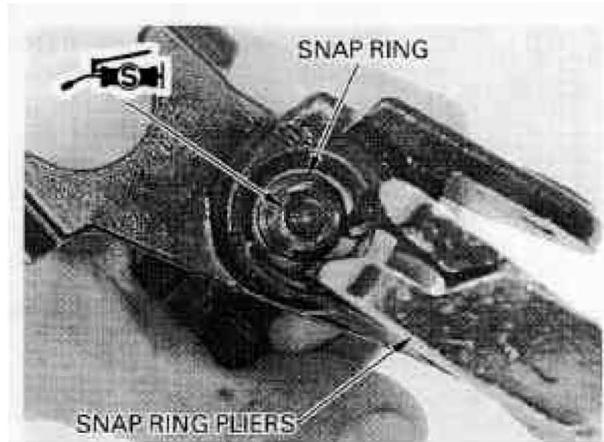
TOOL:

Snap ring pliers

07914-3230001

CAUTION:

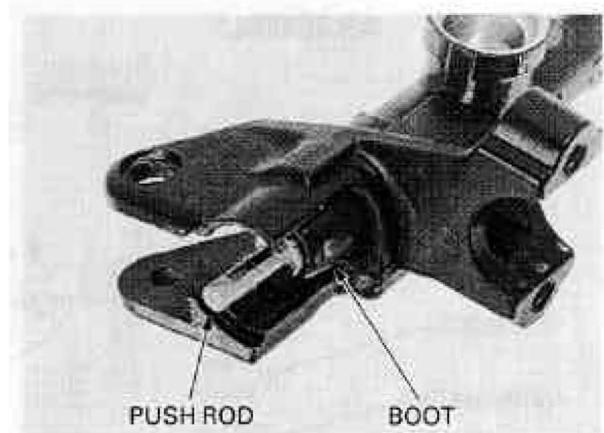
Be certain the snap ring is firmly seated in the groove.



Apply silicone grease to the push rod contacting area of the master piston.

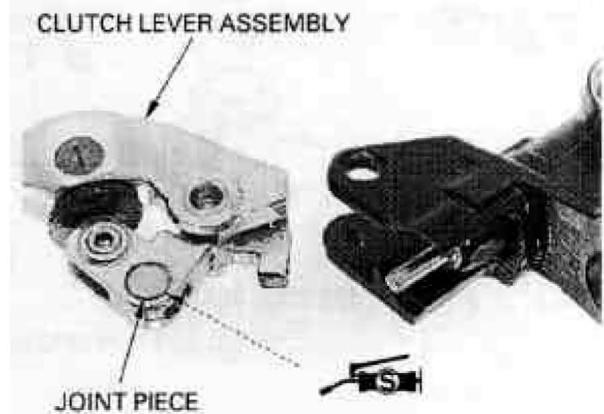
Install the boot onto the push rod.

Install the boot and push rod into the master cylinder.



Apply silicone grease to the push rod hole in the clutch lever joint piece.

Insert the push rod into the hole in the joint piece and install the clutch lever assembly onto the master cylinder.

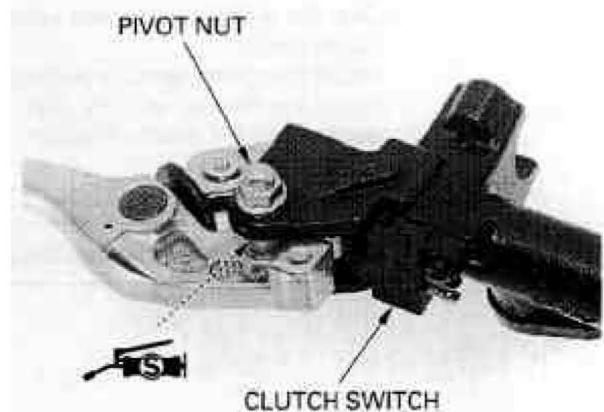


Apply silicone grease to the pivot bolt sliding surface and install the bolt into the master cylinder and clutch lever.

Install and tighten the pivot nut.

TORQUE: 6 N·m (0.6 kgf·m , 4.3 lbf·ft)

Install the clutch switch with the screw.



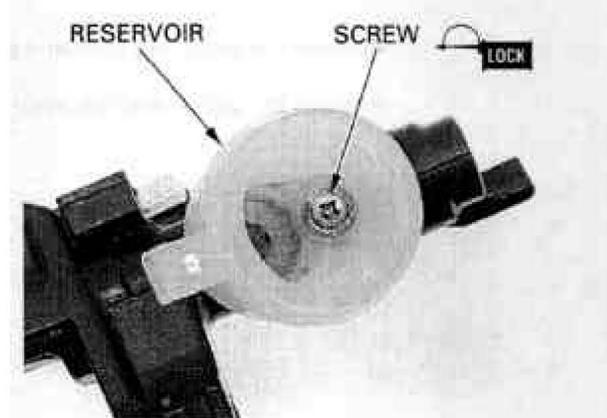
Coat new O-rings with clutch fluid and install them onto the master cylinder.



Apply locking agent to the reservoir mounting screw threads.

Install the reservoir and tighten the mounting screw.

TORQUE: 1 N·m (0.15 kgf·m , 1.1 lbf·ft)



Install the master cylinder and holder with the "UP" mark facing up.

Align the end of the master cylinder with the punch mark on the handlebar, and tighten the upper bolt first, then tighten the lower bolt.



Connect the clutch hose to the master cylinder with the oil bolt and new sealing washers, and tighten the oil bolt.

TORQUE: 34 N·m (3.5 kgf·m , 25 lbf·ft)

Connect the clutch switch connectors.

Fill and bleed the clutch hydraulic system (page 9-4).



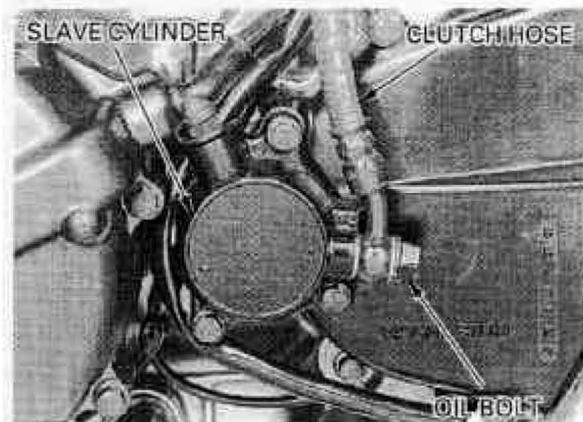
CLUTCH SLAVE CYLINDER DISASSEMBLY

Drain the clutch fluid from the hydraulic system (page 9-4).

Disconnect the clutch hose from the slave cylinder by removing the oil bolt and sealing washers.

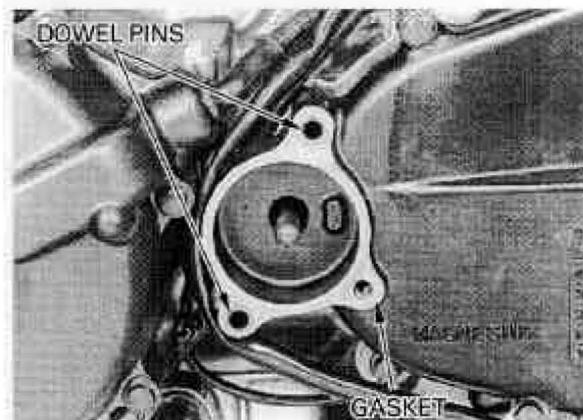
CAUTION:

Avoid spilling clutch fluid on painted, plastic, or rubber parts. Place a rag over these parts whenever the system is serviced.



Remove the mounting bolts and slave cylinder.

Remove the gasket and dowel pins.



Remove the piston from the slave cylinder. If piston removal is hard, place a shop towel over the piston, position the cylinder body with the piston down and apply small squirts of air pressure to the fluid inlet.

WARNING

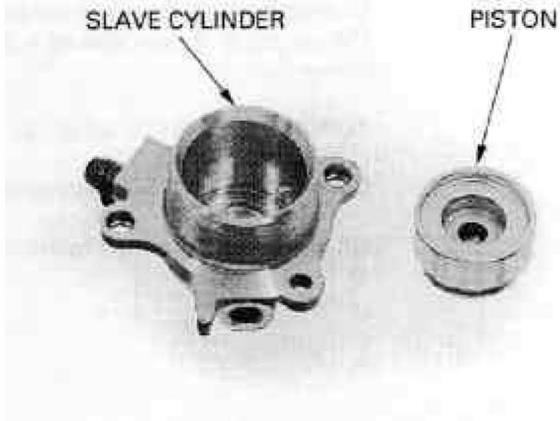
Do not use high pressure air or bring the nozzle too close to the inlet.



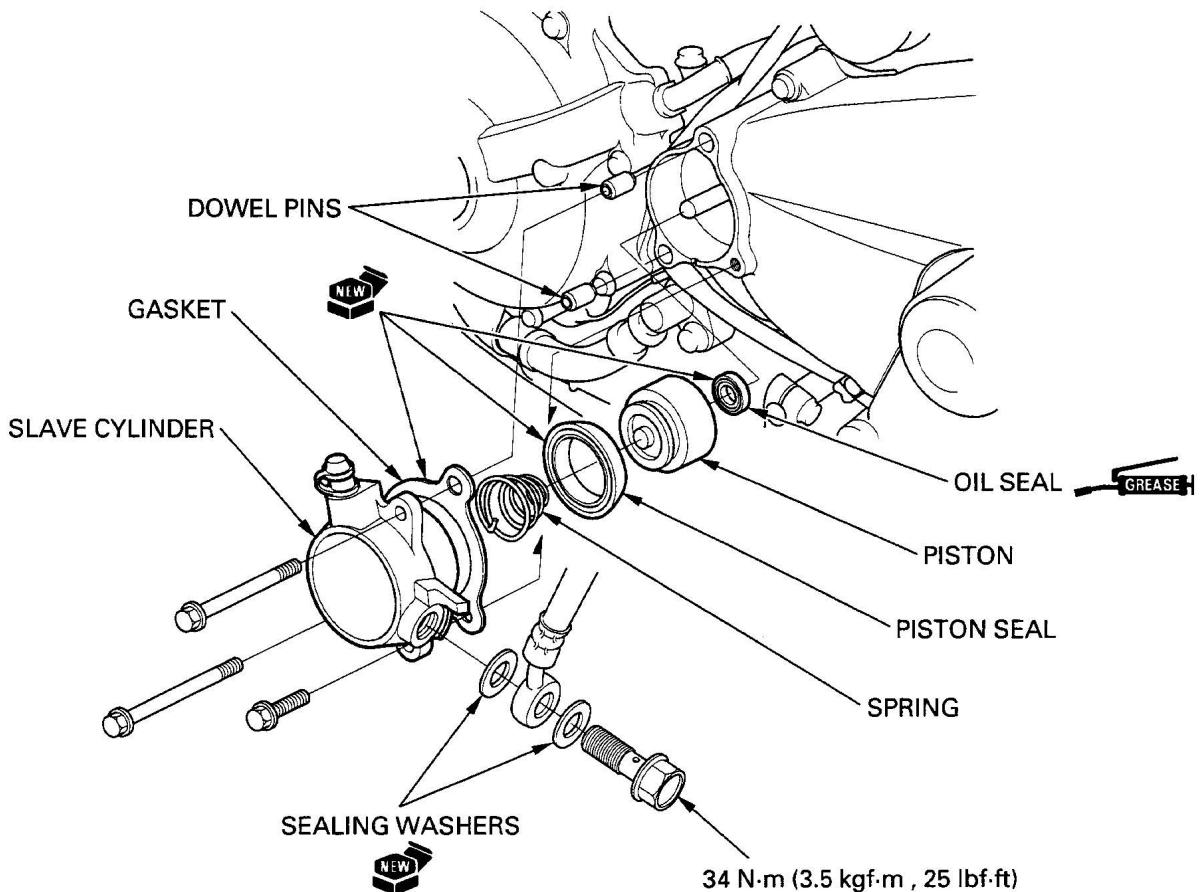
Remove the spring, piston seal and oil seal from the piston.

INSPECTION

Check the piston spring for weakness or damage. Check the slave cylinder and piston for scoring or damage.



ASSEMBLY



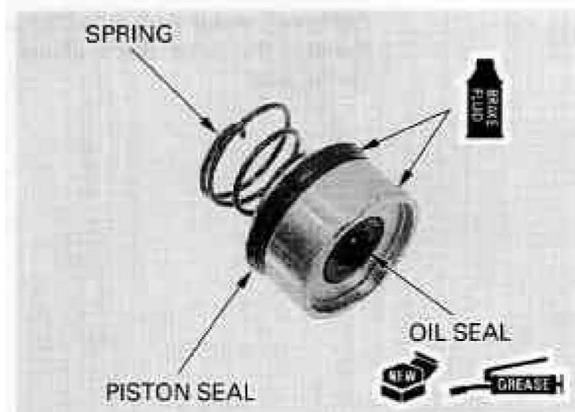
Apply small amount of silicone grease to the lifter rod contacting area of the piston.

Apply grease to new oil seal lips and install the oil seal into the piston.

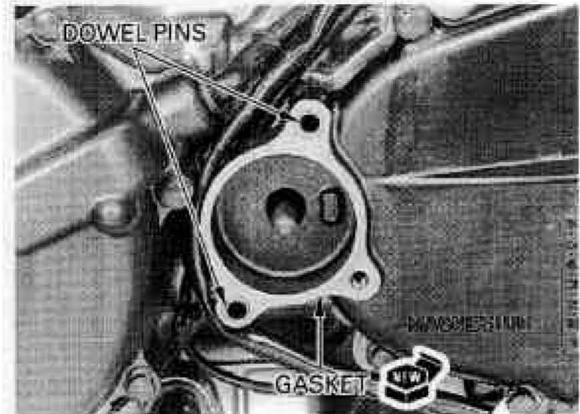
Install a new piston seal into the piston groove.

Install the piston spring onto the piston.

Coat the piston and piston seal with clutch fluid and install piston and spring into the slave cylinder.



Install the dowel pins and a new gasket.



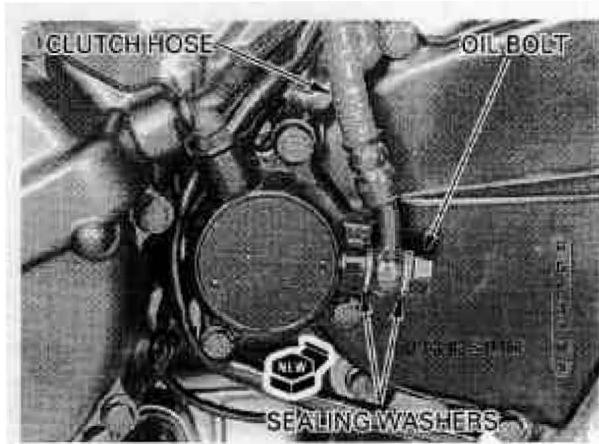
Install the slave cylinder and tighten the mounting bolts securely.

Connect the clutch hose to the slave cylinder with the oil bolt and new sealing washers.

Tighten the oil bolt.

TOQUE: 34 N·m (3.5 kgf·m , 25 lbf·ft)

Fill and bleed the clutch hydraulic system (page 9-4).



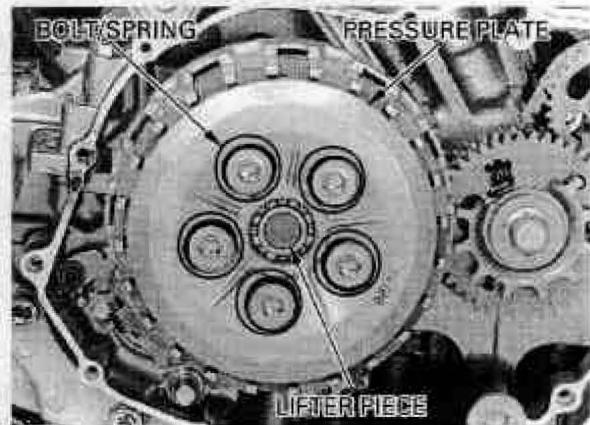
CLUTCH

DISASSEMBLY

Remove the right crankcase cover (page 6-12).

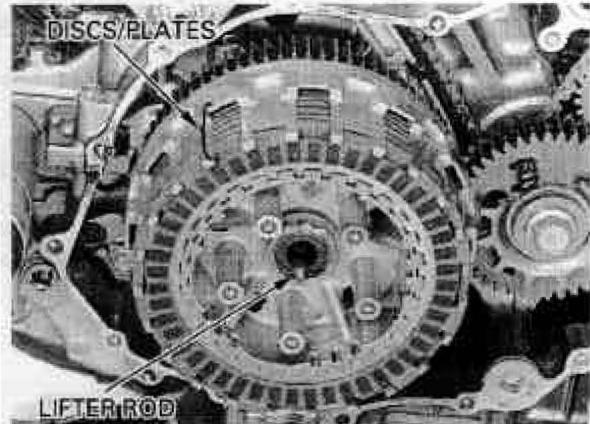
Remove the clutch bolts, springs and pressure plate.

Remove the clutch lifter piece.



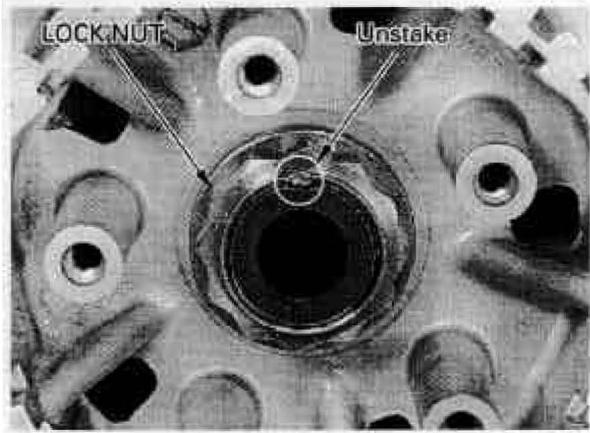
Remove the clutch lifter rod from the mainshaft.

Remove the clutch discs, plates, judder spring and spring seat.



Be careful not to Unstake the clutch center lock nut.

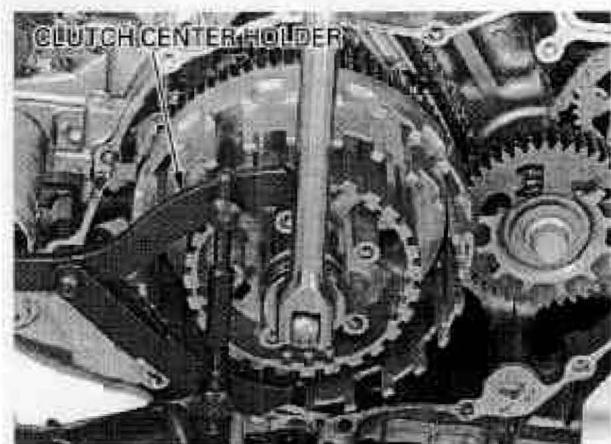
*damage the
mainshaft
threads.*



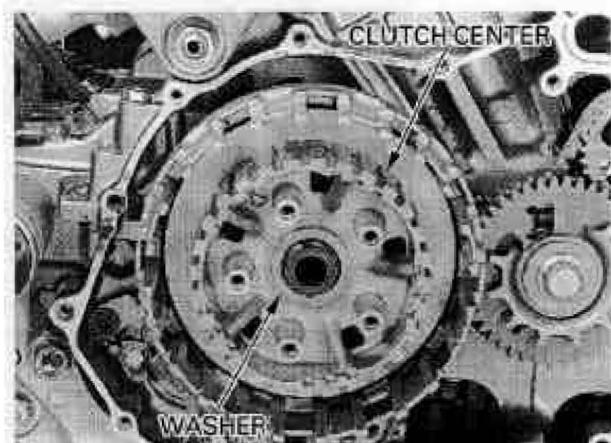
Hold the clutch center with the special tool and remove the clutch center lock nut.

TOOL:**Clutch center holder**

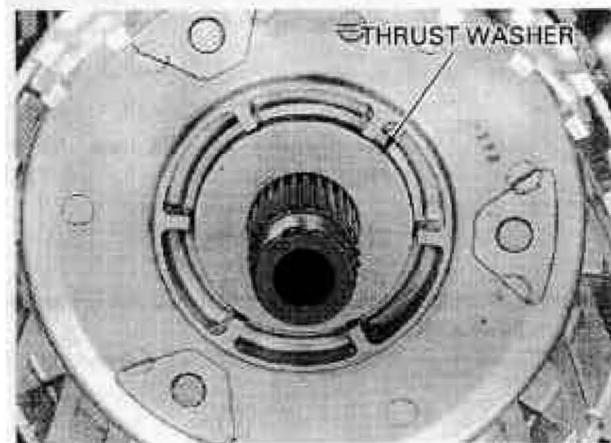
07724-0050002



Remove the special washer and clutch center.

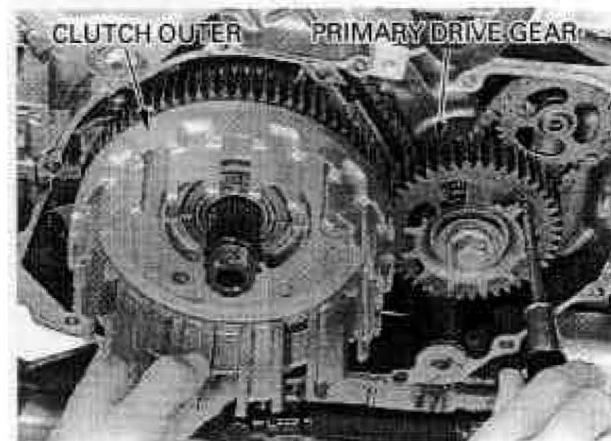


Remove the thrust washer.



When the oil pump driven sprocket will be removed, loosen the driven sprocket bolt with the clutch outer still installed.

Align the gear teeth of the scissors gears (primary drive gear and sub-gear) by inserting a screwdriver into the gear holes, and remove the clutch outer.

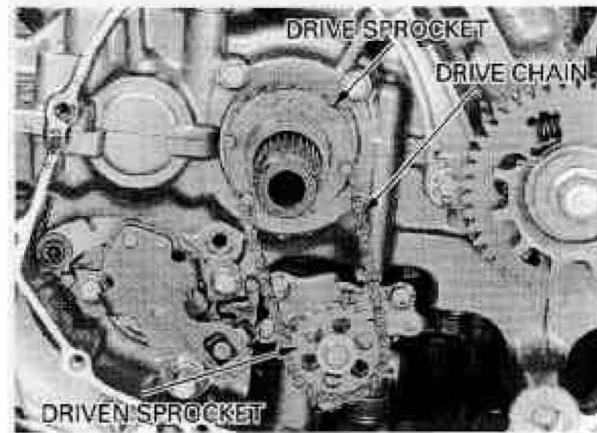


CLUTCH/GEARSHIFT LINKAGE

Remove the oil pump driven sprocket bolt and washer.

Remove the oil pump driven sprocket, drive chain and drive sprocket as a set.

Remove the clutch outer guide.



INSPECTION

LIFTER BEARING

Turn the inner race of the lifter bearing with your finger.

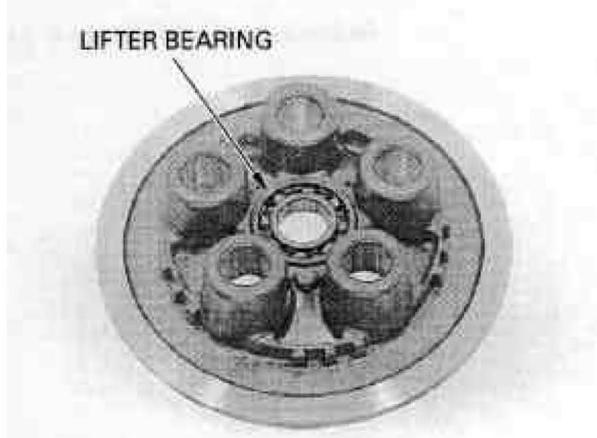
The bearing should turn smoothly and quietly.

Also check that the outer race of the bearing fits tightly in the pressure plate.

Replace the bearing if the inner race does not turn smoothly, quietly, or if the outer race fit loosely in the pressure plate.

Drive the bearing out of the pressure plate.

Drive a new bearing into the plate with its mark side facing out.



TOOLS:

Driver 07749-0010000

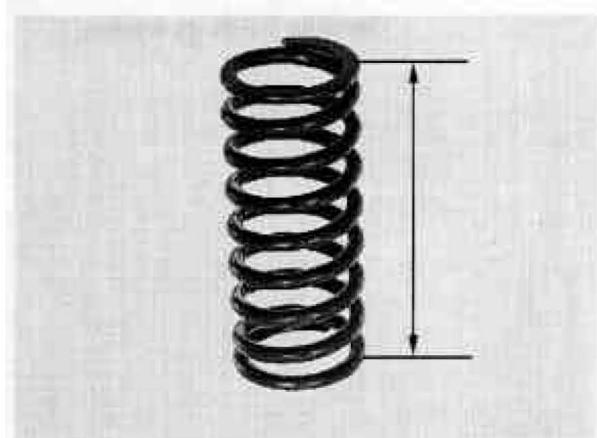
Attachment, 32 × 35 mm 07746-0010100

Pilot, 17 mm 07746-0040400

CLUTCH SPRING

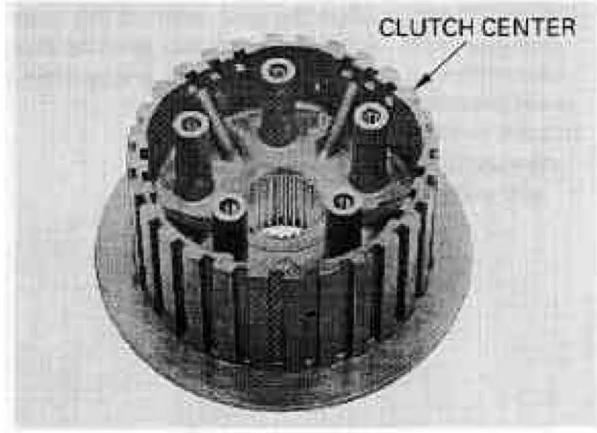
Replace the clutch springs as a set Measure the clutch spring free length.

SERVICE LIMIT: 46.6 mm (1.83 in)



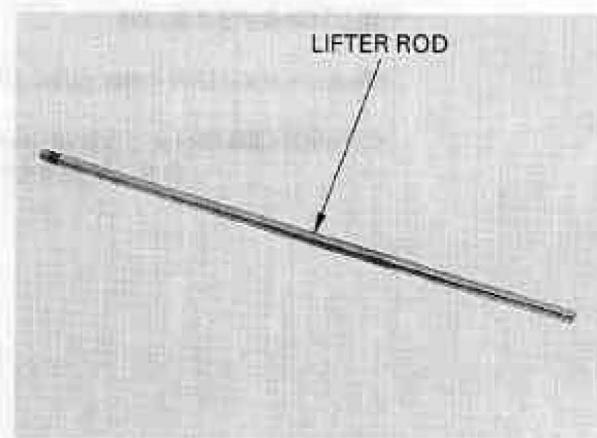
CLUTCH CENTER

Check the clutch center and pressure plate for nicks, indentations or abnormal wear made by the plates.



CLUTCH LIFTER ROD

Check the clutch lifter rod for bending or damage.

**CLUTCH DISC**

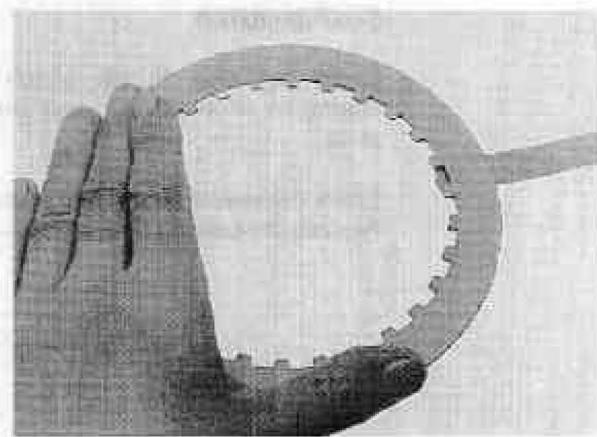
Replace the clutch discs and plates as a set. Check the clutch discs for signs of scoring or discoloration. Measure the clutch disc thickness.

SERVICE LIMIT: 3.5 mm (0.14 in)

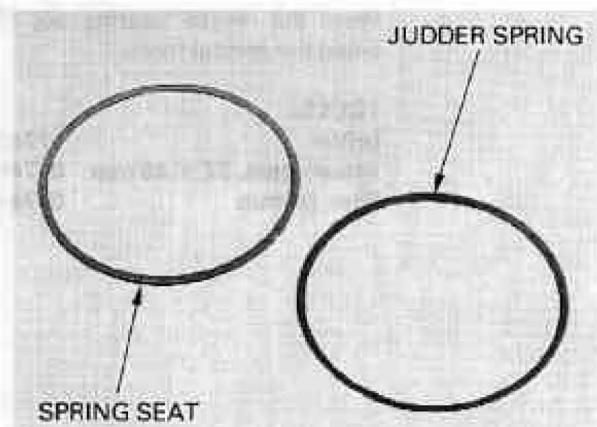
**CLUTCH PLATE**

Replace the clutch discs and plates as a set. Check the plates for discoloration. Check the plate warpage on a surface plate using a feeler gauge.

SERVICE LIMIT: 0.30 mm (0.012 in)

**JUDDER SPRING, SPRING SEAT**

Check the judder spring and spring seat for distortion, wear or damage.

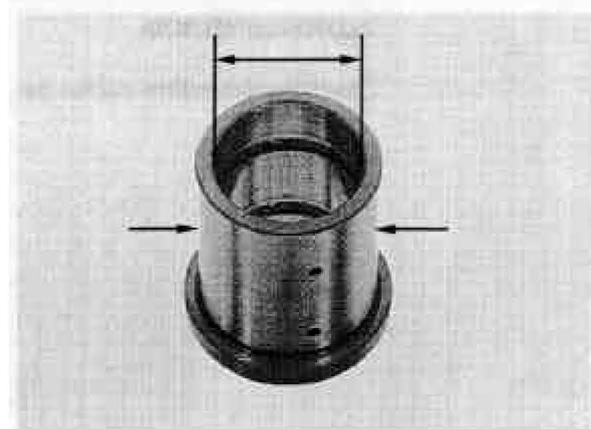


CLUTCH/GEARSHIFT LINKAGE

CLUTCH OUTER GUIDE

Measure the clutch outer guide I.D. and O.D.

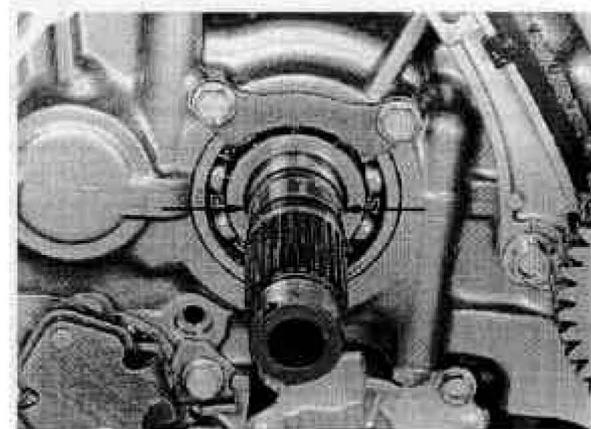
SERVICE LIMITS: I.D. : 28.031 mm (1.1036 in)
O.D. : 34.965 mm (1.3766 in)



MAINSHAFT

Measure the mainshaft O.D. at the clutch outer guide.

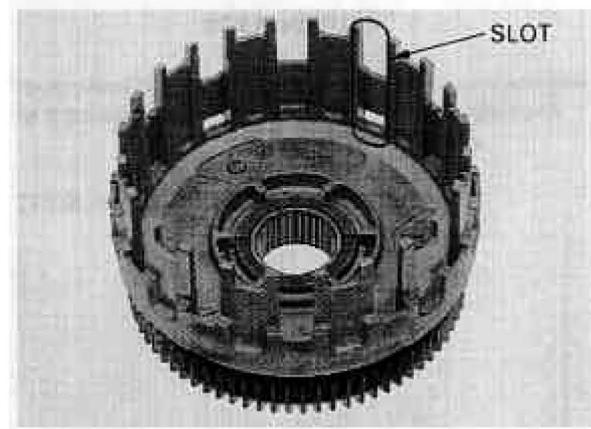
SERVICE LIMIT: 27.970 mm (1.1012 in)



CLUTCH OUTER

Check the slots in the clutch outer for nicks, indentation or abnormal wear made by the clutch discs.

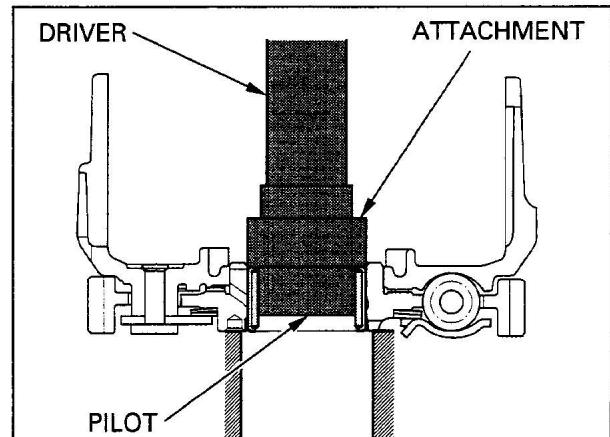
Check the needle bearing for wear or damage.
Replace the bearing if necessary.



Press the needle bearing out of the clutch outer using the special tools.

TOOLS:

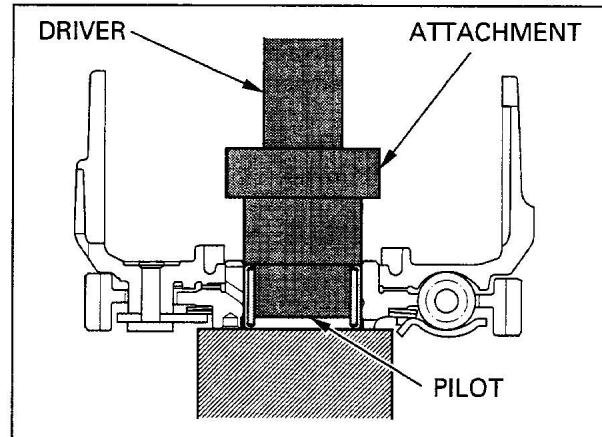
Driver	07749-0010000
Attachment, 37 × 40 mm	07746-0010200
Pilot, 35 mm	07746-0040800



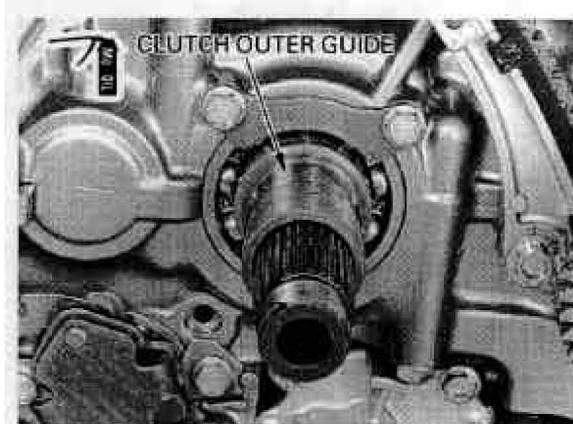
Press in the bearing with the marking side facing up. Press the needle bearing in the clutch outer until it is flush with the inner edge of the clutch outer, using the special tools.

TOOLS:

Driver	07749-0010000
Attachment, 42 × 47 mm	07746-0010300
Pilot, 35 mm	07746-0040800

**ASSEMBLY**

Coat the clutch outer guide with molybdenum oil solution and install it onto the mainshaft with the flange side facing the crankcase.

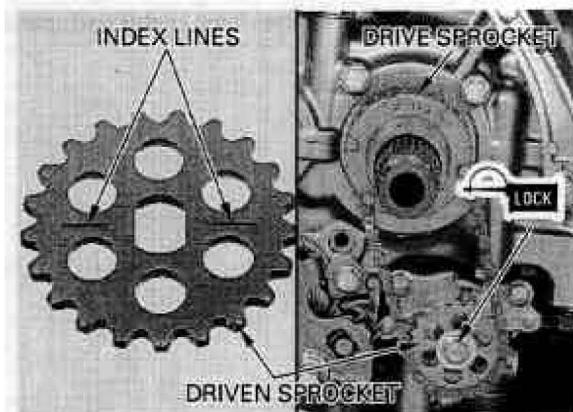


Install the oil pump drive sprocket, drive chain and driven sprocket as a set with the index lines on the driven sprocket facing in.

Apply locking agent to the oil pump driven sprocket bolt threads and install the washer and bolt.

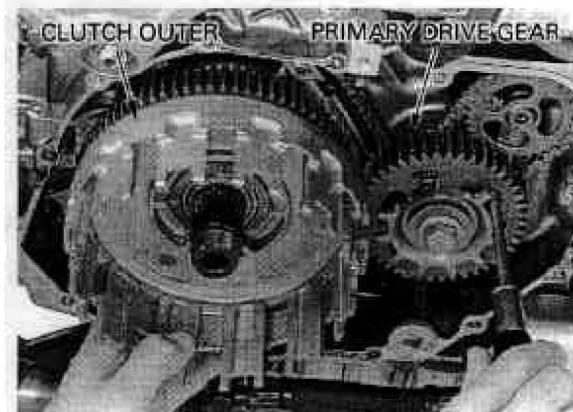
NOTE:

Tighten the driven sprocket bolt to the specified torque after installing the clutch outer.



Apply molybdenum oil solution to the clutch outer needle bearing.

Align the gear teeth of the scissors gears (primary drive gear and sub-gear) by inserting a screwdriver into the gear holes, and install the clutch outer.

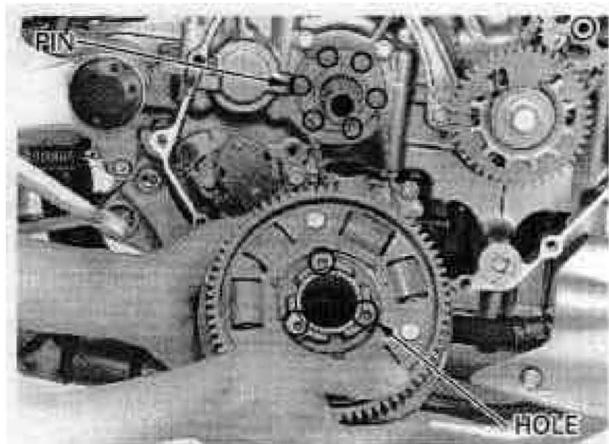


CLUTCH/GEARSHIFT LINKAGE

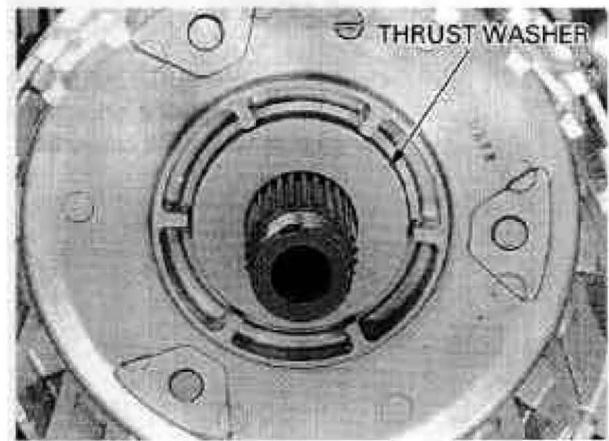
Align the holes in the clutch outer with the pins on the oil pump drive sprocket by turning the oil pump driven sprocket while pushing in the clutch outer.

Tighten the oil pump driven sprocket bolt if it was removed.

TORQUE: 15 N·m (1.5 kgf·m , 11 lbf·ft)



Install the thrust washer.



Install the clutch center and special washer.



Apply oil to the threads and seating surface of a new clutch center lock nut and install it onto the mainshaft.

Hold the clutch center with the special tool and tighten the lock nut.

TOOL:

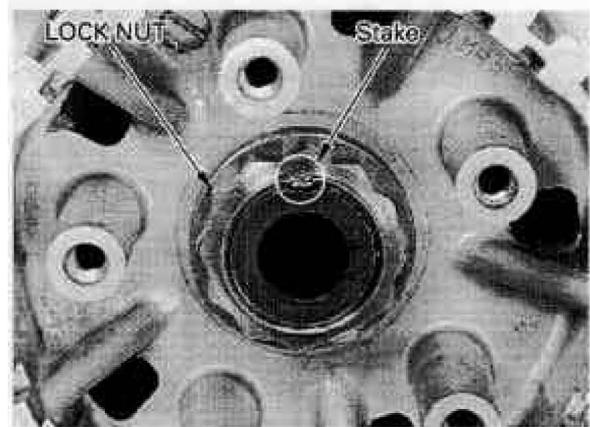
Clutch center holder 07724-0050002

TORQUE: 127 N·m (13.0 kgf·m , 94 lbf·ft)



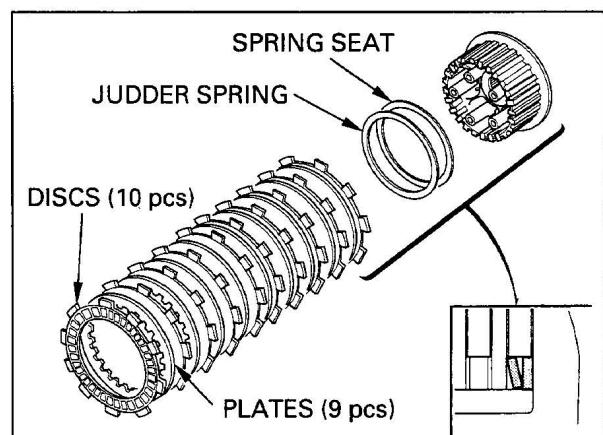
Be careful not to damage the mainshaft threads.

Stake the clutch center lock nut into the mainshaft groove.



Install the spring seat and judder spring, with the concaved side facing out, onto the clutch center.

Coat the clutch discs with clean engine oil.
Install the ten clutch discs and nine plates alternately, starting with the disc.

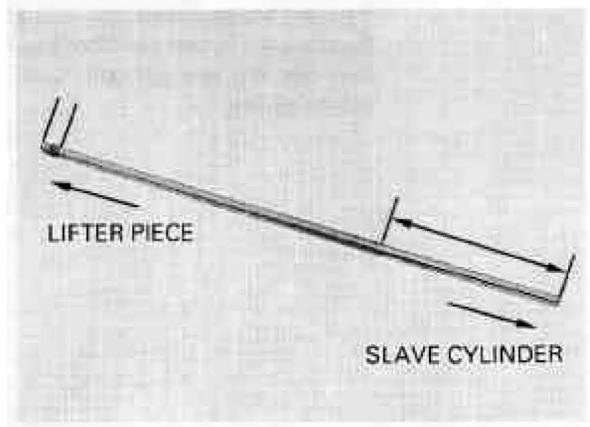


NOTE:

Install the outside clutch disc tabs into the shallow slots of the clutch outer.



Note the clutch lifter rod installation direction and install it into the mainshaft.



CLUTCH/GEARSHIFT LINKAGE

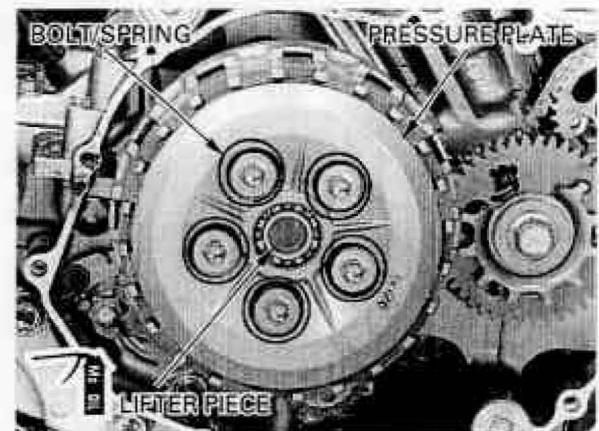
Coat the clutch lifter piece with molybdenum oil solution.

Install the clutch lifter piece and pressure plate.

Install the clutch springs and clutch bolts, and tighten the bolts.

TORQUE: 12 N·m (1.2 kgf·m , 9 lbf·ft)

Install the right crankcase cover (page 6-14).

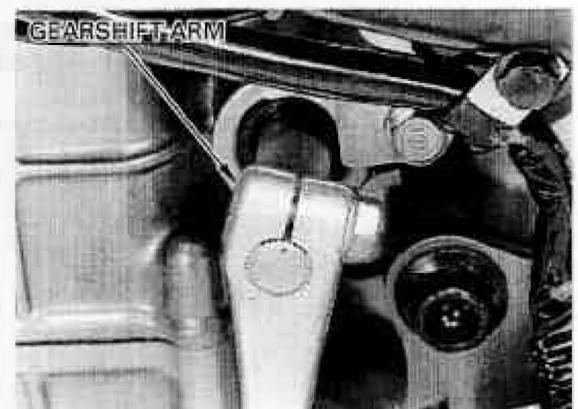


GEARSHIFT LINKAGE

REMOVAL

Disassemble the clutch to the clutch outer (page 9-12).

Remove the gearshift arm.



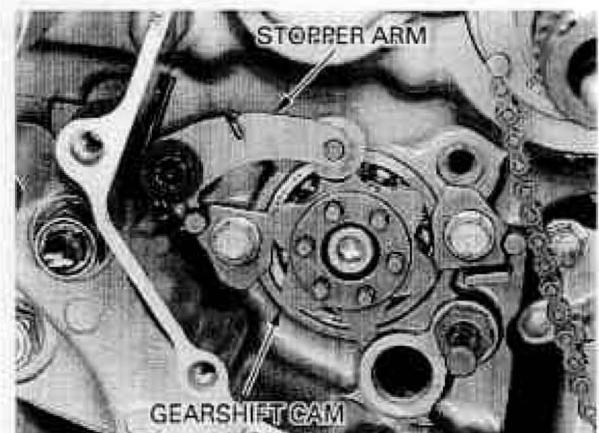
Remove the gearshift spindle assembly and thrust washer.



Remove the gearshift cam bolt and gearshift cam.

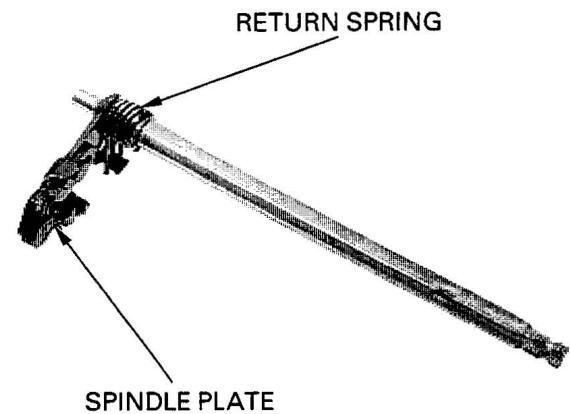
Remove the dowel pin from the shift drum.

Remove the stopper arm bolt, arm, washer and return spring.



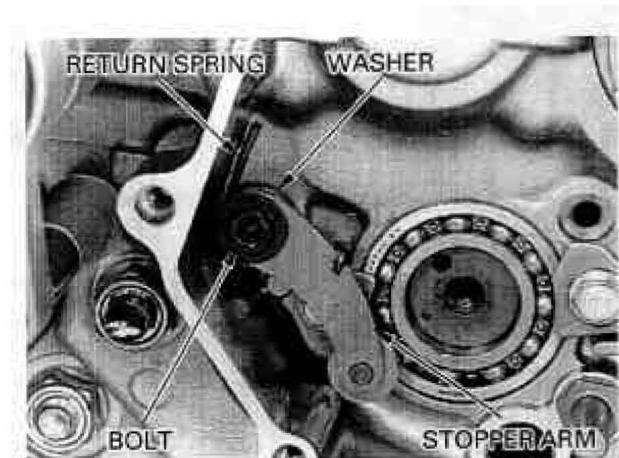
INSPECTION

Check the gearshift spindle for bending.
 Check the spindle plate for wear or damage.
 Check the spindle return spring for fatigue or damage.

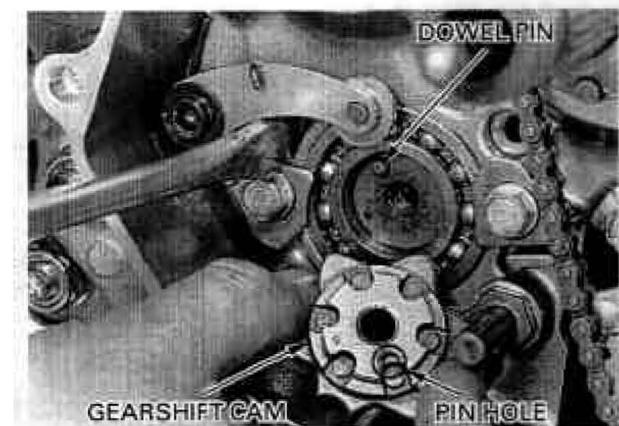


INSTALLATION

Install the washer, return spring, stopper arm and bolt, and tighten the bolt.



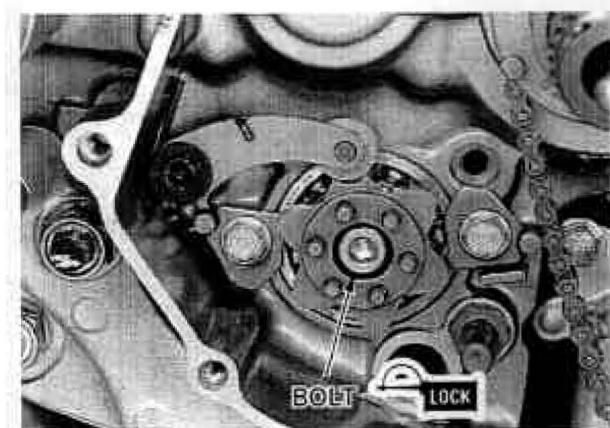
Install the dowel pin into the shift drum.
 Lift the stopper arm with a screwdriver and install the gearshift cam by aligning the pin hole in the cam with the dowel pin.



Apply locking agent to the gearshift cam bolt threads.

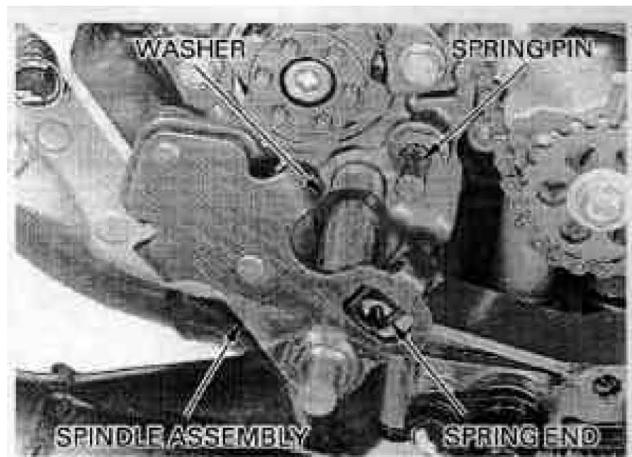
Install and tighten the bolt.

TORQUE: 23 N·m (2.3 kgf·m , 17 lbf·ft)



CLUTCH/GEARSHIFT LINKAGE

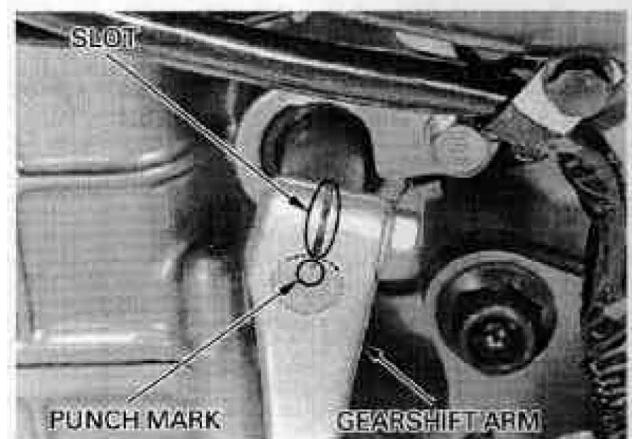
Install the thrust washer onto the gearshift spindle, and insert the spindle into the crankcase, aligning the return spring ends with the spring pin.



Install the gearshift arm onto the spindle, aligning the slit of the arm with the punch mark on the spindle.

Tighten the gearshift arm bolt securely.

Assemble the clutch (page 9-17).



PRIMARY DRIVE GEAR REMOVAL

Disassemble the clutch to the clutch center thrust washer (page 9-12).

Install the special tool between the primary drive and driven gears as shown, loosen the primary drive gear bolt, and remove the bolt and special washer.

TOOL:

Gear holder

07724-0010100

Remove the clutch outer (page 9-13).

Remove the ignition pulse generator rotor and primary drive gear assembly.



Remove the water pump driven sprocket and drive chain.

INSTALLATION

Apply molybdenum oil solution to the water pump driven sprocket shaft.

Install the water pump drive chain over the drive and driven sprockets.

Install the driven sprocket shaft into the crankcase.

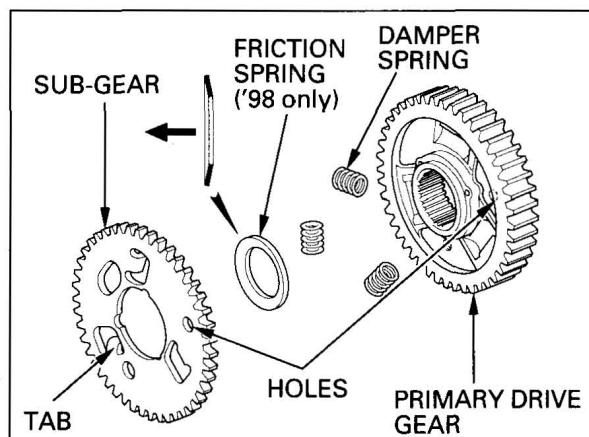


Install the damper springs into the primary drive gear grooves.

NEW '98 only Install the friction spring onto the primary drive gear with the concaved side toward the sub-gear.

Apply molybdenum disulfide grease to the primary drive gear and sub-gear sliding surfaces.

Install the sub-gear onto the primary drive gear boss so that the sub-gear tabs are positioned against the damper spring and holes are aligned.



Install the primary drive gear assembly and ignition pulse generator rotor by aligning the wide grooves with the wide tooth.



Apply oil to the threads and seating surface of the primary drive gear bolt.

Install the special washer and primary drive gear bolt.

Install the clutch outer (page 9-17).

Install the special tool between the primary drive and driven gears as shown and tighten the primary drive gear bolt.

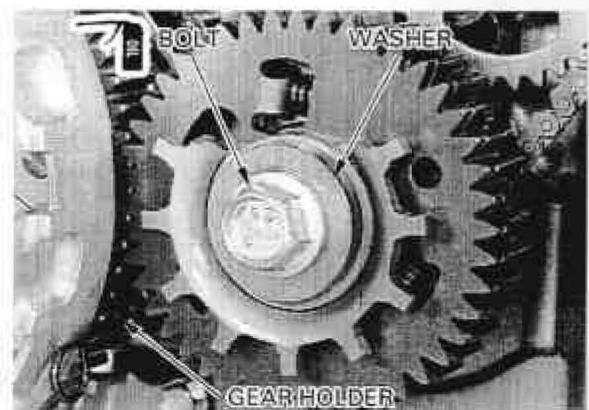
TOOL:

Gear holder

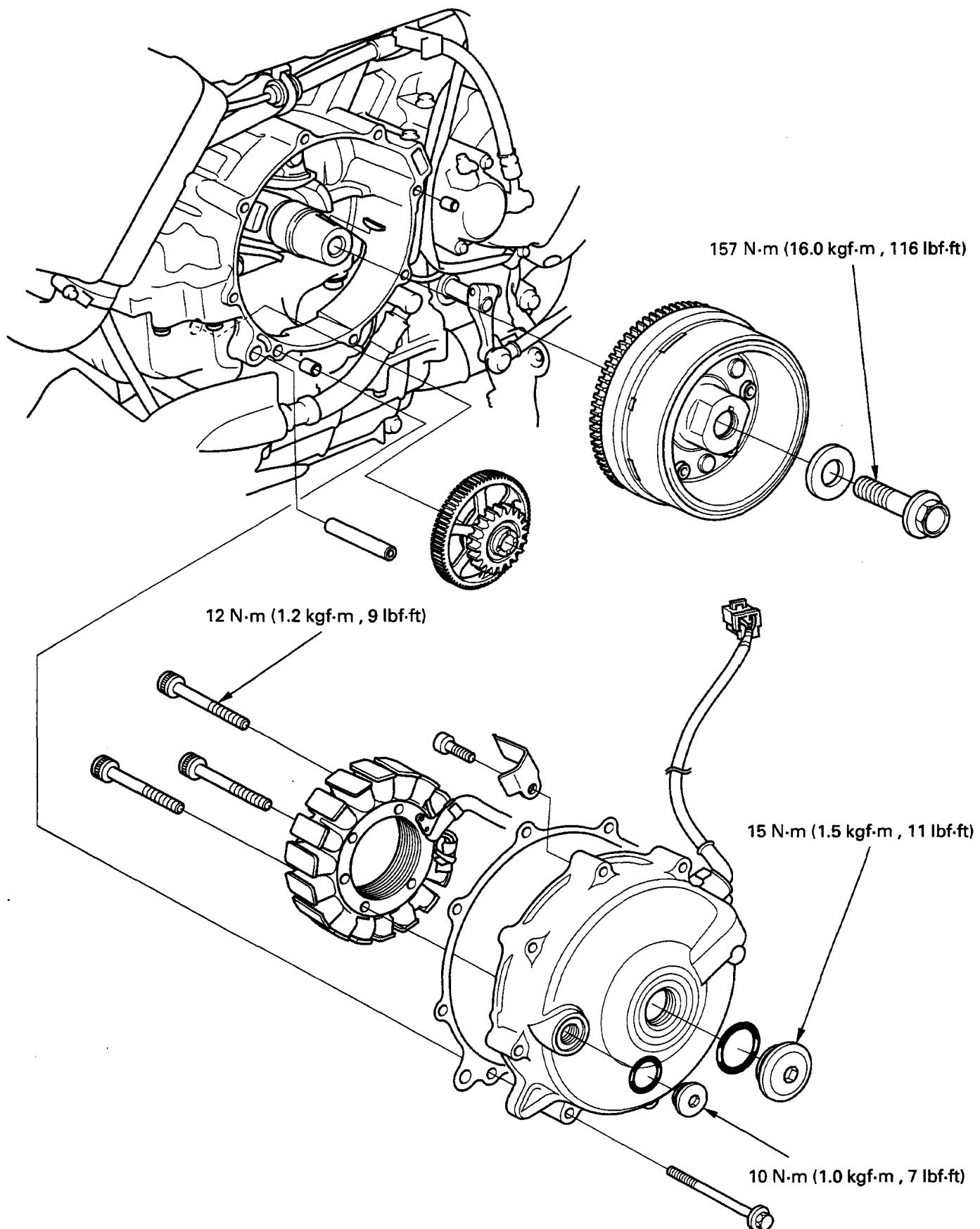
07724-0010100

TORQUE: 88 N·m (9.0 kgf·m, 65 lbf·ft)

Assemble the clutch (page 9-17).



ALTERNATOR/STARTER CLUTCH



10. ALTERNATOR/STARTER CLUCH

SERVICE INFORMATION	10-1	FLYWHEEL REMOVAL	10-3
TROUBLESHOOTING	10-1	STARTER CLUTCH	10-4
ALTERNATOR STATOR	10-2	FLYWHEEL INSTALLATION	10-7

SERVICE INFORMATION

GENERAL

- This section covers service of the alternator stator, flywheel and starter clutch. These parts can be removed with the engine installed in the frame.
- The front cylinder cam sprockets must be removed to remove the starter reduction gear.
- Refer to section 16 for alternator stator inspection.
- Refer to section 18 for starter motor servicing.

SPECIFICATION

Unit: mm (in)

ITEM	STANDARD	SERVICE LIMIT
Starter driven gear boss O.D.	57.749 – 57.768 (2.2736 – 2.2743)	57.639 (2.2692)

10

TORQUE VALUES

Flywheel bolt	157 N·m (16.0 kgf·m , 116 lbf·ft)	Apply oil to the threads and seating surface.
Starter clutch bolt	23 N·m (2.3 kgf·m , 17 lbf·ft)	Apply locking agent to the threads.
Alternator stator bolt	12 N·m (1.2 kgf·m , 9 lbf·ft)	

TOOLS

Flywheel holder	07725-0040000
Rotor puller	07733-0020001

TROUBLESHOOTING

Engine does not turn

- Faulty starter clutch
- Damaged starter reduction gear

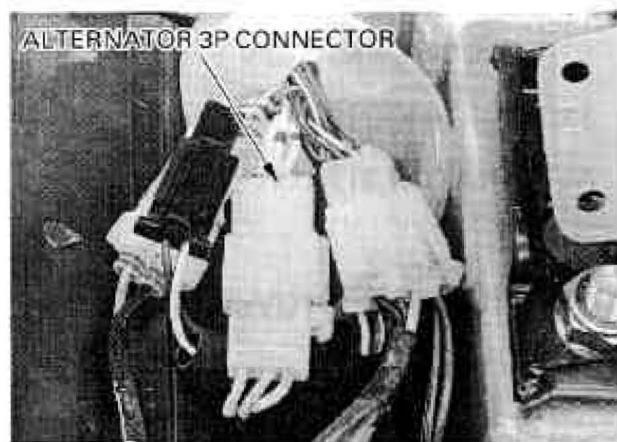
ALTERNATOR STATOR

LEFT CRANKCASE COVER REMOVAL

Remove the following:

- seat (page 2-2)
- front fairing (page 2-3)

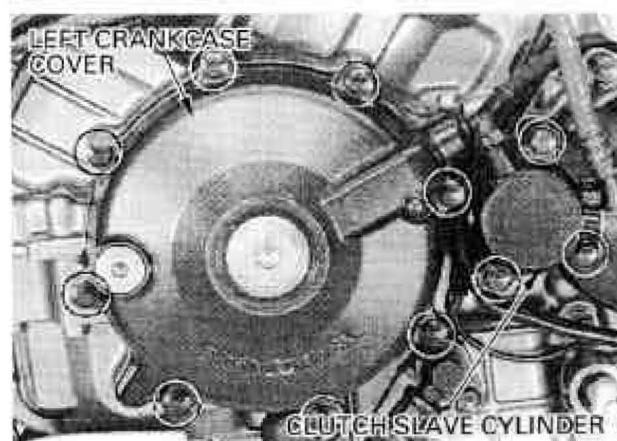
Disconnect the alternator 3P (white) connector.



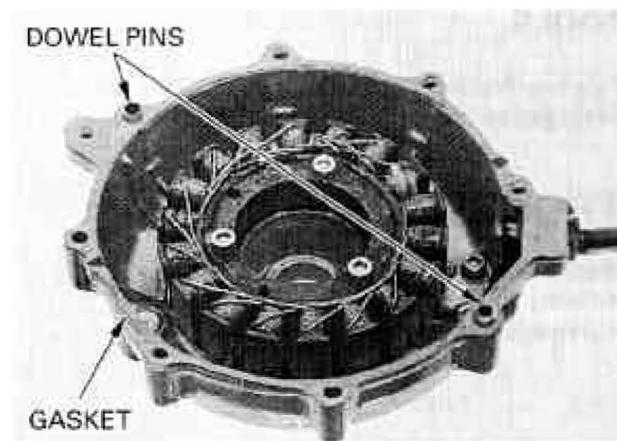
Remove the three bolts and clutch slave cylinder from the drive sprocket cover.

Remove the eight bolts and left crankcase cover.

Temporarily install the clutch slave cylinder.



Remove the dowel pins and gasket.

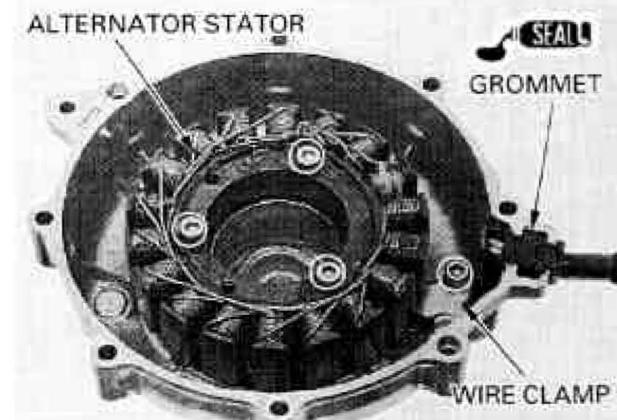


STATOR REPLACEMENT

Remove the four bolts, wire clamp, grommet and stator from the left crankcase cover.

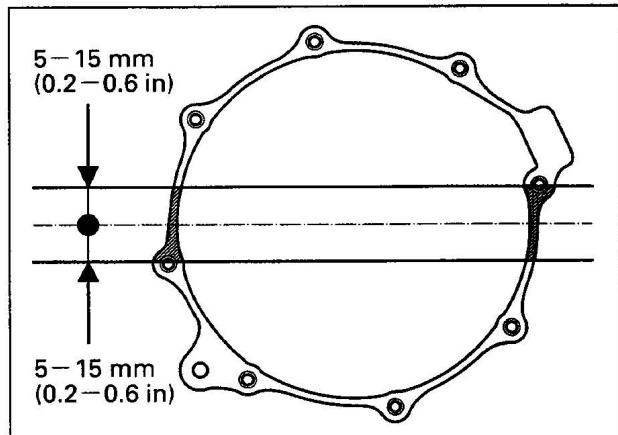
Install a new stator onto the left crankcase cover.
Apply sealant to the grommet seating surface and
install it into the cover groove properly.
Install the wire clamp.
Tighten the four bolts.

TORQUE: 12 N·m (1.2 kgf·m , 9 lbf·ft)

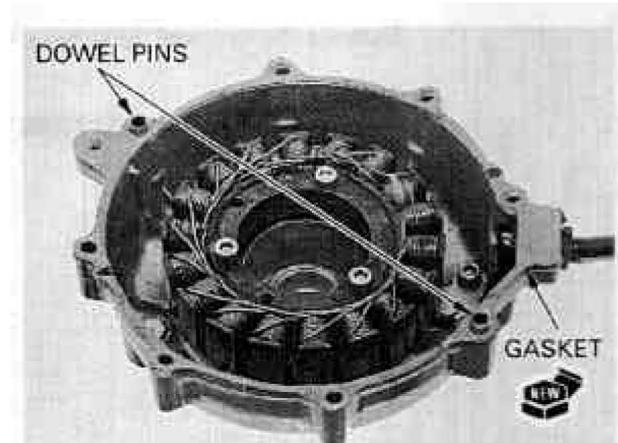


LEFT CRANKCASE COVER INSTALLATION

Apply sealant to the crankcase mating surfaces as shown.



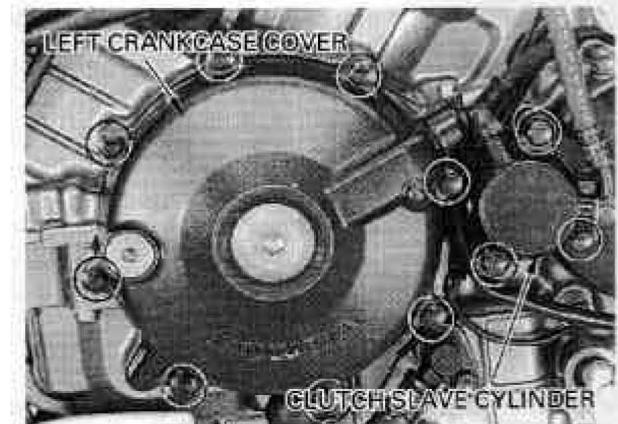
Install the dowel pins and a new gasket.



Remove the three bolts and clutch slave cylinder.

Install the left crankcase cover and tighten the eight bolts securely.

Reinstall the clutch slave cylinder and tighten the three bolts securely.



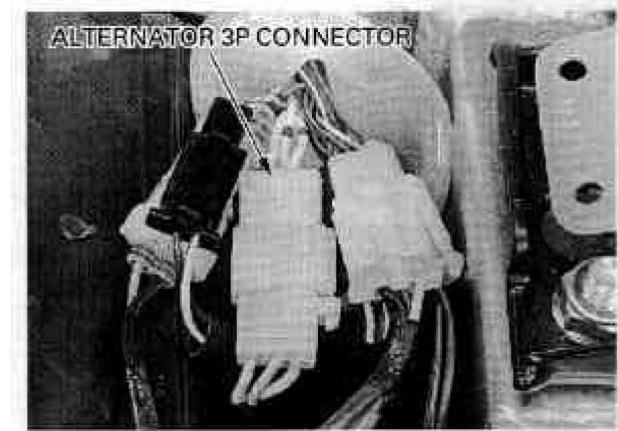
Route the alternator wire properly (page 1-21).

Connect the alternator 3P (white) connector.

Install the following:

- front fairing (page 2-3)
- seat (page 2-2)

Check the oil level and add recommended engine oil if necessary (page 3-10).



ALTERNATOR/STARTER CLUTCH

FLYWHEEL REMOVAL

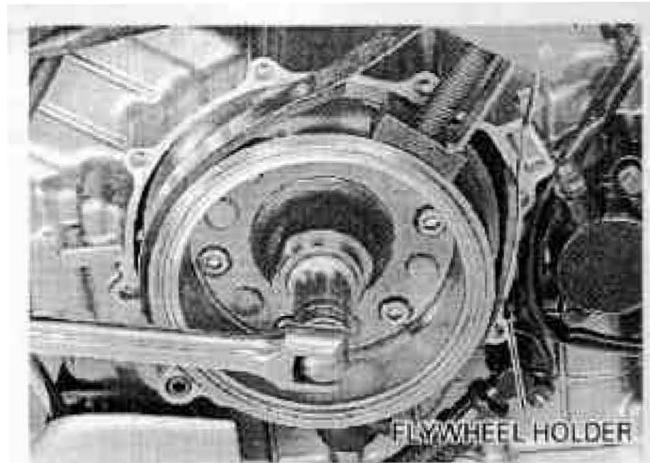
Remove the left crankcase cover (page 10-2).

Hold the flywheel with the special tool and loosen the flywheel bolt.

TOOL:

Flywheel holder 07725-0040000

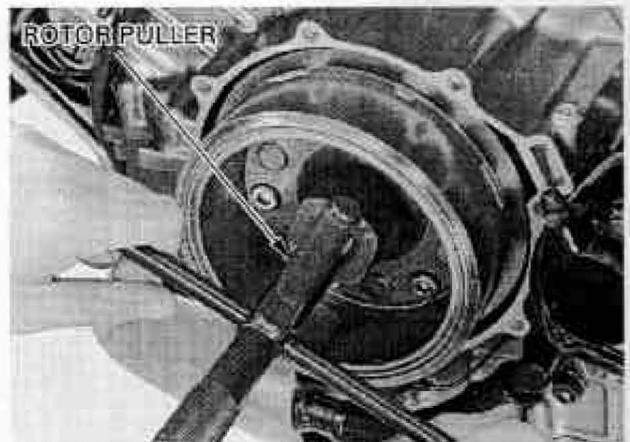
Remove the flywheel bolt and special washer.



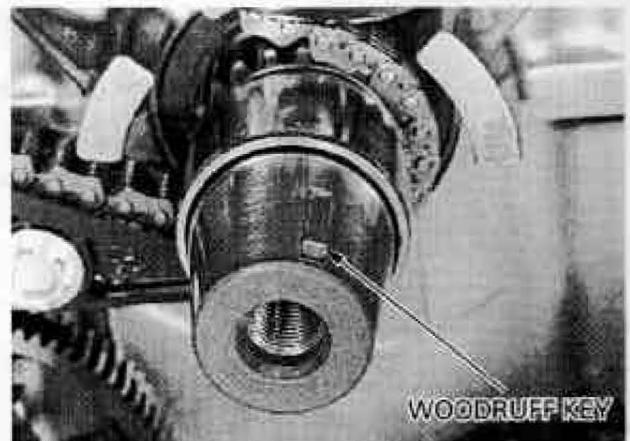
Remove the flywheel using the special tool.

TOOL:

Rotor puller 07733-0020001



Remove the woodruff key from the crankshaft.

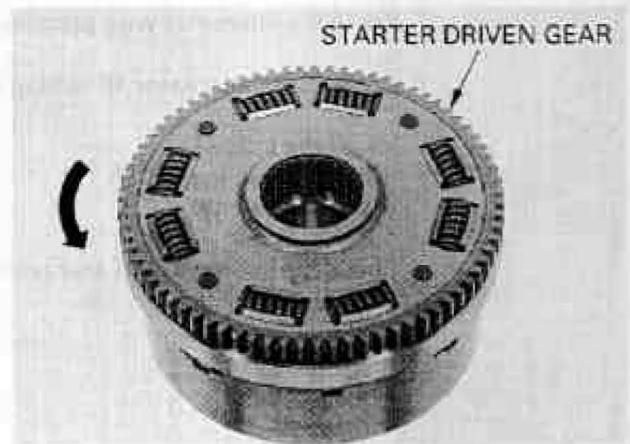


STARTER CLUTCH

REMOVAL

Remove the flywheel.

Remove the starter driven gear while turning it counterclockwise.



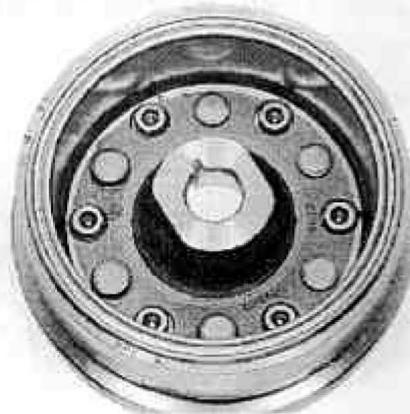
Hold the flywheel with the special tool and remove the starter clutch bolts.

TOOL:

Flywheel holder 07725-0040000

Remove the starter clutch assembly from the flywheel.

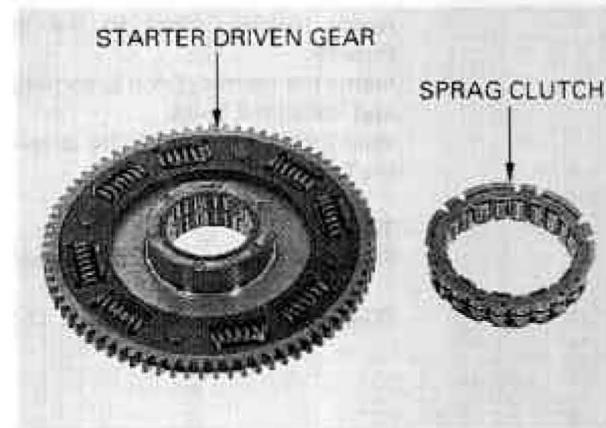
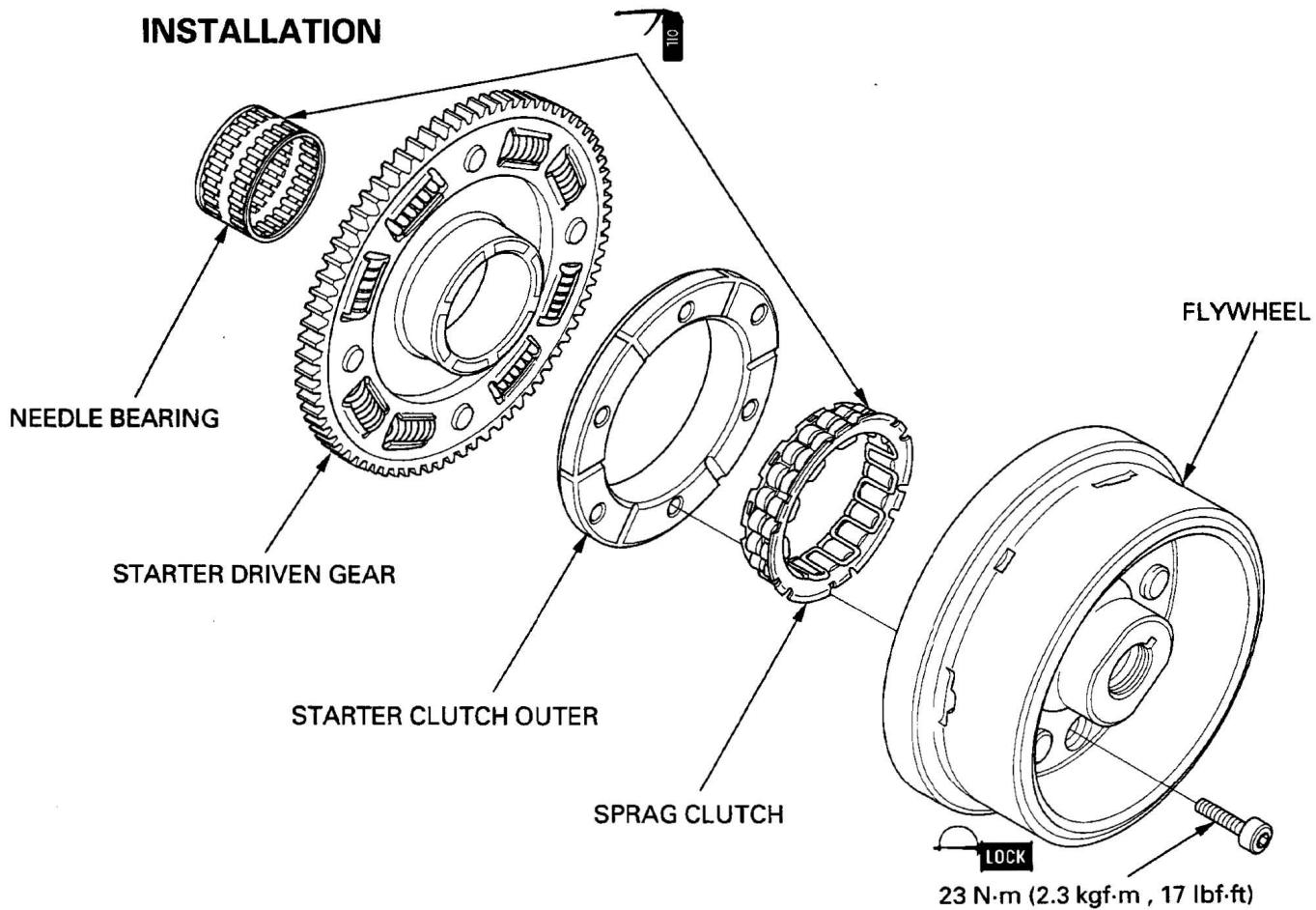
Remove the sprag clutch from the starter clutch outer.

**INSPECTION**

Check the starter driven gear and sprag clutch for abnormal wear or damage.

Measure the starter driven gear O.D.

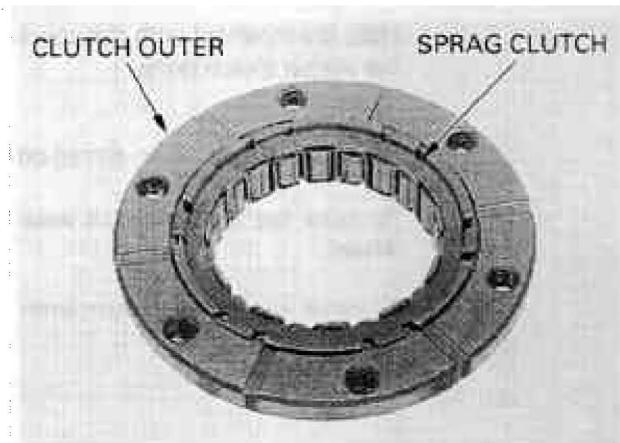
SERVICE LIMIT: 57.639 mm (2.2692 in)

**INSTALLATION**

23 N·m (2.3 kgf·m, 17 lbf·ft)

ALTERNATOR/STARTER CLUTCH

Install the sprag clutch into the starter clutch outer as shown.



Apply locking agent to the starter clutch bolt threads.

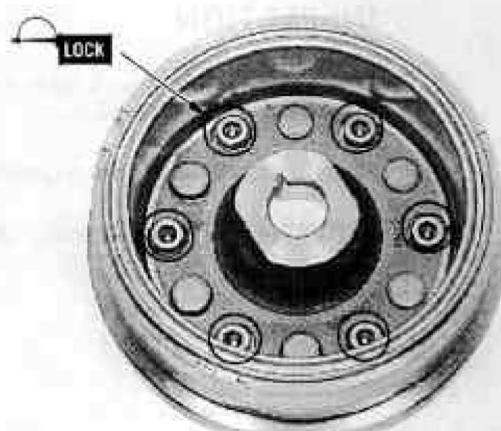
Install the starter clutch assembly onto the flywheel and install the bolts.

Hold the flywheel with the special tool and tighten the bolts.

TOOL:

Flywheel holder 07725-0040000

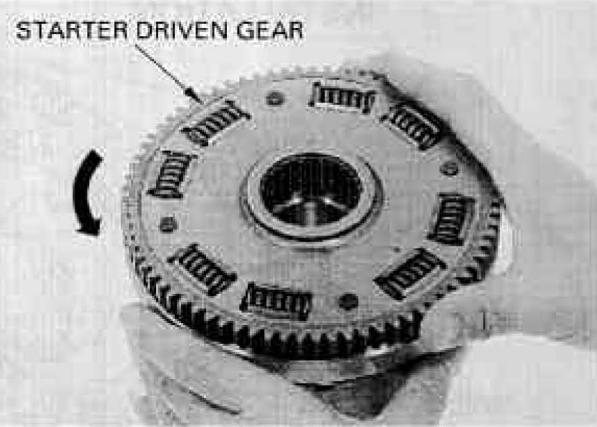
TORQUE: 23 N·m (2.3 kgf·m, 17 lbf·ft)



Install the starter driven gear while turning it counterclockwise.

Make sure that the starter driven gear turns counterclockwise smoothly and does not turn clockwise.

Install the flywheel (page 10-7).

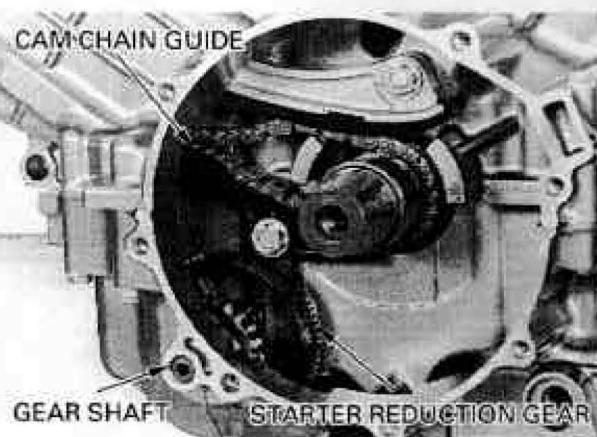


STARTER REDUCTION GEAR

Remove the front cylinder cam sprockets (page 8-4).
Remove the flywheel (page 10-4).

Remove the bolt and cam chain guide.

Pull the starter reduction gear shaft and remove the reduction gear.



Check the starter reduction gear for wear or damage.

Coat the reduction gear shaft with molybdenum oil solution.

Install the starter reduction gear and insert the shaft with the holed end facing out.

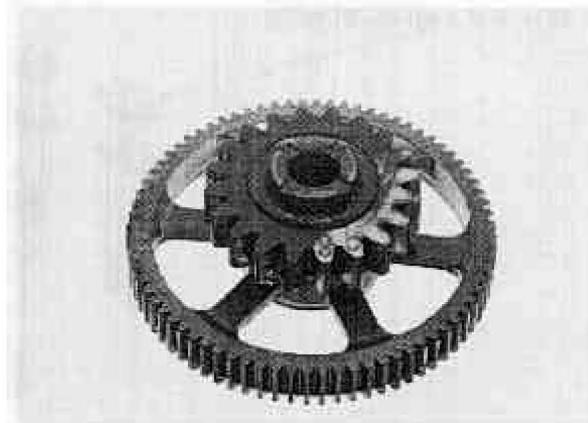
Apply locking agent to the cam chain guide bolt threads.

Install the cam chain guide and tighten the bolt.

TORQUE: 23 N·m (2.3 kgf·m , 17 lbf·ft)

Install the flywheel (see below).

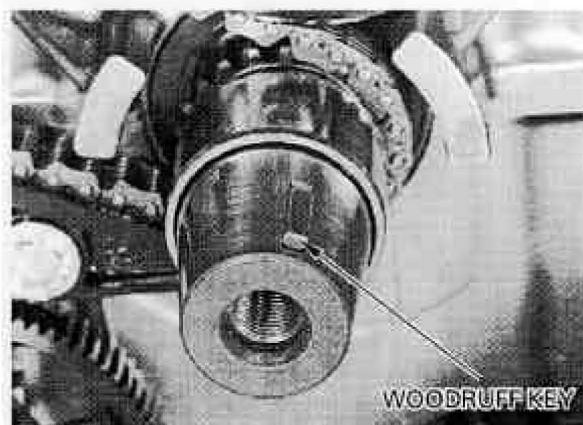
Install the front cylinder cam sprockets (page 8-20).



FLYWHEEL INSTALLATION

Clean any oil from the tapered portion of the crankshaft and flywheel.

Install the woodruff key in the crankshaft key groove.

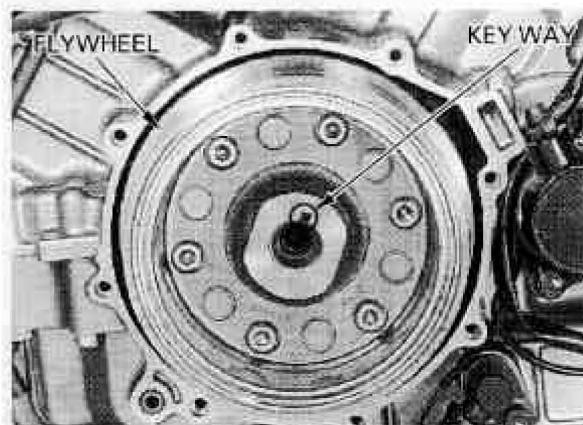


Apply oil to the needle bearing in the starter driven gear.

Install the flywheel on the crankshaft, aligning the key way with the woodruff key, and mesh the starter driven and reduction gears.

If necessary, remove the starter motor and check that the starter driven and reduction gears are meshed by turning the reduction gear.

The reduction gear should turn clockwise and not turn counterclockwise as viewed from starter motor side.



Apply oil to the flywheel bolt threads and seating surface and install the special washer and bolt.

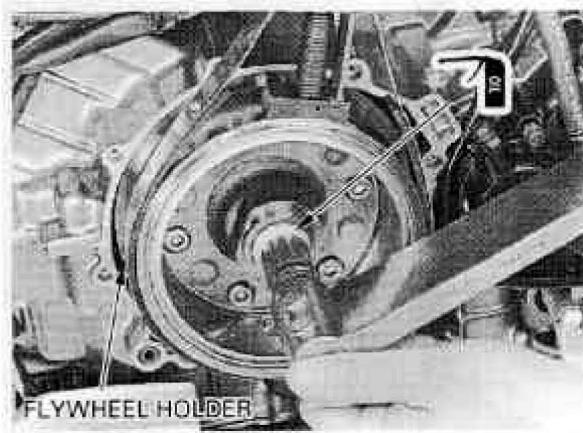
Hold the flywheel with the special tool and tighten the bolt.

TOOL:

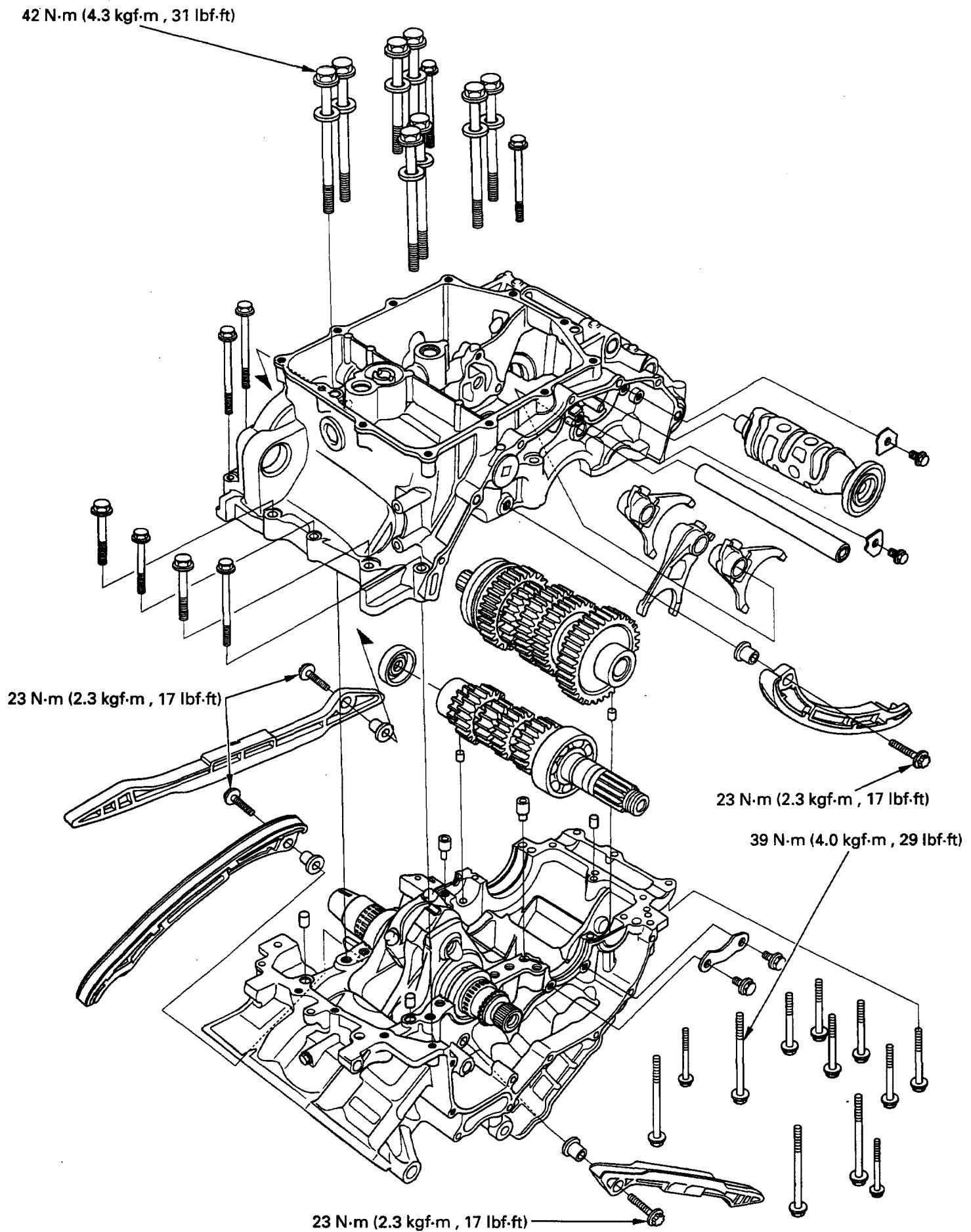
Flywheel holder 07725-0040000

TORQUE: 157 N·m (16.0 kgf·m , 116 lbf·ft)

Install the left crankcase cover (page 10-3).



CRANKCASE/TRANSMISSION



11. CRANKCASE/TRANSMISSION

SERVICE INFORMATION	11-1	SHIFT FORK/SHIFT DRUM	11-4
TROUBLESHOOTING	11-2	TRANSMISSION	11-6
CRANKCASE SEPARATION	11-3	CRANKCASE ASSEMBLY	11-10

SERVICE INFORMATION

GENERAL

- The crankcase must be separated to service the following:
 - transmission
 - crankshaft (section 12)
 - piston/connecting rod (section 12)
- Be careful not to damage the crankcase mating surfaces when servicing.
- Prior to assembling the crankcase halves, apply sealant to their mating surfaces. Wipe off excess sealant thoroughly.

SPECIFICATIONS

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT
Shift fork	I. D.	12.000–12.021 (0.4724–0.4733)	12.03 (0.474)
	Claw thickness	5.93–6.00 (0.233–0.236)	5.9 (0.23)
Shift fork shaft	O. D.	11.957–11.968 (0.4707–0.4712)	11.95 (0.470)
Transmission	Gear I. D.	M5, M6 31.000–31.016 (1.2205–1.2211) C2, C3, C4 33.000–33.025 (1.2992–1.3002)	31.04 (1.222) 33.05 (1.301)
	Gear bushing O. D.	M5, M6 30.955–30.980 (1.2187–1.2197) C2, C3, C4 32.955–32.980 (1.2974–1.2984)	30.93 (1.218) 32.93 (1.296)
	Gear-to-bushing clearance	M5, M6 0.020–0.061 (0.0008–0.0024) C2, C3, C4 0.020–0.070 (0.0008–0.0028)	0.10 (0.004) 0.11 (0.004)
	Gear bushing I. D.	M5 27.985–28.006 (1.1018–1.1026) C2 29.985–30.006 (1.1805–1.1813)	28.02 (1.103) 30.02 (1.182)
	Mainshaft O. D.	at M5 27.967–27.980 (1.1011–1.1016)	27.94 (1.100)
	Countershaft O. D.	at C2 29.950–29.975 (1.1791–1.1801)	29.92 (1.178)
	Bushing-to-shaft clearance	M5 0.005–0.039 (0.0002–0.0015) C2 0.010–0.056 (0.0004–0.0022)	0.06 (0.002) 0.06 (0.002)

11

TORQUE VALUES

Cam chain tensioner bolt	23 N·m (2.3 kgf·m , 17 lbf·ft)	Apply locking agent to the threads.
Cam chain guide bolt	23 N·m (2.3 kgf·m , 17 lbf·ft)	Apply locking agent to the threads.
Crankcase 10 mm flange bolt	39 N·m (4.0 kgf·m , 29 lbf·ft)	
Crankcase 10 mm special bolt	42 N·m (4.3 kgf·m , 31 lbf·ft)	Apply oil to the threads and seating surface.

TOOLS

Inner driver C	07746-0030100
Attachment, 35 mm I. D.	07746-0030400

TROUBLESHOOTING

Hard to shift

- Improper clutch operation (section 9)
- Incorrect engine oil weight
- Bent shift forks
- Bent shift fork shaft
- Bent shift fork claw
- Damaged shift drum cam grooves
- Bent gearshift spindle

Transmission jumps out of gear

- Worn gear dogs
- Worn gear shifter groove
- Bent shift fork shaft
- Broken shift drum stopper arm
- Worn or bent shift forks
- Broken drum stopper arm spring
- Broken gearshift spindle return spring

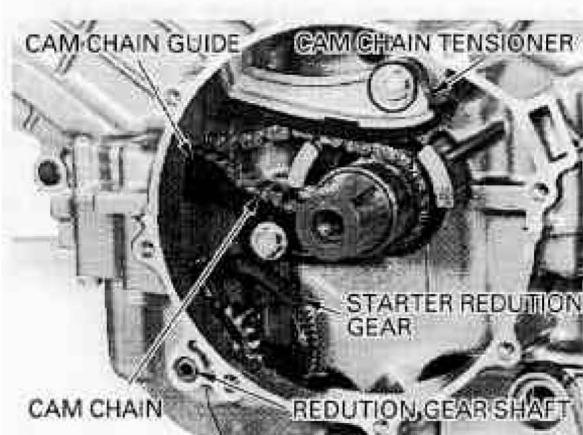
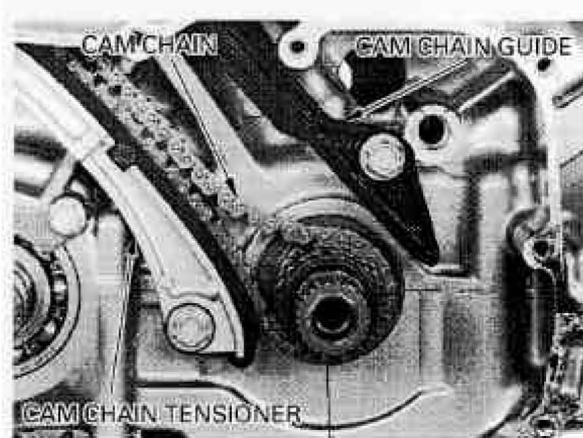
Excessive engine noise

- Worn or damaged transmission gears
- Worn or damaged transmission bearings

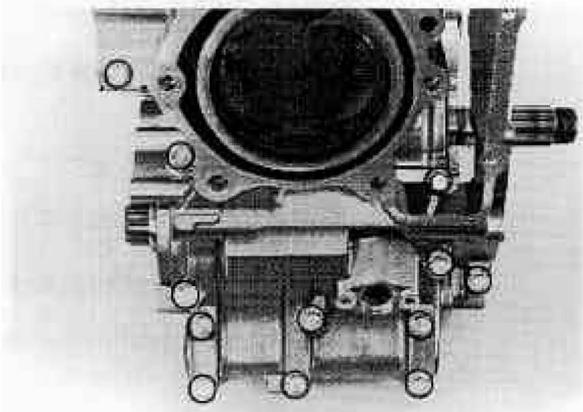
CRANKCASE SEPARATION

Remove the following:

- engine (section 7)
- cylinder head (section 8)
- clutch, gearshift linkage, primary drive gear (section 9)
- flywheel (section 10)
- starter motor (section 18)
- oil pump (section 4)
- cam chain tensioners
- cam chain guides
- starter reduction gear and shaft
- cam chains

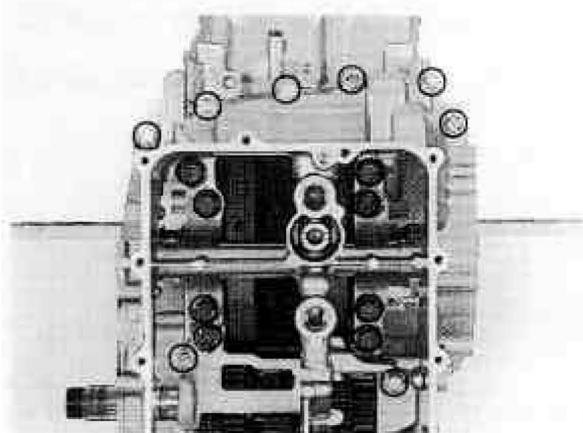


Loosen the two 6 mm bolts, nine 8 mm bolts and 10 mm bolt in a crisscross pattern in 2 or 3 steps and remove them from the upper crankcase.



Place the engine with the upper side down.
Loosen the two 6 mm bolts, six 8 mm bolts and eight 10 mm bolt in a crisscross pattern in 2 or 3 steps and remove them from the lower crankcase.

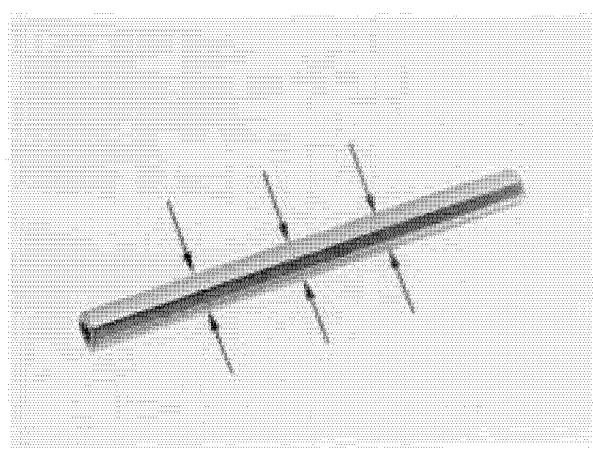
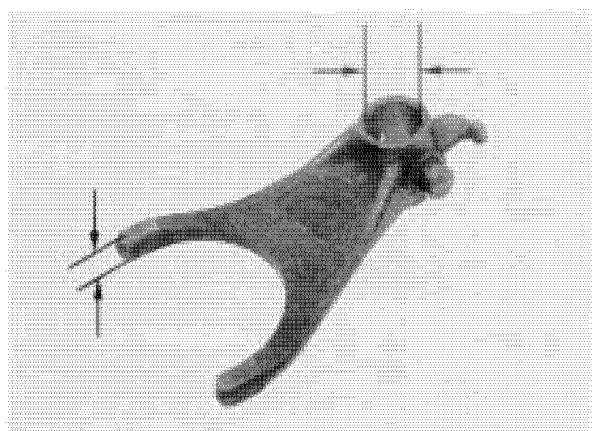
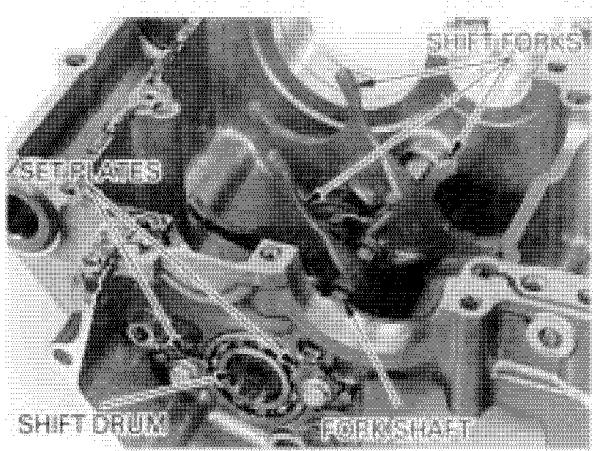
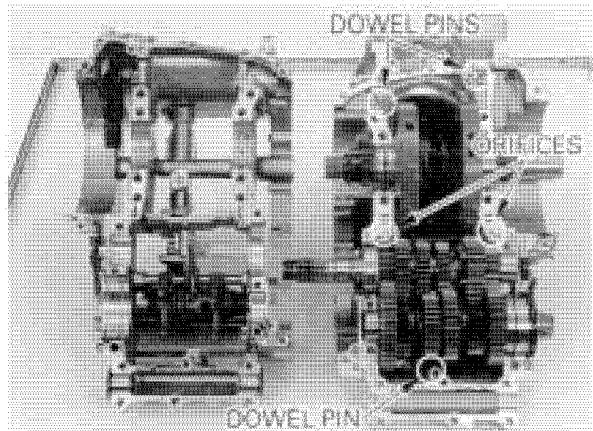
Separate the lower crankcase from the upper crankcase.



NEW

Remove the dowel pins and oil orifices.

Clean any sealant from the crankcase mating surfaces.



SHIFT FORK/SHIFT DRUM REMOVAL

Separate the crankcase halves (page 11-3).

Remove the shift fork shaft set plate, shift fork shaft and shift forks.

Remove the shift drum bearing set plate and shift drum.

INSPECTION

Check the shift fork guide pins for abnormal wear or damage.

Measure the shift fork I. D.

SERVICE LIMIT: 12.03 mm (0.474 in)

Measure the shift fork claw thickness.

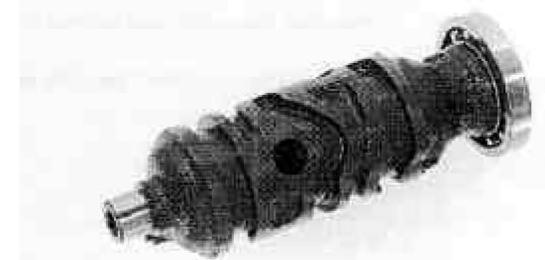
SERVICE LIMIT: 5.9 mm (0.23 in)

Measure the shift fork shaft O.D.

SERVICE LIMIT: 11.95 mm (0.470 in)

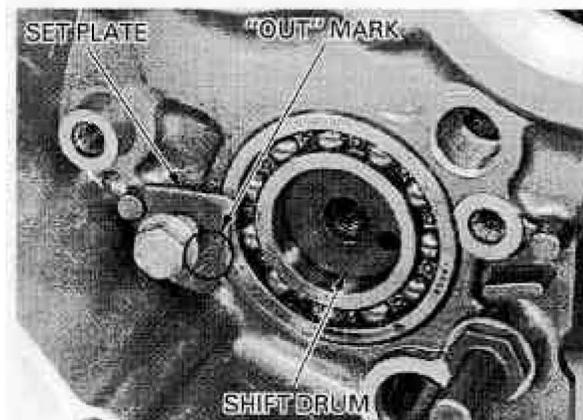
Check the shift drum guide groove for abnormal wear or damage.

Check the shift drum bearings for smooth rotation.



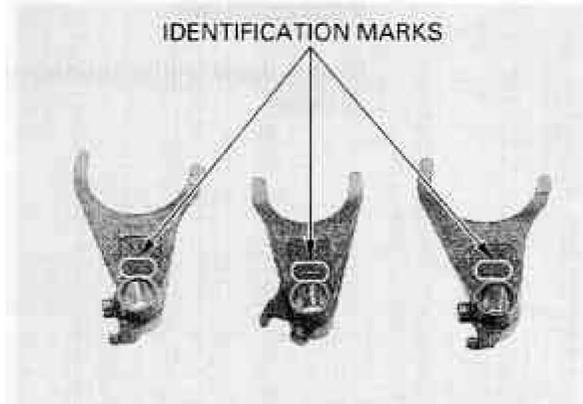
INSTALLATION

Apply locking agent to the set plate bolt threads. Install the shift drum and bearing set plate with the "OUT" mark facing out, and its cutout aligned with the pin on the crankcase. Install and tighten the set plate bolt.



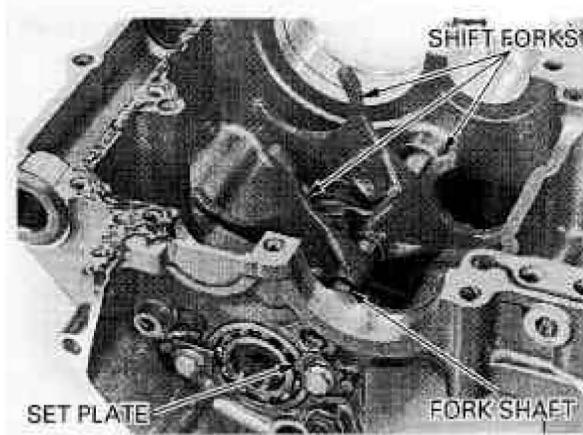
The shift forks have the following identification marks:

RL: right and left shift forks
C: center shift fork



Install the shift forks into the shift drum guide groove with the identification marks facing toward the right side of the engine and insert the fork shaft. Install the set plate in the same manner as that of the shift drum.

Assemble the crankcase halves (page 11-10).

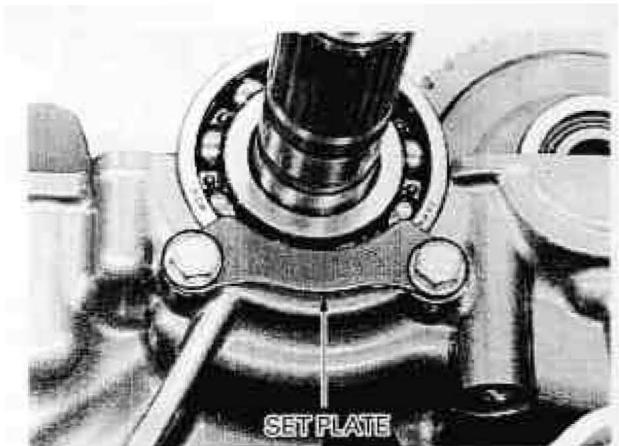


TRANSMISSION

DISASSEMBLY

Separate the crankcase halves (page 11-3).

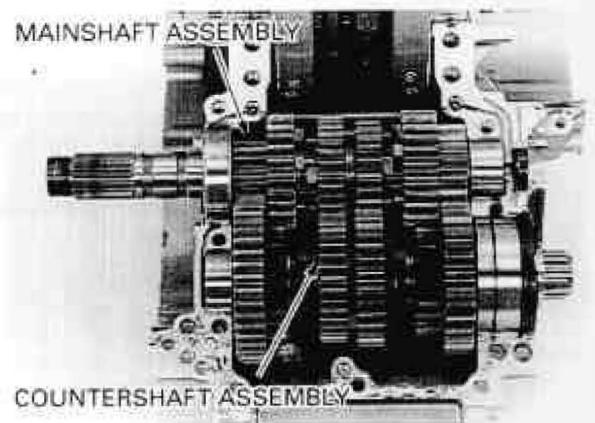
Remove the mainshaft bearing set plate.



Remove the mainshaft and countershaft assemblies.

Disassemble the mainshaft and countershaft.

Clean all disassembled parts in solvent thoroughly.



INSPECTION

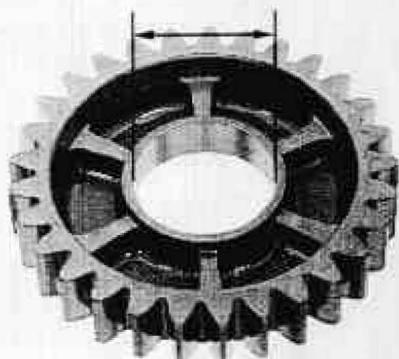
Check the gear shifter groove for abnormal wear or damage.



Check the gear dogs and teeth for abnormal wear or damage.

Measure the gear I.D.

SERVICE LIMITS: M5, M6: 31.04 mm (1.222 in)
C2, C3, C4: 33.05 mm (1.301 in)



Measure the gear bushing O. D.

SERVICE LIMITS: M5, M6: 30.93 mm (1.218 in)
C2, C3, C4: 32.93 mm (1.296 in)

Calculate the gear-to-bushing clearance.

SERVICE LIMITS: M5, M6: 0.10 mm (0.004 in)
C2, C3, C4: 0.11 mm (0.004 in)

Measure the gear bushing I. D.

SERVICE LIMITS: M5: 28.02 mm (1.103 in)
C2: 30.02 mm (1.182 in)

Check the mainshaft and countershaft for abnormal wear or damage.

Measure the mainshaft O. D. at the M5 gear.

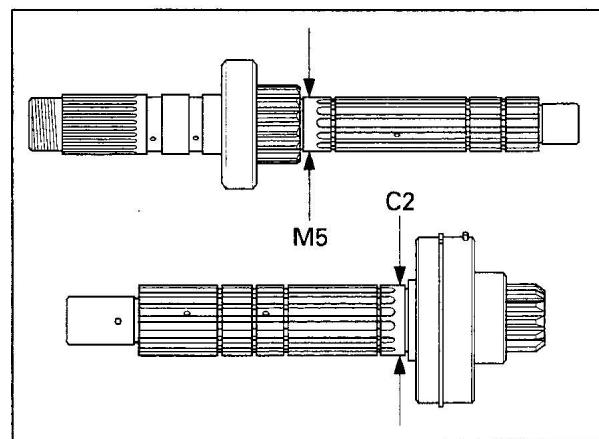
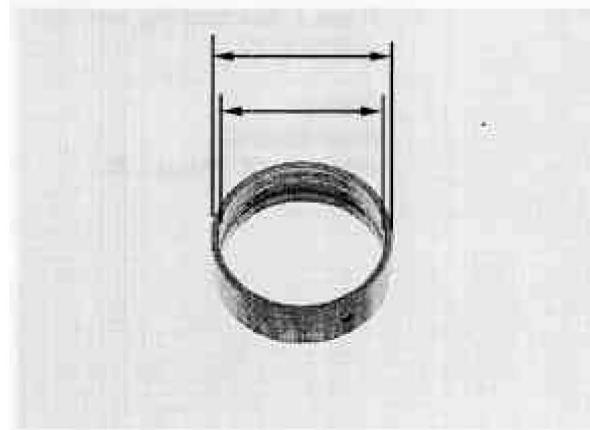
SERVICE LIMIT: 27.94 mm (1.100 in)

Measure the countershaft O. D. at the C2 gear.

SERVICE LIMIT: 29.92 mm (1.178 in)

Calculate the gear bushing-to-shaft clearance.

SERVICE LIMIT: 0.06 mm (0.002 in)

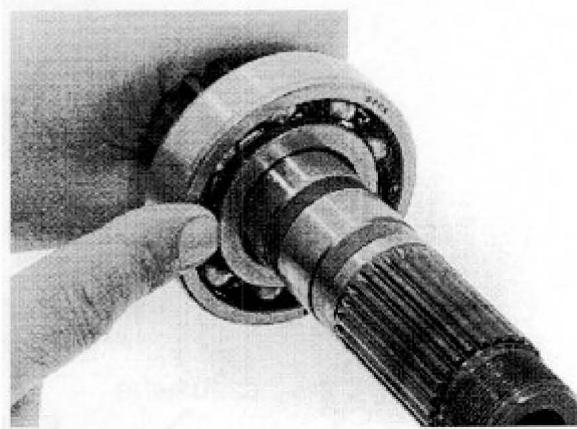


Turn the bearing outer race with your finger. The bearing should turn smoothly and quietly. Also check that the bearing inner race fits tightly on the shaft.

Replace the bearing if the outer race does not turn smoothly, quietly, or if the inner race fit loosely on the shaft.

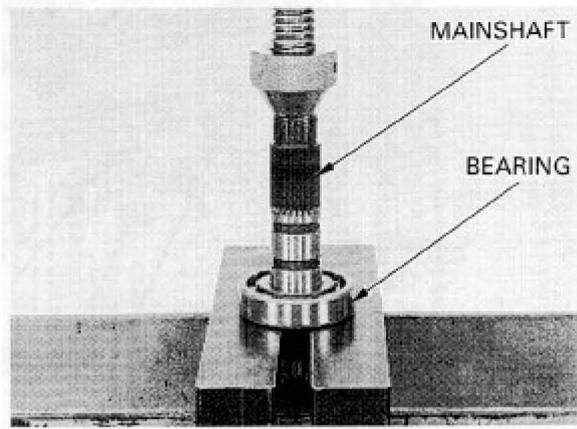
NOTE:

The countershaft bearing cannot be replaced. If the countershaft bearing is faulty, replace the countershaft.



MAINSHAFT BEARING REPLACEMENT

Press the mainshaft out of the bearing.

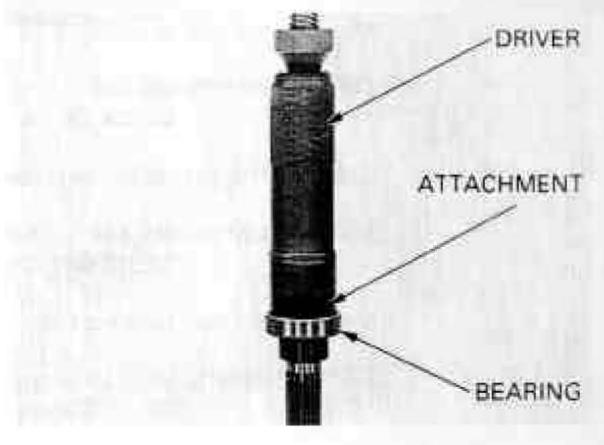


CRANKCASE/TRANSMISSION

Press a new bearing onto the mainshaft with the special tools.

TOOLS:

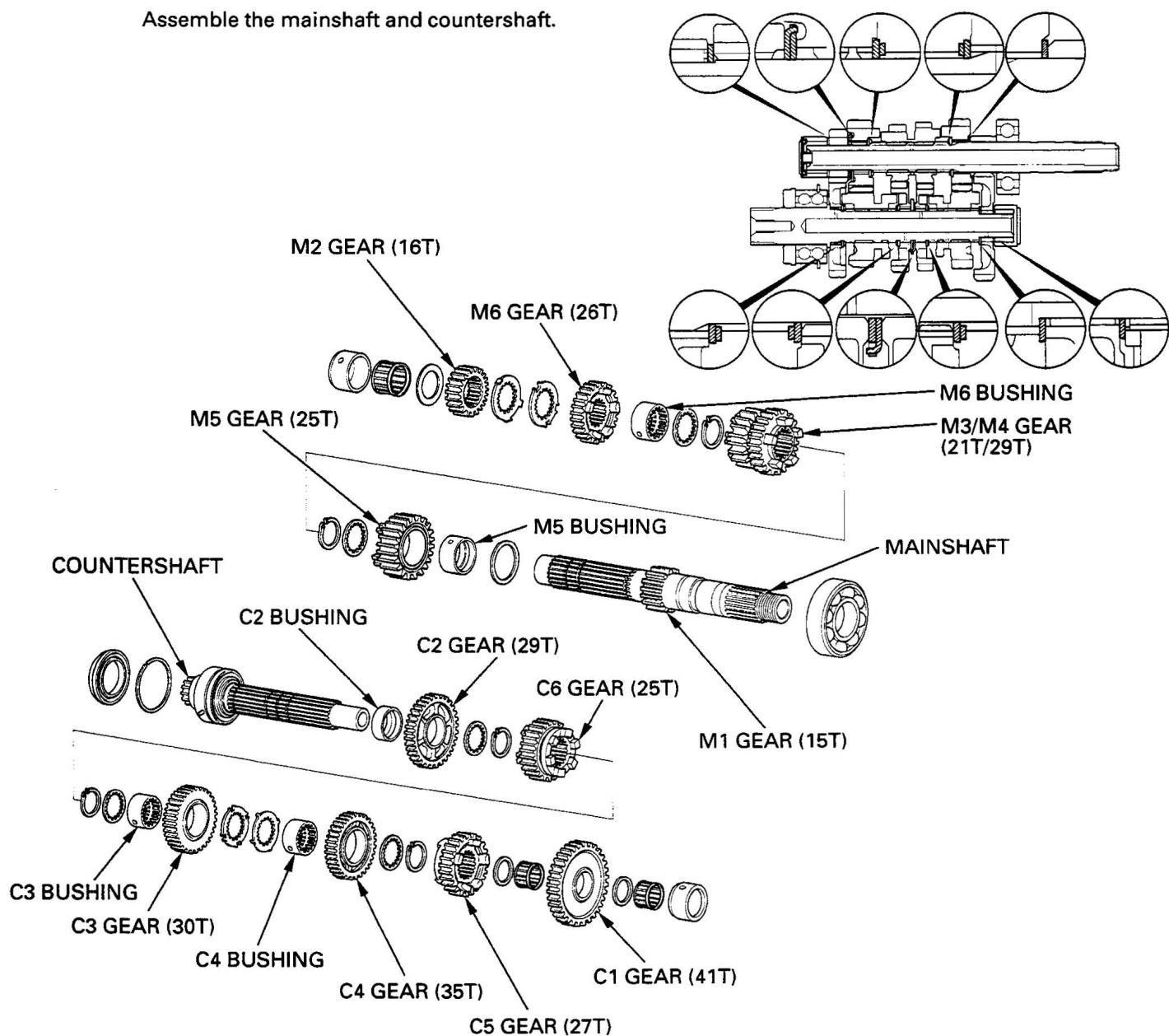
Inner driver C 07746-0030100
Attachment, 35 mm I. D. 07746-0030400



ASSEMBLY

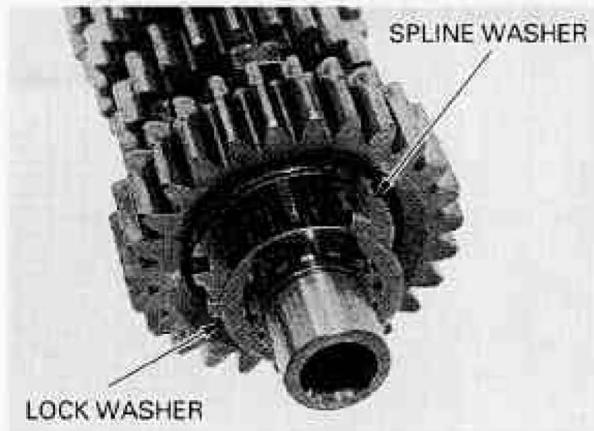
Apply molybdenum oil solution to the gear teeth, sliding surface, shifter grooves and bushings.

Assemble the mainshaft and countershaft.

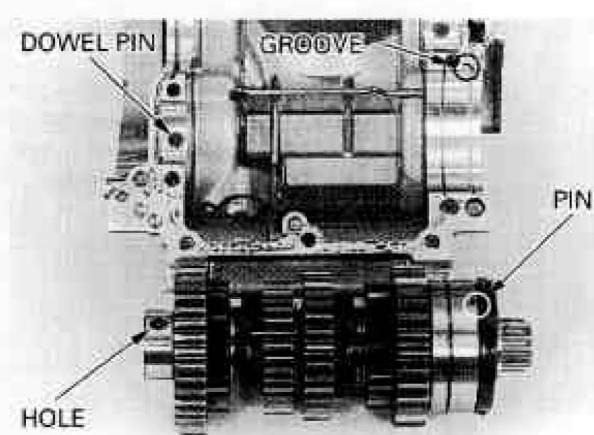


NOTE:

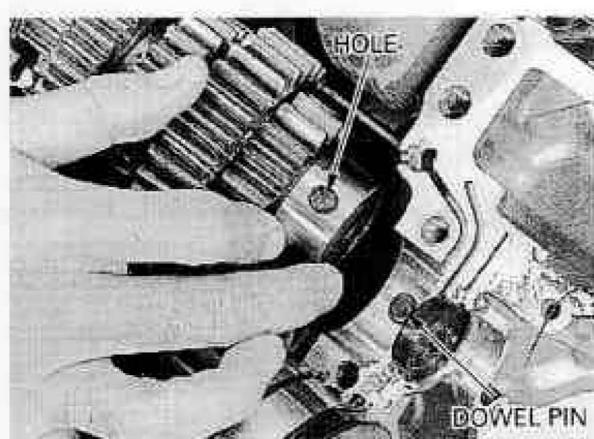
- Align the lock washer tabs with the spline washer grooves.
- Always install the thrust washer and snap ring with the chamfered (rolled) edge facing away from the thrust load.
- Install the snap ring so that its end gap aligns with the groove in the splines.
- Make sure that the snap ring is fully seated in the shaft groove after installing it.



Install the countershaft assembly, aligning the hole in the needle bearing outer race with the dowel pin, and the set ring with the ring groove.
Rest the pin on the ball bearing into the pin groove.

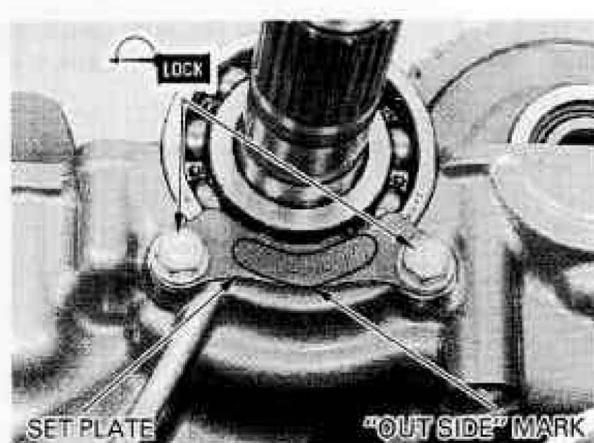


Install the mainshaft assembly, aligning the hole in the needle bearing outer race with the dowel pin.



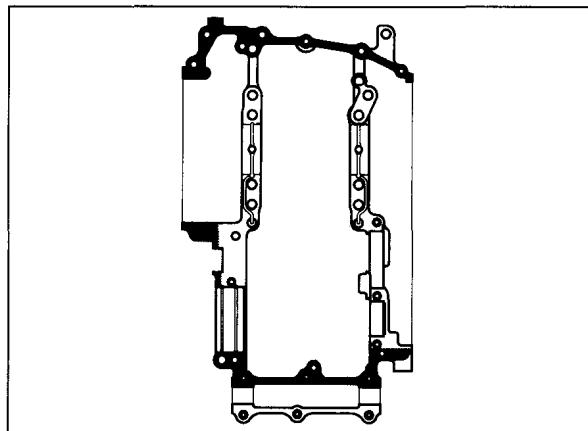
Apply locking agent to the set plate bolt threads.
Install the mainshaft bearing set plate with the "OUT SIDE" mark facing out and tighten the bolts.

Assemble the crankcase halves (page 11-10).



CRANKCASE ASSEMBLY

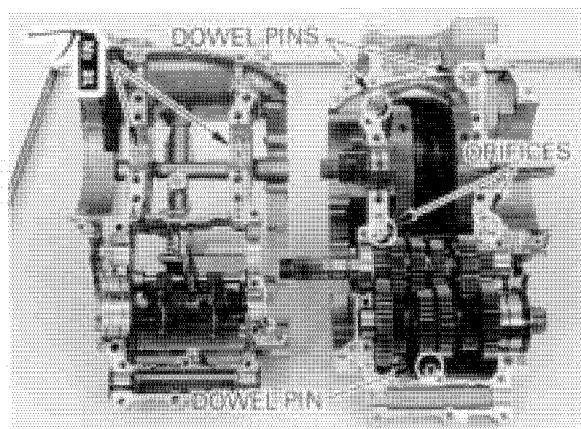
Apply sealant to the crankcase mating surfaces as shown.



NEW Install the dowel pins and oil orifices.

Apply molybdenum oil solution to the main journal bearing surfaces on the lower crankcase.

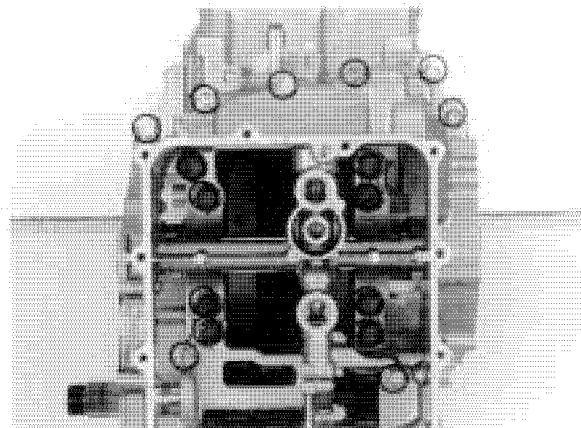
Install the lower crankcase onto the upper crankcase, aligning the shift forks with the gear shifter grooves.



Apply oil to the 10 mm special bolt threads and seating surfaces.

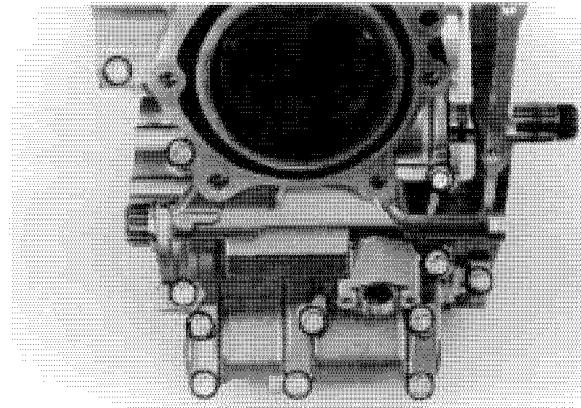
Install the eight 10 mm bolt, six 8 mm bolts and two 6 mm bolts, and tighten them in a crisscross pattern in 2 or 3 steps.

TORQUE: 10 mm bolt : 42 N·m (4.3 kgf·m , 31 lbf·ft)



Install the 10 mm bolt, nine 8 mm bolts and two 6 mm bolts, and tighten them in a crisscross pattern in 2 or 3 steps.

TORQUE: 10 mm bolt : 39 N·m (4.0 kgf·m , 29 lbf·ft)



Coat the reduction gear shaft with molybdenum oil solution.

Install the starter reduction gear and insert the shaft with the holed end facing out.

Install the cam chains.

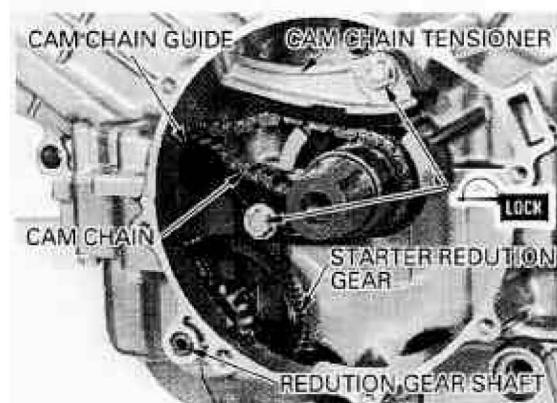
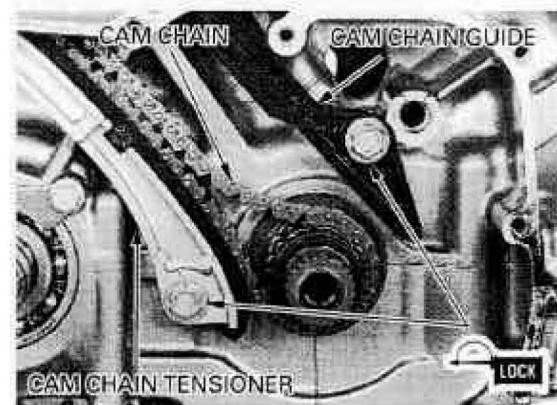
Apply locking agent to the threads of the cam chain tensioner and guide bolts.

Install the cam chain tensioners and guides, and tighten the bolts.

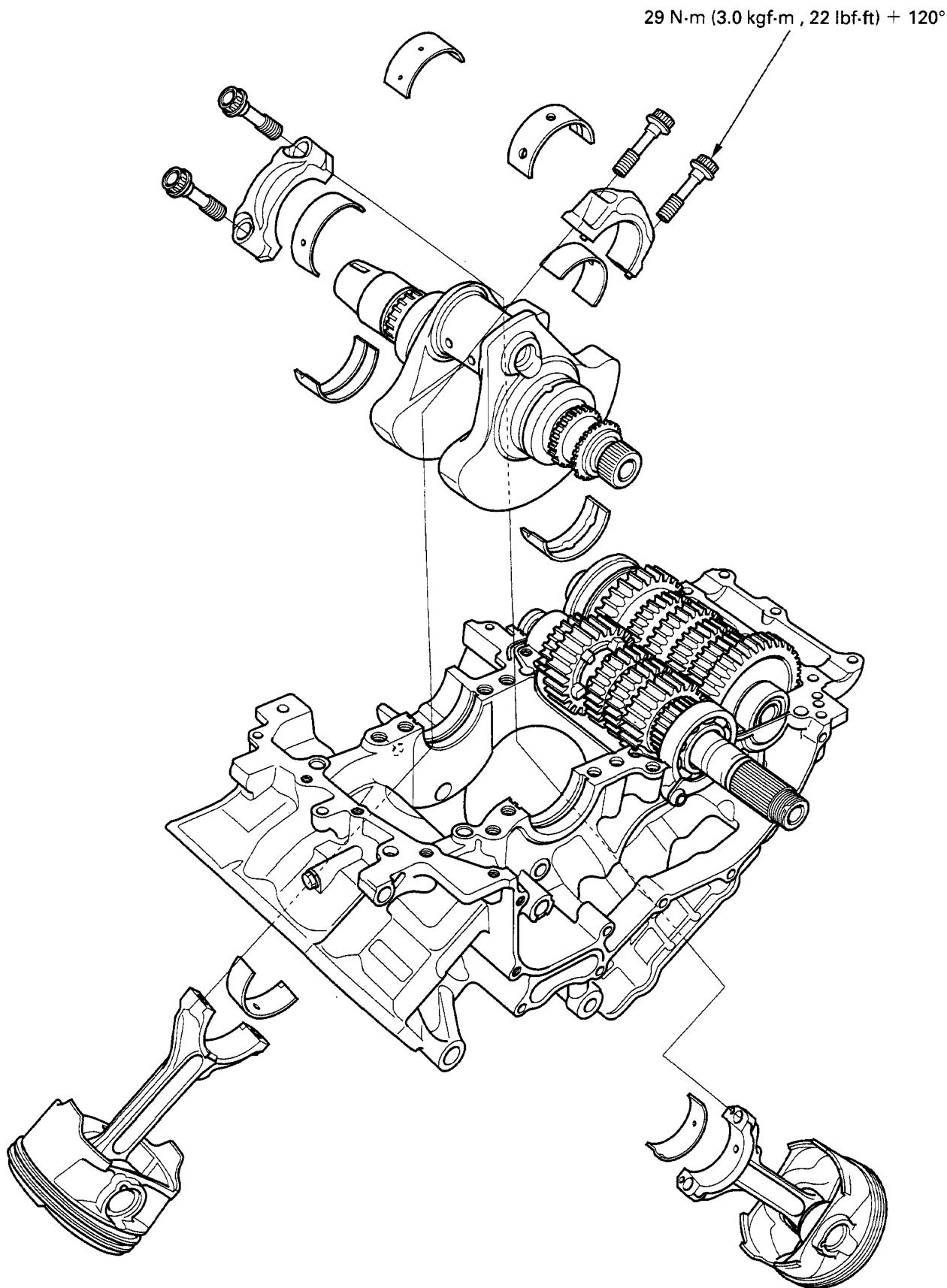
TORQUE: 23 N·m (2.3 kgf·m , 17 lbf·ft)

Install the following:

- oil pump (section 4)
- starter motor (section 18)
- flywheel (section 10)
- clutch, gearshift linkage, primary drive gear (section 9)
- cylinder head (section 8)
- engine (section 7)



CRANKSHAFT/PISTON/CYLINDER



12. CRANKSHAFT/PISTON/CYLINDER

SERVICE INFORMATION	12-1	MAIN JOURNAL BEARING	12-4
TROUBLESHOOTING	12-2	CRANKPIN BEARING	12-6
CRANKSHAFT	12-3	PISTON/CYLINDER	12-8

SERVICE INFORMATION

GENERAL

- The crankcase must be separated to service the crankshaft and piston connecting rod. Refer to section 11 for crankcase separation and assembly.
- Mark and store the connecting rods, bearing caps and bearing inserts to be sure of their correct locations for reassembly.
- The crankpin and main journal bearing inserts are select fit and are identified by color codes. Select replacement bearings from the code tables. After selecting new bearings, recheck the oil clearance with a plastigauge. Incorrect oil clearance can cause major engine damage.

SPECIFICATIONS

Unit: mm (in)

ITEM		STANDARD	SERVICE LIMIT
Crankshaft	Connecting rod side clearance	0.10–0.30 (0.004–0.012)	0.40 (0.016)
	Crankpin bearing oil clearance	0.032–0.050 (0.0013–0.0020)	0.060 (0.0024)
	Main journal bearing oil clearance	0.020–0.038 (0.0008–0.0015)	0.048 (0.0019)
	Runout	—	0.10 (0.004)
Piston, piston pin, piston ring	Piston O. D. at 10 (0.4) from bottom	97.965–97.985 (3.8569–3.8577)	97.900 (3.8543)
	Piston pin hole I. D.	24.002–24.008 (0.9450–0.9452)	24.03 (0.946)
	Piston pin O. D.	23.994–24.000 (0.9446–0.9449)	23.984 (0.9443)
	Piston-to-piston pin clearance	0.002–0.014 (0.0001–0.0006)	0.046 (0.0018)
	Piston ring end gap	Top	0.25–0.40 (0.010–0.016)
		Second	0.40–0.55 (0.016–0.022)
		Oil (side rail)	0.20–0.70 (0.008–0.028)
	Piston ring-to-ring groove clearance	Top	0.065–0.100 (0.0026–0.0039)
		Second	0.035–0.070 (0.0014–0.0028)
Cylinder	I. D.	98.005–98.025 (3.8585–3.8592)	98.100 (3.8622)
	Out of round	—	0.10 (0.004)
	Taper	—	0.10 (0.004)
	Warpage	—	0.05 (0.002)
	Cylinder-to-piston clearance	0.020–0.060 (0.0008–0.0024)	0.200 (0.0079)
Connecting rod small end I. D.		24.020–24.041 (0.9457–0.9465)	24.051 (0.9469)
Connecting rod-to-piston clearance		0.020–0.047 (0.0008–0.0019)	0.067 (0.0026)

12

TORQUE VALUES

Connecting rod bolt (standard)	29 N·m (3.0 kgf·m , 22 lbf·ft) + 120°	Apply oil to the threads and seating surface
Connecting rod bolt (checking the oil clearance)	20 N·m (2.0 kgf·m , 14 lbf·ft) + 120°	Apply oil to the threads and seating surface
Crankcase 10 mm special bolt	42 N·m (4.3 kgf·m , 31 lbf·ft)	Apply oil to the threads and seating surface

TROUBLESHOOTING

Compression too low, hard starting or poor performance at low speed

- Leaking cylinder head gasket
- Worn, stuck or broken piston ring
- Worn or damaged cylinder and piston

Compression too high, overheating or knocking

- Excessive carbon built-up on piston head or combustion chamber

Excessive smoke

- Worn cylinder, piston or piston rings
- Improper installation of piston rings
- Scored or scratched piston or cylinder wall

Abnormal noise

- Worn piston pin or piston pin hole
- Worn connecting rod small end
- Worn cylinder, piston or piston rings
- Worn main journal bearings
- Worn crankpin bearings

CRANKSHAFT

Separate the crankcase halves (page 11-3).

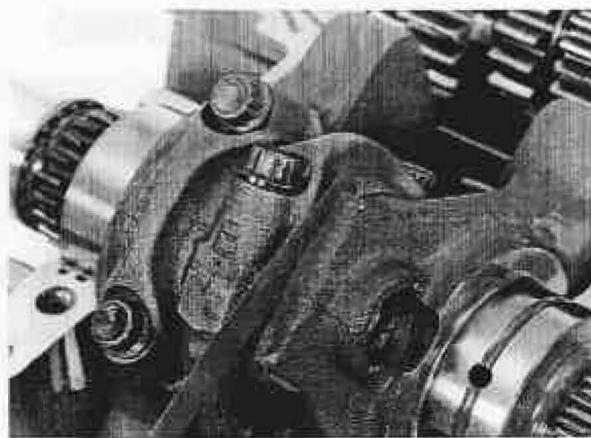
SIDE CLEARANCE INSPECTION

Measure the connecting rod side clearance.

SERVICE LIMIT: 0.40 mm (0.016 in)

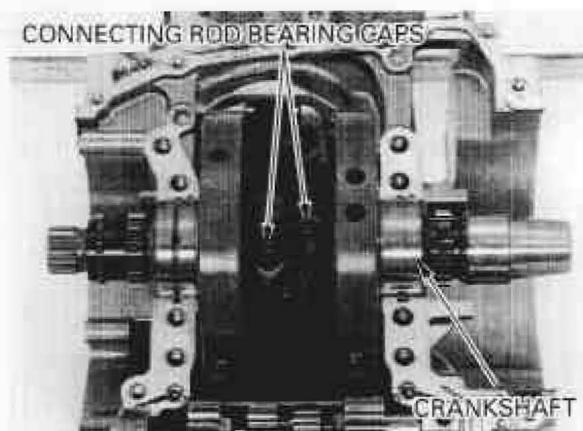
If the clearance exceeds the service limit, replace the connecting rod.

Recheck and if still out of limit, replace the crankshaft.



REMOVAL

Remove the connecting rod bolts and bearing caps.
Remove the crankshaft.



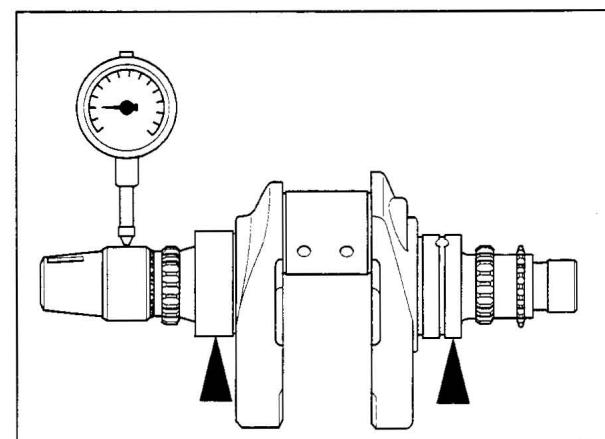
INSPECTION

Place the crankshaft on V-blocks.
Rotate the crankshaft two revolutions and read the runout with a dial indicator.
Divide the total indicator reading in half to get the actual runout.

SERVICE LIMIT: 0.10 mm (0.004 in)

INSTALLATION

Apply molybdenum oil solution to the main journal bearing sliding surfaces on the upper crankcase, and crankpin bearing sliding surfaces on the connecting rods and bearing caps.
Install the crankshaft onto the upper crankcase.
Set the connecting rods onto the crankpin.
Install the bearing caps, aligning the dowel pins with the holes in the connecting rods.
Apply oil to new connecting bolt threads and seating surfaces and install the bolts.



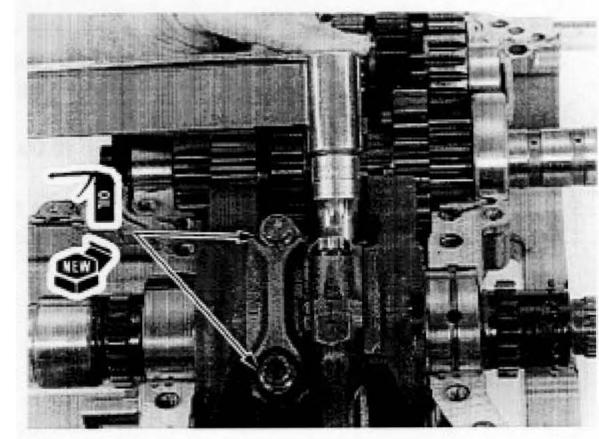
CAUTION:

The connecting rod bolts cannot be reused. Once the connecting rod bolts have been loosened replace them with new ones.

Tighten the bolts in 2 or 3 steps alternately.

TORQUE: 29 N·m (3.0 kgf·m , 22 lbf·ft) + 120°

Assemble the crankcase halves (page 11-10).



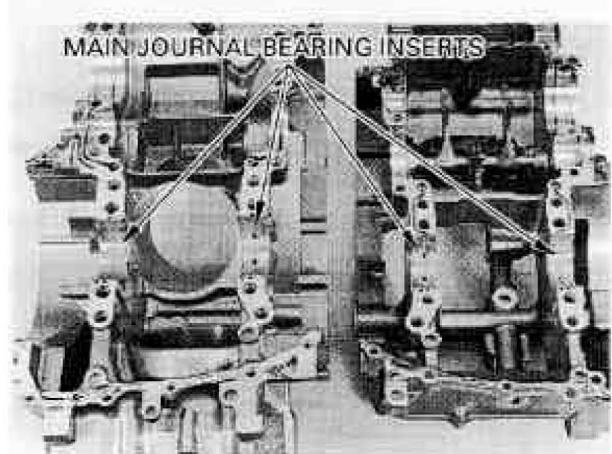
MAIN JOURNAL BEARING

Remove the crankshaft (page 12-3).

BEARING INSPECTION

Check the bearing inserts for unusual wear or peeling.

Check the bearing tabs for damage.

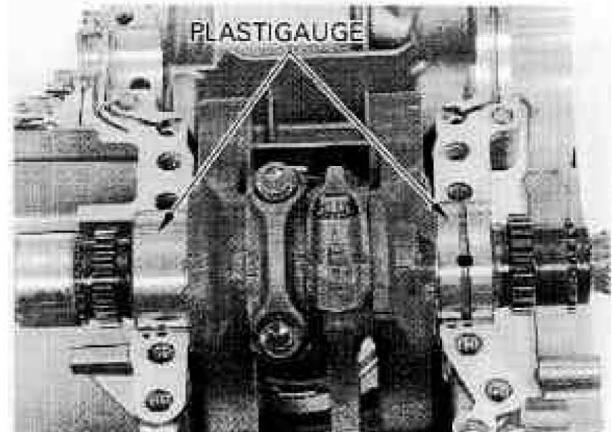


OIL CLEARANCE INSPECTION

Do not rotate the crankshaft during inspection. Clean off any oil from the bearing inserts and main journals.

Install the crankshaft onto the upper crankcase.

Put a strip of plastigauge lengthwise on each main journal avoiding the oil hole.



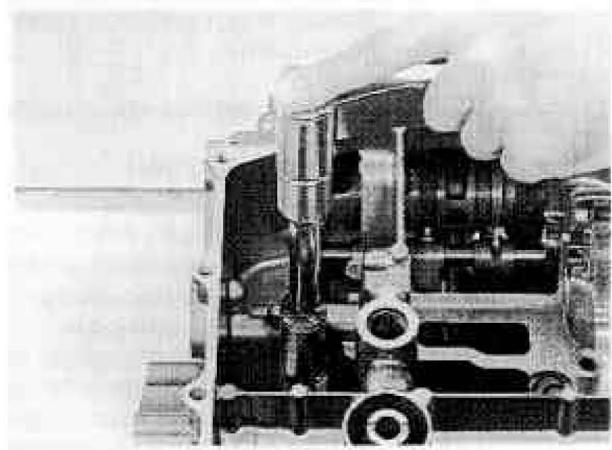
Install the dowel pins.

Carefully install the lower crankcase on the upper crankcase.

Apply oil to the 10 mm special bolt threads and seating surfaces and install them.

Tighten the bolts in a crisscross pattern in 2 or 3 steps.

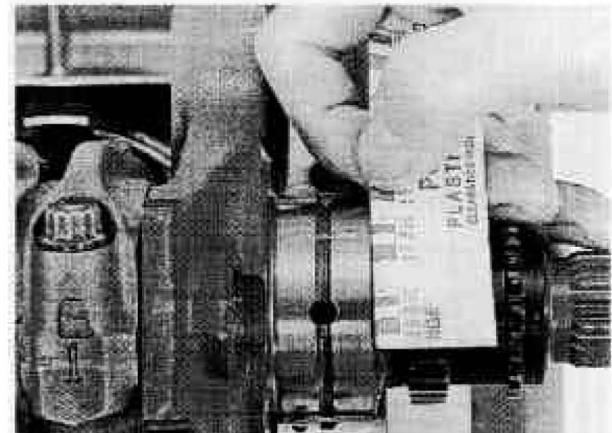
TORQUE: 42 N·m (4.3 kgf·m , 31 lbf·ft)



Remove the lower crankcase and measure the compressed plastigauge at its widest point on each main journal to determine the oil clearance.

SERVICE LIMIT: 0.048 mm (0.0019 in)

If the oil clearance exceeds the service limit, select the correct replacement bearings.



BEARING SELECTION

Record the main journal O. D. code numbers.

NOTE:

Number 1, 2 or 3 on the crank weight is the code for the main journal O. D.

Record the crankcase bearing support I. D. code letters.

NOTE:

Letters A, B or C on the left side of the upper crankcase are the codes for the bearing support I. D.

Cross reference the main journal and bearing support codes to determine the replacement bearing color code.

Bearing support I. D. code	A	B	C
Main journal O. D. code			
1	Yellow	Green	Brown
2	Green	Brown	Black
3	Brown	Black	Blue

MAIN JOURNAL BEARING INSERT THICKNESS:

Yellow: 1.488–1.491 mm (0.0586–0.0587 in)

Green: 1.491–1.494 mm (0.0587–0.0588 in)

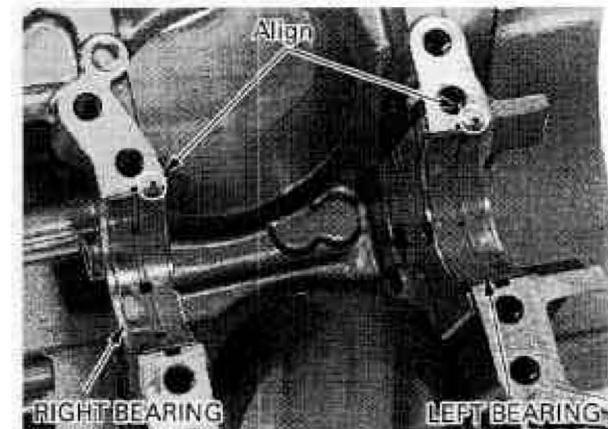
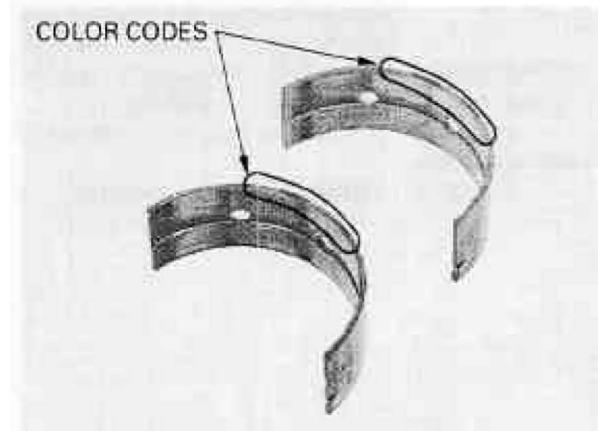
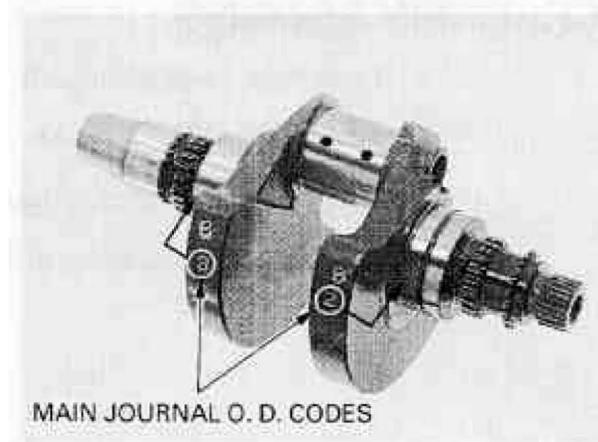
Brown: 1.494–1.497 mm (0.0588–0.0589 in)

Black: 1.497–1.500 mm (0.0589–0.0591 in)

Blue: 1.500–1.503 mm (0.0591–0.0592 in)

CAUTION:

After selecting new bearings, recheck the oil clearance with plastigauge. Incorrect oil clearance can cause major engine damage.



BEARING INSTALLATION

Clean the bearing outer surfaces and crankcase bearing supports.

Install the main journal bearing inserts onto the crankcase bearing supports, aligning each tab with each groove.

CAUTION:

Do not interchange the left and right bearing inserts.

The oil holes in the right bearing insert are larger than the ones in the left bearing insert.

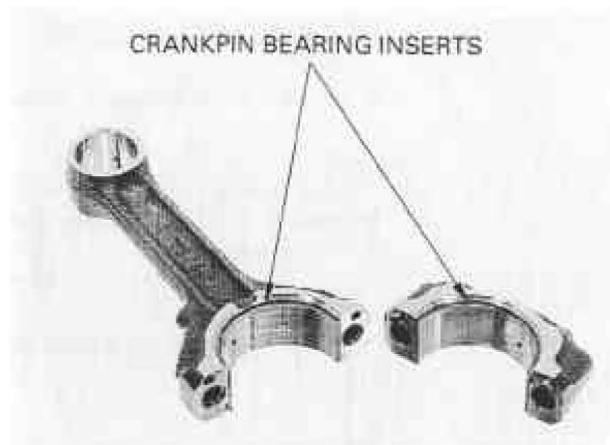
CRANKPIN BEARING

Remove the crankshaft (page 12-3).

BEARING INSPECTION

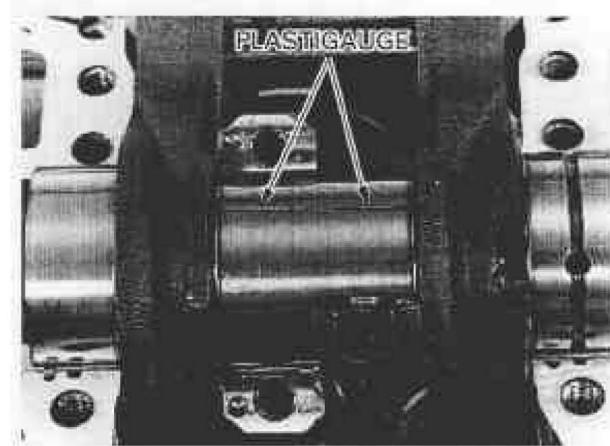
Check the bearing inserts for unusual wear or peeling.

Check the bearing tabs for damage.



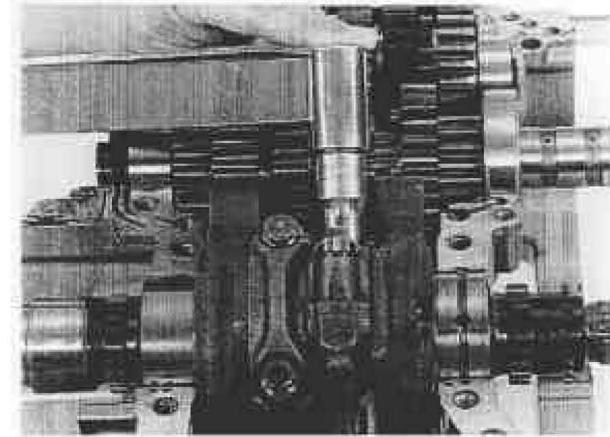
OIL CLEARANCE INSPECTION

- Do not rotate the crankshaft during inspection.*
- Clean off any oil from the bearing inserts and crankpin.
 - Install the crankshaft onto the upper crankcase.
 - Set the connecting rods onto the crankpin.
 - Put a strip of plastigauge lengthwise on the crankpin avoiding the oil hole.



- Use the removed connecting rod bolts when checking the oil clearance.*
- Carefully install the bearing caps, aligning the dowel pins with the holes in the connecting rods.
 - Apply oil to the connecting bolt threads and seating surfaces and install the bolts.
 - Tighten the bolts in 2 or 3 steps alternately.

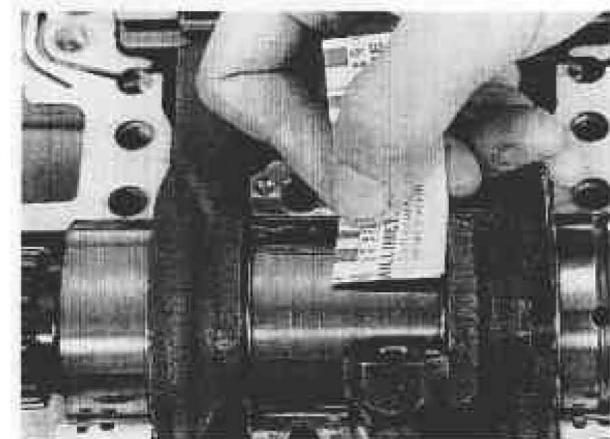
TORQUE: 20 N·m (2.0 kgf·m, 14 lbf·ft) + 120°



Remove the bearing caps and measure the compressed plastigauge at its widest point on the crankpin to determine the oil clearance.

SERVICE LIMIT: 0.060 mm (0.0024 in)

If the oil clearance exceeds the service limit, select the correct replacement bearings.



BEARING SELECTION

Record the connecting rod I. D. code numbers.

NOTE:

Number 1, 2 or 3 on the connecting rod is the code for the connecting rod I. D.

Record the crankpin O. D. code letters.

NOTE:

Letter A, B or C on the crank weight is the code for the crankpin O. D.

Cross reference the connecting rod and crankpin codes to determine the replacement bearing color code.

Connecting rod I. D. code	1	2	3	
Crankpin O. D. code	A	Yellow	Green	Brown
	B	Green	Brown	Black
	C	Brown	Black	Blue

CRANKPIN BEARING INSERT THICKNESS:

Yellow: 1.485 – 1.488 mm (0.0585 – 0.0586 in)

Green: 1.488 – 1.491 mm (0.0586 – 0.0587 in)

Brown: 1.491 – 1.494 mm (0.0587 – 0.0588 in)

Black: 1.494 – 1.497 mm (0.0588 – 0.0589 in)

Blue: 1.497 – 1.500 mm (0.0589 – 0.0591 in)

NOTE:

There are one painted mark on the bearing insert for the front connecting rod, and two painted marks for the rear connecting rod. Use correct bearing inserts.

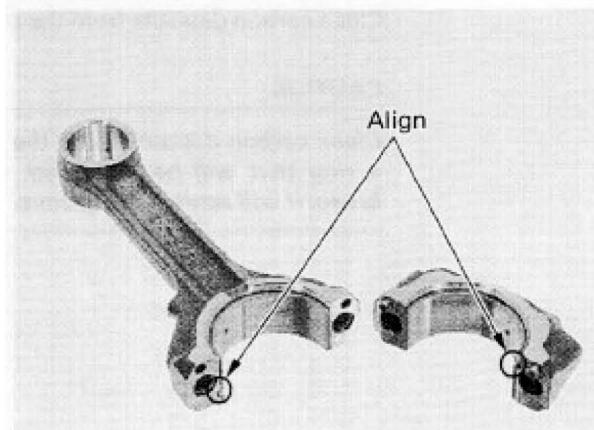
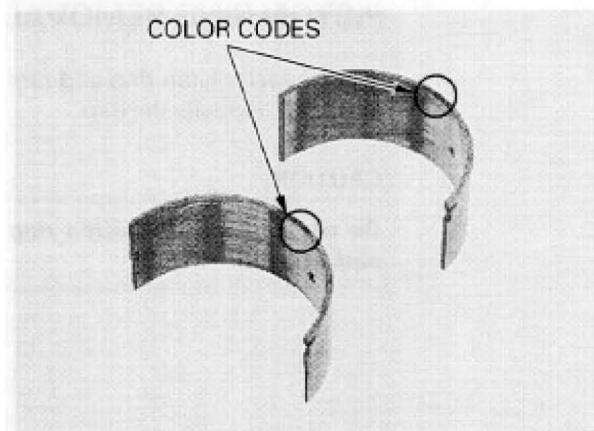
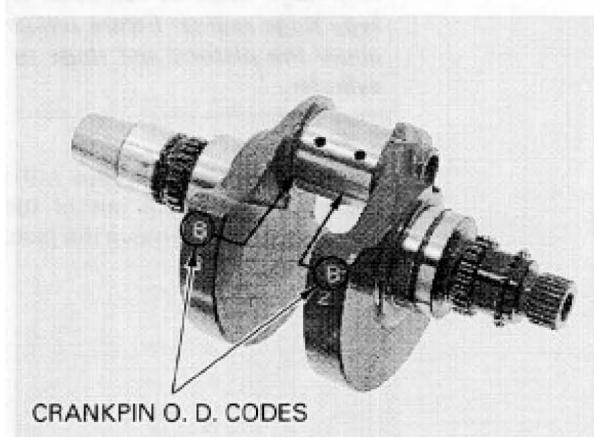
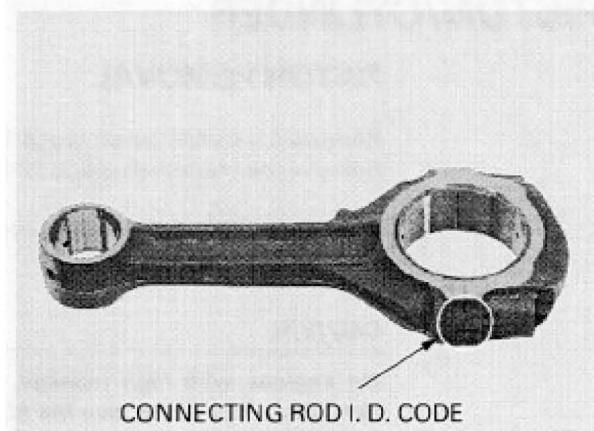
CAUTION:

After selecting new bearings, recheck the oil clearance with plastigauge. Incorrect oil clearance can cause major engine damage.

BEARING INSTALLATION

Clean the bearing outer surfaces, bearing cap and connecting rod.

Install the crankpin bearing inserts onto the bearing cap and connecting rod, aligning each tab with each groove.



PISTON/CYLINDER

PISTON REMOVAL

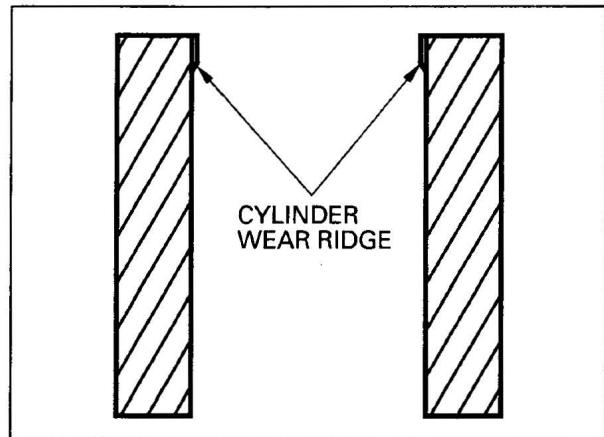
Remove the transmission (page 11-6).
Remove the crankshaft (page 12-3).

Push each piston/connecting rod out through the top of the cylinder bore.

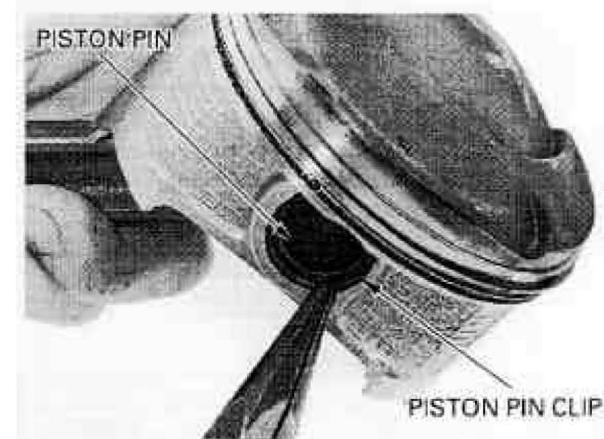
CAUTION:

On engines with high mileage, inspect the cylinders for a ridge just above the highest point of ring travel.

Any ridge must be removed with an automotive type ridge reamer before removing the pistons to allow the pistons and rings to pass through the cylinder.



Remove the piston pin clips with the pliers.
Push the piston pin out of the piston and connecting rod, and remove the piston.

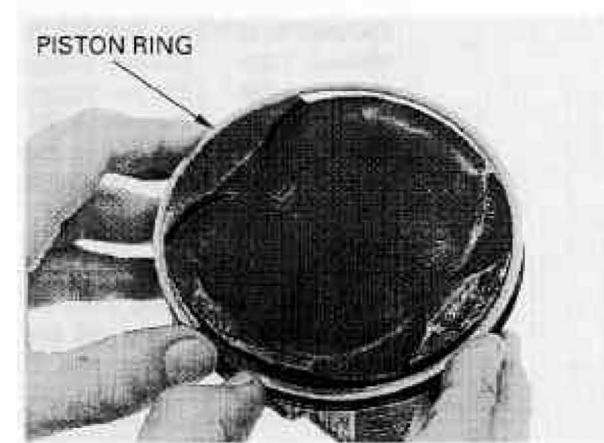


PISTON RING REMOVAL

Spread each piston ring and remove it by lifting up at a point opposite the gap.

CAUTION:

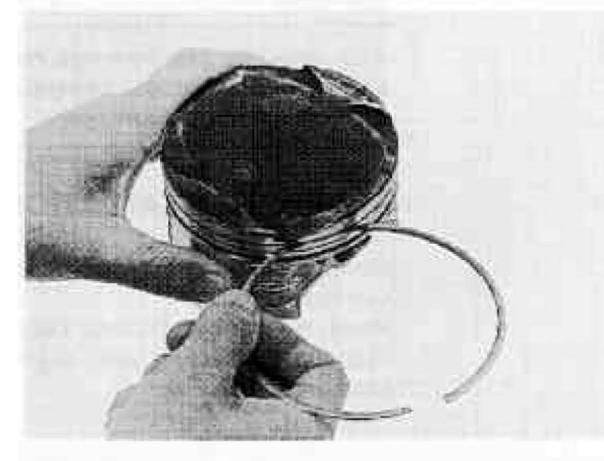
Do not damage the piston ring by spreading the ends too far.



Clean carbon deposits from the piston.

CAUTION:

Clean carbon deposits from the ring grooves with a ring that will be discarded. Never use a wire brush; it will scratch the groove.



PISTON INSPECTION

Inspect the piston rings for movement by rotating the rings. The rings should be able to move in their grooves without catching.

Push the ring until the outer surface of the piston ring is nearly flush with the piston and measure the ring-to-ring groove clearance.

SERVICE LIMITS: **Top:** 0.115 mm (0.0045 in)
Second: 0.085 mm (0.0033 in)

Insert each piston ring into the bottom of the cylinder squarely using the piston.
Measure the ring end gap.

SERVICE LIMITS: **Top:** 0.55 mm (0.022 in)
Second: 0.70 mm (0.028 in)
Oil (side rail): 0.90 mm (0.035 in)

Measure the piston pin O. D. at piston and connecting rod sliding areas.

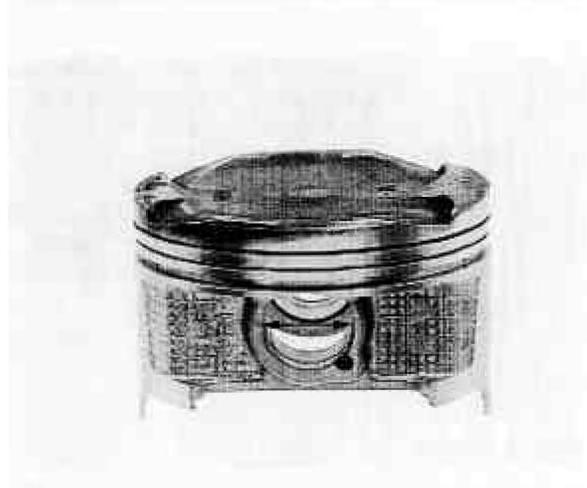
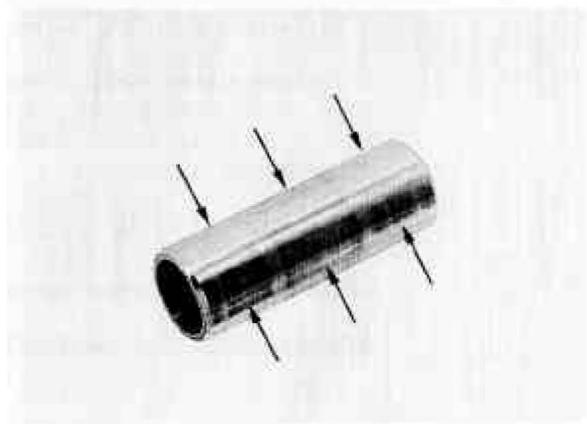
SERVICE LIMIT: 23.984 mm (0.9443 in)

Measure the piston pin hole I. D.

SERVICE LIMIT: 24.03 mm (0.946 in)

Calculate the piston-to-piston pin clearance.

SERVICE LIMIT: 0.046 mm (0.0018 in)

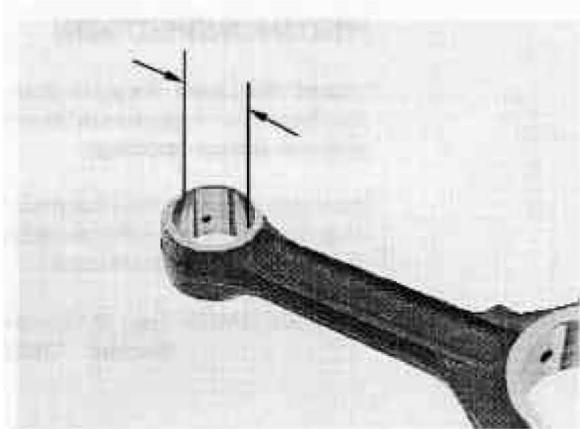


Measure the connecting rod small end I. D.

SERVICE LIMIT: 24.051 mm (0.9469 in)

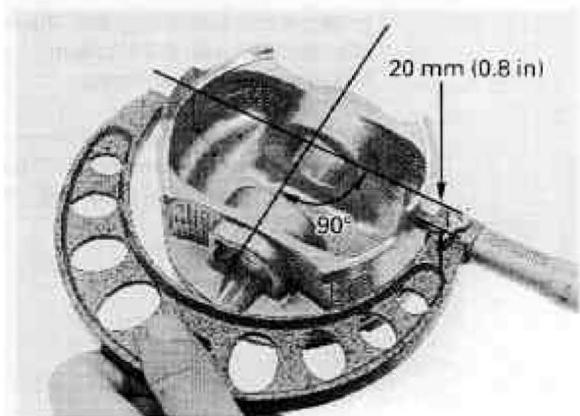
Calculate the connecting rod-to-piston pin clearance.

SERVICE LIMIT: 0.067 mm (0.0026 in)



Measure the piston O. D. at a point 20 mm (0.8 in) from the bottom and 90° to the piston pin hole.

SERVICE LIMIT: 97.900 mm (3.8543 in)



CYLINDER INSPECTION

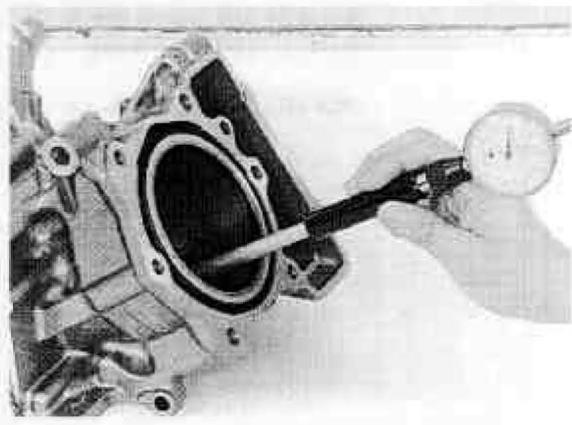
Inspect the cylinder wall for scratch or wear.

Measure the cylinder I. D. at three levels in an X and Y axis. Take the maximum reading to determine the cylinder wear.

SERVICE LIMIT: 98.100 mm (3.8622 in)

Calculate the cylinder-to-piston clearance.

SERVICE LIMIT: 0.200 mm (0.0079 in)



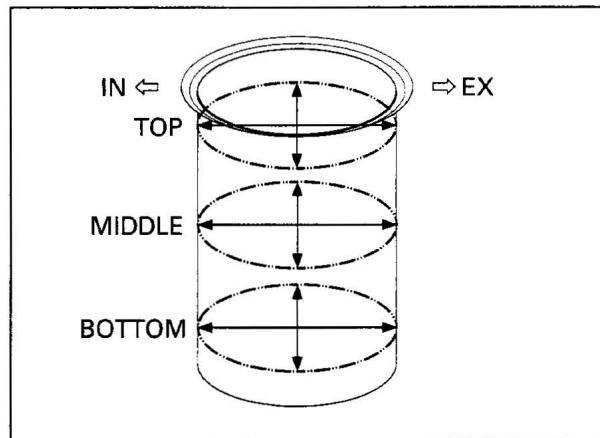
Calculate the cylinder taper and out-of-round at three levels in an X and Y axis. Take the maximum reading to determine the taper and out-of-round.

SERVICE LIMITS: Taper:

0.10 mm (0.004 in)

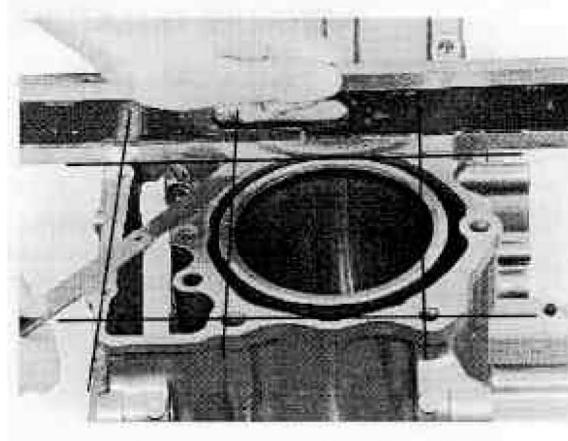
Out-of-round:

0.10 mm (0.004 in)



Check the top of the cylinder for warpage with a straight edge and feeler gauge.

SERVICE LIMIT: 0.05 mm (0.002 in)



PISTON RING INSTALLATION

Carefully install the piston rings into the piston ring grooves with the markings facing up.

CAUTION:

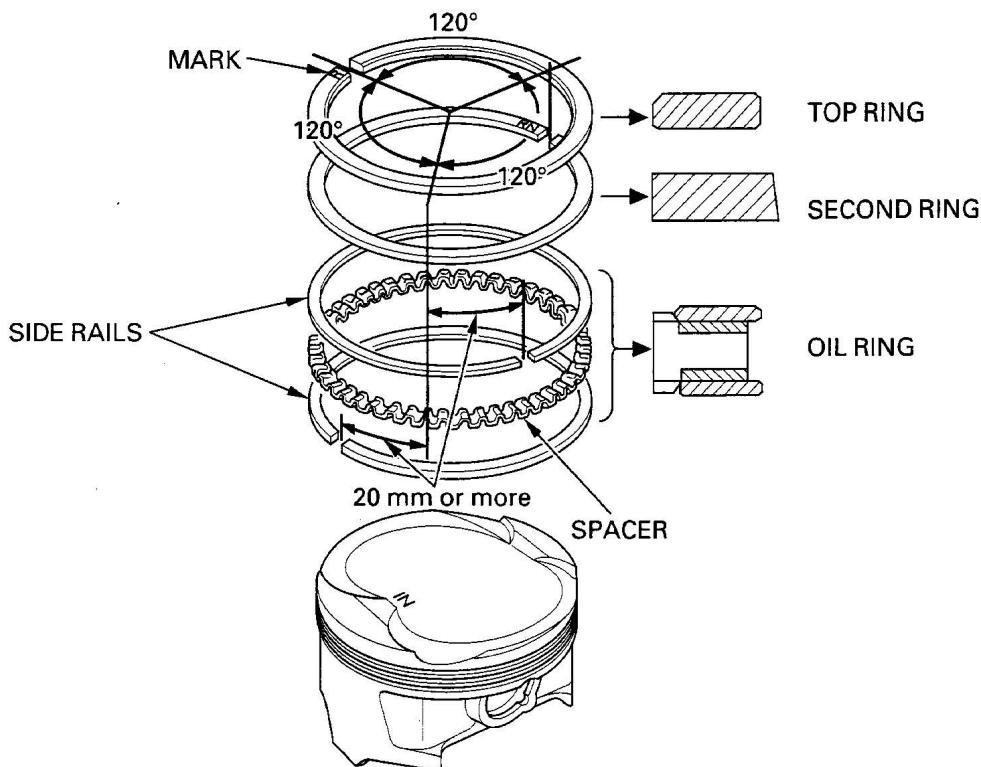
Be careful not to damage the piston and rings during installation.

NOTE:

To install the oil ring, install the spacer first, then install the side rails.

Stagger the piston ring end gaps 120 degrees apart from each other.

Stagger the side rail end gaps as shown.

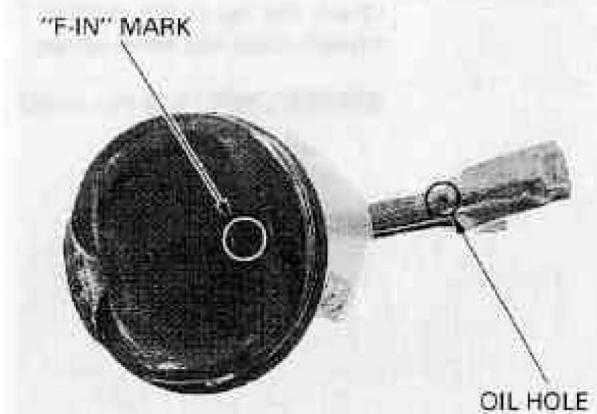


PISTON INSTALLATION

Apply molybdenum oil solution to the connecting rod small end inner surfaces.
Apply oil to the piston pin hole.

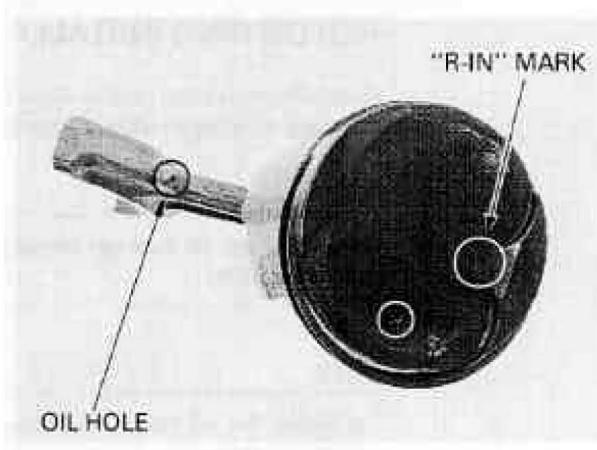
Front cylinder piston:

Note that the connecting rod has "MBBF" mark.
Install the piston on the connecting rod so that the "F-IN" mark is facing the same direction as the oil hole in the rod.



Rear cylinder piston:

Note that the connecting rod has "MBBR" mark.
Install the piston on the connecting rod so that the "R-IN" mark is opposite the oil hole in the rod.

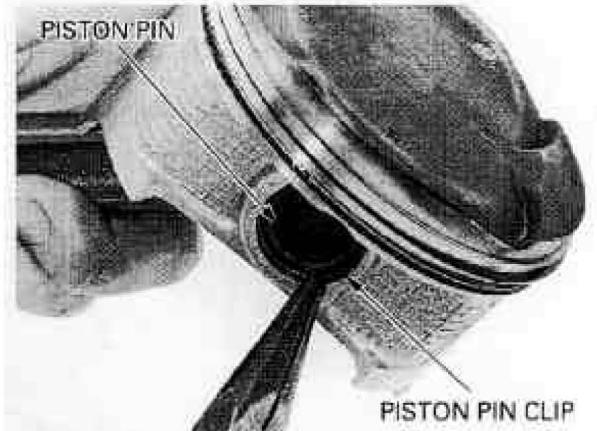


Install the piston pin into the piston and connecting rod.

Install new piston pin clips into the groove of the piston pin hole.

NOTE:

- Make sure that the piston pin clips are seated securely.
- Do not align the piston pin clip end gap with the piston cutout.



Coat the piston and piston rings with engine oil.
Install the piston/connecting rod in the cylinder with the "IN" mark toward the intake side, using a commercially available piston ring compressor tool.

Install the crankshaft (page 12-3).

