

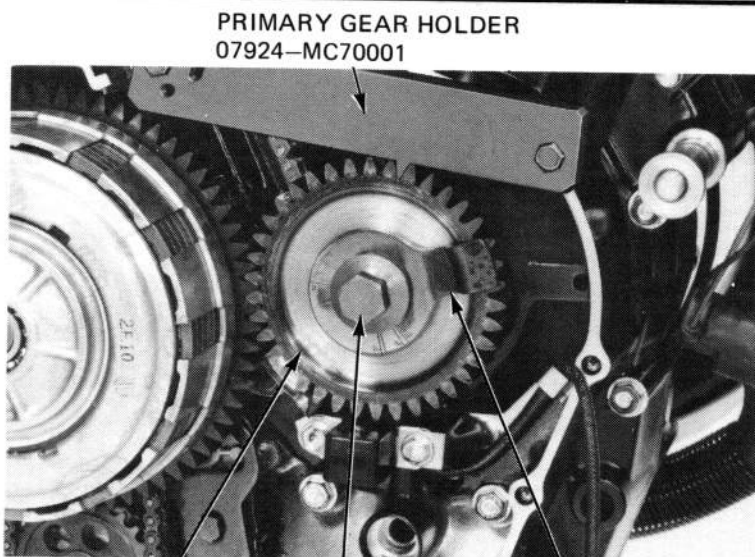
PRIMARY GEAR

REMOVAL

Remove the right crankcase cover (page 7-15).

Hold the primary gear with the gear holder and remove the bolt.

Remove the pulse generator plate and primary gear from the crankshaft.



PRIMARY GEAR HOLDER 07924-MC70001
PRIMARY GEAR BOLT PULSE GENERATOR PLATE

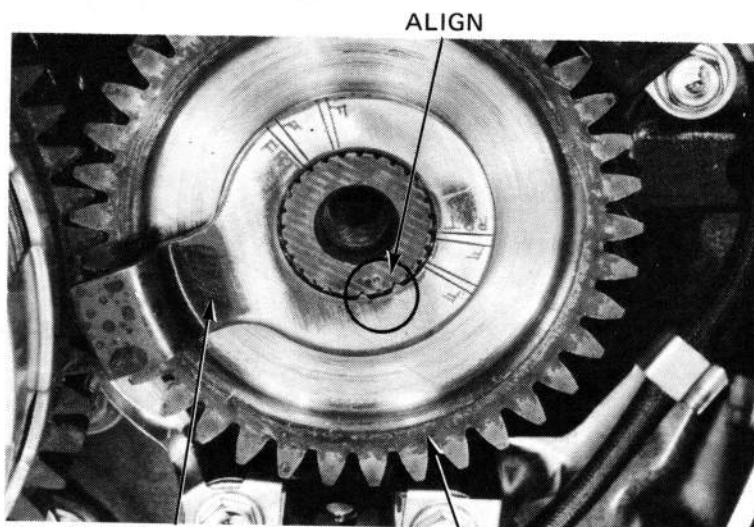
INSTALLATION

Install the primary gear.

Align the center of two pulse generator plate teeth with the flat of the crankshaft serrations and install the plate.

Measure the pulse coil air gap and adjust if necessary.

COIL AIR GAP: 0.3–0.9 mm (0.01–0.04 in)



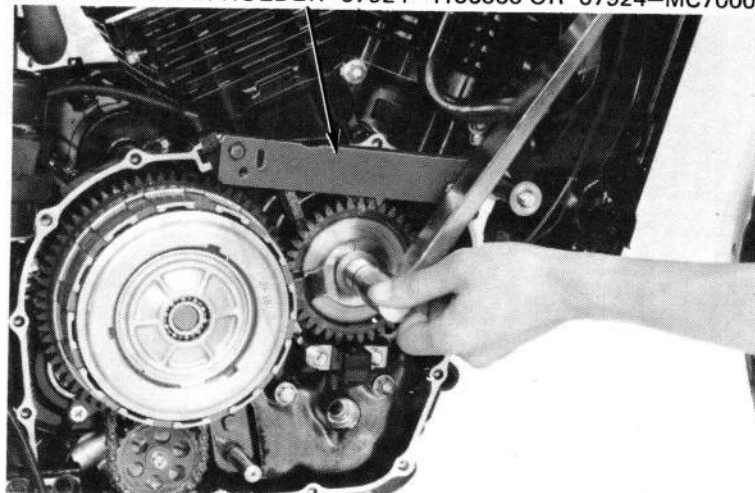
ALIGN
PULSE GENERATOR PLATE PRIMARY GEAR
PRIMARY GEAR HOLDER 07924-MC70001 OR
MODIFIED GEAR HOLDER 07924-4150000 OR 07924-MC70000

Tighten the primary gear bolt.

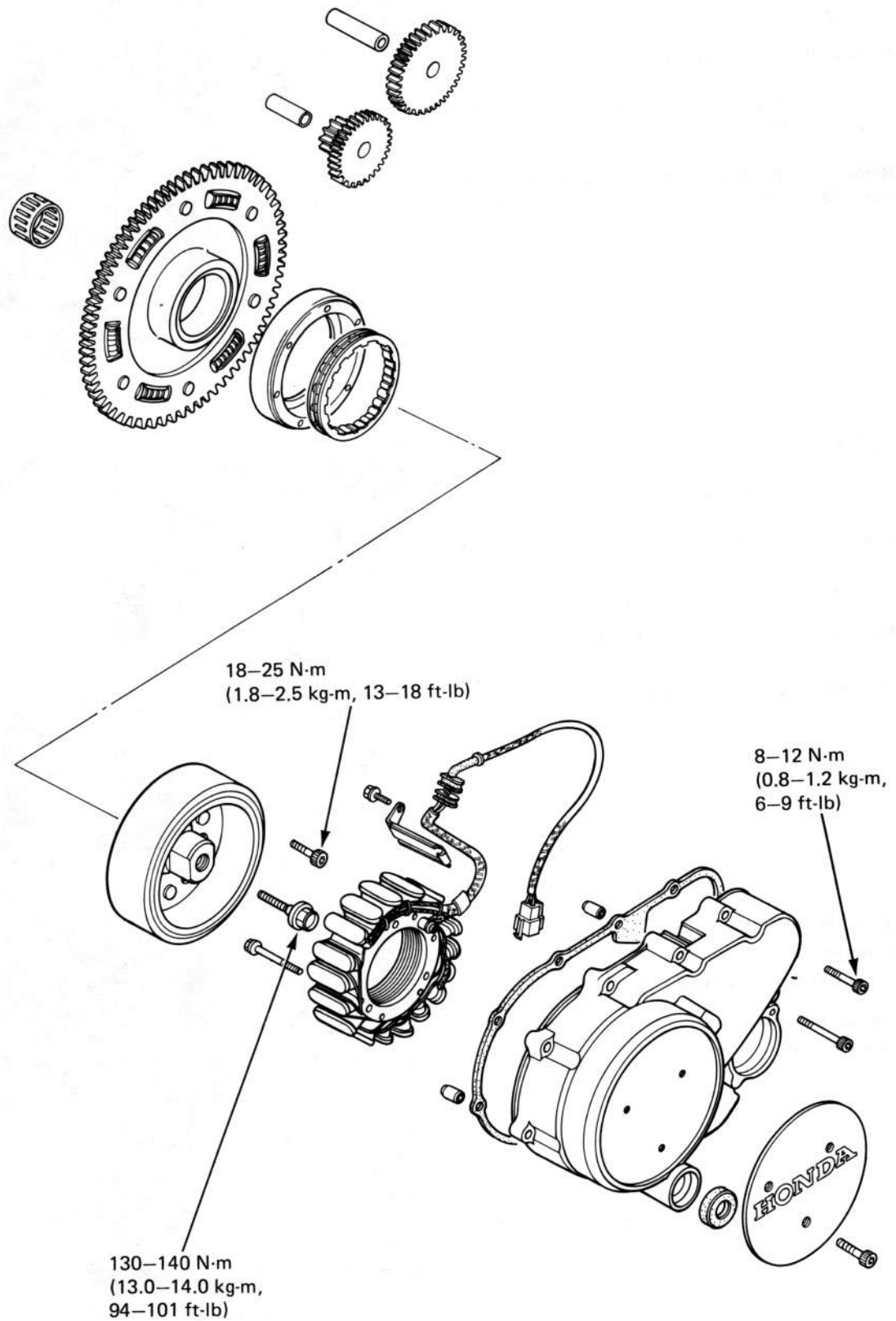
TORQUE:

80–100 N·m (8.0–10.0 kg·m, 58–72 ft·lb)

Remove the gear holder tool and install the right crankcase cover.



ALTERNATOR/STARTER CLUTCH



8. ALTERNATOR / STARTER CLUTCH

| | |
|----------------------------|-----|
| SERVICE INFORMATION | 8-1 |
| STATOR REMOVAL | 8-2 |
| FLYWHEEL REMOVAL | 8-3 |
| STARTER CLUTCH DISASSEMBLY | 8-4 |
| STARTER CLUTCH ASSEMBLY | 8-5 |
| FLYWHEEL INSTALLATION | 8-6 |
| STATOR INSTALLATION | 8-6 |

SERVICE INFORMATION

8

GENERAL

- This section covers removal and installation of the alternator and starter clutch.
- Refer to section 18 for troubleshooting and inspection of the alternator.

SPECIFICATIONS

| | STANDARD | SERVICE LIMIT |
|---------------------------|-------------------------------------|---------------------|
| Starter driven gear O.D. | 57.710–57.840 mm (2.2720–2.2772 in) | 57.60 mm (2.268 in) |
| Starter clutch outer I.D. | 74.414–74.440 mm (2.9297–2.9307 in) | 74.50 mm (2.933 in) |

TORQUE VALUE

| | |
|--------------------------------|--|
| Alternator rotor/Flywheel bolt | 130–140 N·m (13.0–14.0 kg·m, 94–101 ft·lb) |
| Starter clutch Torx bolts | 18–25 N·m (1.8–2.5 kg·m, 13–18 ft·lb) |
| Alternator cover bolts | 8–12 N·m (0.8–1.2 kg·m, 6–9 ft·lb) |

TOOLS

Special

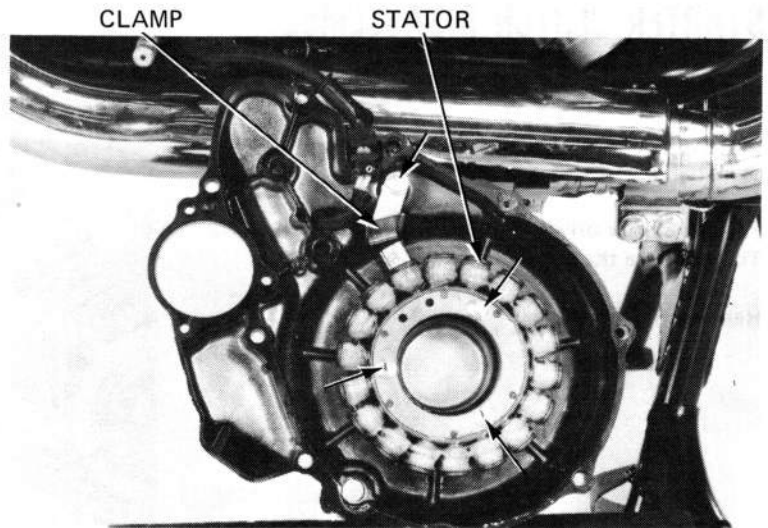
- Torx bit – Commercially available in U.S.A.
- Flywheel holder 07925–ME90000 – or band strap wrench (commercially available in U.S.A.)

Common

- Rotor puller 07733–0020001 or 07933–3250000

Remove the bolt attaching the alternator wire clamp and clamp.

Remove the stator mounting bolts and stator from the alternator cover.



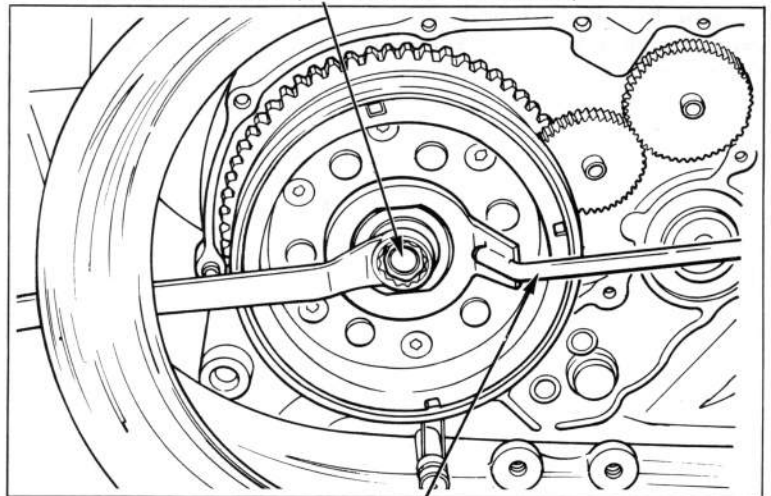
FLYWHEEL REMOVAL

Hold the flywheel with the flywheel holder and remove the flywheel bolt.

NOTE:

The flywheel bolt has left-hand threads.

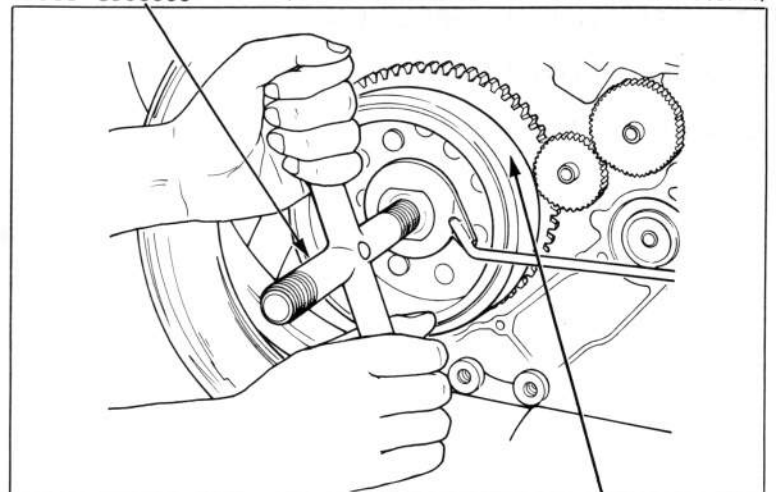
FLYWHEEL BOLT (LEFT-HAND THREADS)



ROTOR PULLER
07733-0020001 OR
07933-3950000

FLYWHEEL HOLDER 07923-ME90000R
BAND STRAP WRENCH
(COMMERCIALLY AVAILABLE IN U.S.A.)

Remove the flywheel with the rotor puller.



FLYWHEEL

ALTERNATOR/STARTER CLUTCH

STARTER CLUTCH DISASSEMBLY

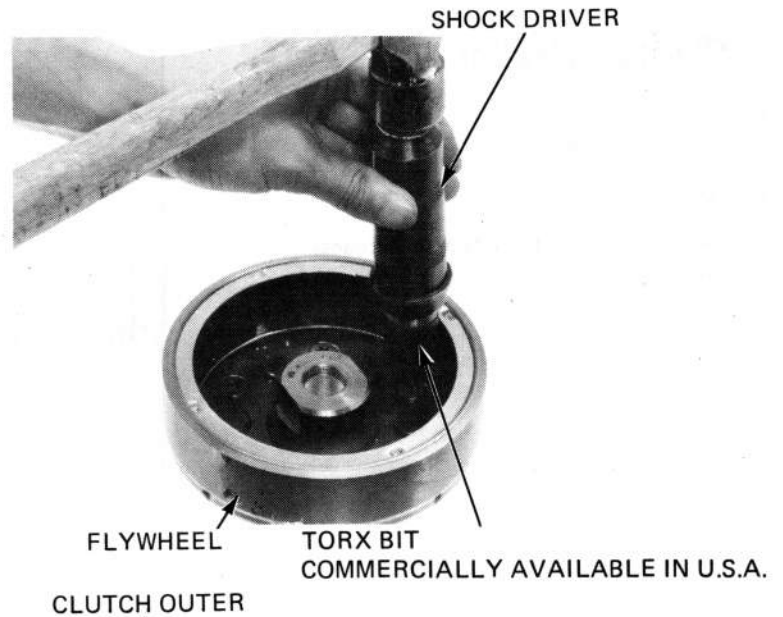
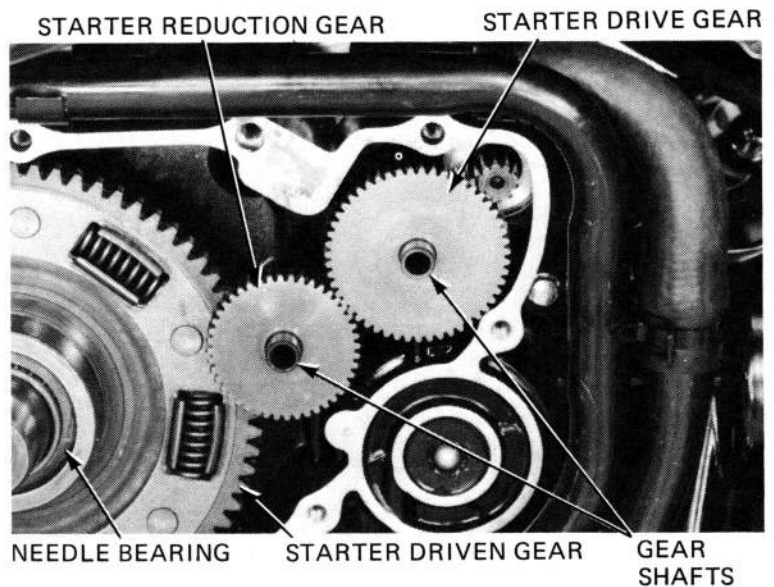
Remove the flywheel (page 8-3).

Remove the starter drive and reduction gears, and gear shafts.

Pull the starter driven gear toward you until it stops. Then remove the needle bearing from the gear.

Remove the driven gear.

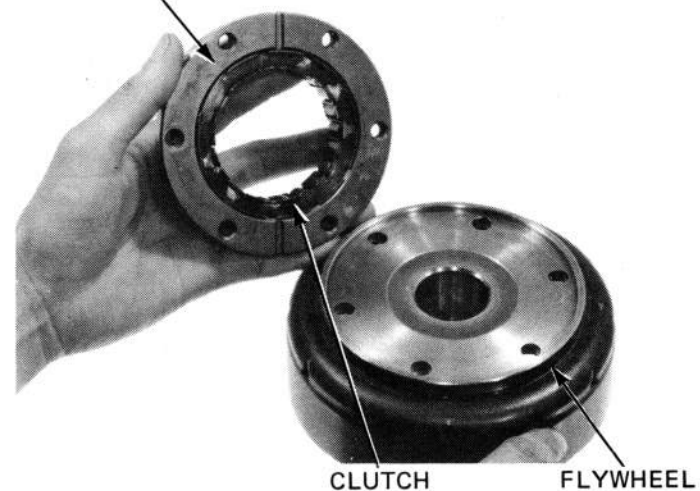
Remove the six torx bolts attaching the starter clutch to the flywheel and remove the starter clutch and clutch outer.



STARTER CLUTCH INSPECTION

Inspect the starter clutch for smooth operation.

Check the rollers for excessive wear.



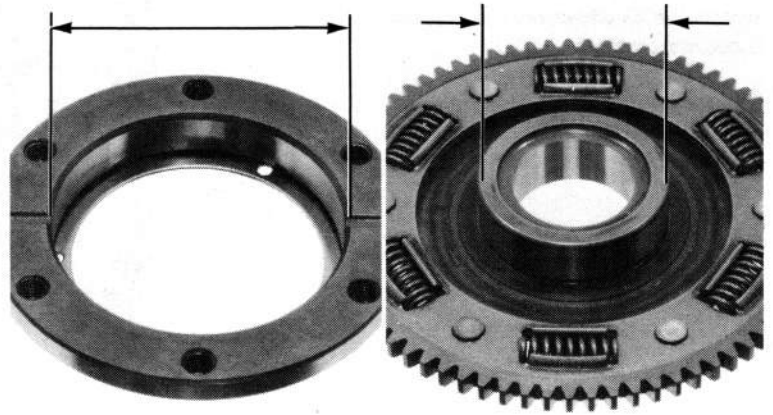
Inspect the driven gear for damage or excessive wear.

Measure the starter clutch outer I.D.

SERVICE LIMIT: 74.50 mm (2.933 in)

Measure the driven gear O.D.

SERVICE LIMIT: 57.60 mm (2.268 in)

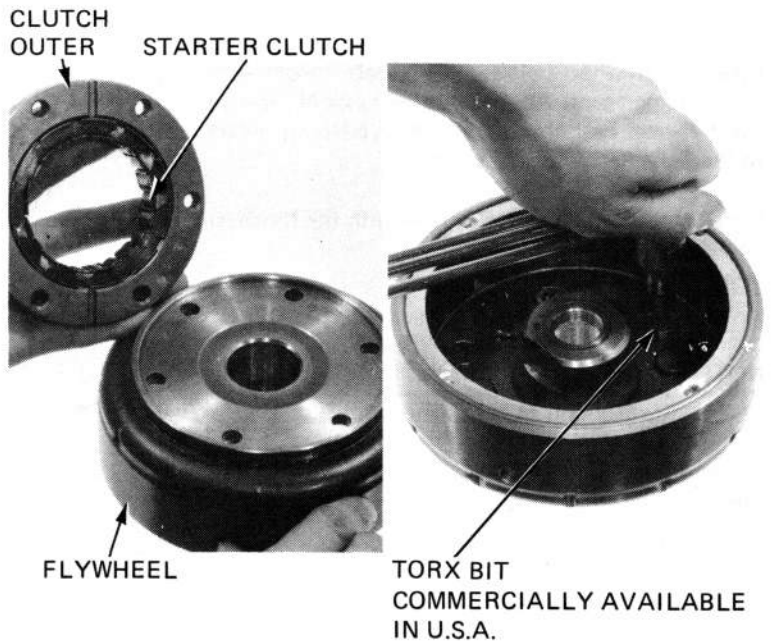


STARTER CLUTCH ASSEMBLY

Install the starter clutch and clutch outer onto the flywheel.

Apply Loctite® Lock N'Seal to the threads of the six torx bolts and tighten the bolts with a torx bit.

TORQUE: 18–25 N·m (1.8–2.5 kg·m, 13–18 ft·lb)

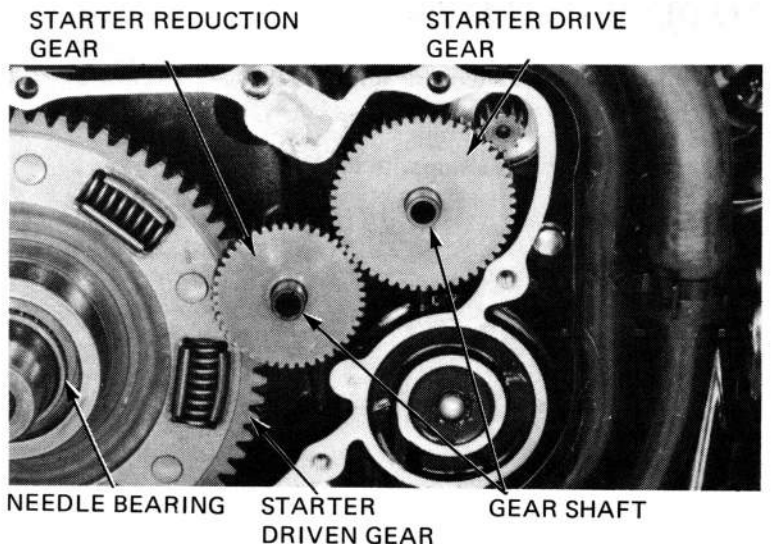


Install the starter driven gear and needle bearing over the crankshaft.

Install the starter reduction gear, drive gear and shafts.

NOTE:

The starter drive gear and reduction gear must be replaced as a set; if either the starter drive gear or reduction gear needs replacement, replace the other gear also.

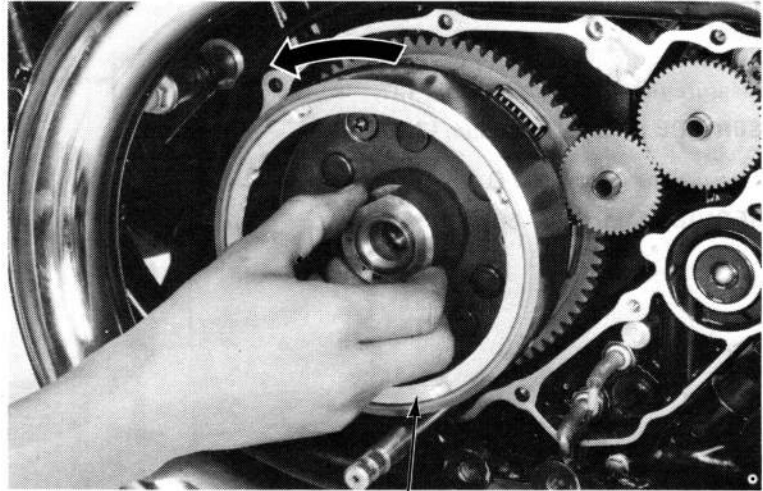


ALTERNATOR/STARTER CLUTCH

FLYWHEEL INSTALLATION

Install the flywheel on the crankshaft while turning it counterclockwise.

Clean the outside of the flywheel so a band strap wrench will not slip when the flywheel bolt is tightened.



FLYWHEEL

Clean the flywheel bolt and crankshaft threads with a degreasing agent. Apply Loctite® Lock N' Seal to the flywheel bolt threads and molybdenum grease to the bolts flange seating surface.

Install the bolt hold the flywheel with the flywheel holder and torque the bolt.

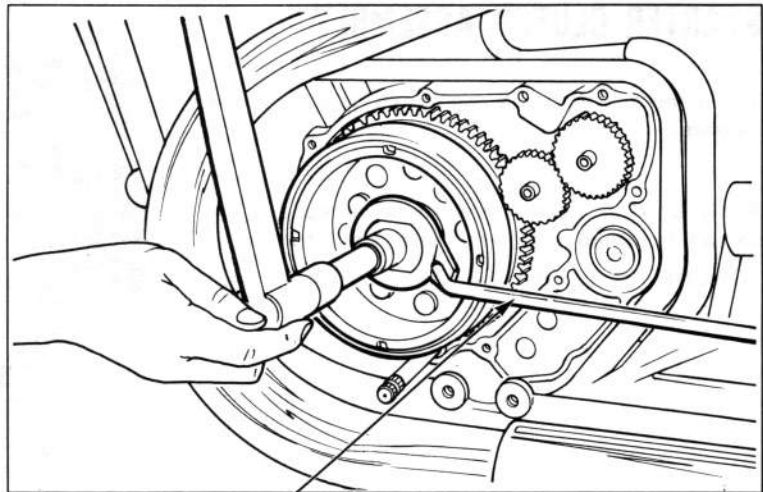
TORQUE:

130–140 N·m (13.0–14.0 kg·m, 94–101 ft·lb)

NOTE:

The flywheel bolt has left-hand threads.

Allow the Loctite® to dry for one hour before operating the engine.



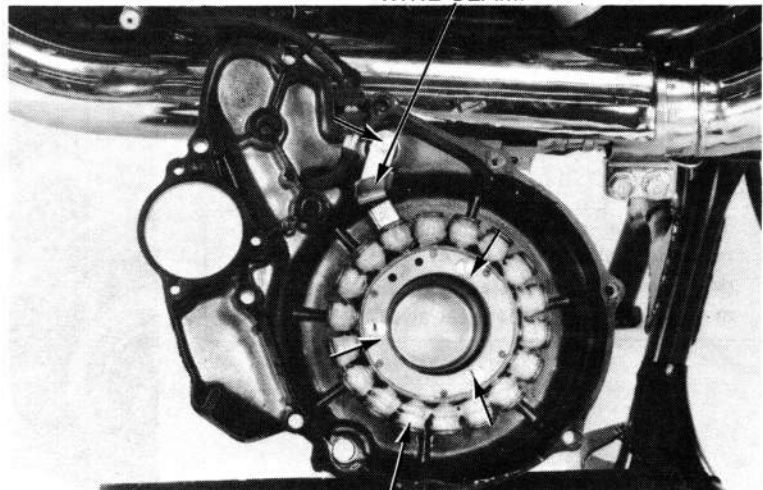
FLYWHEEL HOLDER 07925-ME90000 OR
BAND STRAP WRENCH (COMMERCIALY AVAILABLE IN U.S.A.)

WIRE CLAMP

STATOR INSTALLATION

Install the stator on the alternator cover and tighten the three bolts.

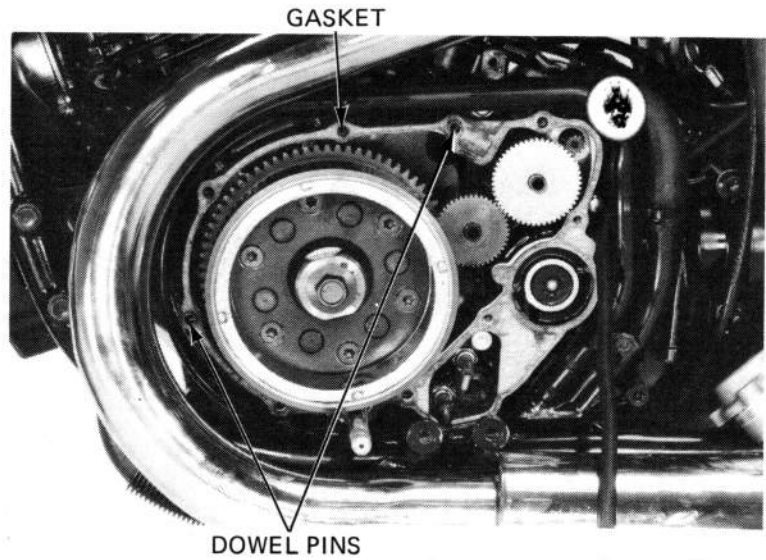
Install the alternator wire clamp with the bolt.



STATOR

ALTERNATOR/STARTER CLUTCH

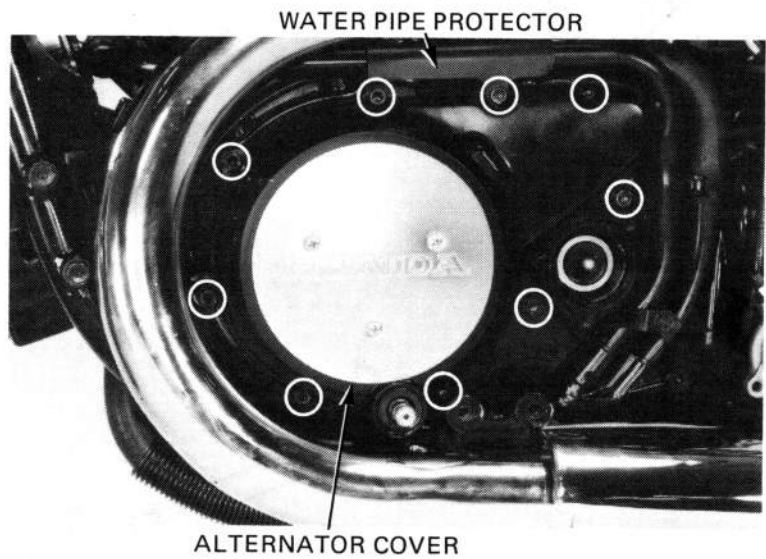
Install the dowel pins and a new gasket.



Install the alternator cover.

Install the water pipe protector and tighten the two bolts.

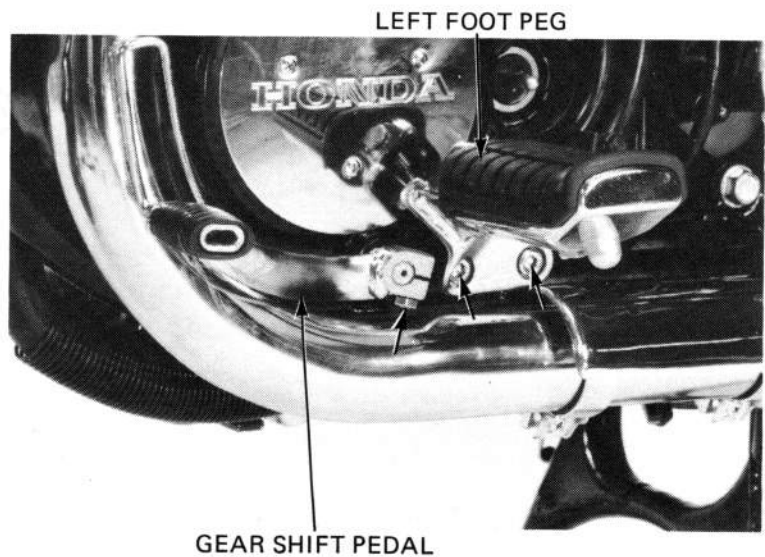
TORQUE: 8–12 N·m (0.8–1.2 kg·m, 6–9 ft·lb)



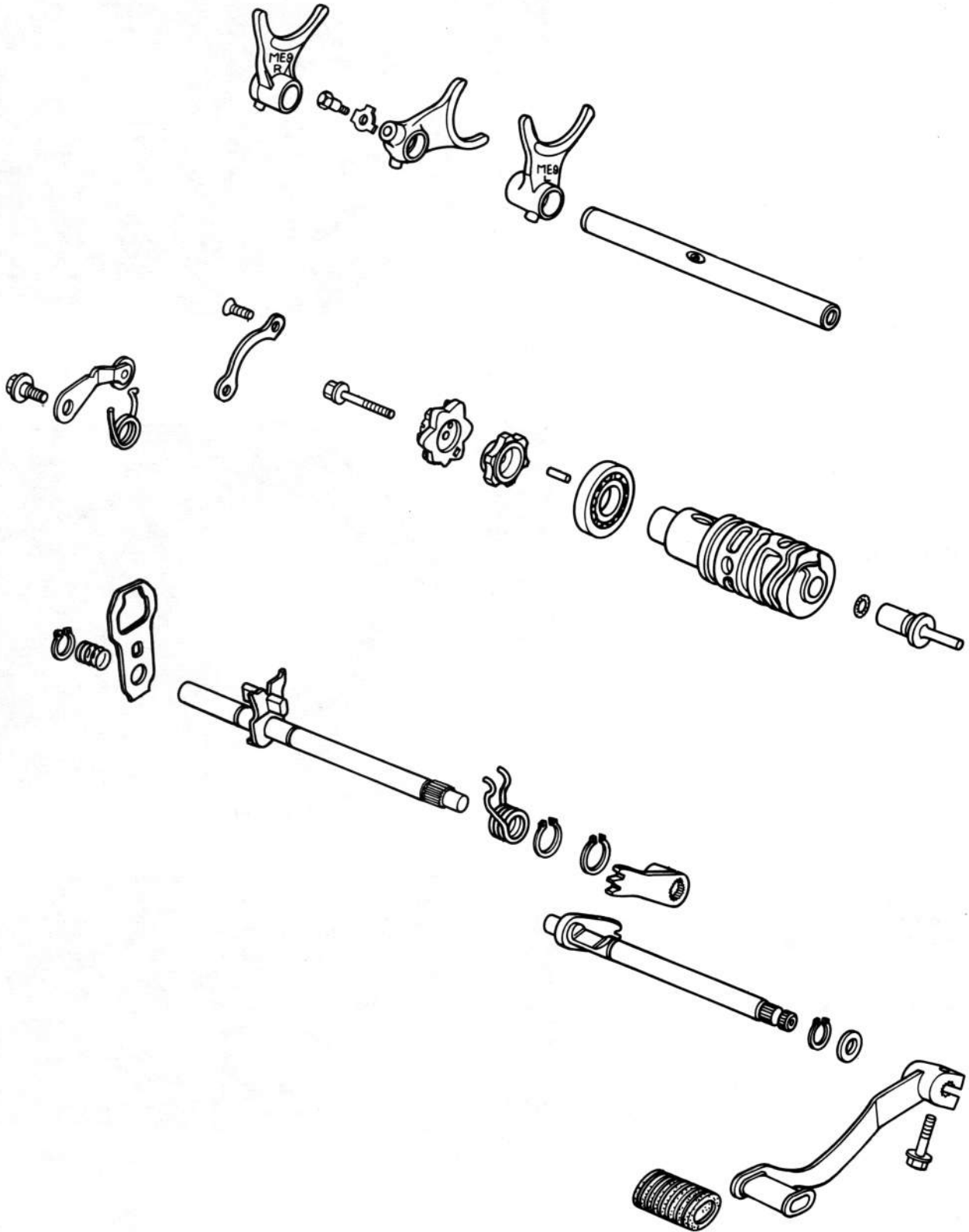
Install the left foot peg and gear shift pedal.

Install the clutch slave cylinder (page 7-10).
Connect the alternator coupler.

Install the seat and frame left side cover.



GEARSHIFT LINKAGE



9. GEARSHIFT LINKAGE

| | |
|--------------------------------|-----|
| SERVICE INFORMATION | 9-1 |
| TROUBLESHOOTING | 9-2 |
| GEARSHIFT LINKAGE REMOVAL | 9-3 |
| GEARSHIFT LINKAGE INSTALLATION | 9-4 |

SERVICE INFORMATION

GENERAL

- The gearshift spindle and stopper arms can be serviced with the engine in the frame.
- If the shift forks, drum and transmission require servicing, remove the engine and separate the crankcase (section 13).

TROUBLESHOOTING

Hard to shift

1. Improper clutch hydraulic system; air in system.
2. Shift forks bent.
3. Shift claw bent.
4. Shift drum cam grooves damaged.

Transmission jumps out of gear

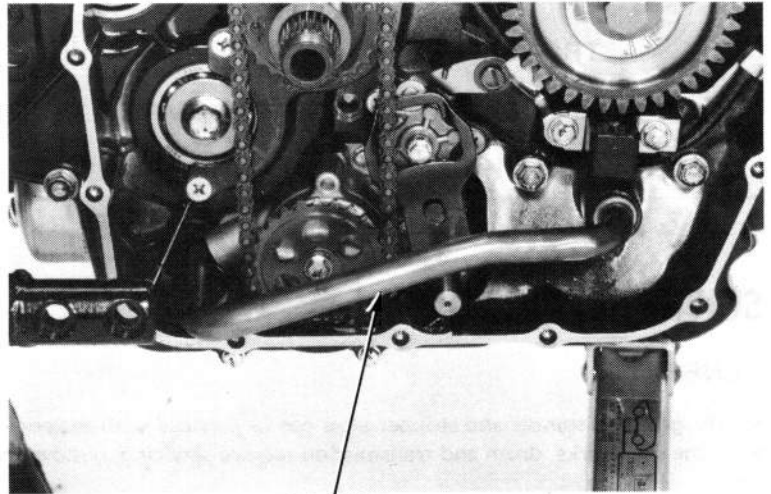
1. Gear dogs worn.
2. Shift shaft bent.
3. Shift drum stopper broken.
4. Shift forks bent.

GEARSHIFT LINKAGE

GEARSHIFT LINKAGE REMOVAL

Remove the right crankcase cover and clutch assembly (section 7).

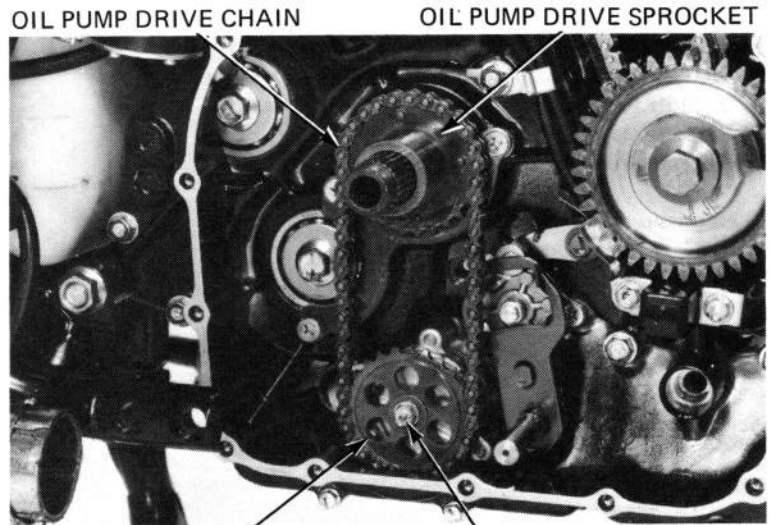
Remove the oil pipe.



OIL PIPE

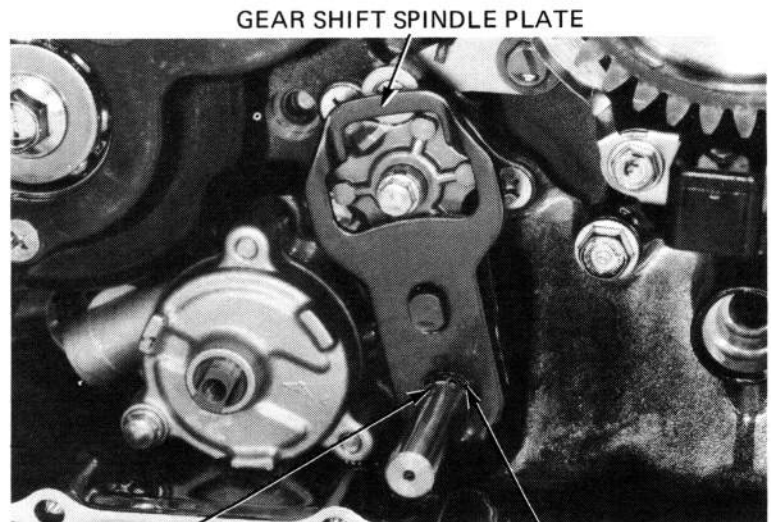
Remove the oil pump driven sprocket bolt.

Remove the oil pump drive chain, drive and driven sprockets.



OIL PUMP DRIVEN SPROCKET BOLT

Remove the snap ring, spring and gearshift spindle plate.

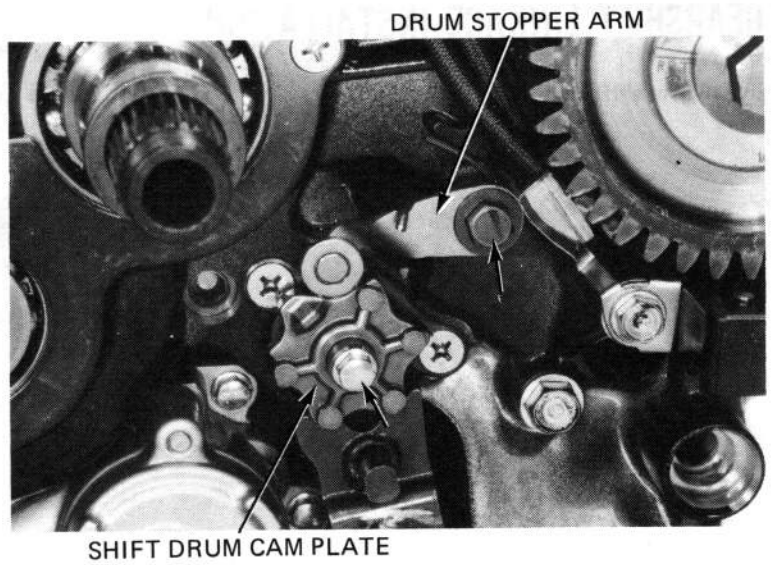


SNAP RING

SPRING

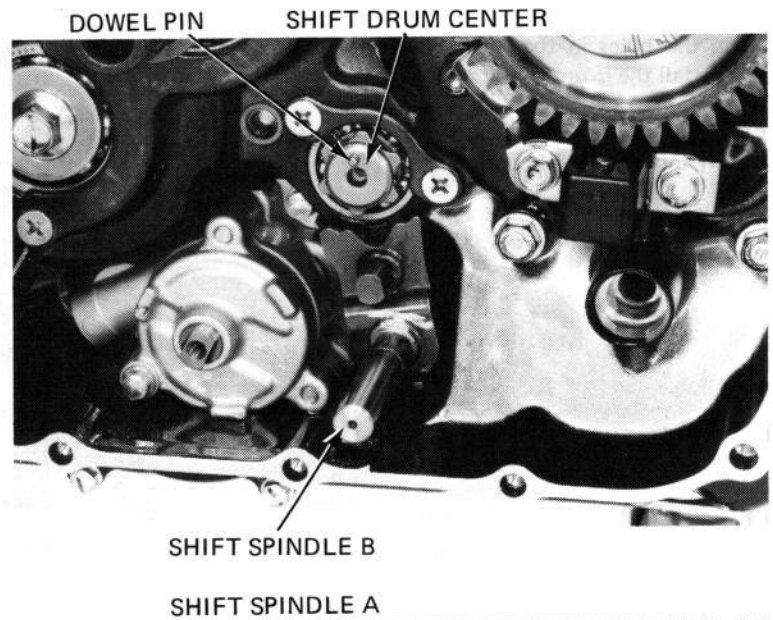
Remove the drum stopper arm bolt, arm and spring.

Remove the shift drum cam plate bolt and cam plate.



Remove the dowel pin and the shift drum center.

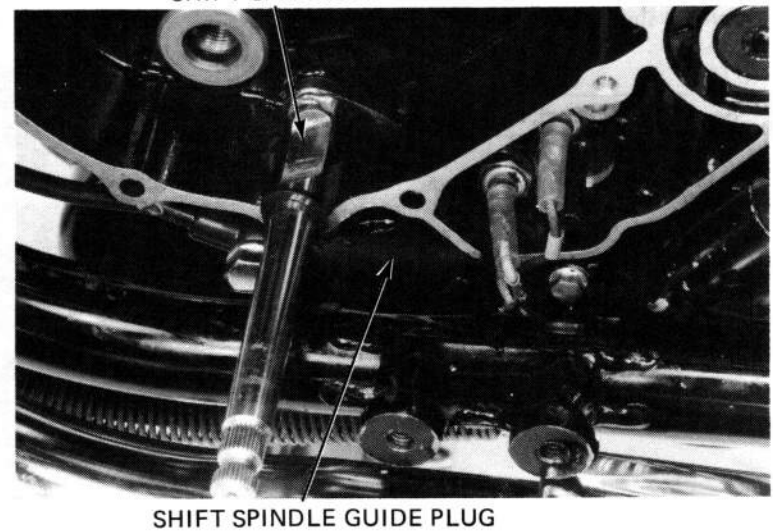
Remove gear shift spindle B.



Remove the flywheel and starter clutch assembly (section 8).

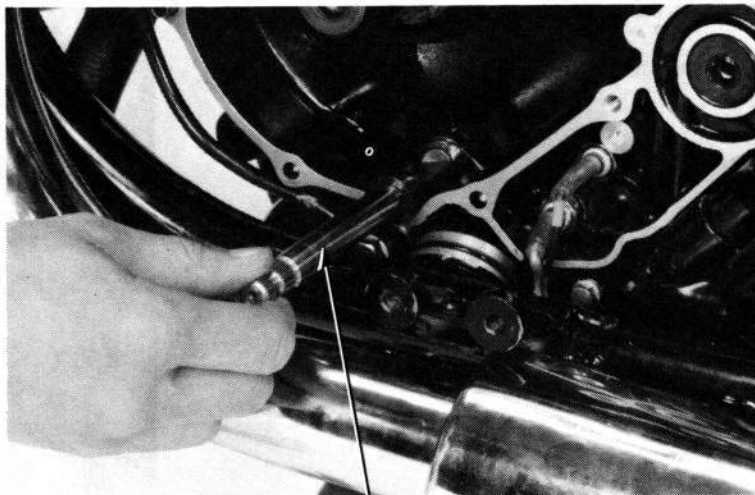
Remove the shift spindle guide plug from the left crankcase.

Remove gear shift spindle A.



GEARSHIFT LINKAGE INSTALLATION

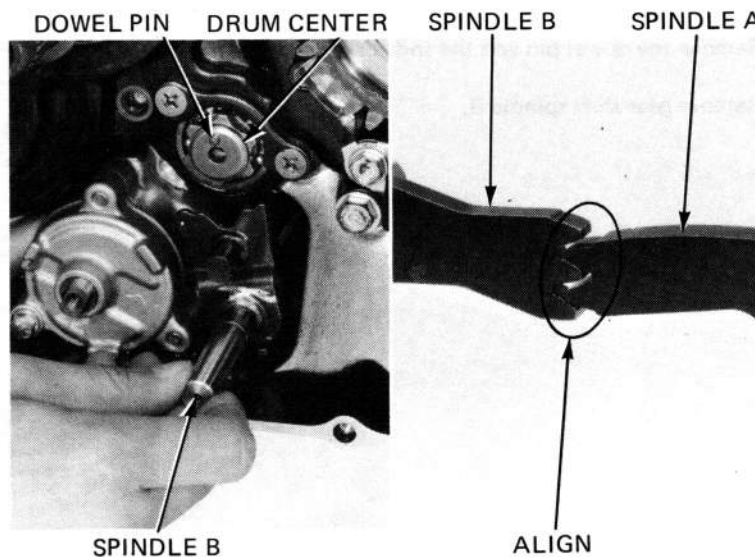
Install gear shift spindle A.



GEAR SHIFT SPINDLE A

Align the holes in the shift drum and drum center and install the drum center and dowel pin.

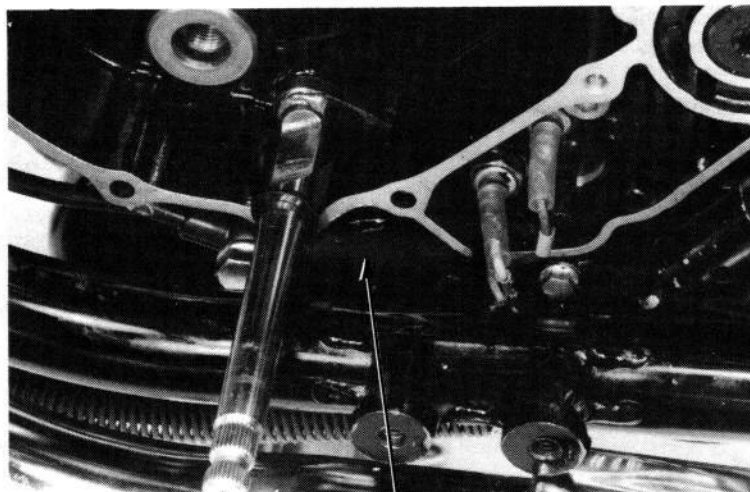
Align the teeth of gear shift spindle A and B as shown and install shift spindle B.



Install the shift spindle guide plug.

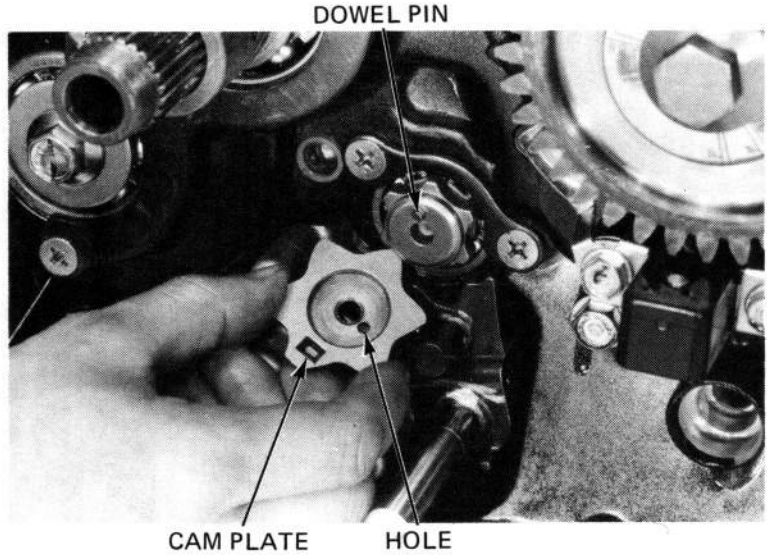
NOTE:

Be careful not to damage the O-ring.



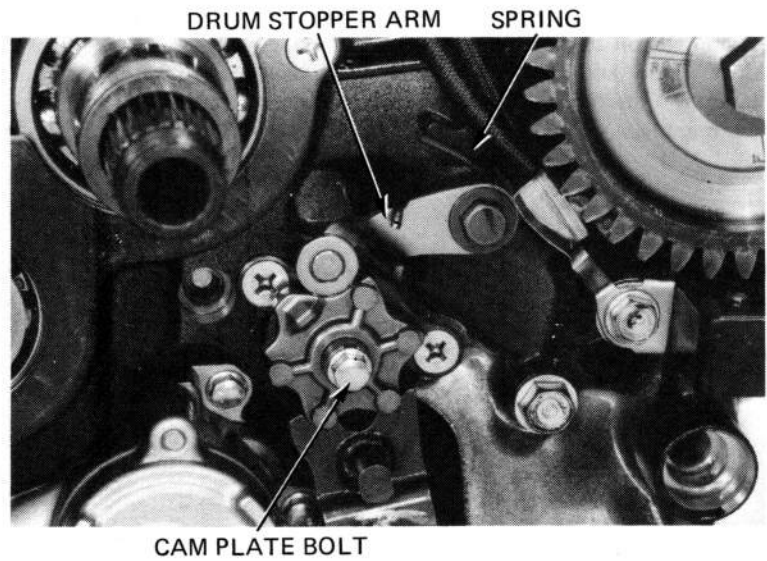
SHIFT SPINDLE GUIDE PLUG

Align the cam plate hole with the dowel pin on the drum center and install the cam plate.



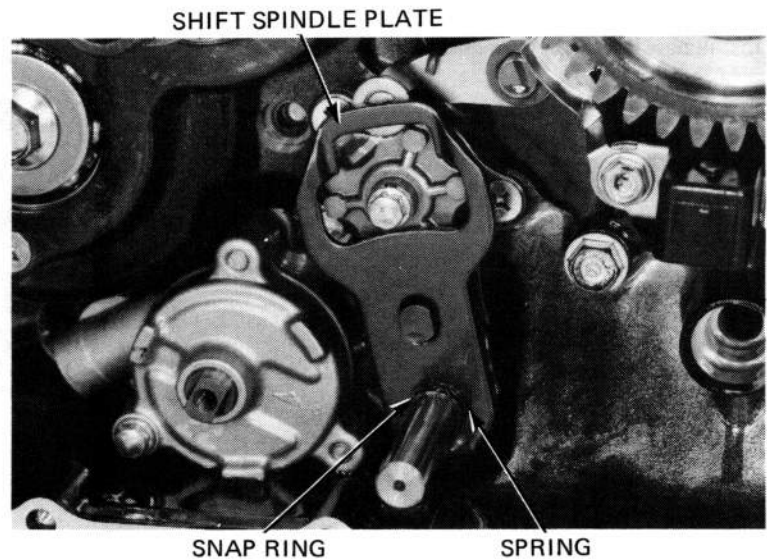
Tighten the cam plate bolt securely.

Install the drum stopper arm, spring and bolt. Tighten the bolt securely.



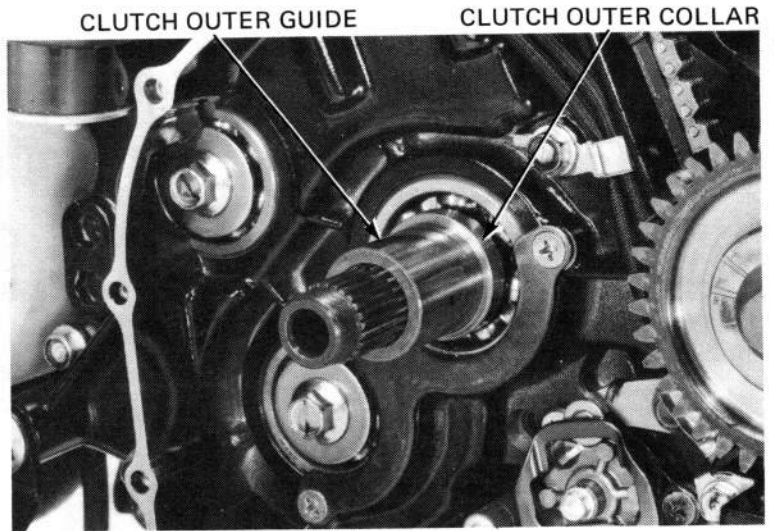
Install the shift spindle plate, spring and snap ring over shift spindle B.

Rotate the gearshift spindle and check the shift mechanism for smooth operation.



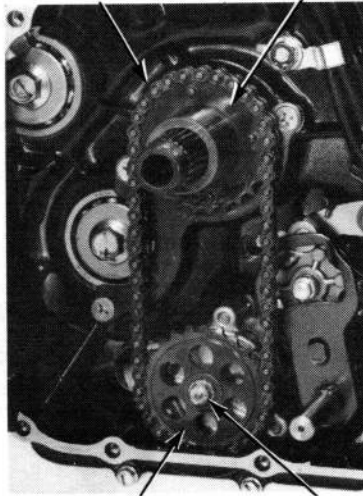
GEARSHIFT LINKAGE

Install the clutch outer collar and guide over the mainshaft.

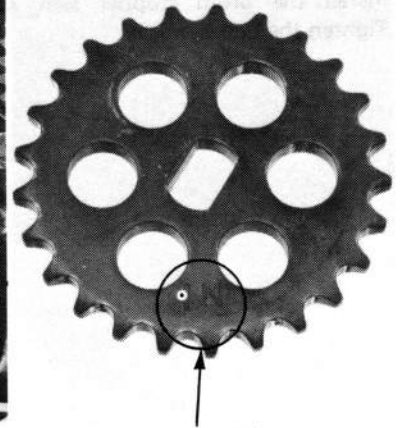


Install the oil pump drive and driven sprockets with drive chain and tighten the driven sprocket bolt securely. The driven sprocket "IN" mark must face the crankcase.

OIL PUMP
DRIVE CHAIN DRIVE SPROCKET



DRIVEN SPROCKET BOLT



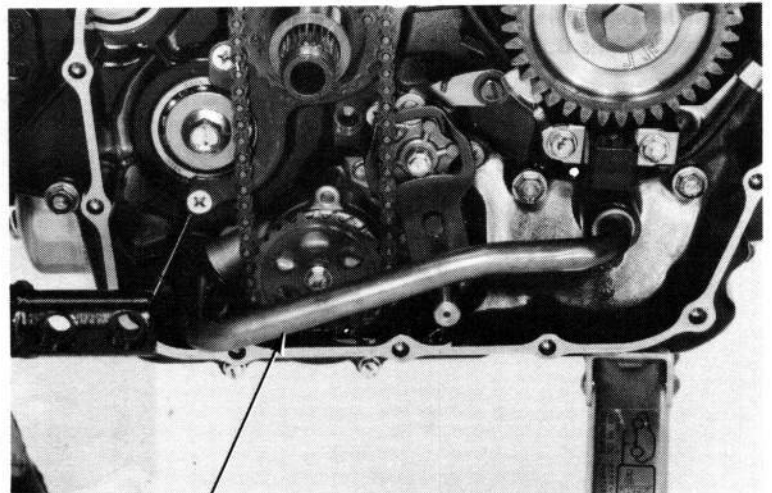
"IN" MARK

Install new O-rings on the ends of the oil pipe.

Install the oil pipe.

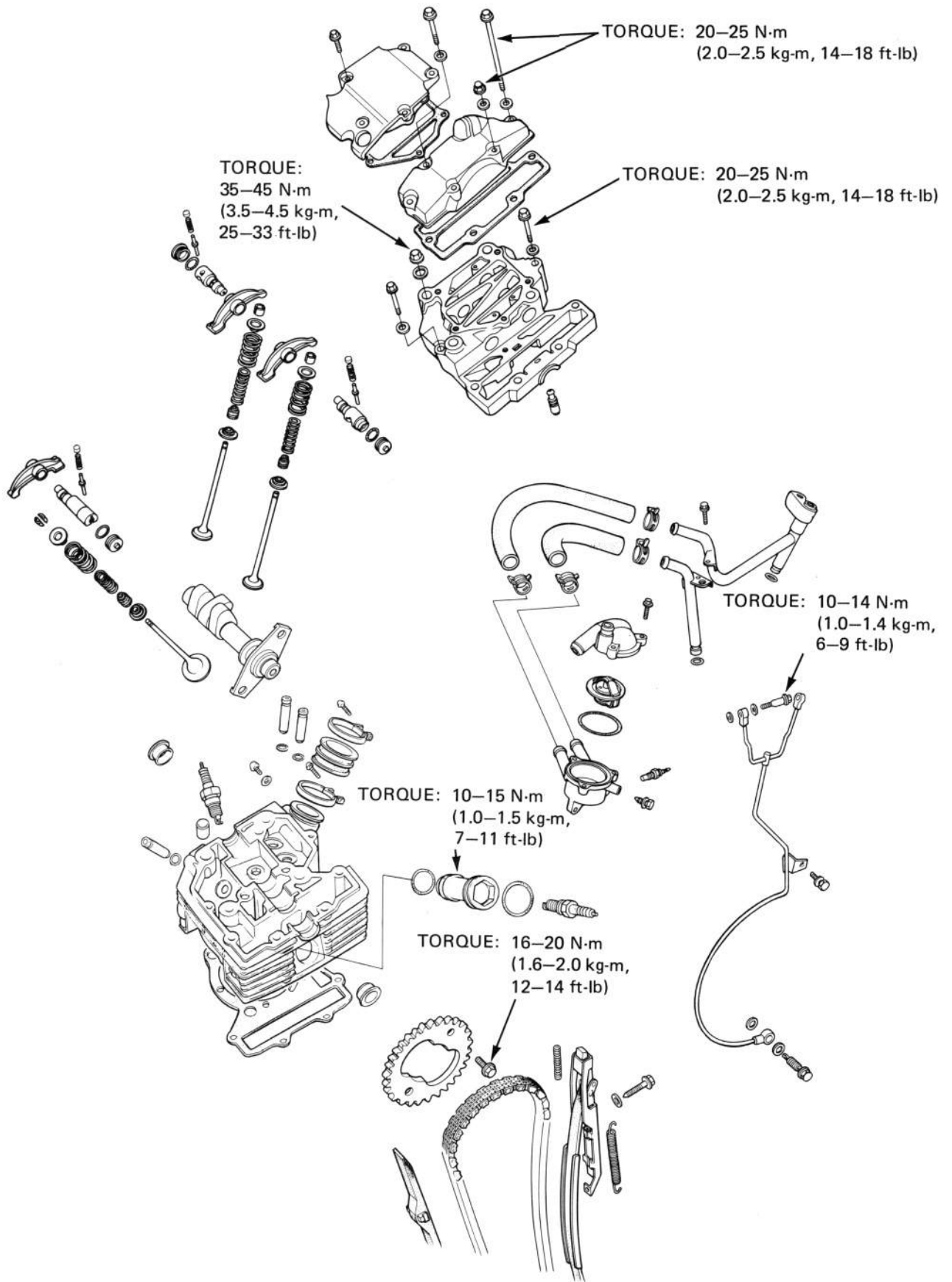
Install the clutch assembly and right crankcase cover (section 7).

Install the starter clutch, flywheel and alternator cover (section 8).



OIL PIPE

CYLINDER HEAD/VALVE



10. CYLINDER HEAD / VALVE

| | | | |
|---------------------------------|-------|-------------------------------------|-------|
| SERVICE INFORMATION | 10-1 | VALVE GUIDE REPLACEMENT | 10-13 |
| TROUBLESHOOTING | 10-2 | VALVE SEAT INSPECTION/ REFACING | 10-14 |
| CYLINDER HEAD COVER REMOVAL | 10-3 | CYLINDER HEAD ASSEMBLY | 10-17 |
| CAMSHAFT REMOVAL | 10-4 | CYLINDER HEAD INSTALLATION | 10-18 |
| CYLINDER HEAD COVER DISASSEMBLY | 10-7 | CAMSHAFT INSTALLATION | 10-19 |
| CYLINDER HEAD REMOVAL | 10-10 | CYLINDER HEAD COVER ASSEMBLY | 10-21 |
| CYLINDER HEAD DISASSEMBLY | 10-10 | CYLINDER HEAD COVER INSTALLATION | 10-23 |

SERVICE INFORMATION

GENERAL

- The engine uses hydraulic tappets. After installing the cylinder head covers, fill the de-foaming chambers in the head covers with fresh engine oil as described in this section.
- To service the cylinder heads, the engine must be removed from the frame. See Section 5 for removal and installation of the engine.
- Camshaft lubricating oil is fed through an oil line. Be sure the hole in the oil line is not clogged.
- During assembly, apply molybdenum disulfide grease to the camshaft holders and rocker arm shafts to provide initial lubrication.
- The hydraulic tappets must be adjusted with shims whenever the following parts are replaced:
 - Cylinder head cover.
 - Cylinder head.
 - Valve, valve guide and valve seat refacing.
 - Camshaft.
 - Rocker arm and rocker arm shaft.

10

SPECIFICATIONS

Unit: mm (in)

| ITEM | | STANDARD | SERVICE LIMIT | |
|---|----------------------------------|--|-------------------------------|----------------|
| Compression pressure | | 12 ± 2 kg/cm ² (171 ± 28 psi) | — | |
| Camshaft | Cam lobe height | IN | 36.497 (1.4369) | |
| | | EX | 36.497 (1.4369) | |
| | Runout | | 0.03 (0.0010) | |
| | Oil clearance | Both ends | 0.020–0.062 (0.0008–0.0024) | 0.07 (0.0027) |
| Center | | 0.020–0.062 (0.0008–0.0024) | 0.07 (0.0027) | |
| Rocker arm | Rocker arm I.D. | | 13.750–13.768 (0.5413–0.5420) | |
| | Rocker arm shaft O.D. | IN | 13.716–13.734 (0.5400–0.5406) | |
| | | EX | 13.716–13.737 (0.5400–0.5408) | |
| | Camshaft holder I.D. | | 20.000–20.021 (0.7874–0.7882) | |
| | Tappet assist spring free length | | 19.46 (0.7661) | |
| Tappet compression stroke with kerosene | | — | 0.20 (0.0079) | |
| Valves and valve guides | Valve stem O.D. | IN | 6.570–6.595 (0.2587–0.2596) | |
| | | EX | 6.550–6.575 (0.2579–0.2589) | |
| | Valve guide I.D. | | 6.600–6.620 (0.2598–0.2606) | |
| | Stem-to-guide clearance | IN | 0.005–0.050 (0.0002–0.0020) | |
| | | EX | 0.025–0.070 (0.0010–0.0028) | |
| Valve seat width | | 0.9–1.1 (0.0354–0.0433) | 1.50 (0.0591) | |
| Valve springs | Free length | OUTER | IN | 45.70 (1.7992) |
| | | | EX | 43.50 (1.7126) |
| | | INNER | IN | 37.9 (1.4921) |
| | | | EX | 37.9 (1.4921) |
| Cylinder head warpage | | — | 0.10 (0.0040) | |

CYLINDER HEAD/VALVE

TORQUE VALUES

| | |
|---------------------|---|
| Cylinder head cover | |
| 10 mm cap nut | 35–45 N·m (3.5–4.5 kg·m, 25–33 ft·lb) |
| 8 mm bolt | 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb) |
| Cam chain cover | |
| 8 mm bolt/cap nut | 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb) |
| Oil pass pipe | 10–14 N·m (1.0–1.4 kg·m, 6–8 ft·lb) |
| Spark plug sleeve | 10–15 N·m (1.0–1.5 kg·m, 7–11 ft·lb) |
| | – Apply molybdenum disulfide grease to the threads. |
| Cam sprocket bolt | 16–20 N·m (1.6–2.0 kg·m, 12–14 ft·lb) |

TOOLS

Special

| | |
|------------------------------------|---------------|
| Valve Guide Reamer | 07984–6570100 |
| Valve Guide Driver | 07942–6110000 |
| Valve Guide Driver Attachment (IN) | 07943–6570100 |
| (EX) | 07943–6890100 |
| Hydraulic Tappet Bleeder | 07973–ME90000 |
| Spark Plug Sleeve Socket | 07930–KA50100 |

Common

| | |
|-------------------------|--------------------------------|
| Valve Spring Compressor | 07757–0010000 or 07957–3290001 |
|-------------------------|--------------------------------|

TROUBLESHOOTING

Engine top-end problems usually affect engine performance. These can be diagnosed by a compression test, or by tracing noises to the top-end with a sounding rod or stethoscope.

Low Compression

1. Valves

- hydraulic tappet locked.
(Engine will not start)
- Depress hydraulic tappet.
(Chatter noise)
 - insufficient air bleeding, noise will stop after about 10 minutes.
- Burned or bent valves.
- Broken or damaged valve springs.
- Incorrect valve timing.
- Valve stuck open.

2. Cylinder head

- Leaking or damaged head gasket.
- Warped or cracked cylinder head.

3. Cylinder and piston (Refer to Section 13)

Compression too high

- Excessive carbon build-up on piston or combustion chamber.

Excessive Noise

1. Hydraulic tappet.

- Worn or damaged tappet.
- Clogged oil hole or oil passage to cylinder head.
- Weak or damaged assist spring.
- Worn or damaged assist shaft.
- Worn or damaged rocker arm or shaft.
- Worn or damaged rocker arm shaft mount hole in head cover.
- Air in oil passage caused by low oil level.
- Excessively worn valve seat.
- Worn rocker arm follower or valve stem end.

2. Sticking valve or broken valve spring.

3. Weak valve spring.

4. Worn or damaged camshaft.

5. Worn or damaged cam chain.

6. Worn or damaged cam chain tensioner.

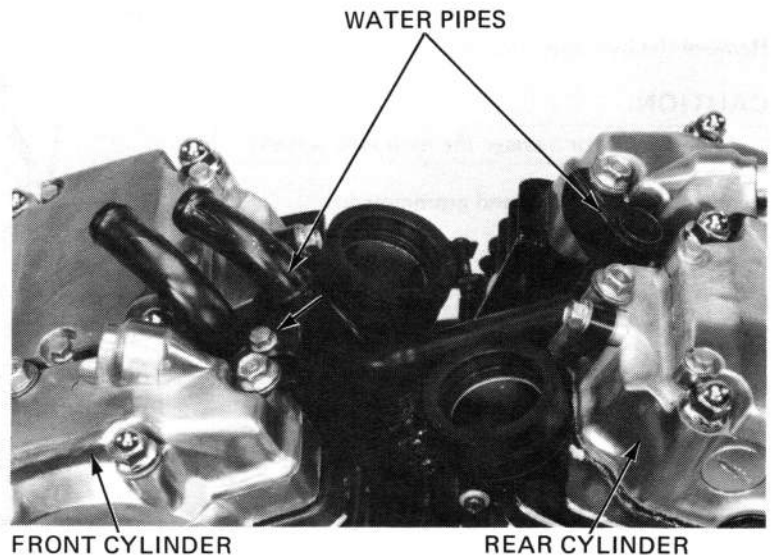
7. Worn cam sprocket.

CYLINDER HEAD COVER REMOVAL

Remove the engine from the frame (page 5-2).

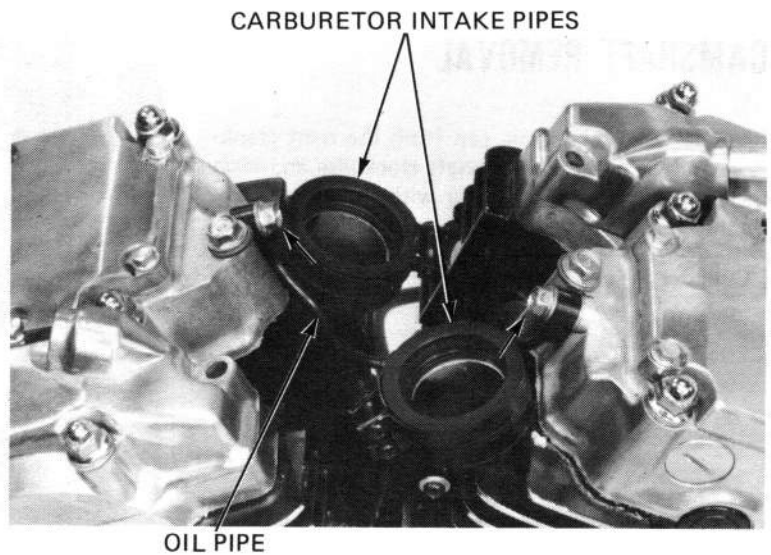
Remove the water pipes from the front and rear cylinder heads.

Remove the O-ring from the water pipes.



Remove the oil pipe from the front and rear cylinder heads.

Remove the carburetor intake pipes.



Loosen the rocker arm cover 6 mm mount bolts.

NOTE:

Carefully remove the rocker arm covers to keep the hydraulic tappet assist springs from falling into the cylinder head.

Remove the cylinder head covers and cam sprocket covers.

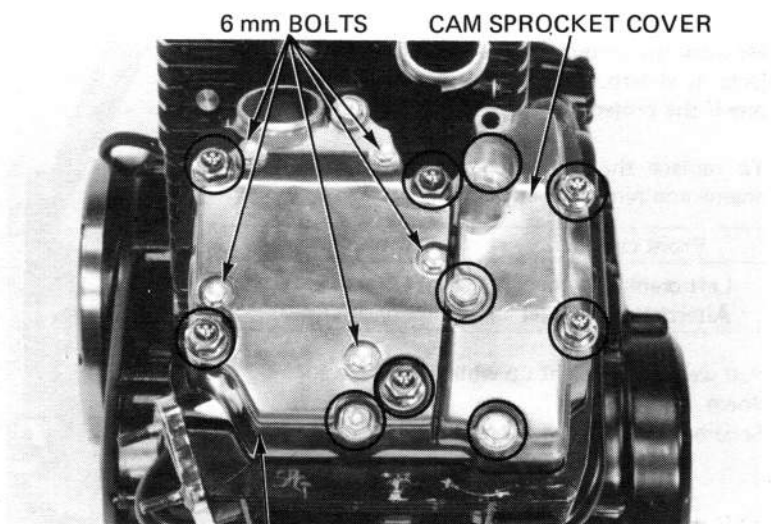
NOTE:

The hydraulic tappets may come out with the cylinder head cover. Be careful they do not fall out.

Loosen the 6 mm bolts in the criss-cross pattern in 2-3 steps, starting with the center bolt.

NOTE:

Tilt the engine about 40° to the right (left) when removing the front (rear) cylinder head cover.



CYLINDER HEAD COVER

Remove the cover gaskets.

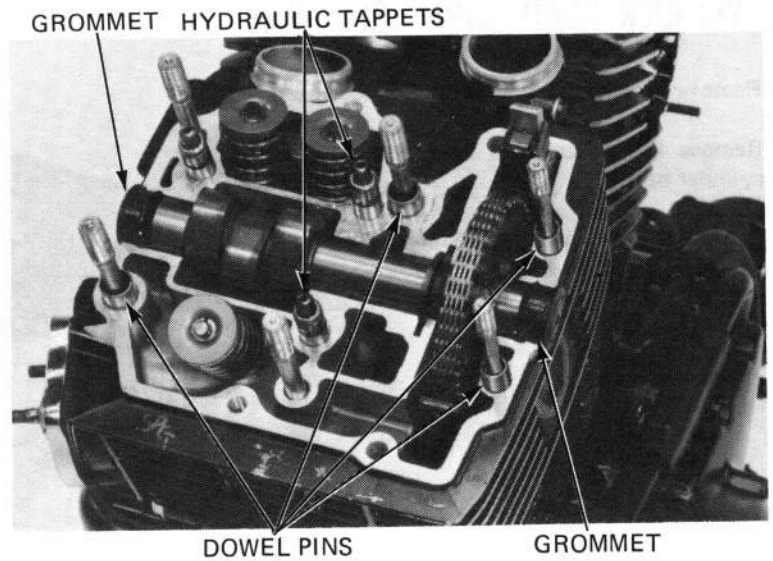
CYLINDER HEAD/VALVE

Remove the hydraulic tappets.

CAUTION:

Do not strike or damage the hydraulic tappets.

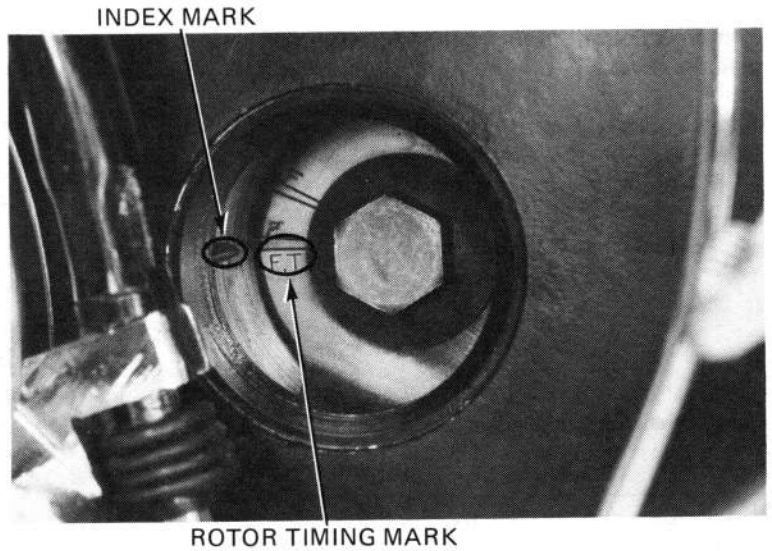
Remove the dowel pins and grommets.



CAMSHAFT REMOVAL

Remove the timing hole cap from the right crankcase cover. Turn the crankshaft clockwise and align the timing mark on the rotor with the index mark on the crankcase cover.

| Cylinder | Rotor timing mark |
|----------|-------------------|
| Front | F.T. |
| Rear | R.T. |



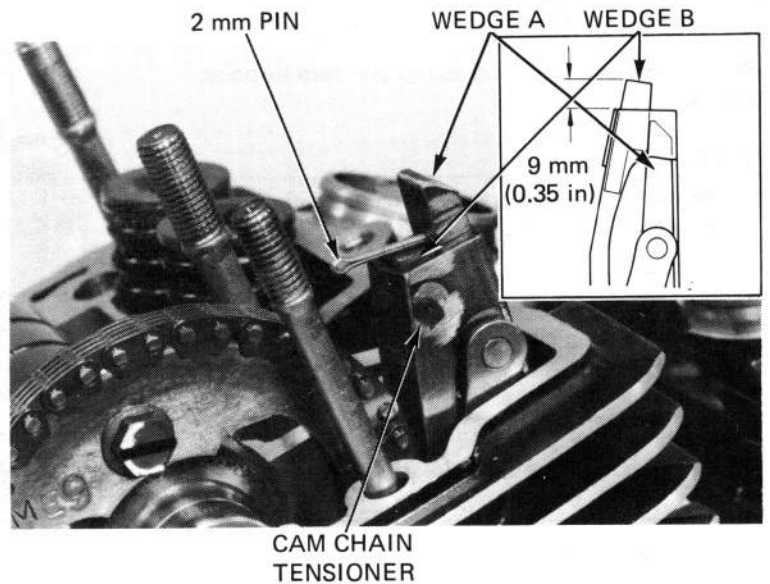
Measure the amount of the cam chain tensioner projects as shown. Replace the cam chain with a new one if the projection exceeds 9.0 mm (0.35 in.).

To replace the cam chain, drain the oil from the engine and remove the following parts:

| Front cylinder | Rear cylinder |
|------------------------|-------------------------|
| • Left crankcase cover | • Right crankcase cover |
| • Alternator flywheel | • Primary drive gear |

Pull wedge A straight up while holding wedge B down.

Secure wedge A with a 2 mm pin as shown.



CYLINDER HEAD/VALVE

Remove the sleeve with fork tube holder attachment (07930-KA50100) from the spark plug hole on the cam chain side.

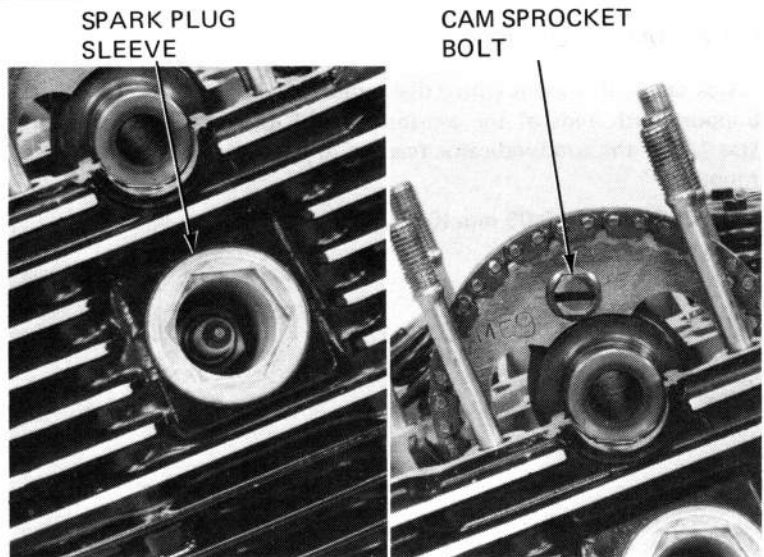
Remove the cam sprocket bolts.

Rotate the crankshaft clockwise one turn (360°) and remove the other cam sprocket bolts.

NOTE:

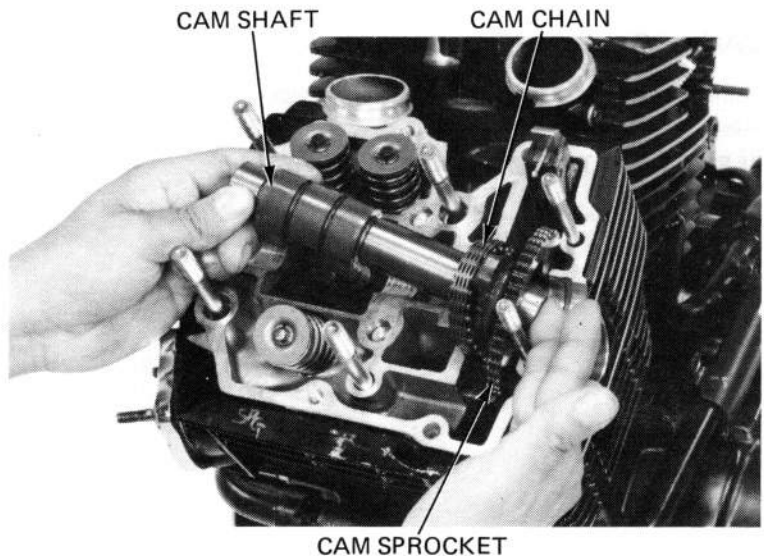
Be careful not to let the cam sprocket bolts fall into the crankcase.

Remove the cam sprocket from the camshaft flange with the cam chain. Rotate the crankshaft clockwise half a turn (180°) and remove the cam chain from the sprocket.



Hang the cam chain on the camshaft behind the camshaft flange and remove the cam sprocket while lifting the camshaft out.

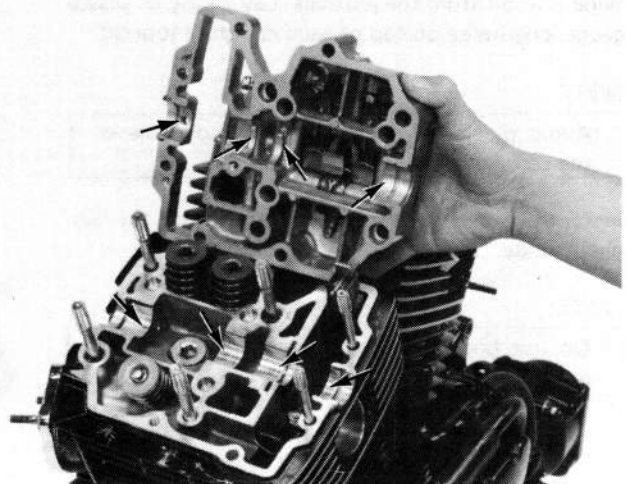
Attach a piece of wire to the cam chain to prevent it from being dropped into the crankcase.



INSPECTION

CAMSHAFT HOLDER/CYLINDER HEAD

Inspect the camshaft holder and cylinder head journal surfaces for scoring, scratches, or evidence of insufficient lubrication.

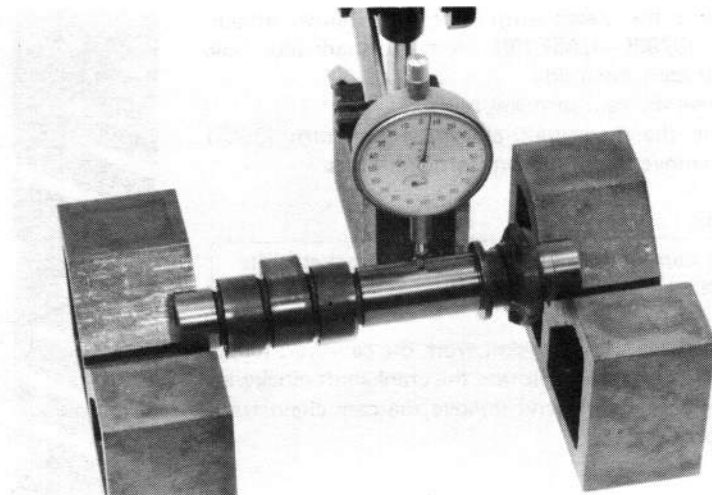


CYLINDER HEAD/VALVE

CAMSHAFT RUNOUT

Check camshaft runout with a dial indicator. Support both ends of the camshaft with V-blocks. Use 1/2 of the total indicator reading to determine runout.

SERVICE LIMIT: 0.05 mm (0.002 in)



CAM LOBE HEIGHT

Using a micrometer, measure the height of each cam lobe.

SERVICE LIMITS: IN/EX: 36.38 mm (1.4282 in)



Wipe any oil from the journals. Lay a strip of plastigauge lengthwise on top of each camshaft journal.

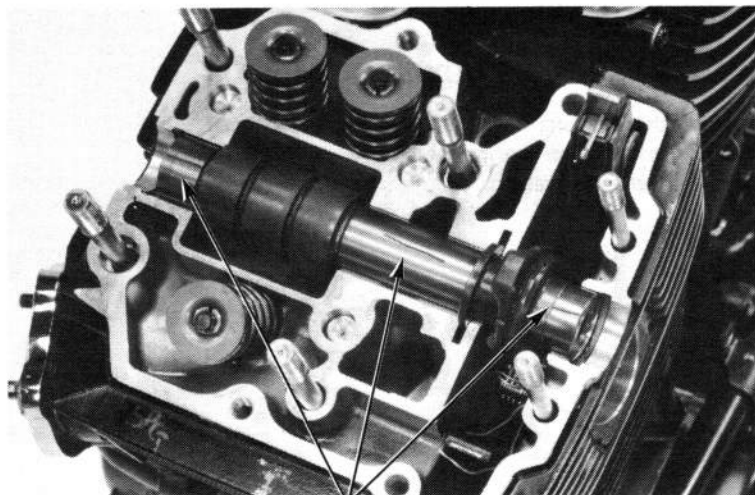
NOTE:

Avoid placing plastigauge over the oil hole in the cam holder.

Hook the cam chain suspension wire against the cam chain guide.

NOTE:

Do not hook the wire against the head cover mating surface.



PLASTIGAUGE

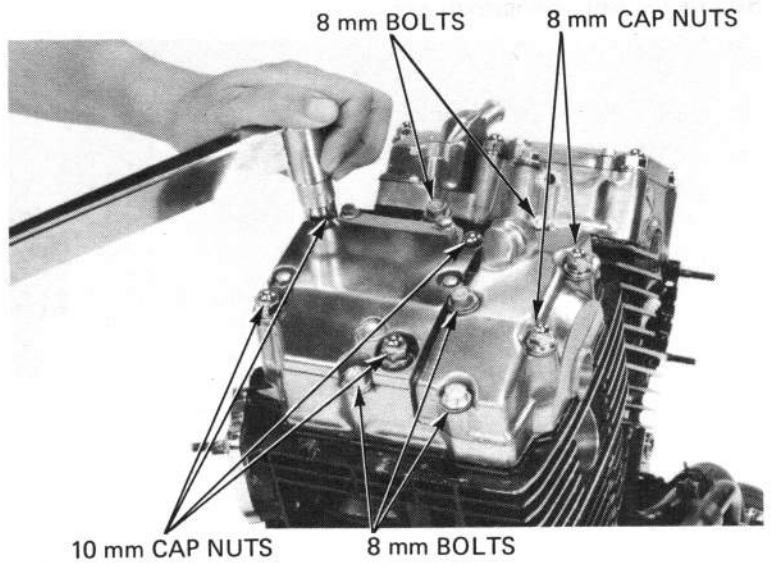
Install the cylinder head cover and tighten in a crisscross pattern in 2–3 steps. Also, install the cam chain cover.

NOTE:

Do not rotate the camshaft when using plasti-gauge.

TORQUES:

- 8 mm bolt/nut: 20–25 N·m
(2.0–2.5 kg·m, 14–18 ft·lb)
- 10 mm cap/nut: 35–45 N·m
(3.5–4.5 kg·m, 25–33 ft·lb)



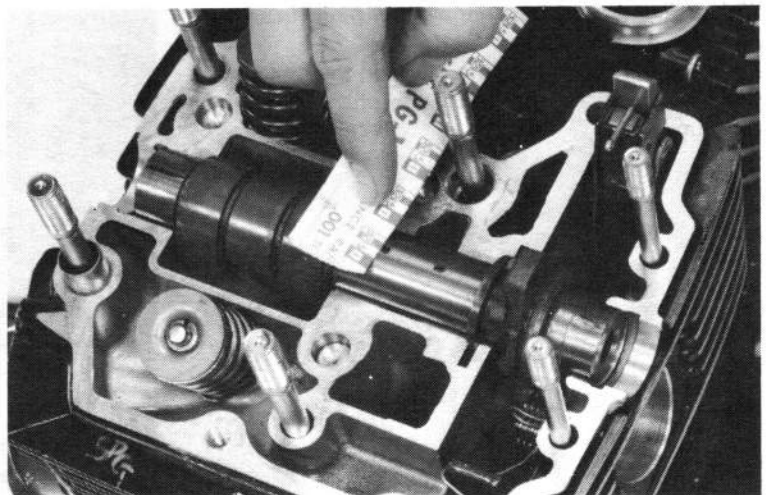
Remove the cylinder head cover and measure the width of each plastigauge. The widest thickness determines the oil clearance.

SERVICE LIMITS:

- CENTER: 0.07 mm (0.0027 in)
- BOTH ENDS: 0.07 mm (0.0027 in)

When the service limits are exceeded, replace the camshaft and recheck the oil clearance.

Replace the cylinder head and cover if the clearance still exceeds the service limits.

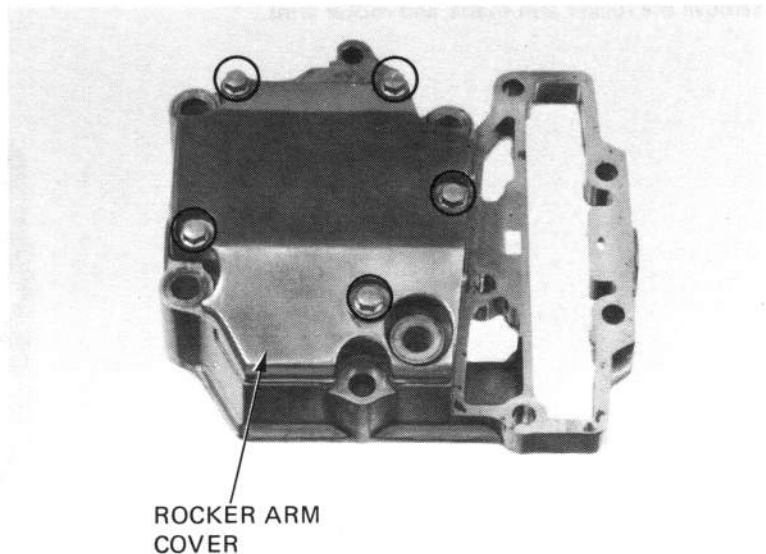


CYLINDER HEAD COVER DISASSEMBLY

Remove the rocker arm cover and cover gasket.

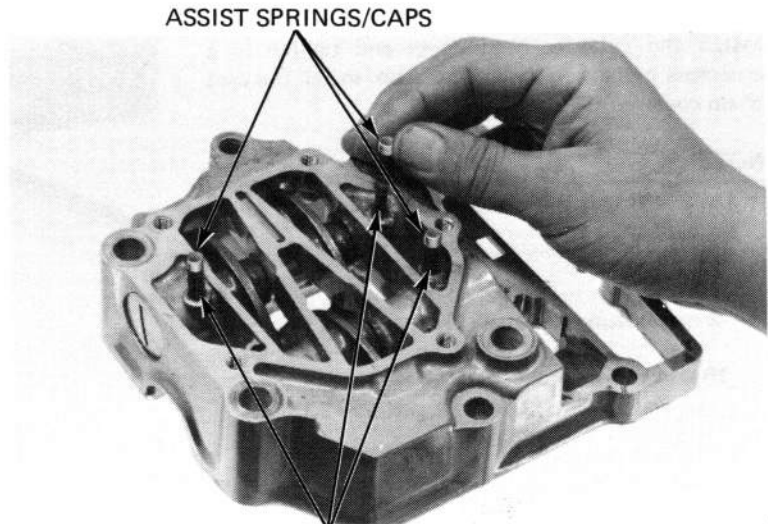
NOTE:

Remove the rocker arm covers carefully as the assist springs and caps will pop out.

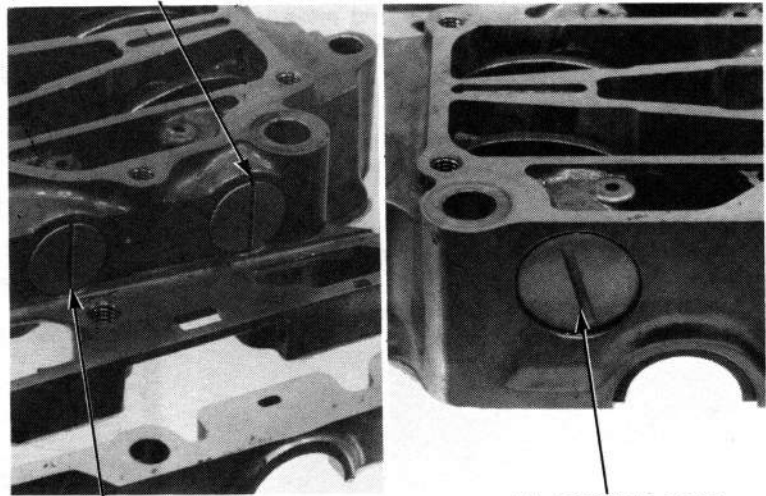


CYLINDER HEAD/VALVE

Remove the assist springs/caps and shafts.



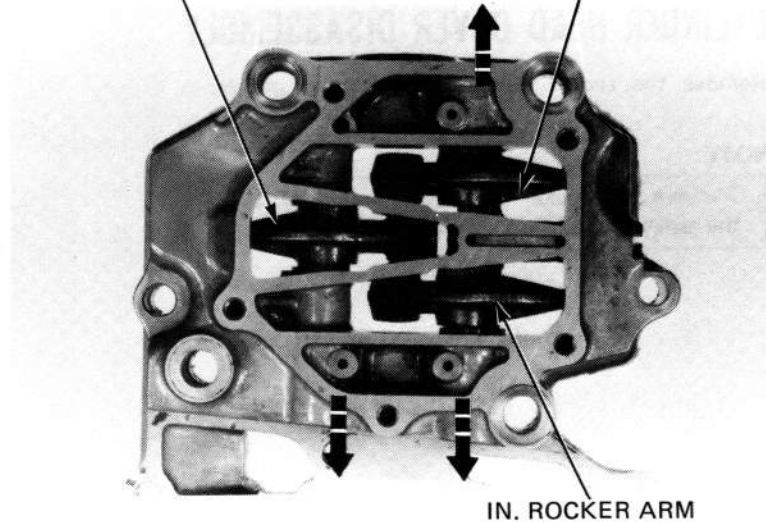
IN. ROCKER ARM SHAFT PLUG
(CAM CHAIN SIDE)



EX. ROCKER ARM

IN. ROCKER ARM

Remove the rocker arm shafts and rocker arms.



INSPECTION

**ROCKER ARM SHAFT/
ROCKER ARM**

Inspect the rocker arm shafts and rocker arms for wear or damage.

Check the rocker arms for clogged oil holes.

Measure the O.D. of each rocker arm shaft.

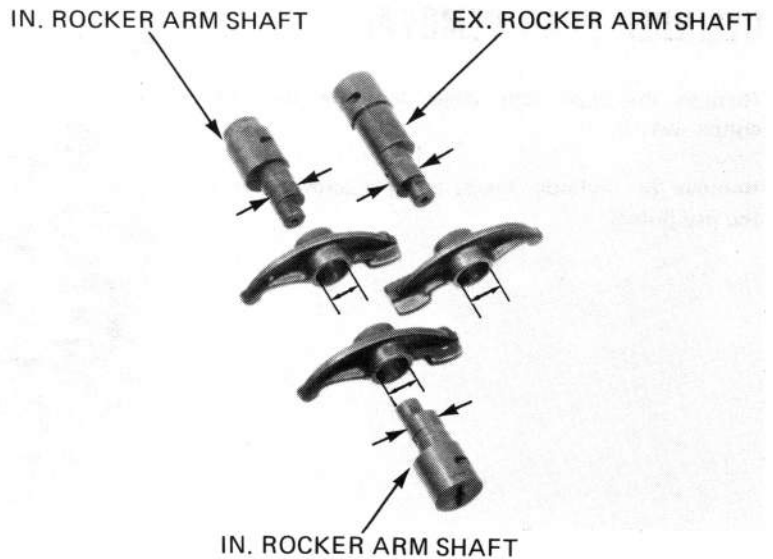
SERVICE LIMITS:

IN: 13.58 mm (0.5346 in)

EX: 13.58 mm (0.5346 in)

Measure the I.D. of each rocker arm.

SERVICE LIMIT: 13.80 mm (0.5433 in)



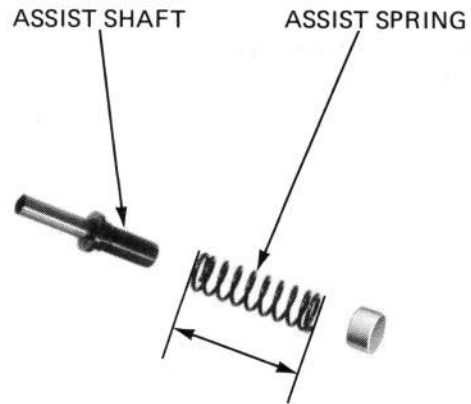
INSPECTION

ASSIST SPRING/SHAFT

Inspect the assist springs and shafts for wear or damage.

Measure the free length of each assist spring.

SERVICE LIMIT: 18.68 mm (0.7354 in)



HYDRAULIC TAPPET

Inspect the hydraulic tappet for wear or damage or for a clogged oil hole.

Measure the free length of each hydraulic tappet as follows:

Attach the Hydraulic Tappet Bleeder to the hydraulic tappet and compress and extend the hydraulic tappet slowly in a jar filled with kerosene.

NOTE:

Hold the hydraulic tappet upright while compressing and extending the hydraulic tappet.

Continue operating the hydraulic tappet until there are no air bubbles from the hydraulic tappet and it does not make no further action.

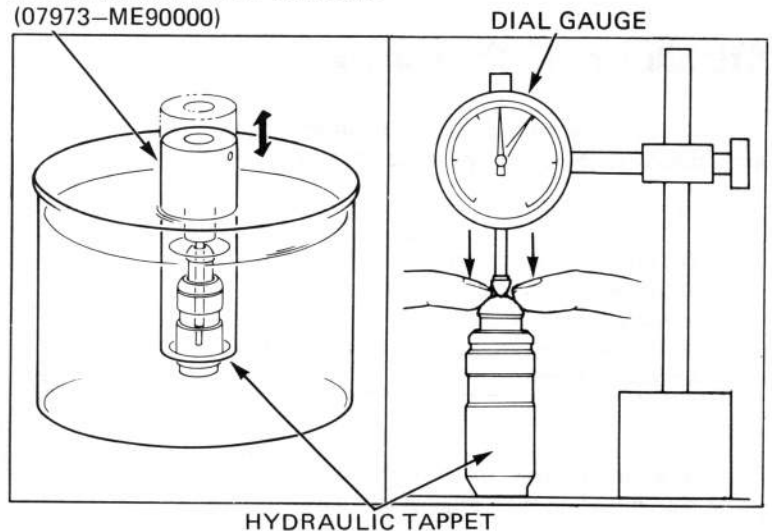
Remove the hydraulic tappet and try to compress quickly the tappet by hand. Measure the compression stroke with the dial gauge on the flat place.

COMPRESSION STROKE: 0–0.2 mm

NOTE:

Keep the hydraulic tappet below the surface of kerosene while priming the hydraulic tappet.

HYDRAULIC TAPPET BLEEDER (07973–ME90000)

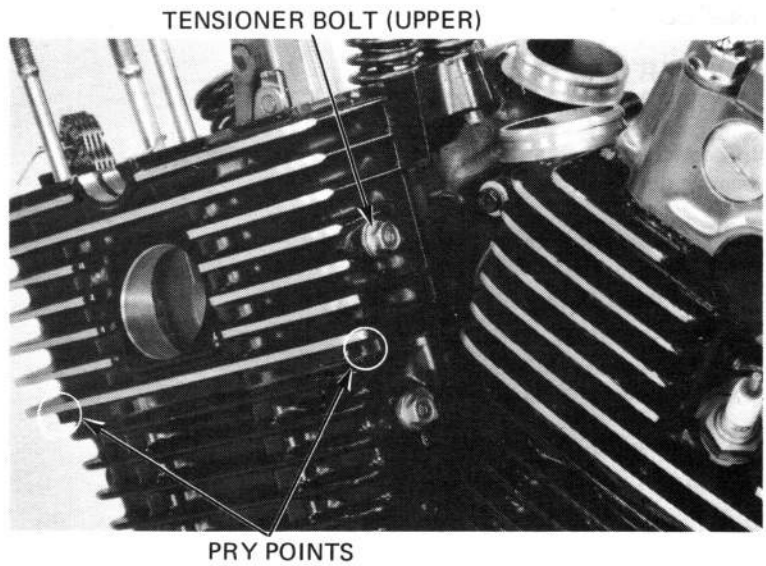


CYLINDER HEAD/VALVE

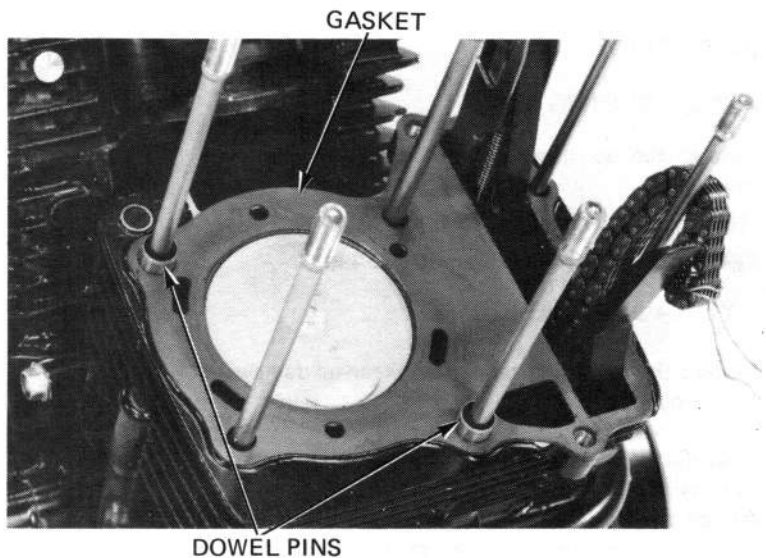
CYLINDER HEAD REMOVAL

Remove the upper cam chain tensioner bolt and copper washer.

Remove the cylinder heads using a screwdriver at the pry points.



Remove the front and rear cylinder head gaskets and dowel pins.



CYLINDER HEAD DISASSEMBLY

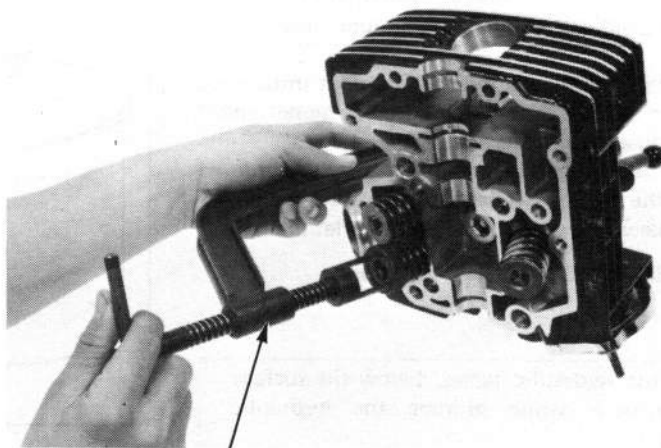
Remove the valve spring cotters, retainers, springs and valves with the Valve Spring Compressor.

CAUTION:

- *To prevent loss of tension, do not compress the valve springs more than necessary to remove the cotters.*
- *Avoid damaging the sliding surfaces of the hydraulic tappets.*

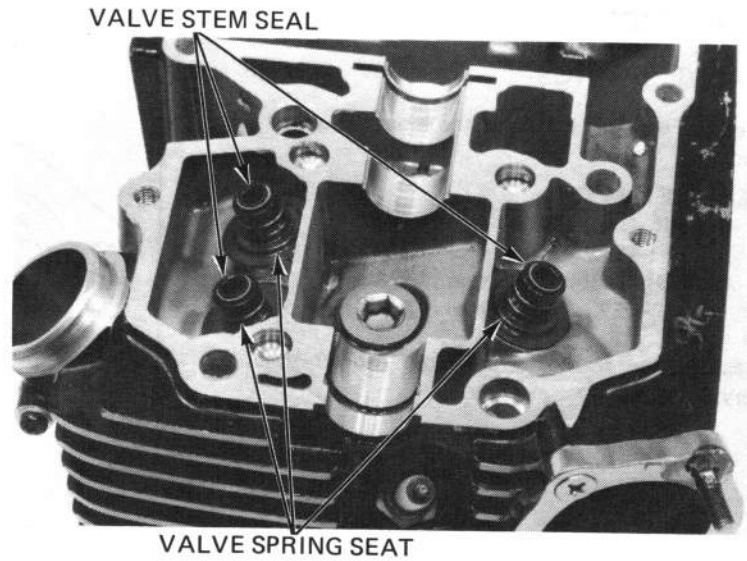
NOTE:

Mark all parts during disassembly so they can be placed back in their original locations.



VALVE SPRING COMPRESSOR
07757-0010000 OR 07959-3290001

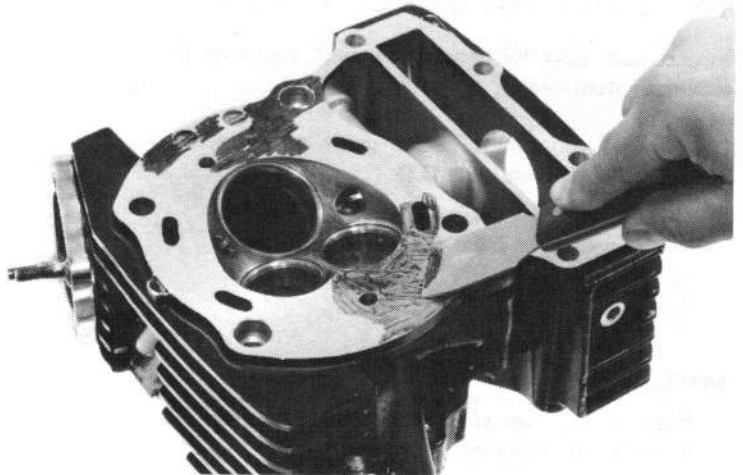
Remove the valve stem seals and valve spring seats.



Remove carbon deposits from the combustion chamber and clean off the head gasket surfaces.

NOTE:

- Avoid damaging the gasket surfaces.
- Gaskets will come off easier if soaked in solvent.



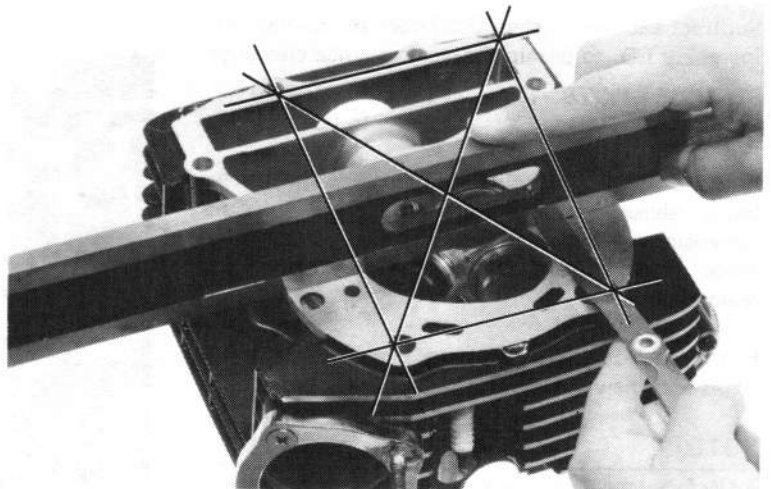
INSPECTION

CYLINDER HEAD

Check the spark plug hole and valve areas for cracks.

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

SERVICE LIMIT: 0.10 mm (0.004 in)



CYLINDER HEAD/VALVE

INSPECTION

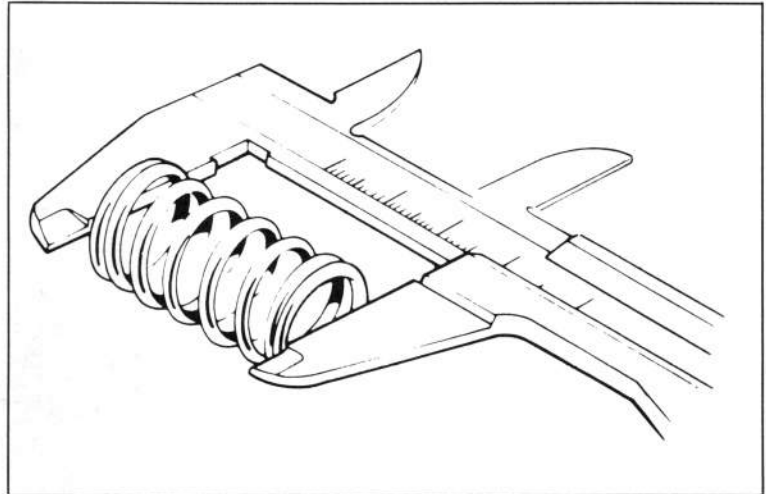
VALVE SPRINGS

Measure the free length of the inner and outer valve springs.

SERVICE LIMITS:

INNER (IN): 36.40 mm (1.4331 in)
(EX): 36.40 mm (1.4331 in)
OUTER (IN): 43.90 mm (1.7283 in)
(EX): 41.80 mm (1.6457 in)

Replace the springs if they are shorter than the service limits.



VALVE STEM-TO-GUIDE CLEARANCE

Inspect each valve for bending, burning, scratches or abnormal stem wear.

Check valve movement in the guide and measure and record each valve stem O.D.

SERVICE LIMITS: IN: 6.55 mm (0.2579 in)
EX: 6.54 mm (0.2575 in)

NOTE:

Ream the guides to remove any carbon deposits before checking clearances.

Measure and record each valve guide I.D.

SERVICE LIMIT: 6.66 mm (0.2622 in)

Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem to guide clearance.

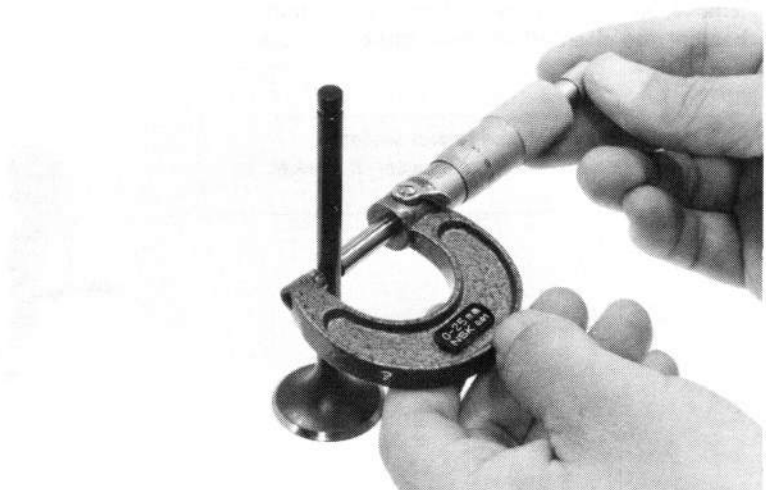
SERVICE LIMITS: IN: 0.11 mm (0.0043 in)
EX: 0.12 mm (0.0047 in)

If the stem-to-guide clearance exceeds the service limits, determine if a new guide with standard dimensions would bring the clearance within tolerance. If so, replace any guides as necessary and ream to fit.

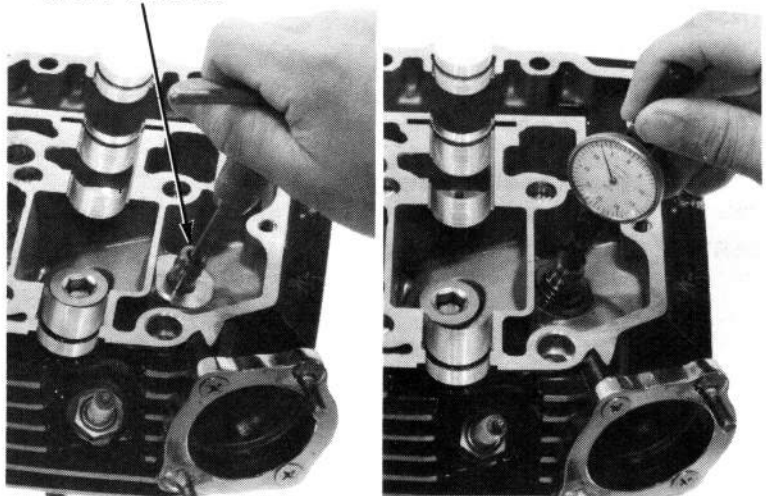
If the stem-to-guide clearance exceeds the service limits with new guides, also replace the valves.

NOTE:

Reface the valve seats whenever the valve guides are replaced.



VALVE GUIDE REAMER
07984-6570100



VALVE GUIDE REPLACEMENT

Heat the cylinder head to 100°C (212°F) with a hot plate or oven.

WARNING

To avoid burns, wear heavy gloves when handling the heated cylinder head.

CAUTION:

- *Do not use a torch to heat the cylinder head; it may cause warping.*

Support the cylinder head and drive out the old guides from the combustion chamber side of the cylinder head.

NOTE:

Avoid damaging the cylinder head.

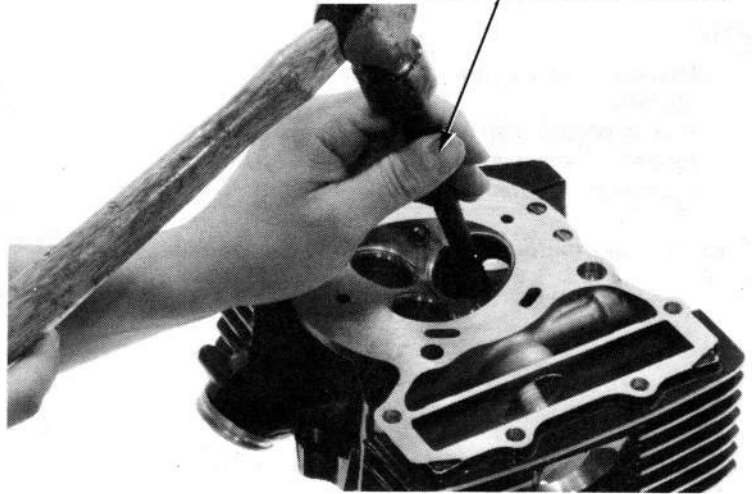
Drive new guides in from the rocker arm side of the cylinder head.

VALVE GUIDE PROJECTION ABOVE CYLINDER HEAD:

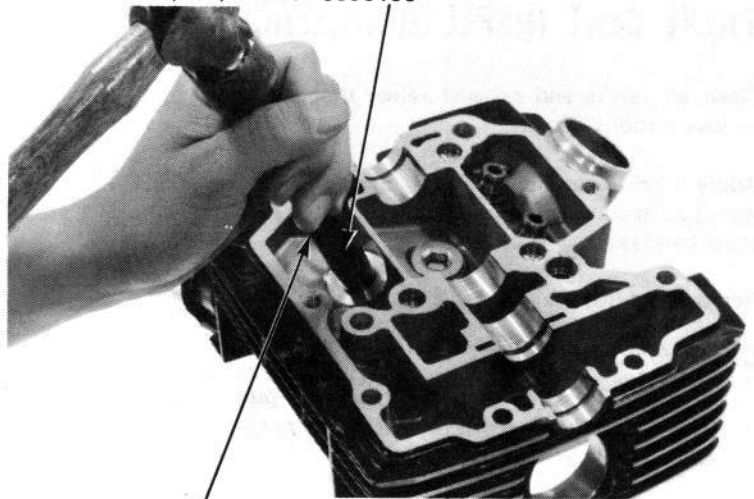
IN: 14.5 ± 0.1 mm (0.5709 ± 0.004 in)

EX: 15.5 ± 0.1 mm (0.6102 ± 0.004 in)

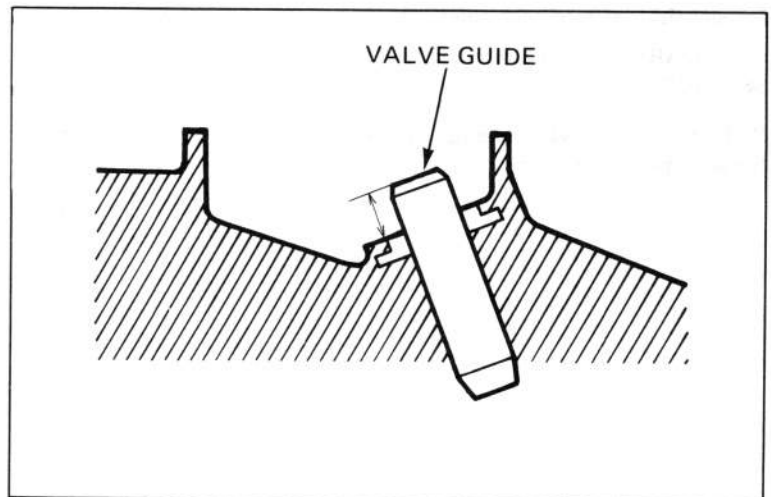
VALVE GUIDE REMOVER, 6.1 mm
07742-0010200 OR 07942-6110000



VALVE GUIDE DRIVER ATTACHMENT
(IN.) 07943-6570100
(EX.) 07943-6890100



VALVE GUIDE REMOVER
07942-6110000



CYLINDER HEAD/VALVE

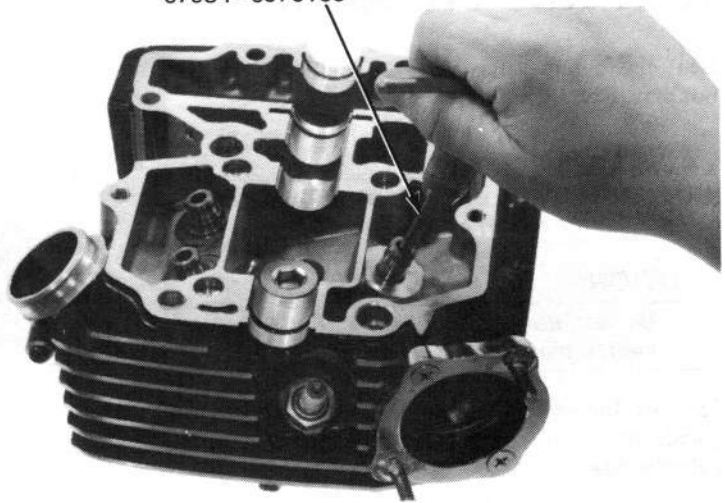
Ream the new valve guides after installation.

NOTE:

- Use cutting oil on the reamer during this operation.
- It is important that the reamer always be rotated in the same direction when it is inserted or removed.

Clean the head thoroughly after reaming the valve guides.

VALVE GUIDE REAMER
07984-6570100



VALVE SEAT INSPECTION/REFACING

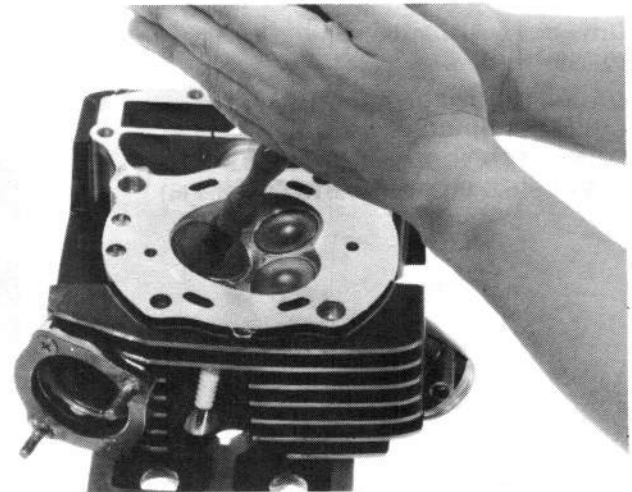
Clean all intake and exhaust valves thoroughly to remove carbon deposits.

Apply a light coating of Prussian Blue to each valve seat. Lap each valve and seat using a rubber hose or other hand-lapping tool.

Remove and inspect each valve.

CAUTION:

The valve cannot be ground. If the valve face is burned or badly worn or if it contacts the seat unevenly, replace the valve.

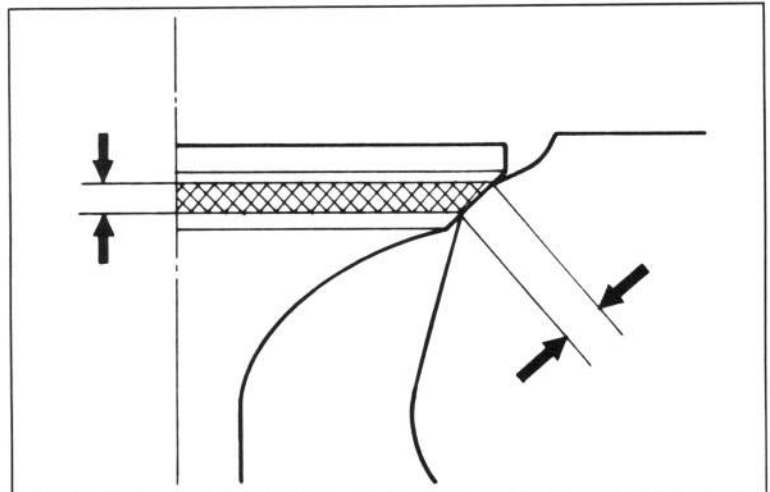


Inspect the width of each valve seat.

STANDARD: 1.1–1.3 mm (0.04–0.05 in)

SERVICE LIMIT: 2.0 mm (0.08 in)

If the seat is too wide, too narrow or has low spots, the seat must be ground.

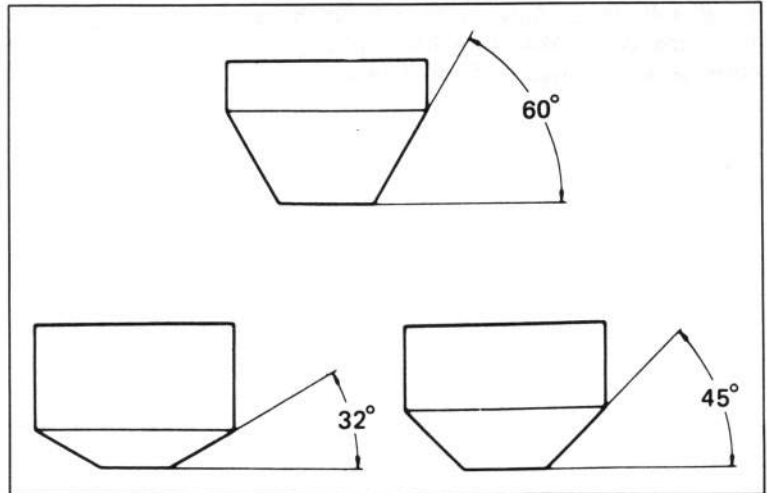


VALVE SEAT CUTTERS

Honda Valve Seat Cutters, grinder or equivalent valve seat refacing equipment are recommended to correct a worn valve seat.

NOTE:

- Follow the refacer manufacturer's operating instructions.



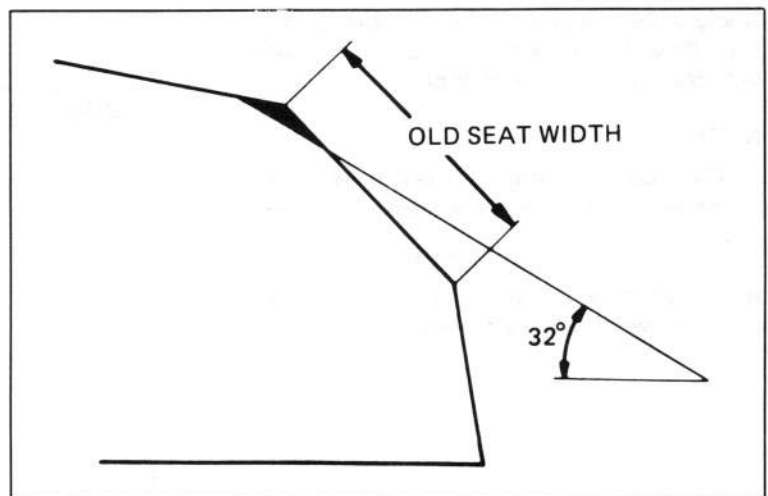
VALVE SEAT REFACING

Use a 45 degree cutter to remove any roughness or irregularities from the seat.

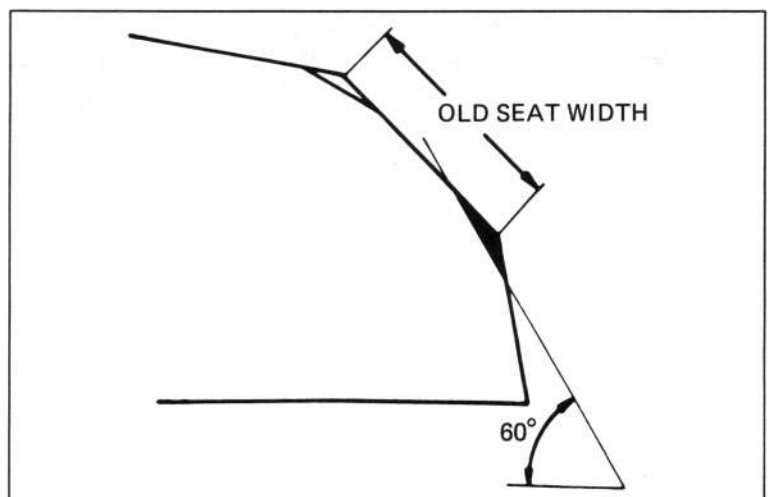
NOTE:

- Reface the seat with a 45 degree cutter when a valve guide is replaced.

Use a 32 degree cutter to remove the top 1/4 of the existing valve seat material.

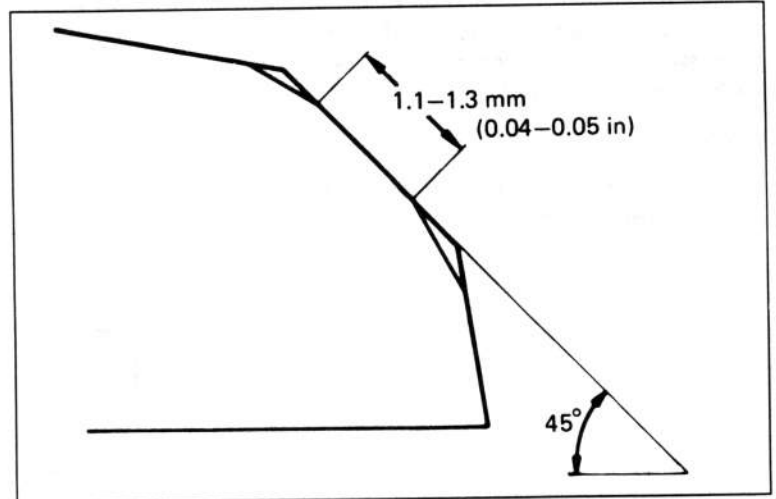


Use a 60 degree cutter to remove the bottom 1/4 of the old seat. Remove the cutter and inspect the area you have refaced.



CYLINDER HEAD/VALVE

Install a 45 degree finish cutter and cut the seat to the proper width. Make sure that all pitting and irregularities are removed. Refinish if necessary.

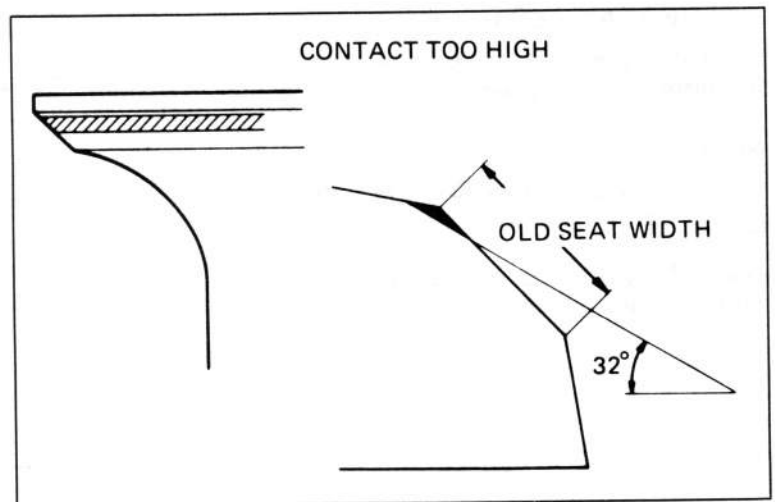


Apply a thin coating of Prussian Blue to the valve seat. Press the valve through the valve guide and onto the seat to make a clear pattern.

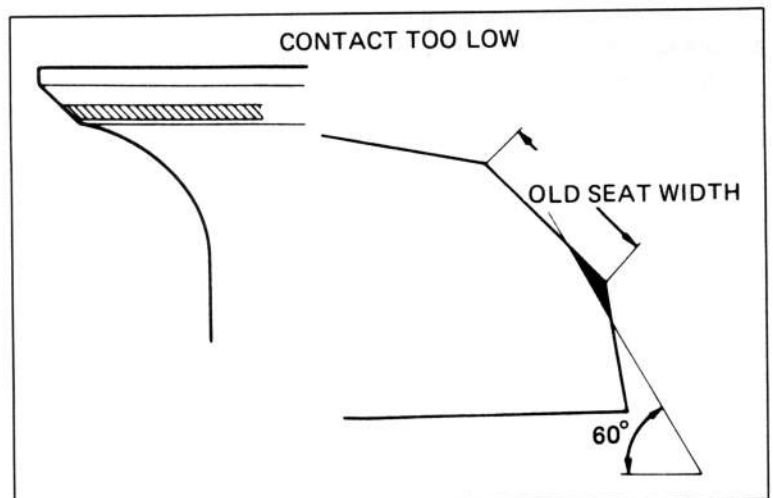
NOTE:

The location of the valve seat in relation to the valve face is very important for good sealing.

If the contact area is too high on the valve, the seat must be lowered using a 32 degree flat cutter.



If the contact area is too low on the valve, the seat must be raised using a 60 degree inner cutter.

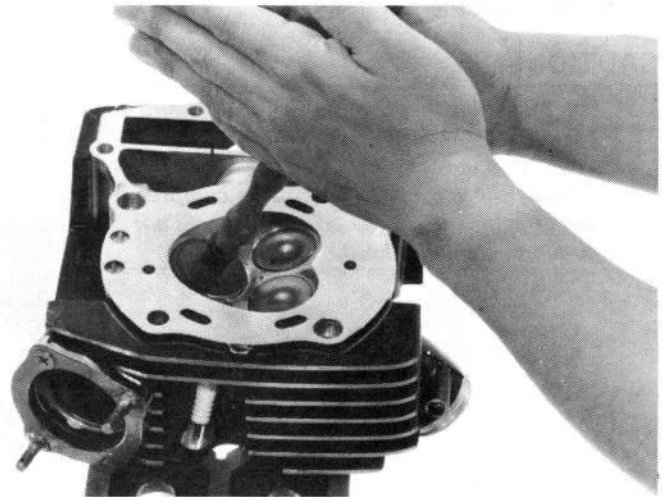


Refinish the seat to specifications, using a 45 degree finish cutter.

After cutting the seat, apply lapping compound to the valve face, and lap the valve using light pressure. After lapping, wash all residual compound off the cylinder head and valve.

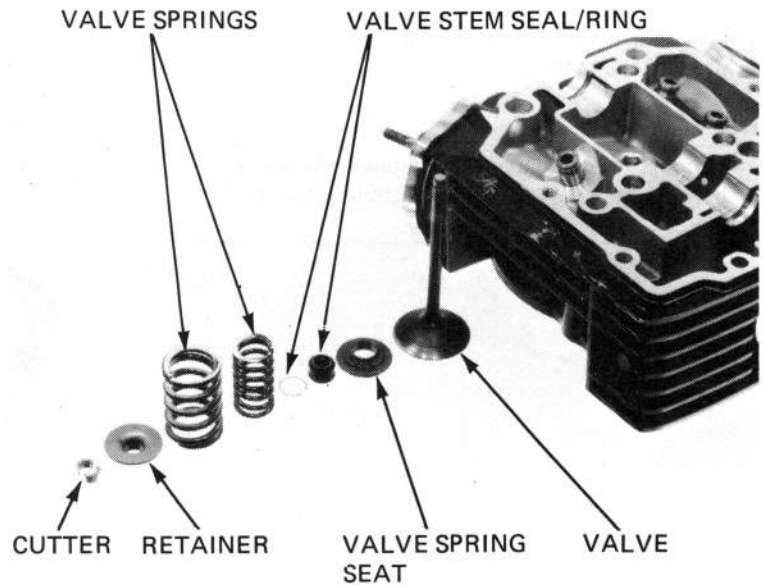
NOTE:

Do not allow lapping compound to enter the guides.



CYLINDER HEAD ASSEMBLY

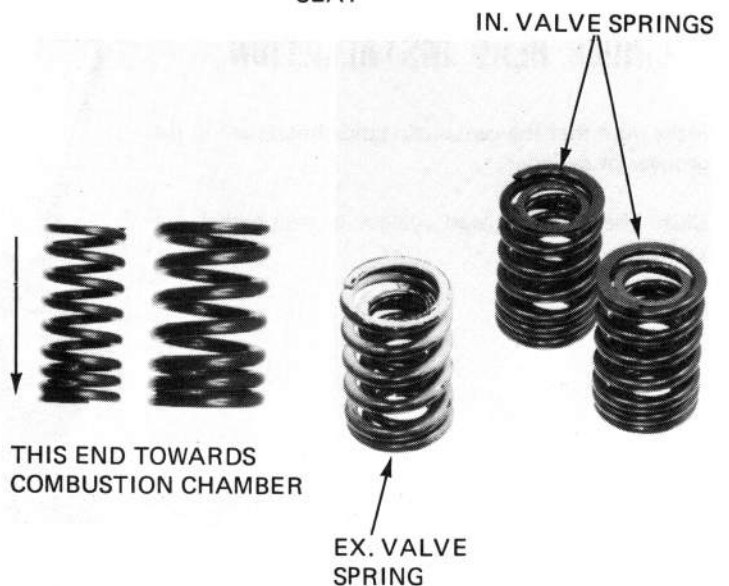
Install the valve spring seat and a new stem seal. Lubricate each valve stem with molybdenum disulfide grease and insert the valve into the valve guide. To avoid damage to the stem seal, turn the valve slowly when inserting.



Install the valve springs and retainers. The springs tightly wound coils should face in toward the combustion chamber.

NOTE:

Springs with green paint are exhaust valve springs.

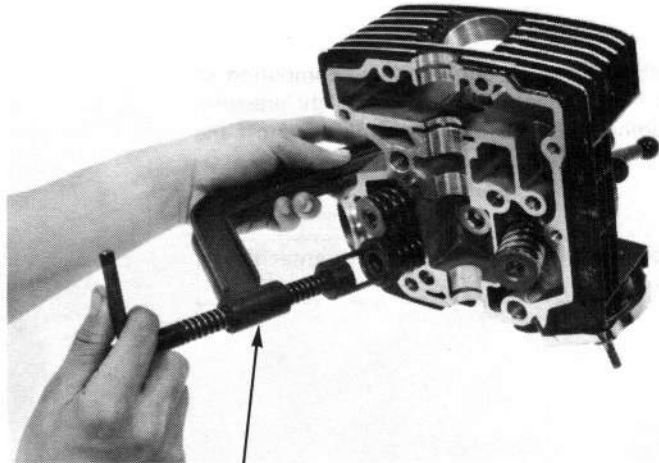


CYLINDER HEAD/VALVE

Install the valve cotters.

CAUTION:

- *To prevent loss of tension, do not compress the valve springs more than necessary to install the valve keepers.*
- *Thread the large retainer on the compressor attachment, so the compressor will not touch the cylinder head.*

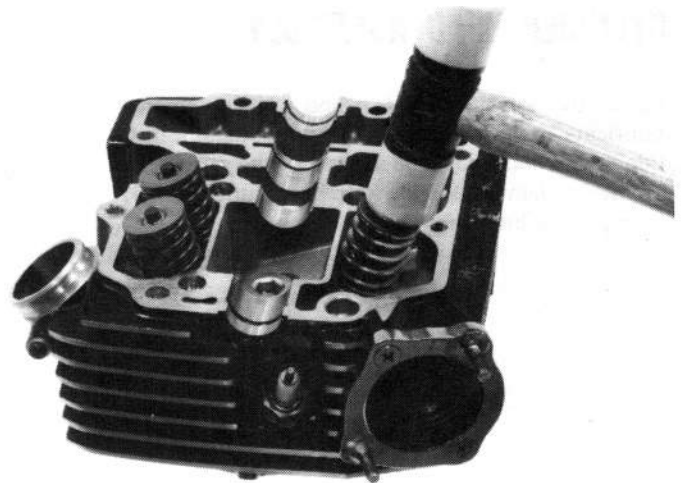


VALVE SPRING COMPRESSOR
07757-0010000 OR 07959-3290001

Tap the valve stems gently with a soft hammer to firmly seat the cotters.

NOTE:

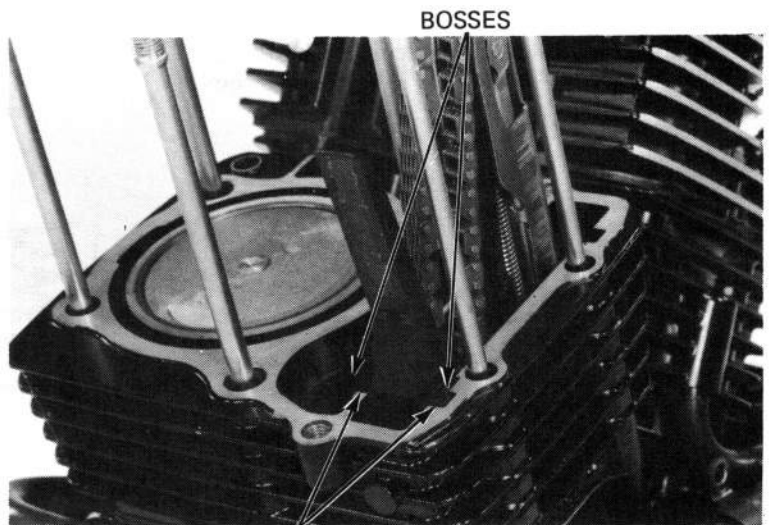
Support the cylinder head above the work bench surface to prevent possible valve damage.



CYLINDER HEAD INSTALLATION

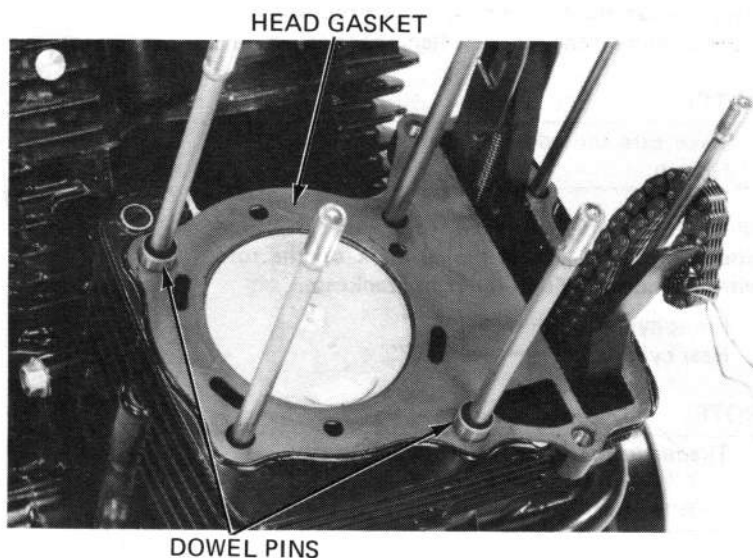
Make sure that the cam chain guide bosses are in the grooves of cylinder.

Clean the cylinder head surface of any gasket material.



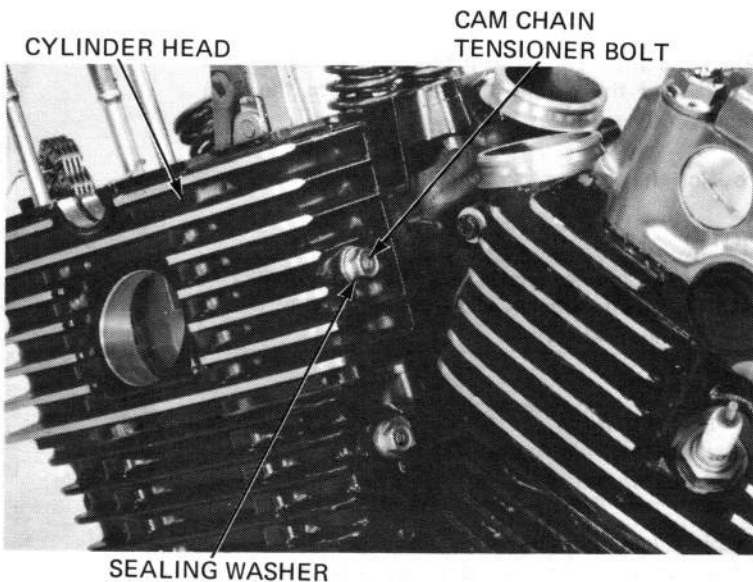
GROOVES

Install the dowel pins and a new head gasket.



Install the cylinder head.

Install the cam chain tensioner bolt and sealing washer.



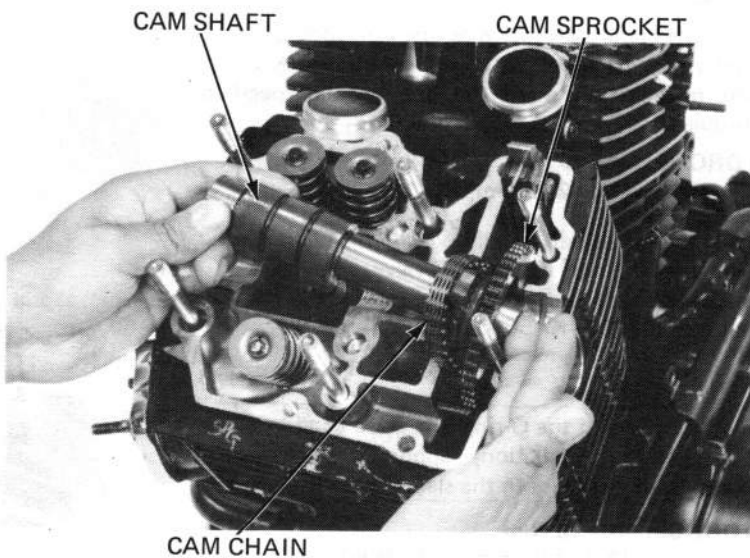
CAMSHAFT INSTALLATION

Lubricate the camshaft journal surface of the cylinder head with molybdenum disulfide grease.

Run the camshaft through the cam chain and install the cam sprocket on the shaft flange.

NOTE:

Install the cam sprocket with the timing mark (punch mark) facing the outside.



CYLINDER HEAD/VALVE

Place the camshafts into their correct positions with the markings on the sprocket flanges facing up.

NOTE:

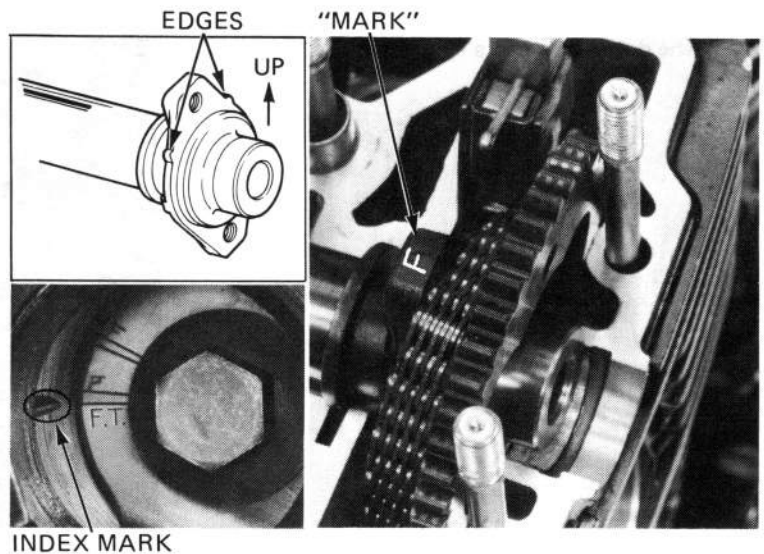
Make sure the edges on the sprocket flanges face up.

While lifting the cam chain, rotate the crankshaft clockwise and align the timing mark on the rotor with the index mark on the right crankcase.

Front cylinder → "F.T"
Rear cylinder → "R.T"

NOTE:

The marks on the camshaft flanges mean:
"F" → Front cylinder camshaft
"R" → Rear cylinder camshaft



Align the timing marks on the cam sprocket with the top of the cylinder head and place the cam chain on the sprocket.

Position the cam sprocket on the camshaft flange.

NOTE:

After installing, check that the timing marks on the cam sprocket align with the top of the cylinder head.

CAUTION:

After installing the front cylinder, turn the crankshaft clockwise 225° turn and then install the rear cylinder.

Apply a locking agent to the threads and underside of the head of the cam sprocket bolt, but do not tighten at this time.

Turn the crankshaft lockwise one turn (360°). Apply locking agent to the other cam sprocket bolt and install it. Tighten the bolt to the specified torque.

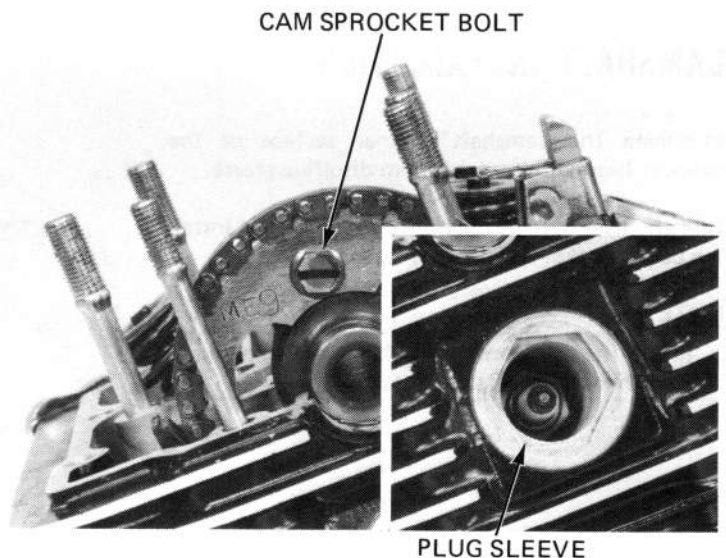
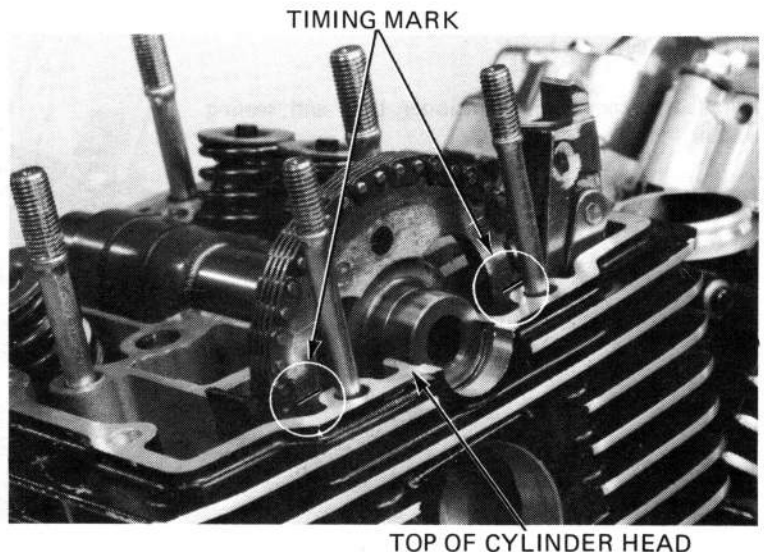
TORQUE: 16–20 N·m
(1.6–2.0 kg·m, 12–14 ft·lb)

Turn the crankshaft clockwise one turn and torque the remaining bolt to the same valve. Install and torque the spark plug sleeve with the special tool (07930–KA50100).

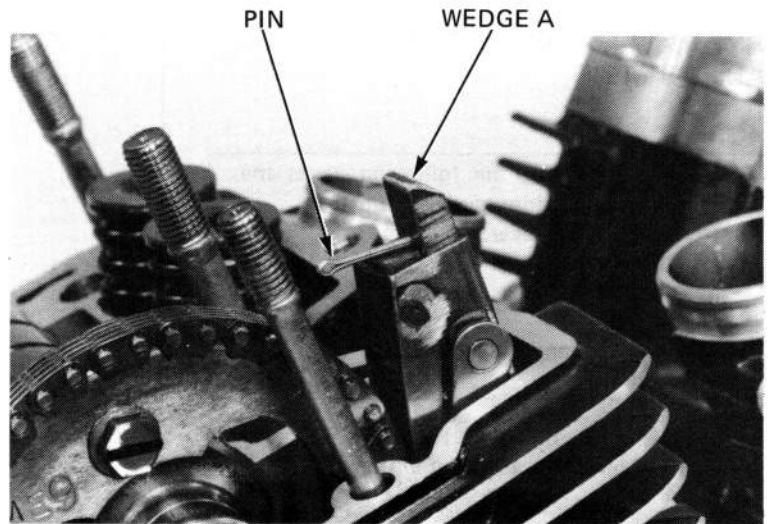
NOTE:

- Check that the O-ring is in good condition.
- Before installation, apply molybdenum disulfide grease to the sleeve threads.

TORQUE: 10–15 N·m
(1.0–1.5 kg·m, 7–11 ft·lb)



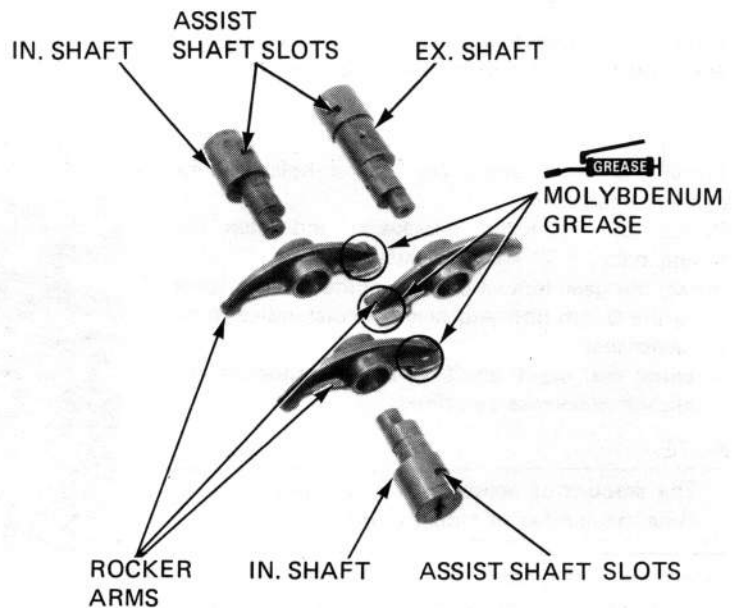
Remove the 2 mm pin holding wedge A.



CYLINDER HEAD COVER ASSEMBLY

Brush Molybdenum Disulfide grease on the slipper surfaces of the rocker arms and coat the contact surfaces of the rocker shafts with clean engine oil.

Install the rocker arms and shafts into the cylinder head cover, making sure that the assist shaft slots are facing up.



Rotate each rocker shaft so that the arms are moved in toward the center of the cover.

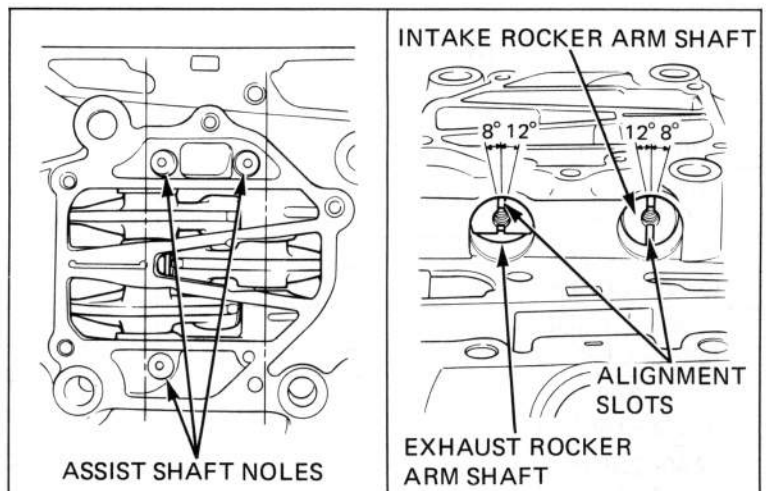
NOTE:

Put your finger on the rocker arms as you rotate the shaft to be sure which way the are moving.

Check that the alignment slots in the rocker shafts are within the limits shown.

NOTE:

Both intake rocker arm shafts should fall within the same limits.



CYLINDER HEAD/VALVE

HYDRAULIC TAPPET SHIM ADJUSTMENT

NOTE:

Whenever replacing the following parts, the hydraulic tappet shim must be adjusted.

- Cylinder head cover.
- Cylinder head.
- Valve stem, valve guide and valve seat refacing.
- Rocker arm and rocker arm shaft.
- Camshaft.

After bleeding the oil in the hydraulic tappets with the tappet bleeder, install the tappets into the cylinder head.

Install the cylinder head cover and tighten the 8 mm bolts and 10 mm cap nuts to the specified torque.

Install the assist shafts in the holes of the cylinder head cover.

Rotate the crankshaft clockwise and align the timing mark "F.T" with the index mark.

Install the gear holder on the cylinder head cover using the 6 mm bolt and place the dial indicator on the assist shaft.

Measure the assist shaft stroke by rotating the crankshaft clockwise two times.

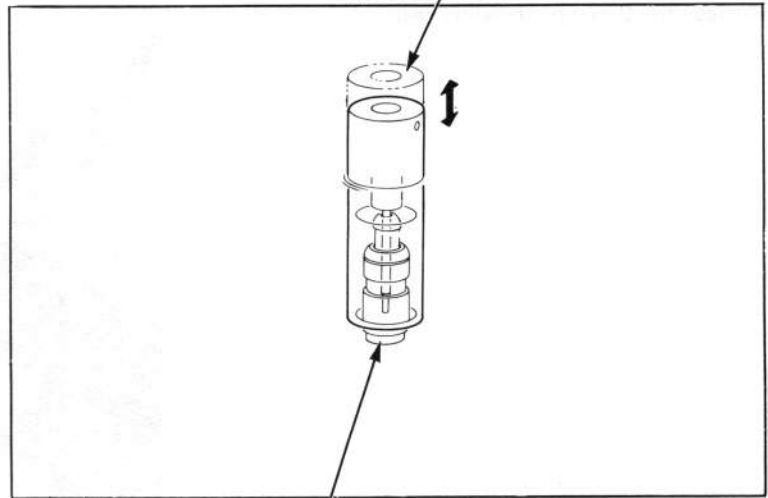
NOTE:

The amount of assist shaft stroke will determine the number of tappet shims needed.

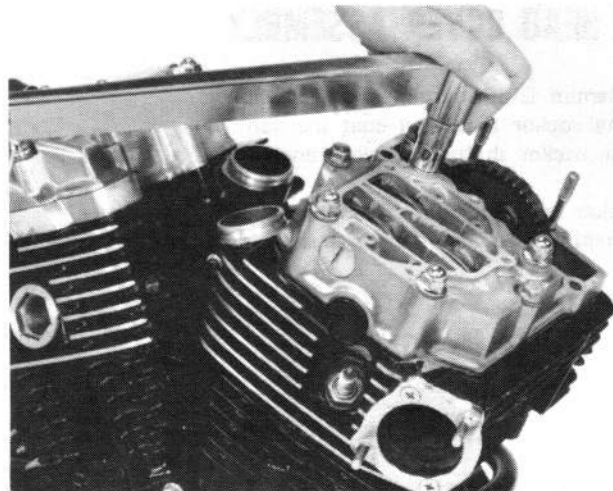
Determine and record the number of shims to be used to each tappet according to the following chart.

| Assistant shaft stroke | Number of shims needed 0.5 mm (0.02 in) |
|----------------------------------|--|
| 0–1.20 mm (0–0.047 in) | 0 |
| 1.20–1.50 mm (0.047–0.059 in) | 1 |
| 1.50–1.80 mm (0.059–0.070 in) | 2 |
| 1.80–2.10 mm (0.070–0.083 in) | 3 |
| 2.10–2.40 mm (0.083–0.094 in) | 4 |
| 2.40–2.70 mm (0.094–0.106 in) | 5 |

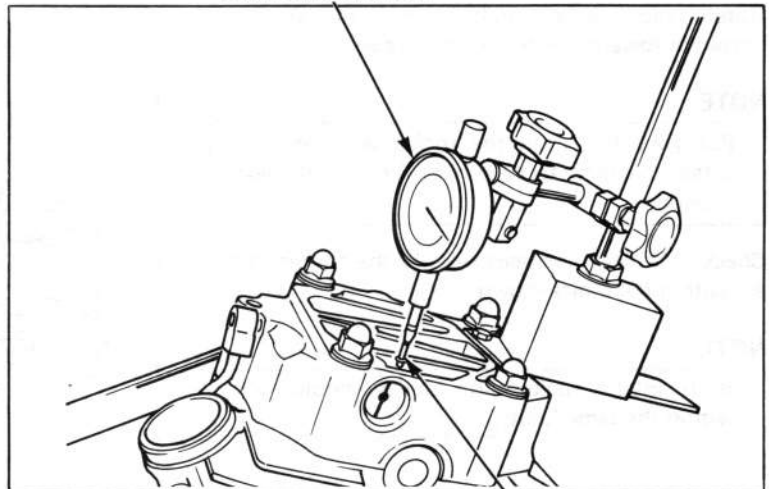
TAPPET BLEEDER
07973–ME90000



HYDRAULIC TAPPET



DIAL INDICATOR

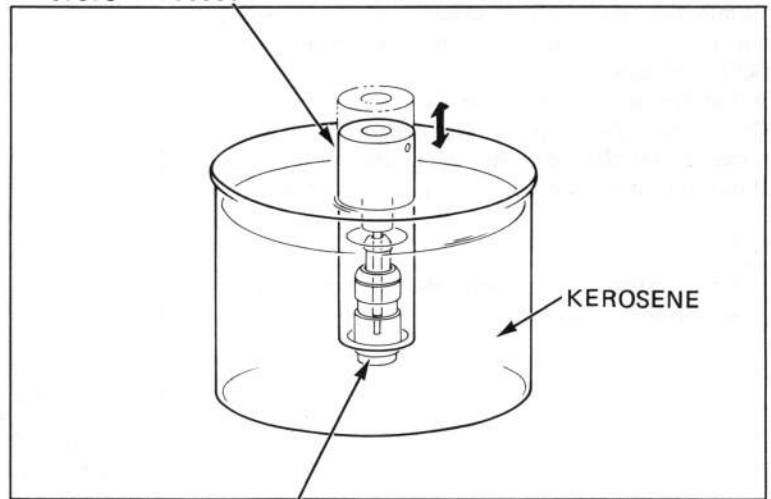


ASSIST SHAFT

CYLINDER HEAD COVER INSTALLATION

Place the tappet in a jar filled with kerosene.
Place the tappet bleeder into the tappet.
Hold the tappet upright and pump the tappet until air bubbles stop coming out. Remove the tool, and try to quickly compress the tappet by hand. You should not be able to compress it more than 0.2 mm (0.008 in).
Remove the tappet from the fluid keeping it upright.

HYDRAULIC TAPPET BLEEDER
07973-ME90000



Install the shims into each hydraulic tappet hole of the cylinder head.
Install the hydraulic tappets into the cylinder head.

CAUTION:

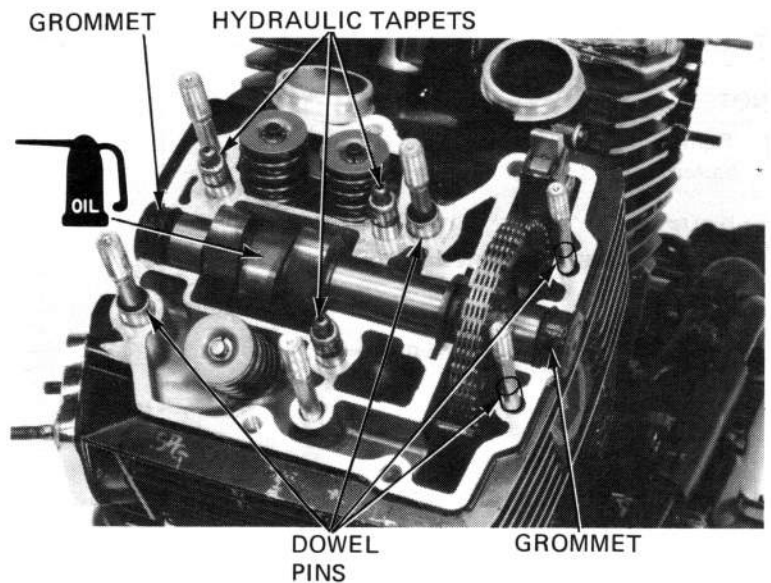
Do not tilt the hydraulic tappets, keep them as upright as possible.

Install the dowel pins and grommets.

NOTE:

Apply a liquid sealant to the oil seals where they contact the cylinder head.

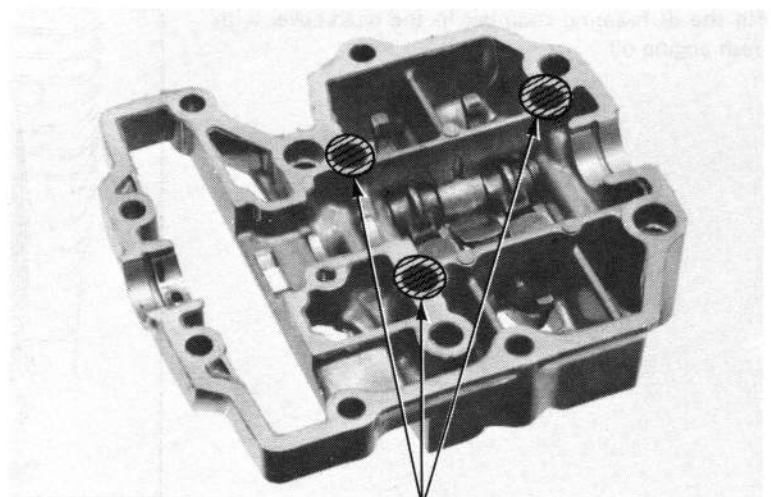
Pour fresh oil into the oil pockets in the cylinder head until the cams are submerged.



Apply a liquid sealant to the mating surfaces of the cylinder head cover.

NOTE:

Do not apply liquid sealant to the shadowed area. Failure to do so could cause a faulty hydraulic tappet.



DO NOT APPLY SEALANT
TO THESE AREAS

CYLINDER HEAD/VALVE

Rotate the crankshaft clockwise and align the timing mark on the rotor with the index mark on the right crankcase.

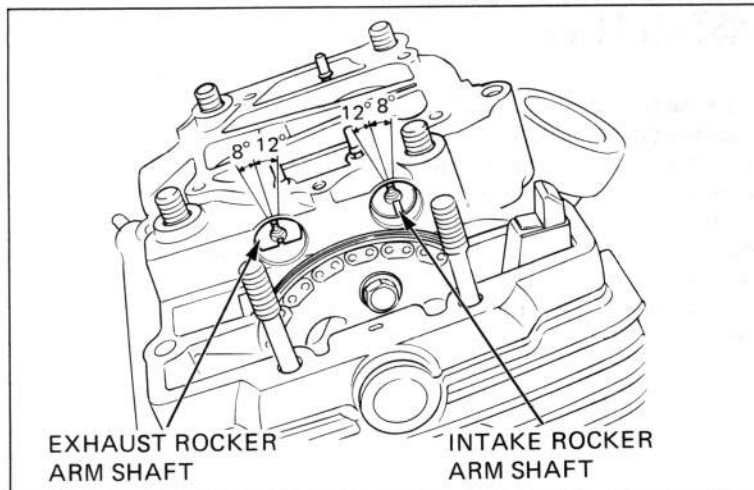
Install the cylinder head cover.

Check that the slots in the exhaust and intake rocker arm shafts are within the limits shown.

If not, repeat the preceding step and recheck.

NOTE:

Both intake rocker arm shafts should fall within the same limits.



Torque the cylinder head cover bolts and cap nuts.

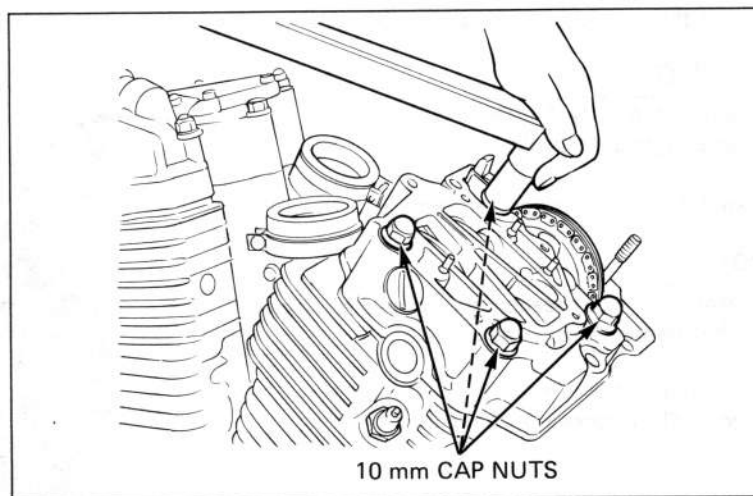
NOTE:

Tighten the bolts and cap nuts in a criss-cross pattern in 2–3 steps.

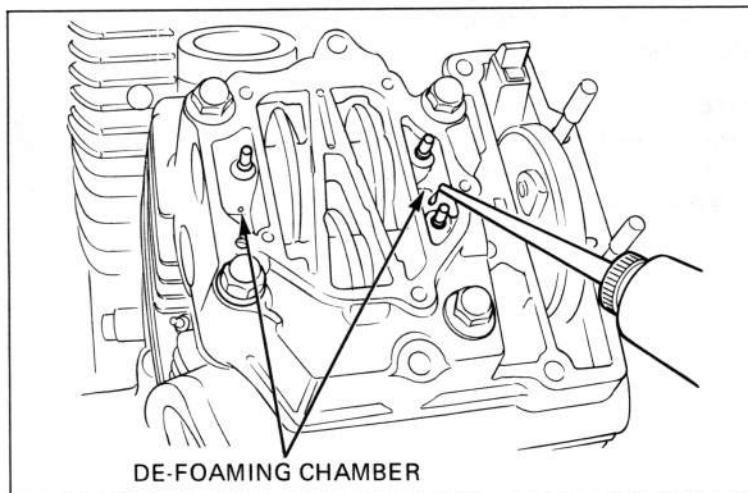
TORQUES:

10 mm cap nut: 35–45 N·m
(3.5–4.5 kg·m, 25–33 ft·lb)

8 mm bolt: 20–25 N·m
(2.0–2.5 kg·m, 14–18 ft·lb)



Fill the de-foaming chamber in the head cover with fresh engine oil.



Place a new O-ring on each rocker arm shaft plug and install the plugs.

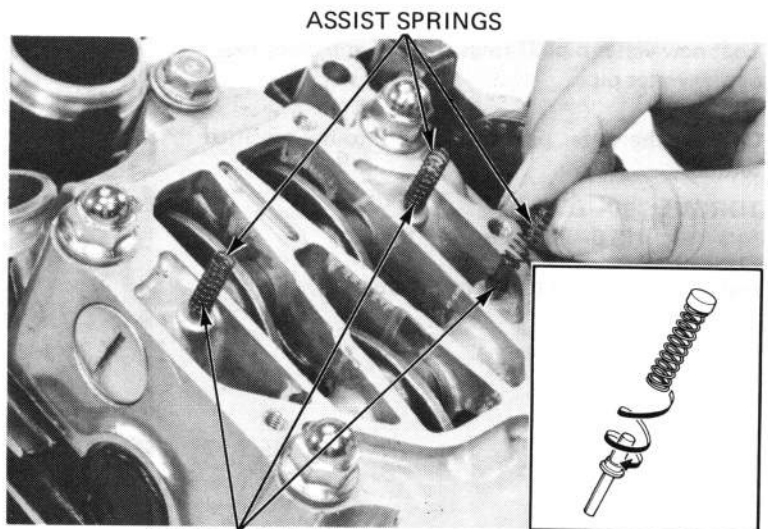


PLUG

Install assist spring onto assist shaft while twisting it so that assist spring end seats flange face tightly. Install the assist shafts and springs in the holes of the cylinder head cover as shown.

Rotate the crankshaft clockwise and align the timing mark (T.D.C.) on the rotor with the index mark on the right crankcase.

Make sure the rocker arm can be slid side way.



ASSIST SPRINGS

ASSIST SHAFTS

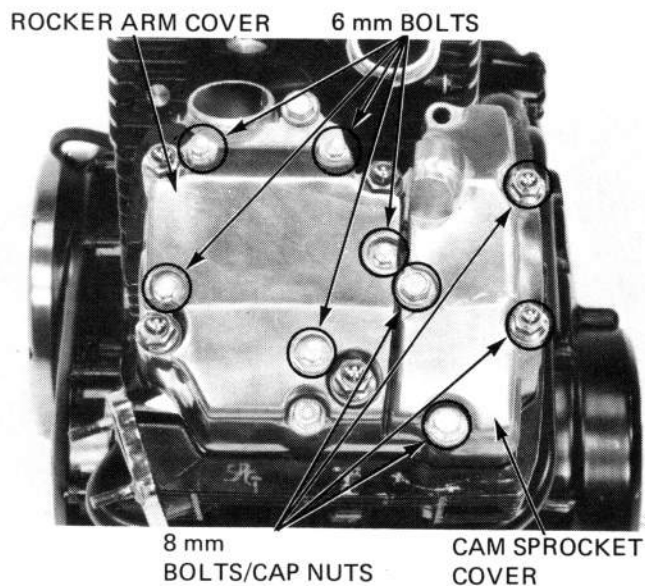
Install the cam sprocket cover with a new gasket. Torque the 8 mm bolts and cap nuts.

NOTE:

Tighten the bolts and cap nuts in a criss-cross pattern in 2–3 steps.

TORQUE: 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb)

Place a new gasket on the cylinder head cover. Install the rocker arm cover and torque the 6 mm bolts in a crisscross pattern in 2–3 steps.



ROCKER ARM COVER

6 mm BOLTS

8 mm BOLTS/CAP NUTS

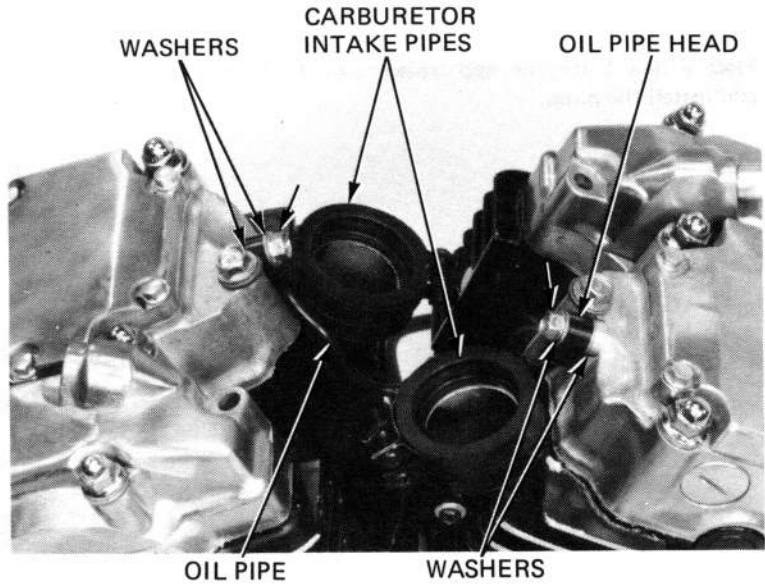
CAM SPROCKET COVER

CYLINDER HEAD/VALVE

Install the carburetor intake pipes.

Connect the oil pipe to the cylinder head cover and tighten to the specified torque.

TORQUE: 10–14 N·m
(1.0–1.4 kg·m, 6–9 ft·lb)

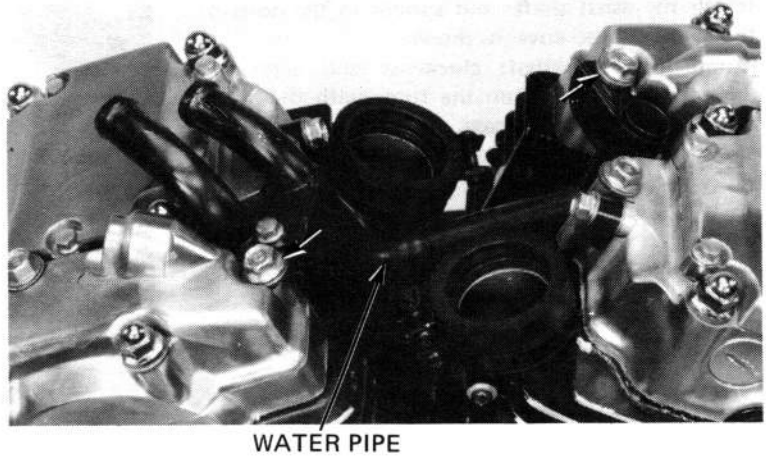


Coat new water pipe O-rings with oil and place them on the water pipe.

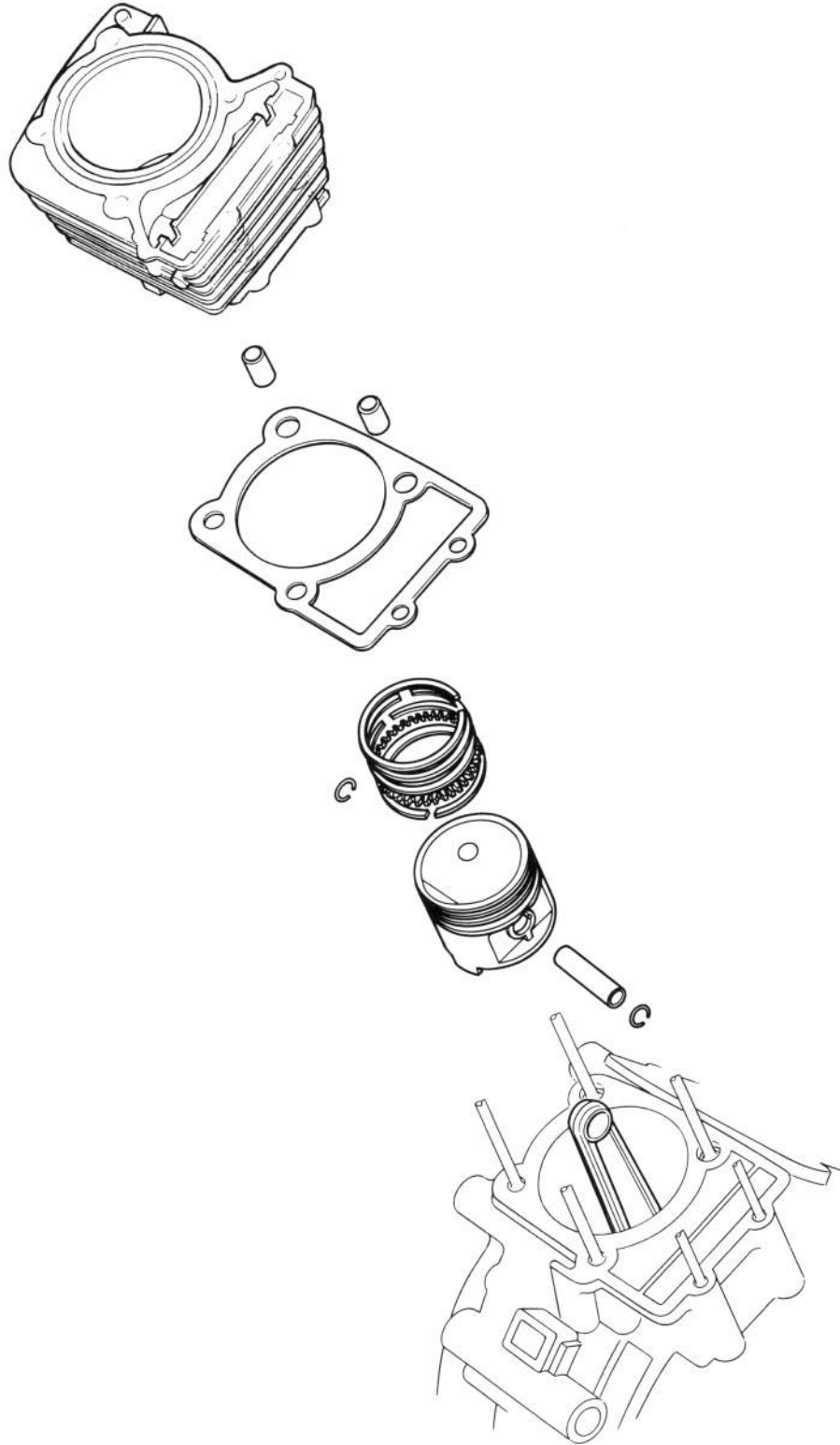
Connect the water pipe and tighten to the specified torque.

TORQUE: 20–25 N·m
(2.0–2.5 kg·m, 14–18 ft·lb)

Install the engine in the frame (Section 5).



CYLINDER/PISTON



11. CYLINDER/PISTON

| | |
|--------------------------|------|
| SERVICE INFORMATION | 11-1 |
| TROUBLESHOOTING | 11-2 |
| CYLINDER REMOVAL | 11-3 |
| PISTON REMOVAL | 11-5 |
| PISTON RING INSTALLATION | 11-7 |
| PISTON INSTALLATION | 11-9 |
| CYLINDER INSTALLATION | 11-9 |

SERVICE INFORMATION

GENERAL

- Cylinder head coolant is fed through water jackets in the cylinder.
- Be sure that the water pipe O-ring, gasket and dowel pins are in place before installing the cylinder head.

SPECIFICATIONS

Unit: mm (in)

| ITEM | | STANDARD | SERVICE LIMIT | |
|--|---------------------------------|-------------------------------|----------------------------|--------------|
| Cylinder | I.D. '83: | 79.500-79.515 (3.1299-3.1305) | 79.67 (3.137) | |
| | I.D. After '83: | 76.500-76.515 (3.0118-3.0124) | 76.66 (3.018) | |
| | Out-of-round | — | 0.05 (0.002) | |
| | Taper | — | 0.05 (0.002) | |
| | Warpage | — | 0.10 (0.004) | |
| Pistons, piston rings, and piston pins | Piston skirt O.D. '83: | 79.470-79.490 (3.1287-3.1295) | 79.35 (3.124) | |
| | Piston skirt O.D. After '83: | 76.210-76.230 (3.0004-3.0012) | 76.09 (2.996) | |
| | Piston pin hole | 20.002-20.008 (0.7875-0.7877) | 20.05 (0.789) | |
| | Piston pin O.D. | 19.994-20.000 (0.7872-0.7874) | 19.80 (0.780) | |
| | Piston pin-to-piston clearance | 0.002-0.014 (0.0001-0.0005) | 0.10 (0.004) | |
| | Piston ring-to groove clearance | Top/second | 0.03-0.035 (0.0012-0.0014) | 0.25 (0.010) |
| | | Oil | 0.03-0.035 (0.0012-0.0014) | 0.10 (0.004) |
| | Piston ring end gap | Top/second | 0.20-0.35 (0.0079-0.0138) | 0.50 (0.002) |
| Oil (side rail) | | 0.30-0.90 (0.0118-0.035) | 1.1 (0.04) | |
| Piston-to-cylinder clearance | | 0.010-0.045 (0.0004-0.0018) | 0.32 (0.013) | |

TROUBLESHOOTING

Low or uneven compression

1. Worn cylinder or piston rings.
2. Leaking head gasket.
3. Incorrect valve timing.

Excessive smoke

1. Worn cylinder and piston rings.
2. Improperly installed piston rings.
3. Damaged piston or cylinder.

Overheating

1. Excessive carbon deposits on piston or combustion chamber.
2. Faulty water pump

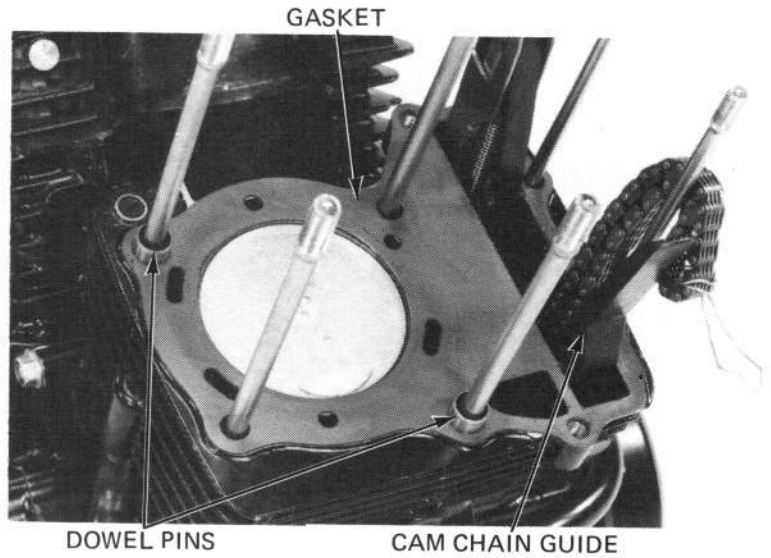
Piston noise

1. Worn cylinder and piston.
2. Excessive carbon deposits.

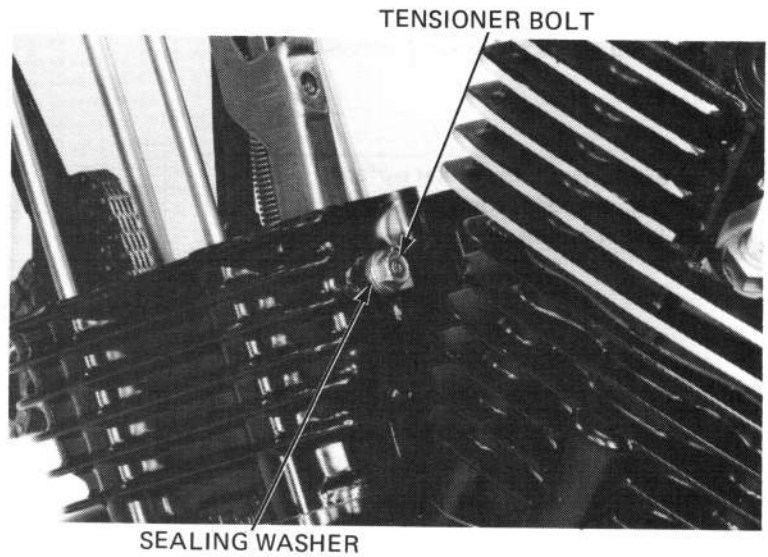
CYLINDER REMOVAL

Remove the cylinder heads (Refer to Section 10).

Remove the gaskets and dowel pins and the cam chain guides.

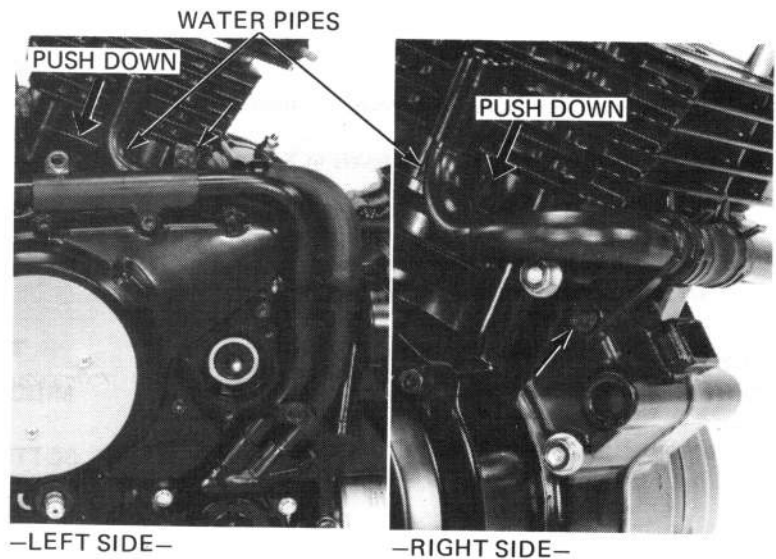


Remove the cam chain tensioner bolt and sealing washer.



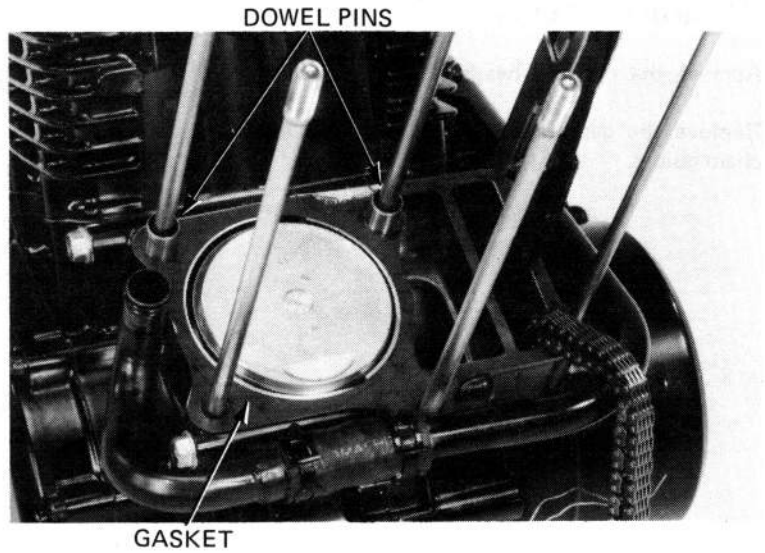
Remove the union bolts and remove the right and left water pipes from the cylinders by pulling them out by hand.
Remove the O-rings from the water pipes.

Remove the cylinders.



CYLINDER/PISTON

Remove the gaskets and dowel pins.



Clean the top of each cylinder thoroughly with a scraper.

NOTE:

- Avoid damaging the gasket surface.
- The gasket will come off easier if it is soaked in solvent.



CYLINDER INSPECTION

Inspect the cylinder bores for wear or damage.

Measure the cylinder I.D. at three levels in X and Y axis.

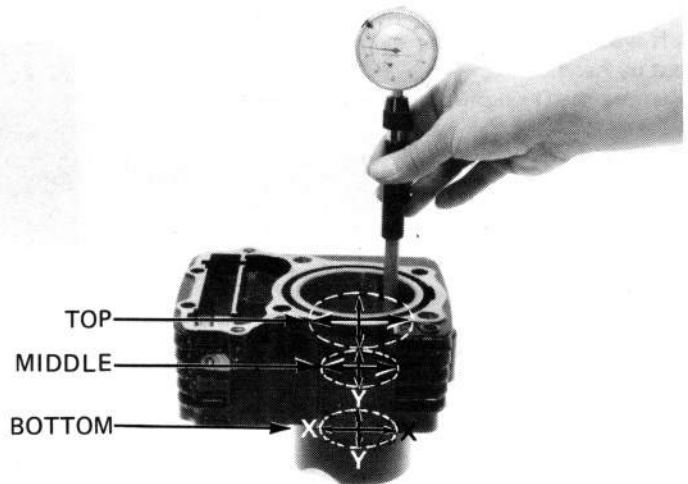
SERVICE LIMIT:

- '83: 79.67 mm (3.137 in)
- After '83: 76.66 mm (3.018 in)

Calculate the taper and out of round.

SERVICE LIMIT:

- Taper: 0.05 mm (0.002 in)
- Out of round: 0.05 mm (0.002 in)

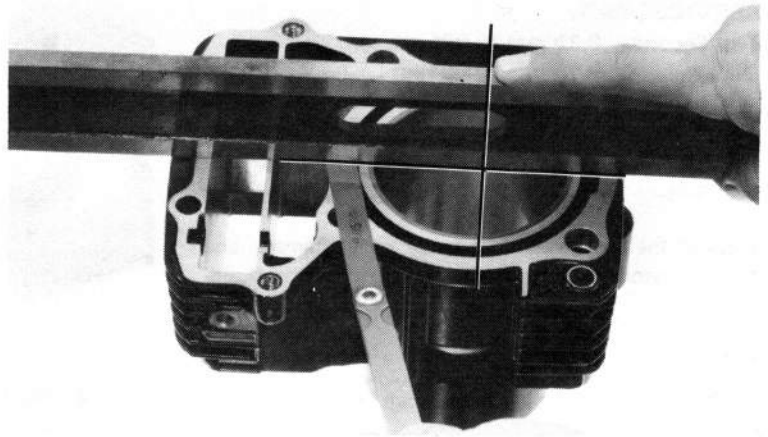


Inspect the cylinders for transverse warpage across the top.

NOTE:

Measure warpage using a straight edge and feeler gauge in the directions shown.

SERVICE LIMIT: 0.10 mm (0.004 in)



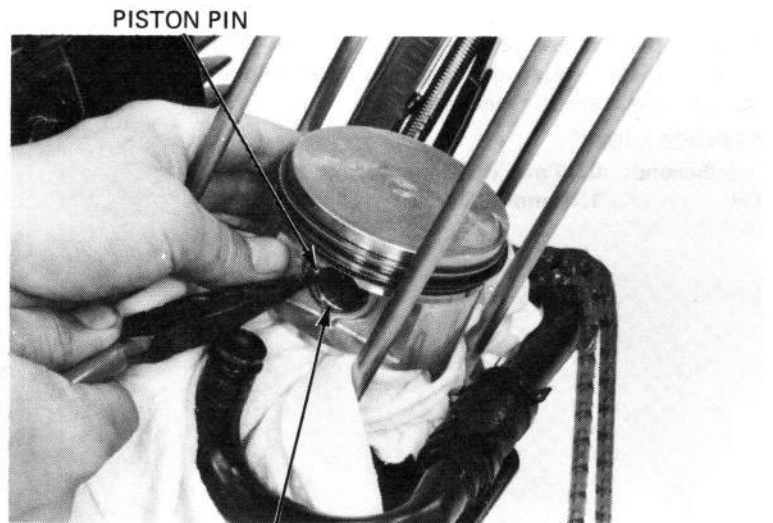
PISTON REMOVAL

Place a shop towel into the crankcase and remove the piston pin clips.

NOTE:

Do not let the clips fall into the crankcase.

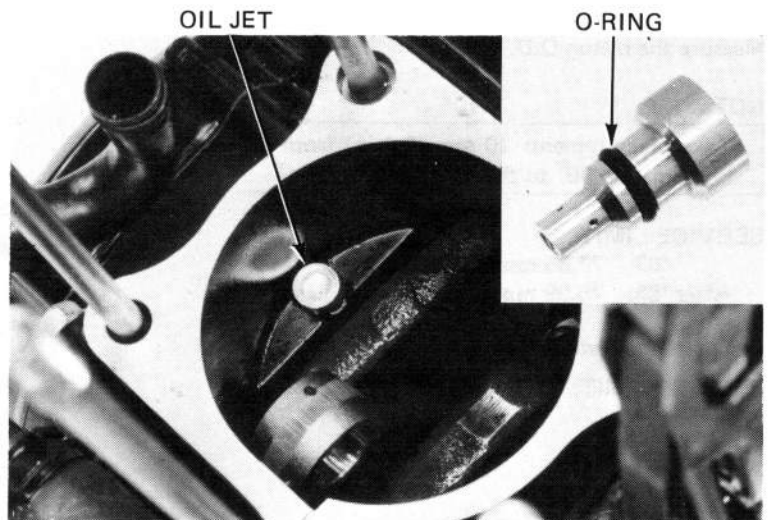
Push the piston pin out and remove the piston.



PISTON PIN

PISTON PIN CLIP

Remove the oil jet and check for clogging. Check the O-ring for damage or deterioration.



OIL JET

O-RING

CYLINDER/PISTON

PISTON/PISTON RING INSPECTION

Measure the piston ring-to-groove clearance.

SERVICE LIMIT:

Top/Second: 0.10 mm (0.004 in)

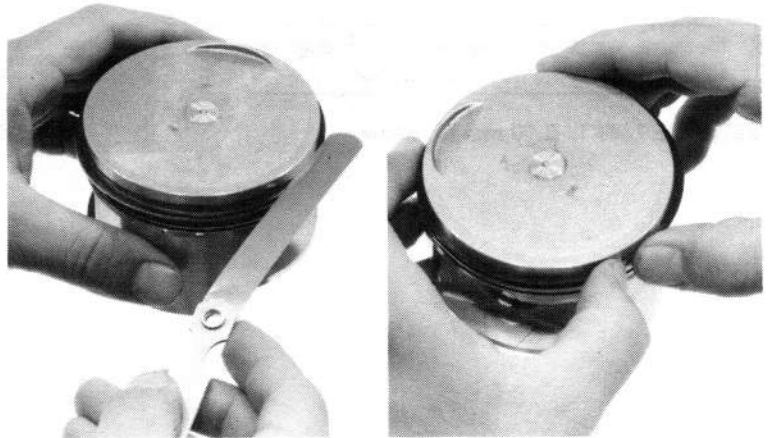
Oil: 0.10 mm (0.004 in)

Remove the piston rings and mark them to indicate the correct cylinder and piston position for re-assembly.

Inspect the piston for cracks or other damage and the ring grooves for excessive wear or carbon build-up.

NOTE:

Do not damage the piston rings when removing them.

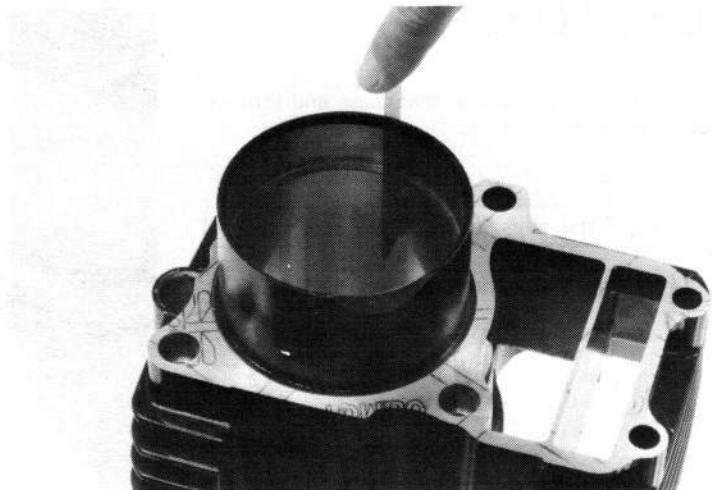


Measure the top and second piston ring end gaps; using a piston, push the ring into the cylinder squarely and make the measurement.

SERVICE LIMIT:

Top/Second: 0.50 mm (0.02 in)

Oil: 1.10 mm (0.04 in)



Measure the piston O.D.

NOTE:

Take measurements 10 mm (0.4 in) from the bottom, and 90° to the piston pin hole.

SERVICE LIMIT:

'83: 79.35 mm (3.124 in)

After '83: 76.09 mm (2.996 in)

Calculate the piston-to-cylinder clearance.

SERVICE LIMIT: 0.32 mm (0.013 in)



Measure each piston pin hole I.D.

SERVICE LIMIT: 20.05 mm (0.789 in)

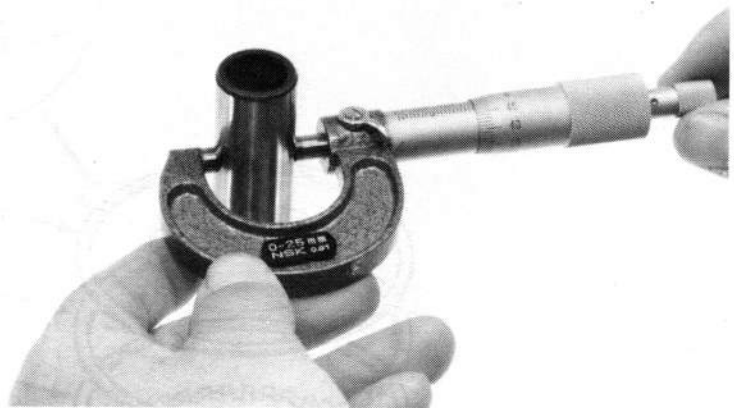


Measure each piston pin O.D.

SERVICE LIMIT: 19.80 mm (0.780 in)

Calculate the piston pin to piston clearance.

SERVICE LIMIT: 0.25 mm (0.010 in)



PISTON RING INSTALLATION

Clean the piston domes, ring lands, and skirts.

NOTE:

Insert the outside surface of the ring into the proper ring groove and roll around in the groove to make sure that the ring has a free fit around the piston's circumference.



CYLINDER/PISTON

Carefully install the piston rings onto the piston with the markings facing up.

NOTE:

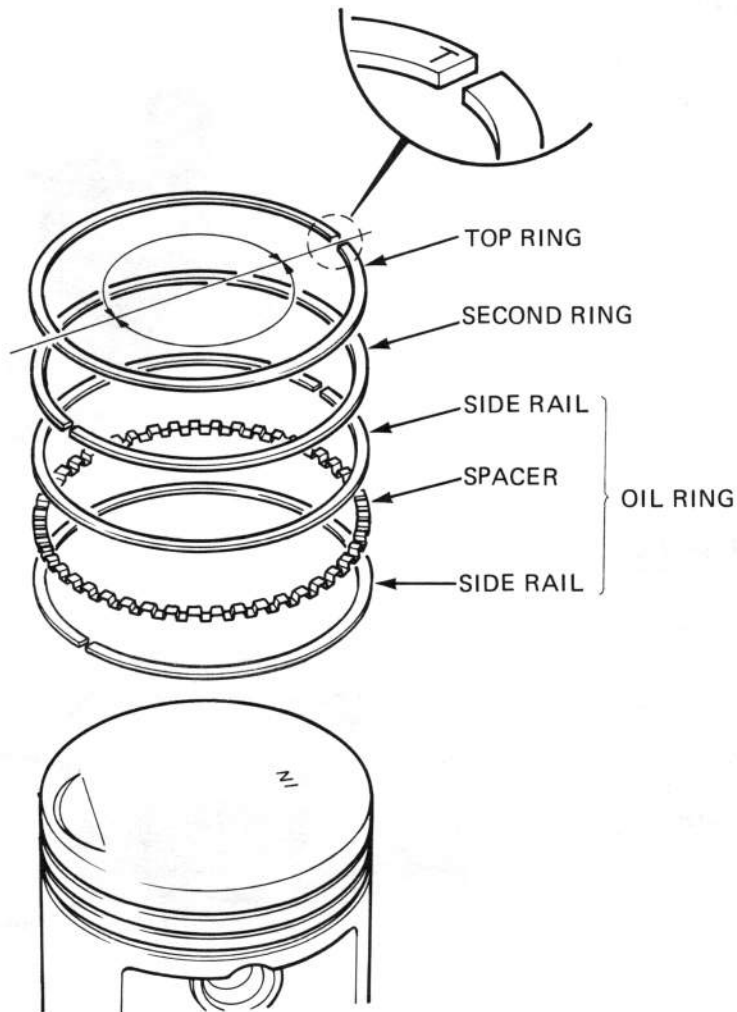
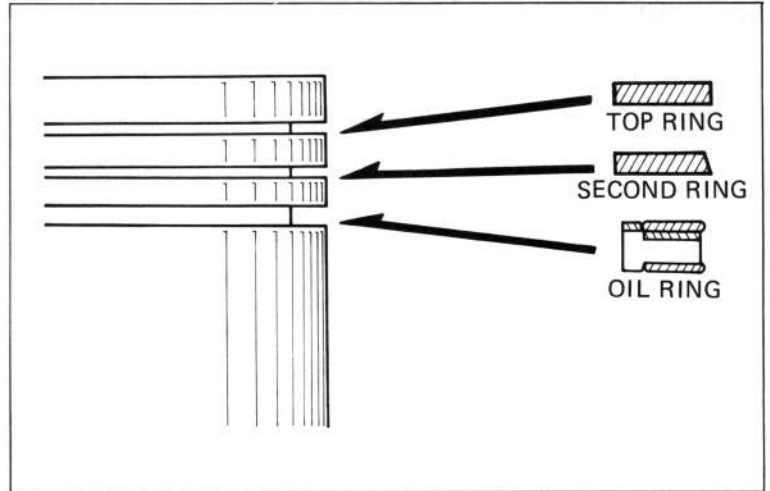
Be careful not to damage the piston and piston rings during assembly.

Stagger the ring end gaps 180° apart from each other as shown.

NOTE:

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

After installing the rings, check that they rotate freely without sticking.



PISTON INSTALLATION

Install the oil jets.

NOTE:

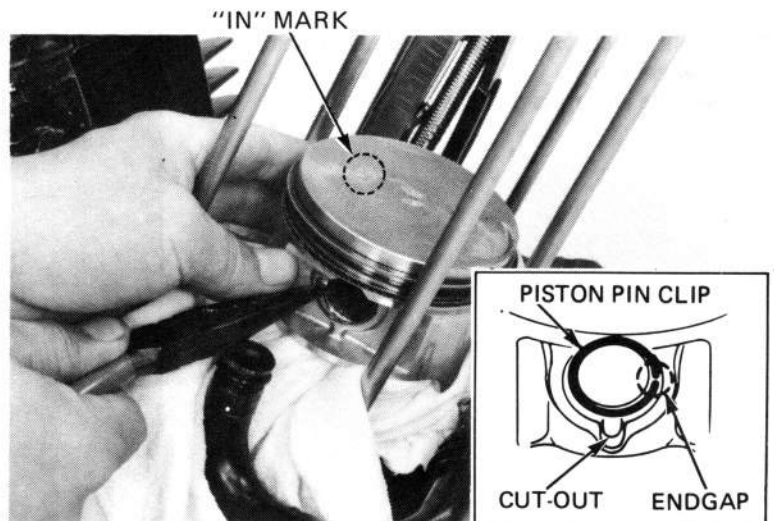
Before installing the oil jets, make sure that the O-Rings are installed on the oil jets.



Coat the rod small end with molybdenum disulfide grease. Assemble the piston and connecting rod with the piston and piston pin clips as shown.

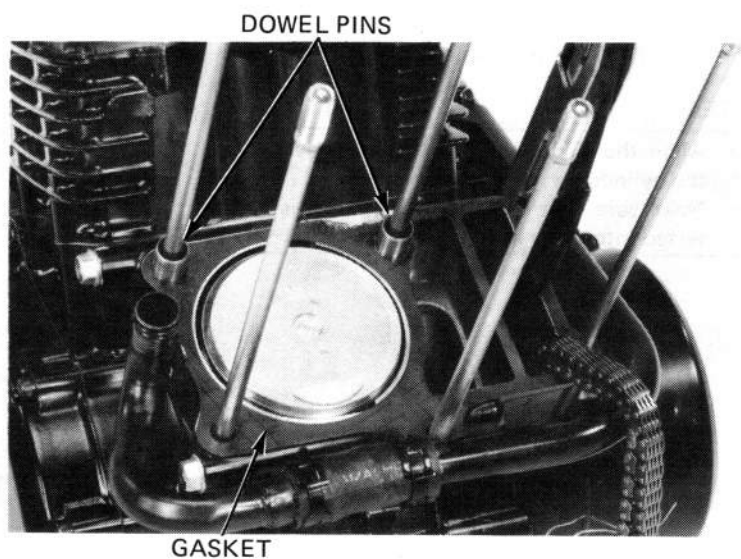
NOTE:

- Install the pistons with the marking "IN" facing towards the inlet side.
- After installing the piston pin clips, make sure that they are seated properly and not aligned with the cutout in the piston.
- Do not let the piston pin clips fall into the crankcase.



CYLINDER INSTALLATION

Install the gasket and dowel pins.



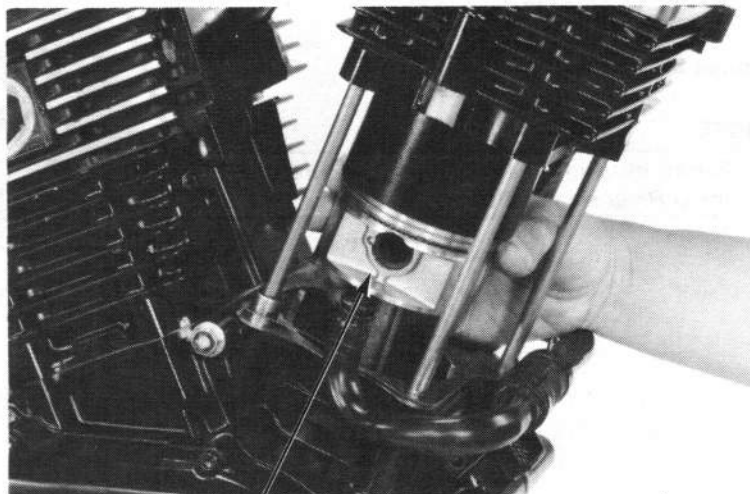
CYLINDER/PISTON

Coat the cylinders, piston rings/grooves and pistons with oil.

Install the piston assemblies into the cylinders from the top of the crankcase while compressing the piston rings with your fingers. Be sure each assembly is returned to its original position as noted during removal.

NOTE:

Be careful not to damage the piston rings during assembly.

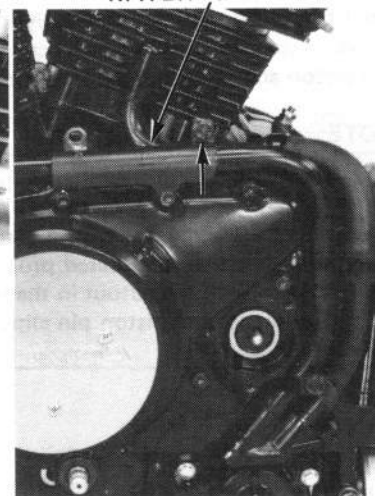
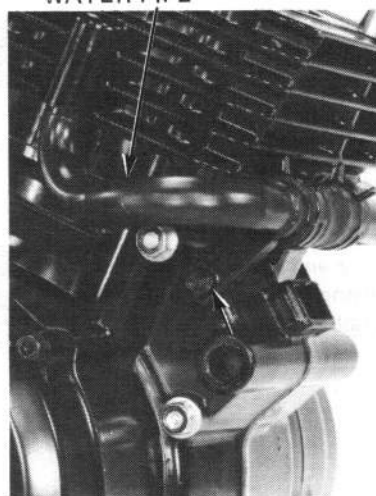


PISTON

FRONT CYLINDER
WATER PIPE

REAR CYLINDER
WATER PIPE

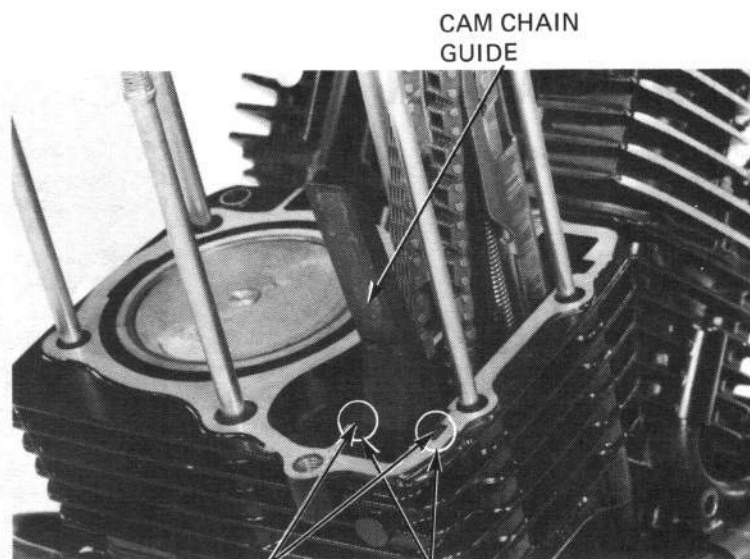
Apply oil to new water pipe O-rings and place them on the water pipes. Connect the water pipes to the cylinders.



Install the cam chain guides.

NOTE:

- Align the guide bosses with the grooves in the cylinders.
- Make sure that the end of the guide is inserted into place in the crankcase.

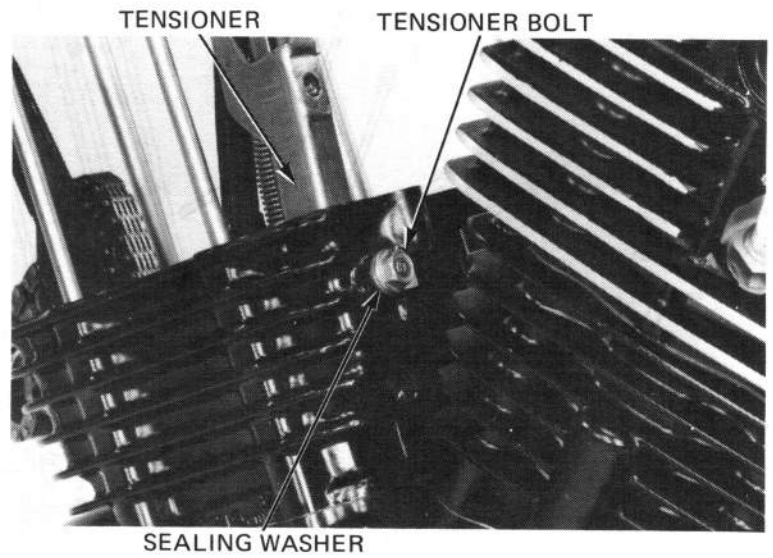


CAM CHAIN
GUIDE

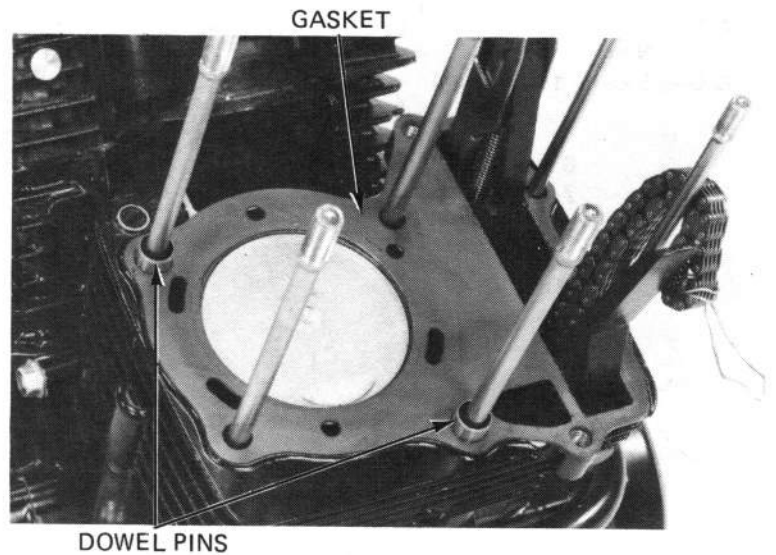
BOSSES

GROOVES

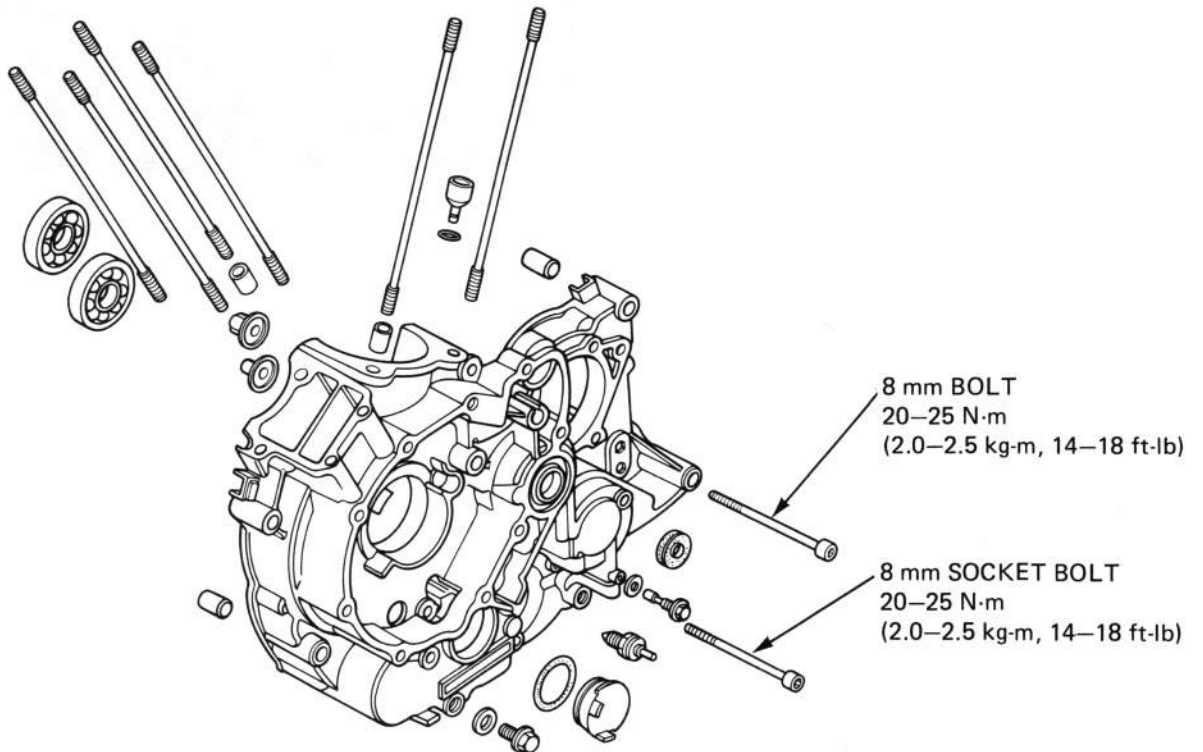
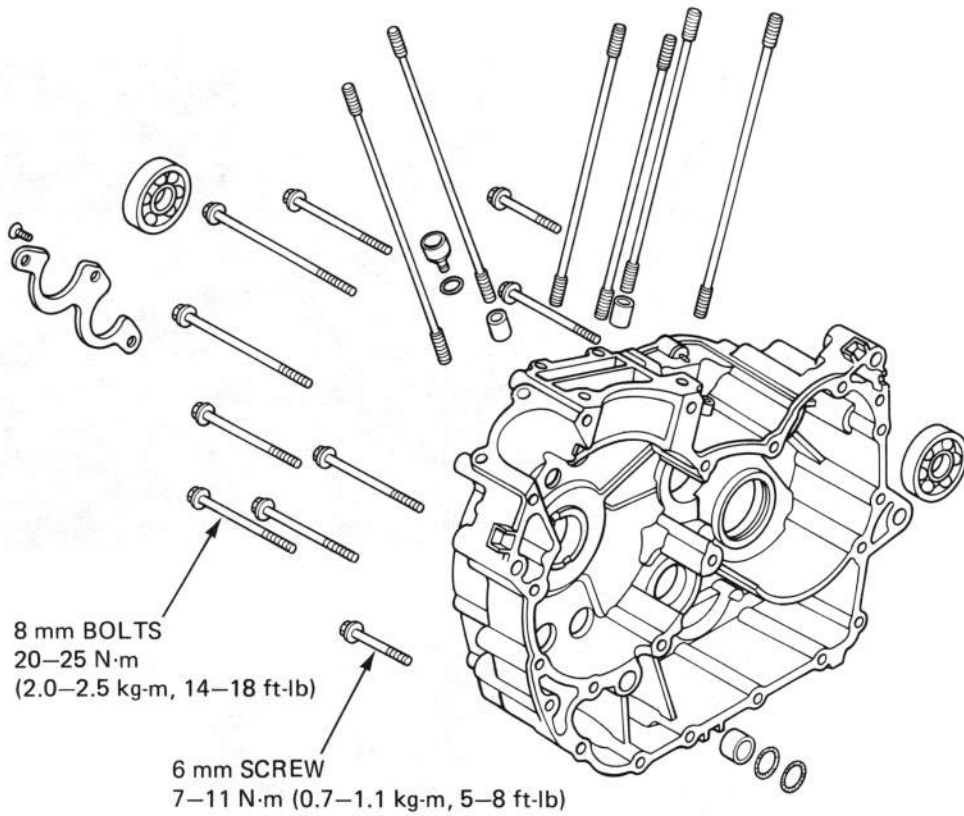
Install the tensioner bolts and sealing washers while pulling up on the tensioners.



Install the dowel pins.
Install new gaskets.
Clean the cylinder contacting faces of the cylinder heads of gasket material and carbon deposits.
Install the cylinder heads (Page 10-18).



CRANKCASE



12. CRANKCASE

| | |
|----------------------|------|
| SERVICE INFORMATION | 12-1 |
| CRANKCASE SEPARATION | 12-2 |
| CRANKCASE ASSEMBLY | 12-4 |

SERVICE INFORMATION

- To service the connecting rods, crankshafts and transmission, the crankcase must be separated.

TORQUE VALUES

| | |
|-------------------------------|--|
| 8 mm bolt: | 20–25 N·m (2.0–2.5 kg-m, 14–18 ft-lb) |
| 8 mm socket head bolt: | 20–25 N·m (2.0–2.5 kg-m, 14–18 ft-lb) |
| 6 mm bearing set plate screw: | 7–11 N·m (0.7–1.1 kg-m, 5–8 ft-lb) (Apply LOCTITE® to the threads) |
| 10 mm special bolt: | 35–45 N·m (3.5–4.5 kg-m, 25–33 ft-lb) |

TOOL

| | |
|----------------|---------------|
| Special | |
| Shaft holder | 07923–6890101 |

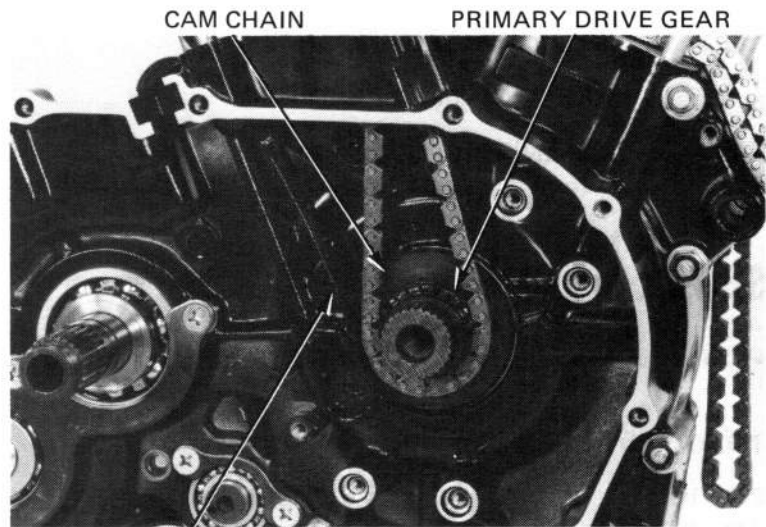
CRANKCASE

CRANKCASE SEPARATION

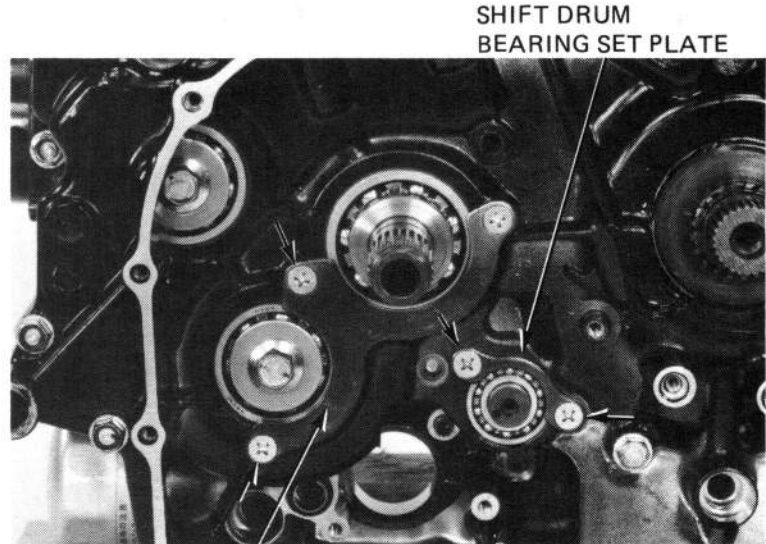
The following parts must be removed before disassembling the crankcase.

- Oil pump (Refer to section 2)
- Water pump and water pipes (Refer to section 6)
- Clutch (Refer to section 7)
- Gearshift linkage (Refer to section 8)
- Alternator rotor/starter clutch (Refer to section 9)
- Cylinder heads (Refer to section 10)
- Cylinders/pistons (Refer to section 11)
- Starter motor (Refer to section 20)

Remove the cam chain tensioners, cam chains and primary drive gear.

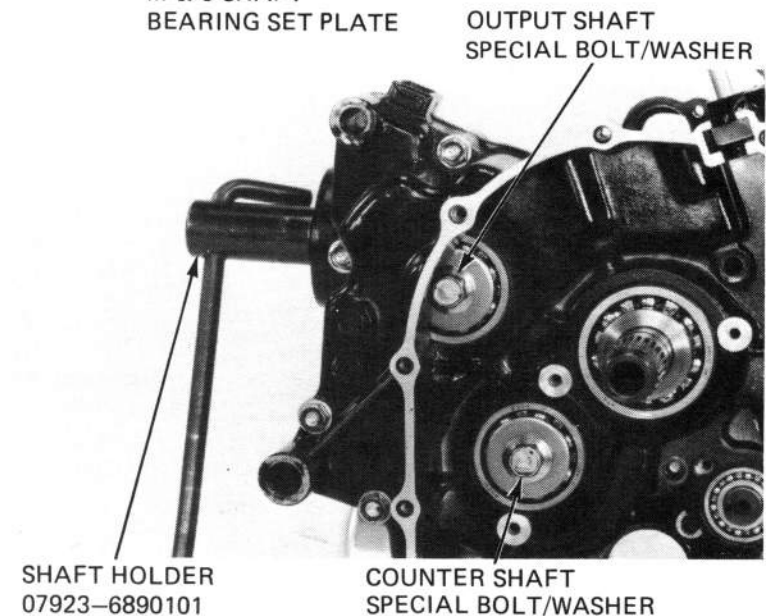


Remove the mainshaft, countershaft and shift drum bearing holders by removing the respective screws.



Install the Shaft Holder on the output gear shaft.

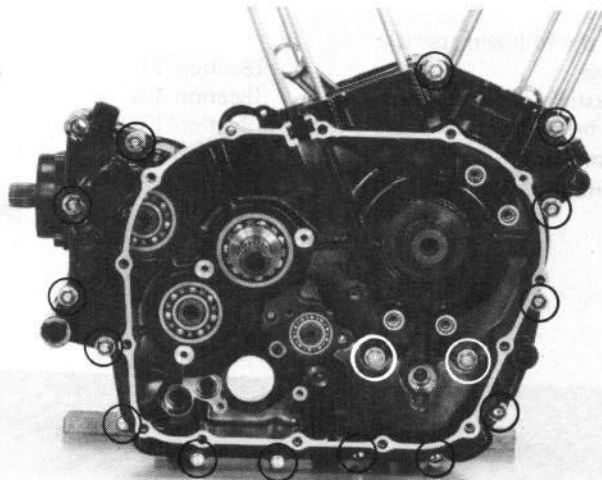
Remove the special bolts and washers holding the countershaft and final drive shaft.



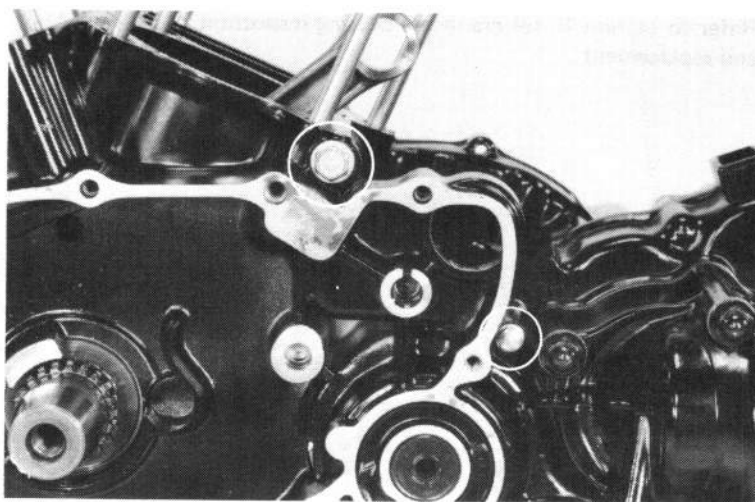
Remove the right crankcase 8 mm and 6 mm bolts.

NOTE:

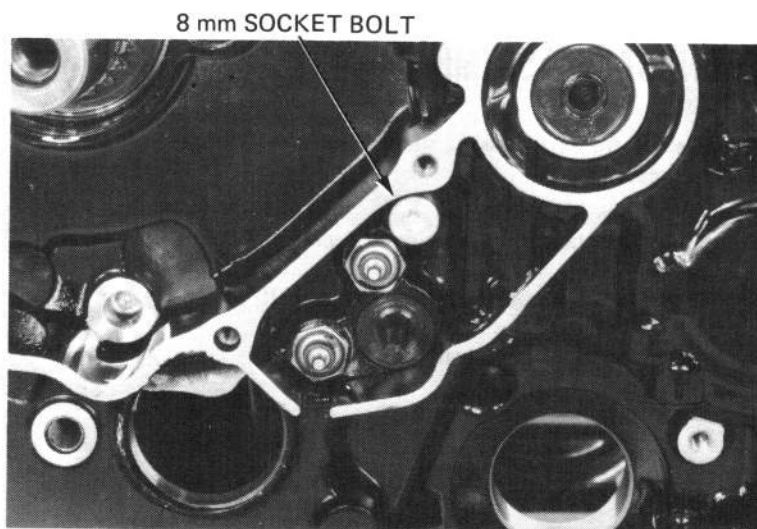
To prevent a distorted crankcase, loosen the bolts in a crisscross pattern in 2-3 steps.



Remove the left crankcase 8 mm and 6 mm bolts.



Remove the 8 mm socket head bolt.

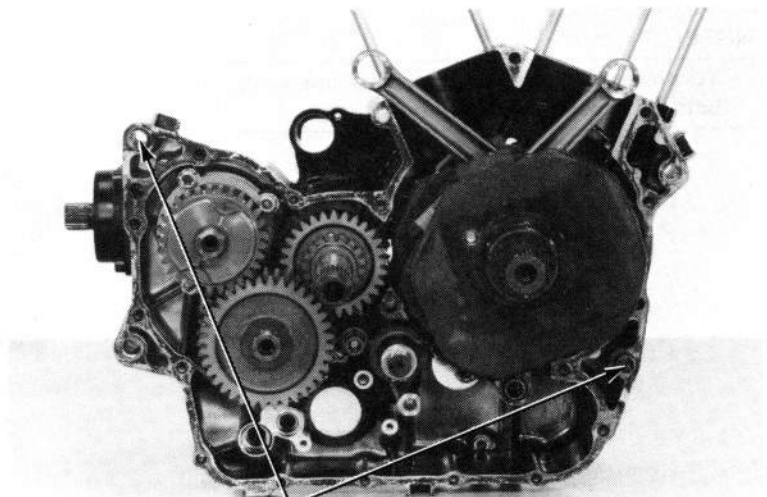


CRANKCASE

Separate the crankcase. Remove the dowel pins.

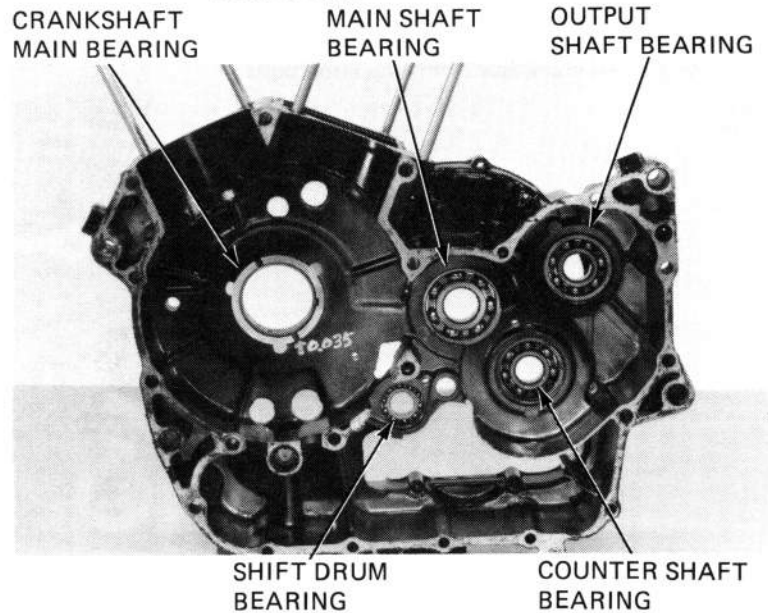
Remove the following parts:

- Oil jets (Section 11)
- Crankshaft/connecting rods (Section 13)
- Shift forks/drum (Section 13)
- Transmission (Section 13)
- Output gear assembly (Section 13)



DOWEL PINS

Refer to section 13 for crankcase bearing inspection and replacement.



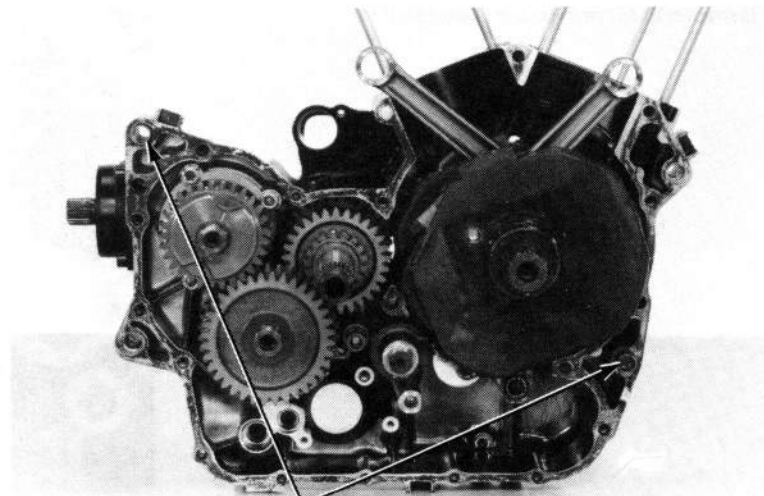
CRANKCASE ASSEMBLY

Remove all traces of gasket mating surfaces from the crankcase halves.

Apply liquid sealant to the mating surfaces.

Install the dowel pins in the left crankcase half.

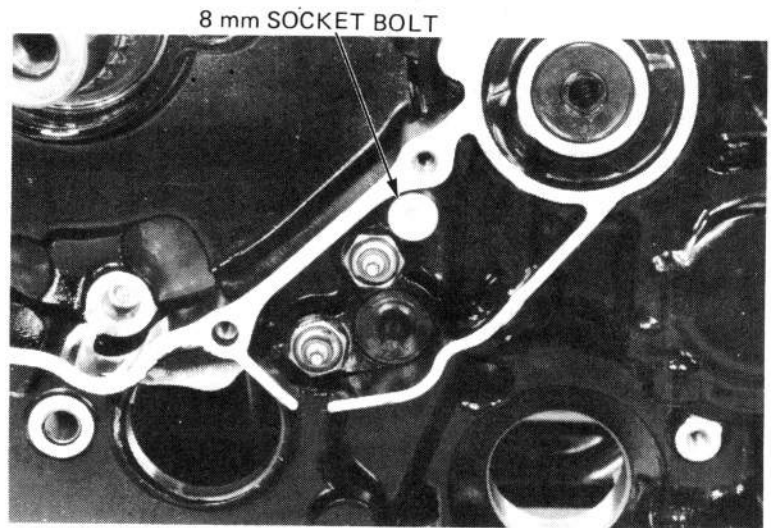
Assemble the crankcase halves.



DOWEL PINS

Tighten the left crankcase 8 mm socket head bolt to the specified torque.

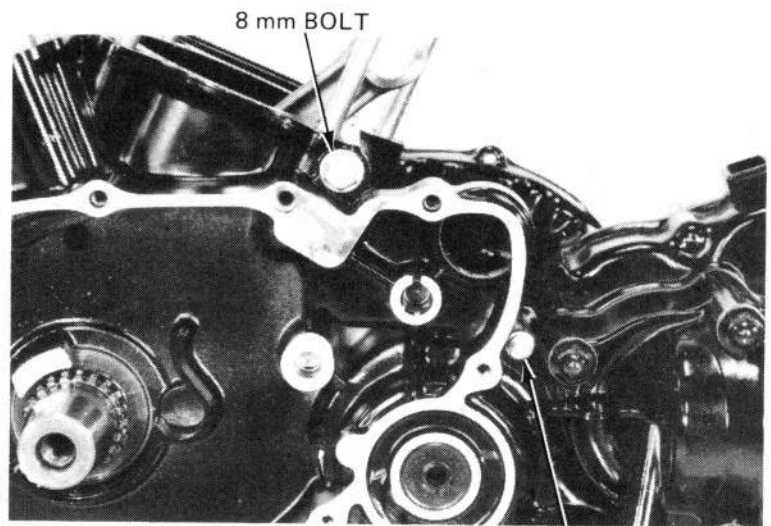
TORQUE: 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb)



NEW Tighten the left crankcase 8 mm hex head bolt to the specified torque.

TORQUE: 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb)

Tighten the 6 mm bolt to the standard torque.



6 mm BOLT

Tighten the right crankcase 8 mm bolts in the sequence shown in 2-3 steps, to the specified torque.

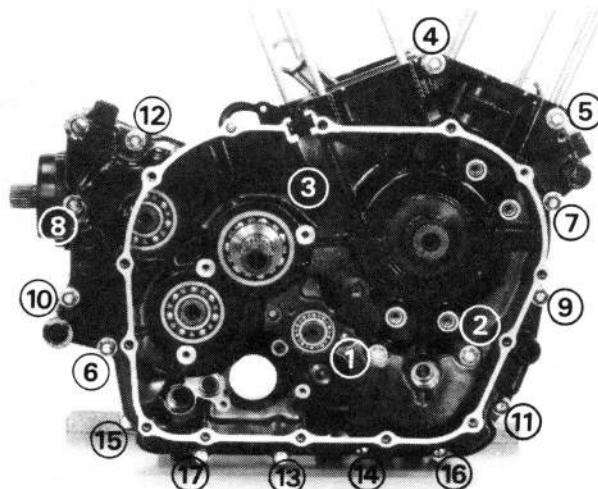
TORQUE: 20–25 N·m (2.0–2.5 kg·m, 14–18 ft·lb)

NOTE:

The bolts 1 through 12 are 8 mm.

Tighten the 6 mm bolts in 2-3 steps to the standard torque.

TORQUE: 8–12 N·m (0.8–1.2 kg·m, 6–9 ft·lb)



NEW

CRANKCASE

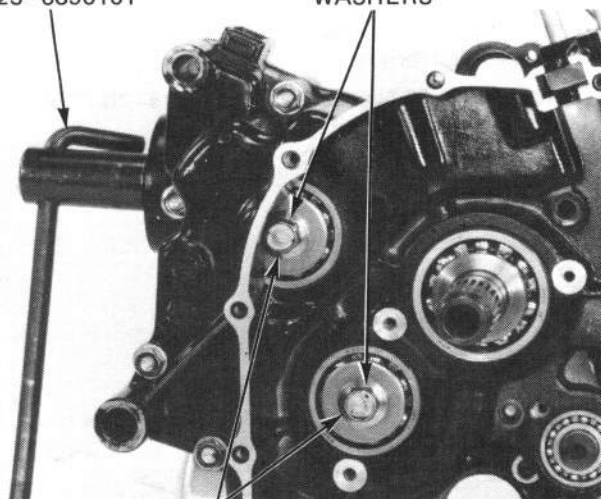
Install the Shaft Holder on the side gear output shaft.

Install the washers and 10 mm special bolts on the countershaft and output shaft. Tighten the bolts.

TORQUE: 35–45 N·m (3.5–4.5 kg·m, 25–33 ft·lb)

SHAFT HOLDER
07923–6890101

WASHERS



10 mm SPECIAL BOLTS

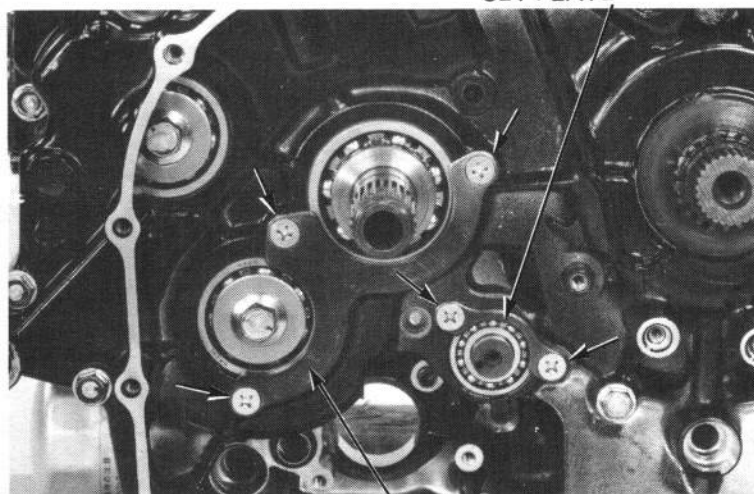
SHIFT DRUM BEARING
SET PLATE

Install the bearing holders with the 6 mm screws.

TORQUE: 7–11 N·m (0.7–1.1 kg·m, 5–8 ft·lb)

NOTE:

Apply Loctite® to the threads of the 6 mm screws.



SHAFT BEARING
SET PLATE

PRIMARY DRIVE
GEAR

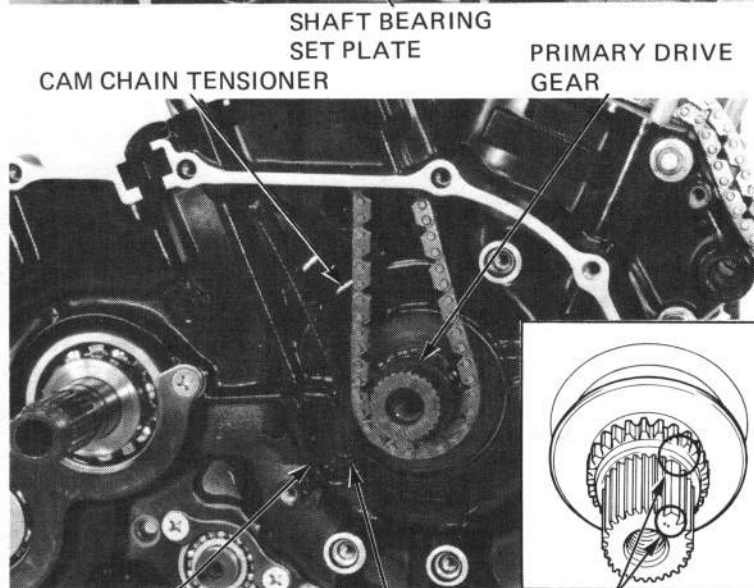
Install the primary drive gear on the crankshaft with the flat on the drive gear aligned with the flat on the crankshaft splines.

Install the cam chain over the drive gear.

Install the lower end of the cam chain tensioner slipper in the holder securely.

Install the following parts:

- Starter motor (Section 20)
- Cylinders/pistons (Section 11)
- Cylinder heads (Section 10)
- Oil pump (Section 2)
- Gearshift linkage (Section 8)
- Water pump/water pipes (Section 6)
- Clutch (Section 7)
- Starter clutch/alternator (Section 9)



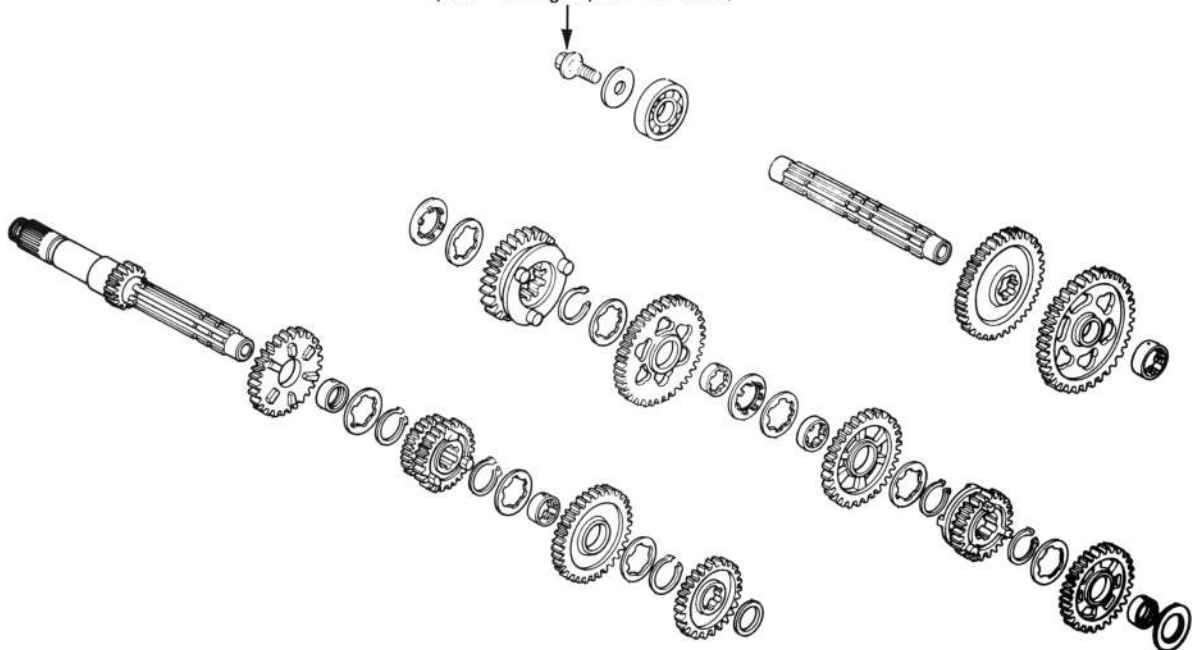
HOLDER

TENSIONER
SLIPPER

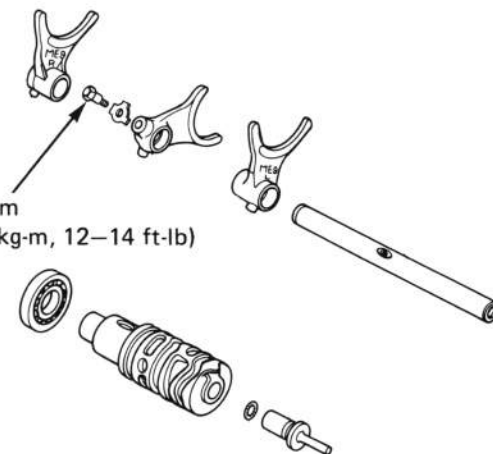
ALIGNING
POSITION

CRANKSHAFT/TRANSMISSION

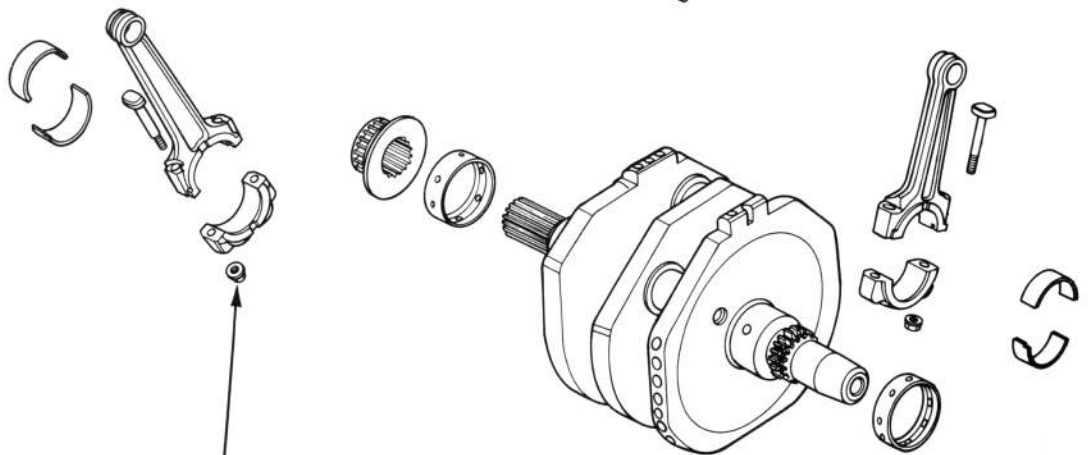
35–45 N·m
(3.5–4.5 kg-m, 25–33 ft-lb)



16–20 N·m
(1.6–2.0 kg-m, 12–14 ft-lb)

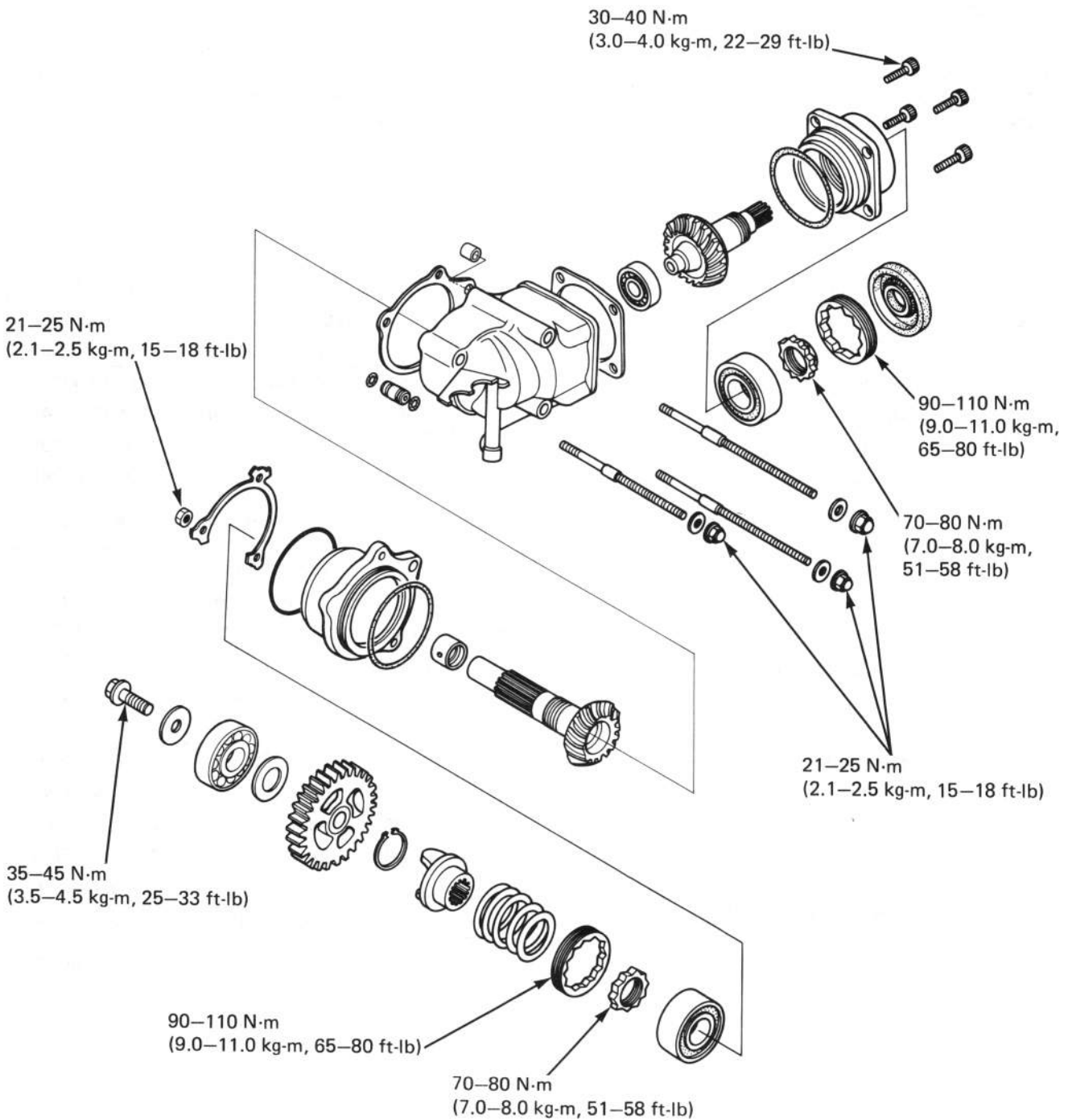


41–45 N·m
(4.1–4.5 kg-m, 30–33 ft-lb)



13. CRANKSHAFT/TRANSMISSION

| | | | |
|-------------------------------|------|--------------------------------|-------|
| SERVICE INFORMATION | 13-2 | TRANSMISSION REMOVAL | 13-12 |
| TROUBLESHOOTING | 13-3 | OUTPUT GEAR | 13-17 |
| OUTPUT GEAR CASE REMOVAL | 13-4 | SHIFT FORK/SHIFT DRUM | 13-32 |
| OUTPUT GEAR CASE INSTALLATION | 13-4 | CRANKCASE BEARINGS REPLACEMENT | 13-34 |
| CRANKSHAFT/CONNECTING ROD | 13-5 | TRANSMISSION INSTALLATION | 13-35 |



SERVICE INFORMATION

GENERAL

- For crankshaft and transmission repair, the crankcase must be separated (Section 12).
- All bearing inserts are select fitted and are identified by color code. Select replacement bearings from the code tables. After installing new bearings, recheck them with plastigauge to verify clearance.
- Apply molybdenum disulfide grease to the main journals and crankpins during assembly.
- When replacing the following output gear components, a new adjustment shim must be selected.
 - Output gear case.
 - Output gear assembly.
 - Output gear bearing.
 - Output gear bearing holder.
- Replace the final drive and output drive shafts as a set.
- When using the lock nut wrench, use a deflecting beam type torque wrench 14-20 inches long. The lock nut wrench increases, the torque wrench's leverage, so the torque wrench reading will be less than the torque actually applied to the lock nut. The specification given is the actual torque applied to the lock nut, not the reading on the torque wrench when used with the lock nut wrench. The torque scale reading is given with the actual torque specifications.

SPECIFICATIONS

Unit: mm (in)

| ITEM | | STANDARD | | SERVICE LIMIT | |
|-------------------------------|---------------------------------------|----------------------------------|-------------------------------|-----------------------------|---------------|
| Crankshaft/ connecting rod | Connecting rod big end side clearance | | 0.10–0.25 (0.0039–0.010) | 0.40 (0.0157) | |
| | Connecting rod small end I.D. | | 20.020–20.041 (0.7882–0.7890) | 20.09 (0.7909) | |
| | Crankpin oil clearance | | 0.028–0.052 (0.0011–0.0020) | 0.07 (0.0028) | |
| | Main journal oil clearance | | 0.025–0.041 (0.0010–0.0016) | 0.06 (0.0024) | |
| | Crankshaft runout | | — | 0.05 (0.0020) | |
| Countershaft | Backlash | Low | 0.089–0.170 (0.0035–0.0067) | 0.24 (0.0094) | |
| | | 2nd, 3rd, 4th, 5th and 6th gears | 0.068–0.136 (0.0027–0.0054) | 0.18 (0.0071) | |
| | Gear I.D. | M5, M6 | 28.000–28.021 (1.1023–1.1034) | 28.04 (1.1039) | |
| | | C1, C2, C3 | 28.000–28.021 (1.1023–1.1034) | 28.04 (1.1039) | |
| | | C4 | 29.000–29.021 (1.1417–1.1426) | 29.04 (1.1433) | |
| | Gear bushing O.D. | M5, M6 | 27.959–27.980 (1.1007–1.1016) | 27.94 (1.1000) | |
| | | C1, C2, C3 | 23.959–23.980 (0.9433–0.9441) | 23.94 (0.9425) | |
| | | C4 | 28.959–28.980 (1.1401–1.1410) | 28.94 (1.1394) | |
| | Gear bushing I.D. | M5 | 24.985–25.006 (0.9837–0.9845) | 25.04 (0.9858) | |
| | | C4 | 24.985–25.006 (0.9837–0.9845) | 25.04 (0.9858) | |
| | Mainshaft O.D. | M5 | 24.959–24.980 (0.9826–0.9835) | 24.90 (0.9803) | |
| | Countershaft O.D. | C4 | 24.959–24.980 (0.9824–0.9835) | 24.90 (0.9803) | |
| | Gear-to-bushing or shaft clearance | M5, 6 gear to bushing | | 0.020–0.060 (0.0008–0.0024) | 0.10 (0.0039) |
| | | M5 bushing to shaft | | 0.005–0.047 (0.0002–0.0019) | 0.06 (0.0024) |
| | | C1, 2, 3, 4 gear to bushing | | 0.020–0.062 (0.0008–0.0025) | 0.10 (0.0039) |
| C4 gear to bushing | | 0.005–0.047 (0.0002–0.0019) | 0.06 (0.0024) | | |

CRANKSHAFT/TRANSMISSION

Unit: mm (in)

| ITEM | | | STANDARD | | SERVICE LIMIT |
|-----------------------|--------------------------------|------------------|---------------|-----------------|----------------|
| Output gear | Backlash | Final drive gear | 0.08–0.023 | (0.0031–0.0091) | 0.40 (0.0157) |
| | Damper shaft gear | Gear I.D. | 24.000–24.021 | (0.9449–0.9457) | 24.10 (0.9488) |
| | | Bushing O.D. | 23.959–23.980 | (0.9433–0.9441) | 23.70 (0.9331) |
| | | Bushing I.D. | 20.020–20.041 | (0.7882–0.7890) | 20.10 (0.7913) |
| | Final drive shaft O.D. | | 19.979–20.000 | (0.7866–0.7874) | 20.05 (0.7894) |
| | Damper spring free length | | 65.1 (2.5630) | | 63.8 (2.5118) |
| Shift fork/fork shaft | Claw thickness | | 6.50–6.57 | (0.2559–0.2587) | 6.20 (0.2441) |
| | Right and left shift fork I.D. | | 14.000–14.021 | (0.5512–0.5520) | 14.04 (0.5528) |
| | Shaft O.D. | | 13.966–13.984 | (0.5498–0.5506) | 13.90 (0.5472) |
| Shift drum | Shift drum I.D. | | 12.500–12.518 | (0.4921–0.4928) | 12.54 (0.4937) |
| | Shift drum holder O.D. | | 12.457–12.484 | (0.4904–0.4915) | 12.33 (0.4854) |

TORQUE

| | | |
|------------------------------|---------------------------------------|---|
| Connecting rod | 41–45 N·m (4.1–4.5 kg-m, 30–33 ft-lb) | |
| Final drive shaft | 35–45 N·m (3.5–4.5 kg-m, 25–33 ft-lb) | |
| Countershaft | 35–45 N·m (3.5–4.5 kg-m, 25–33 ft-lb) | |
| Output gear case | 8 mm cap nut | 21–25 N·m (2.1–2.5 kg-m, 15–18 ft-lb) |
| | 8 mm lock nut | 21–25 N·m (2.1–2.5 kg-m, 15–18 ft-lb) |
| | 8 mm socket bolt | 30–40 N·m (3.0–4.0 kg-m, 22–29 ft-lb) |
| Output gear bearing lock nut | (Inner) | 70–80 N·m (7.0–8.0 kg-m, 51–58 ft-lb) |
| | (Outer) | 90–110 N·m (9.0–11.0 kg-m, 65–80 ft-lb) |
| Shift fork | 16–20 N·m (1.6–2.0 kg-m, 12–14 ft-lb) | |

TOOLS

Special

| | |
|-------------------------------------|---------------|
| Lock Nut Wrench, 30 x 64 mm | 07916–MB00000 |
| Shaft Holder | 07923–6890101 |
| Main Bearing Remover Attachment | 07946–ME90100 |
| Main Bearing Drive Attachment | 07946–ME90200 |
| Remover Handle | 07936–3710100 |
| Remover Weight | 07936–3710200 |
| Bearing Remover, 17 mm | 07936–3710300 |
| Main Journal Bearing Remover/Driver | 07973–MC70000 |
| Ring gear Dis/Assembly Tool | 07965–3710100 |
| Damper Compressor | 07964–3710000 |
| Bearing remover, 20 mm | 07936–3710600 |
| Driver | 07949–3710000 |
| Attachment | 07946–3710200 |

Common

| | |
|------------------------|---------------|
| Remover weight | 07741–0010201 |
| Attachment, 32 x 35 mm | 07746–0010100 |
| Attachment, 42 x 47 mm | 07746–0010300 |
| Attachment, 52 x 55 mm | 07746–0010400 |
| Attachment, 62 x 68 mm | 07746–0010500 |
| Pilot, 17 mm | 07746–0040400 |
| Pilot, 25 mm | 07746–0040600 |
| Pilot, 30 mm | 07746–0040700 |
| Driver | 07749–0010000 |
| Attachment, 30 mm I.D. | 07746–0030300 |

TROUBLESHOOTING

Excessive noise

1. Crankshaft
 - Worn main bearing
 - Worn rod bearing
2. Connecting rod
 - Worn rod small end

Hard to shift

1. Air in clutch system
2. Shift fork bent
3. Shift fork shaft bent
4. Shift spindle claw bent
5. Shift drum cam grooves damaged
6. Shift fork guide pin damaged

Transmission jumps out of gear

1. Gear dogs worn
2. Shift shaft bent
3. Shift shaft stopper broken
4. Shift forks bent

Excessive output gear noise

1. Output drive and driven gears worn or damaged
2. Bearings worn or damaged
3. Excessive backlash between output drive and driven gears
4. Improper shim thickness

OUTPUT GEAR CASE REMOVAL

NOTE:

- The following output gear service can be performed with engine removed from the frame and without separating the crankcase.
- Final drive shaft side bearing holder O-ring replacement (page 13-4).
 - Drive gear seal replacement (page 13-25).
 - Driven gear shaft bearing replacement (page 13-26).
 - Driven gear bearing holder O-ring replacement (page 13-26).
 - Tooth contact adjustment (page 13-30).
 - Oilorifice and O-ring inspection and replacement.

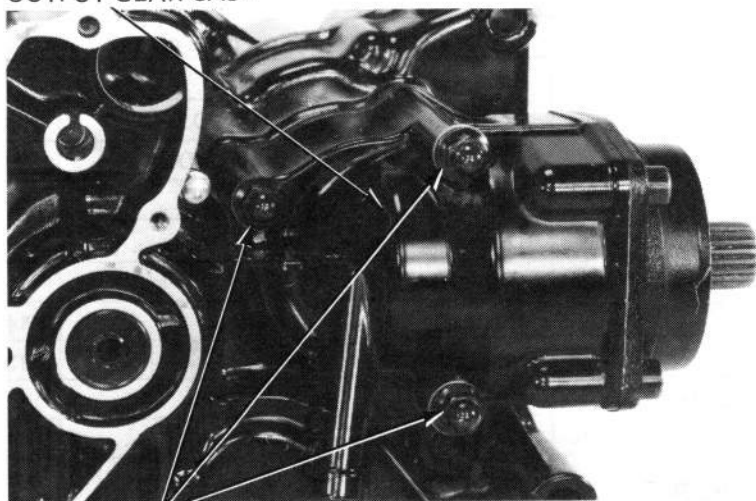
Remove the 8 mm cap nuts and sealing washers.
Remove the output gear case.

Remove the O-ring, dowel pin and shim from the bearing holder.

NOTE:

- Take care not to damage the shim.

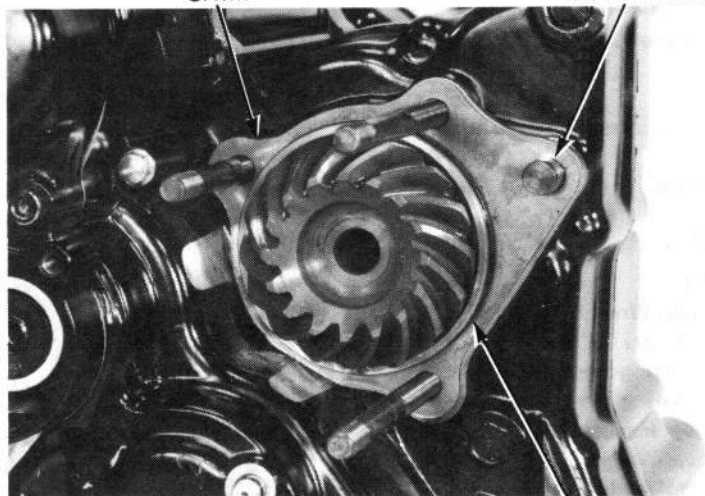
OUTPUT GEAR CASE



8 mm CAP NUT
AND SEALING WASHERS

SHIM

DOWEL PIN

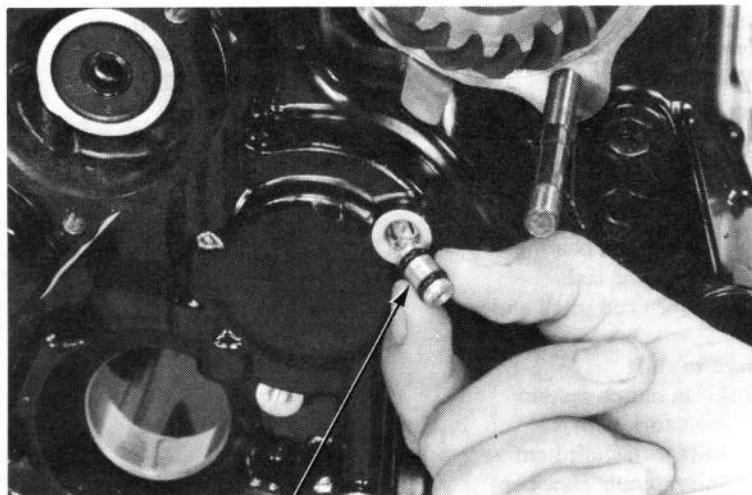


O-RING

Remove the oil orifice and clean it with the compressed air.

OUTPUT GEAR CASE INSTALLATION

Replace the O-rings with new ones and install the output gear case in the reverse order of removal.

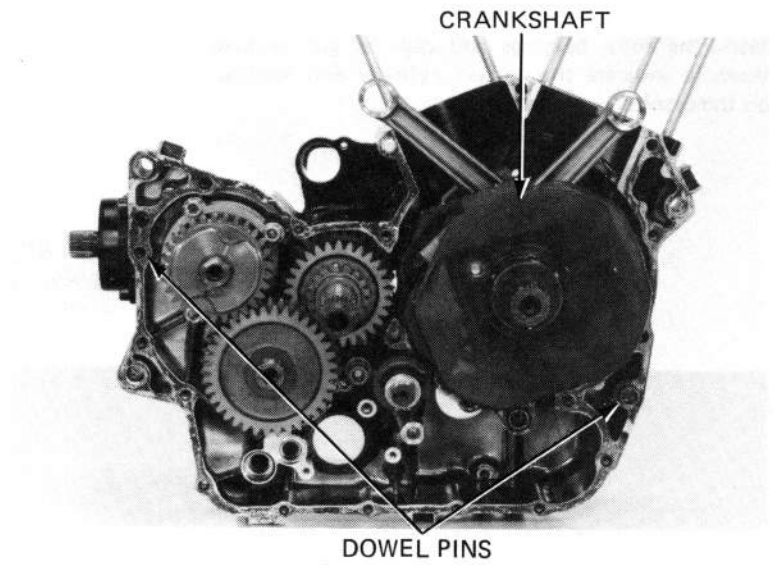


OIL ORIFICE

CRANKSHAFT/CONNECTING ROD

CRANKSHAFT REMOVAL

Separate the crankcase (page 12-2) and remove the dowel pins.
Remove the crankshaft.



CONNECTING ROD REMOVAL

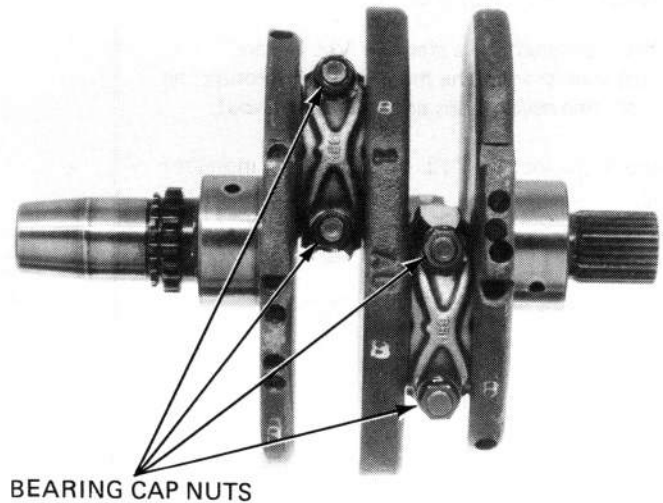
Check the connecting rod side clearance.
SERVICE LIMIT: 0.40 mm (0.0157 in)



Remove the connecting rod bearing caps and note their locations.

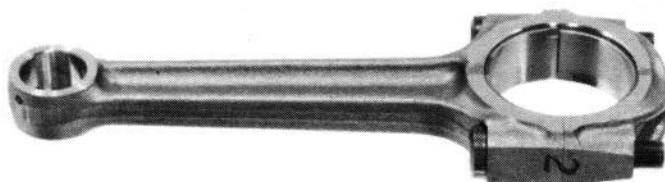
NOTE:

Tap the side of the cap lightly if it is hard to remove.

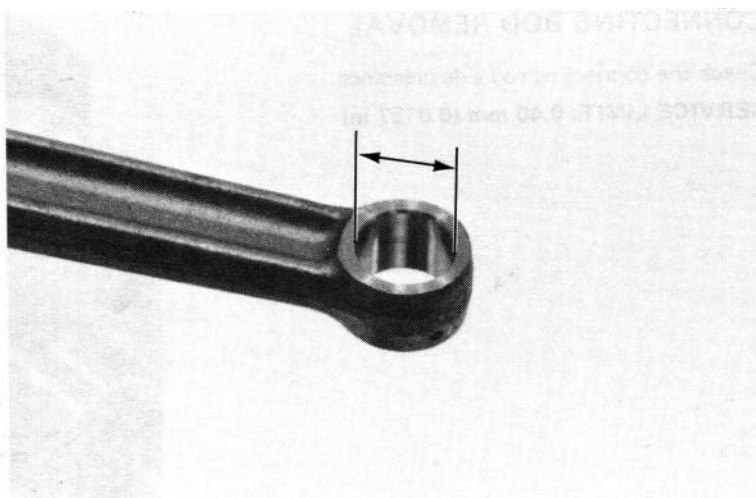


CRANKSHAFT/TRANSMISSION

Mark the rods, bearings and caps as you remove them to indicate the correct cylinder and position on the crankpins for reassembly.



Measure the connecting rod small end I.D.
SERVICE LIMIT: 20.09 mm (0.7909 in)

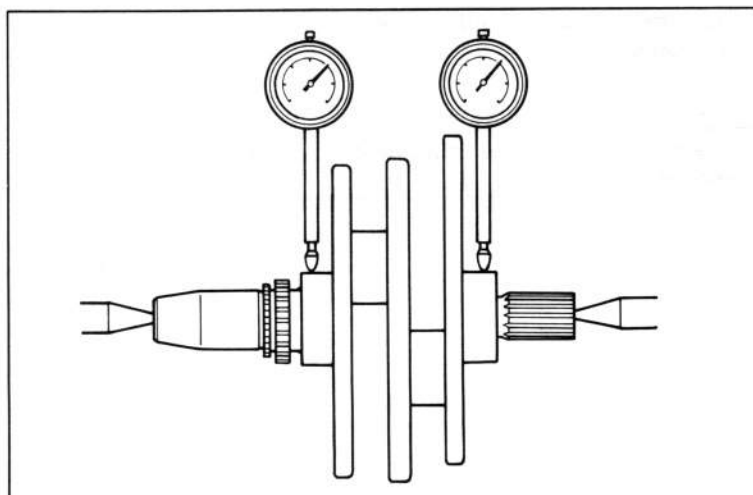


CRANKSHAFT INSPECTION

Place the crankshaft on a stand or Vee blocks.
Set a dial indicator on the main journals. Rotate the crankshaft two revolutions and read the runout.

The actual runout is 1/2 of the total indicator reading.

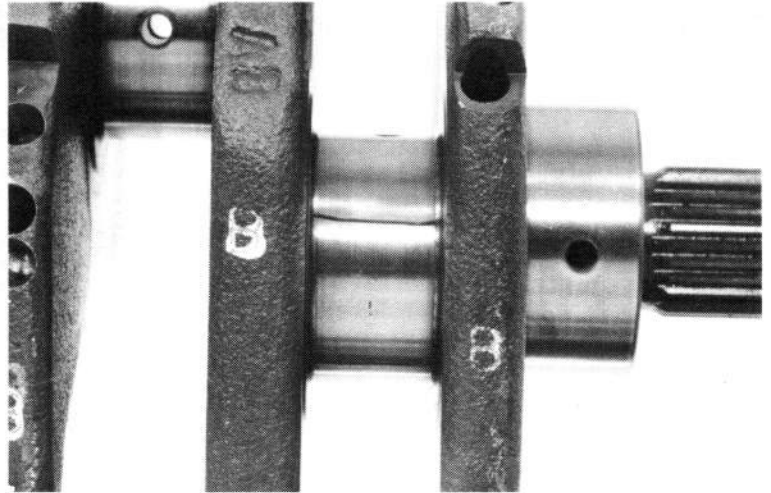
SERVICE LIMIT: 0.05 mm (0.002 in)



BEARING INSPECTION

CONNECTION ROD

Inspect the bearing inserts for damage or separation. Clean all oil from the bearing inserts and crankpins. Put a piece of plastigauge on each crankpin avoiding the oil hole.

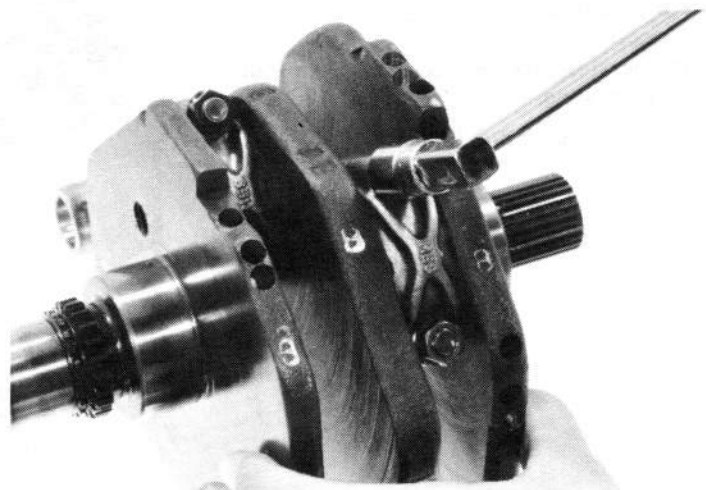


Install the bearing caps and rods on the correct crankpins, and tighten them evenly.

TORQUE: 41–45 N·m (4.1–4.5 kg·m, 30–33 ft·lb)

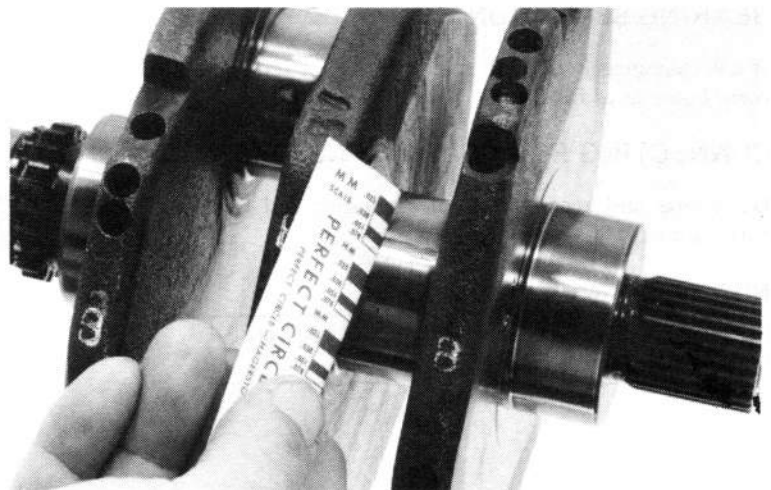
NOTE:

Do not rotate the crankshaft during inspection.



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

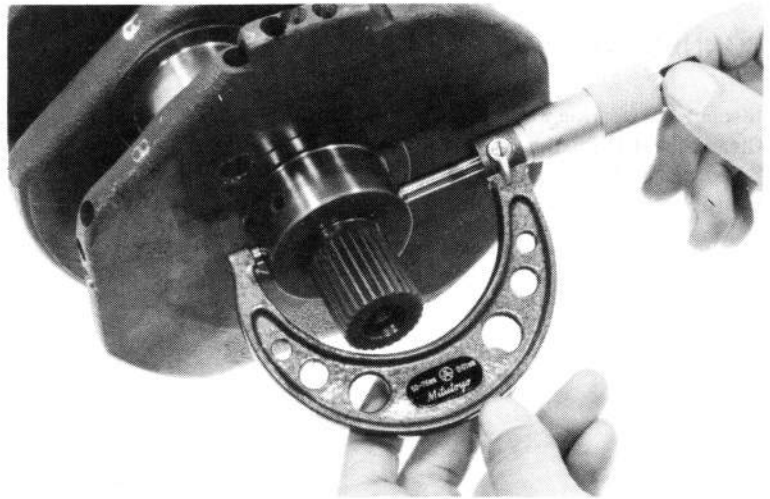
SERVICE LIMIT: 0.07 mm (0.003 in)



CRANKSHAFT/TRANSMISSION

MAIN BEARINGS

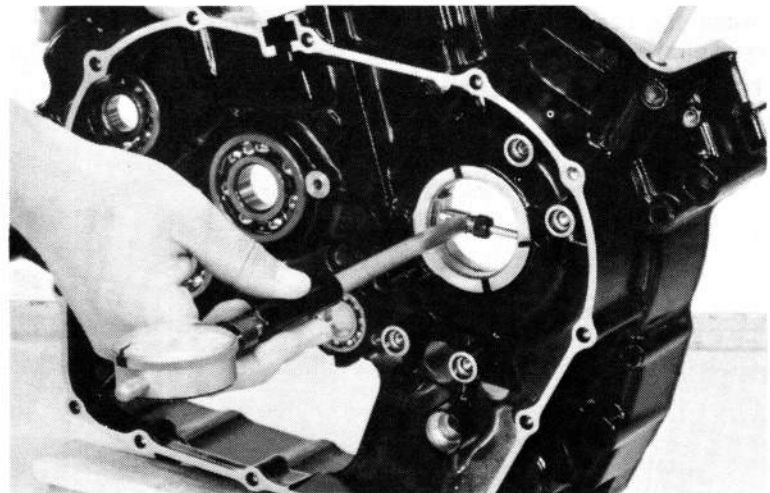
Measure the main journal O.D. and record it.



Measure the main journal bearing I.D. in the crankcase and record it.

Calculate the clearance between the main journal and the main bearing.

SERVICE LIMIT: 0.06 mm (0.0024 in)



BEARING SELECTION

If oil clearance is beyond tolerance, select replacement bearings as follows:

CONNECTING ROD BEARING INSERTS

Determine and record the corresponding rod I.D. code number.

NOTE:

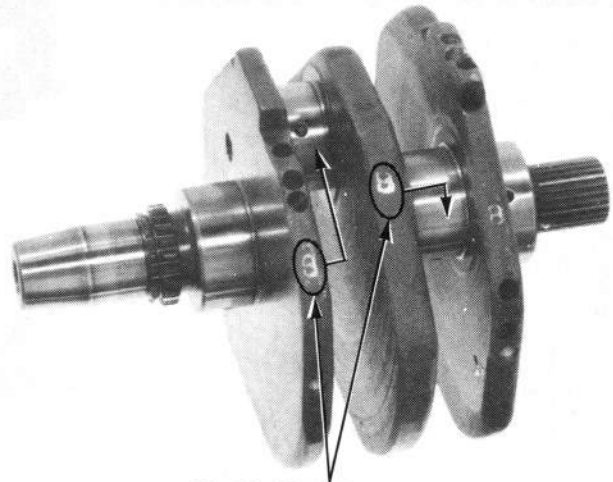
Numbers 1 or 2 on the connecting rods are the codes for the connecting rod I.D.



Determine and record the corresponding crankpin O.D. code number (or measure the crankpin O.D.).

NOTE:

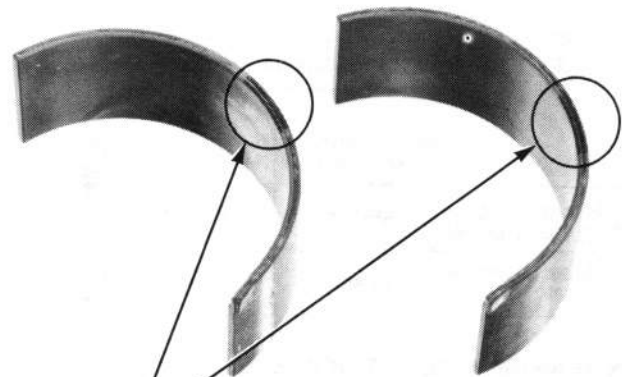
Letters A or B on each crank weight are the codes used for each crankpin O.D.



CRANK PIN O.D. CODE

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

| | | CONNECTING ROD I.D. CODE NO. | |
|---------------------|---|------------------------------|------------|
| | | 1 | 2 |
| CRANK PIN O.D. CODE | A | 42.982–42.990mm | F (Pink) |
| | B | 42.974–42.982mm | E (Yellow) |
| | | 46.000–46.008mm | E (Yellow) |
| | | 46.008–46.016mm | D (Green) |



COLOR CODE

BEARING INSERT THICKNESS:

D (Green): 1.495–1.499 mm (0.0589–0.0590 in)

E (Yellow): 1.491–1.495 mm (0.0578–0.0589 in)

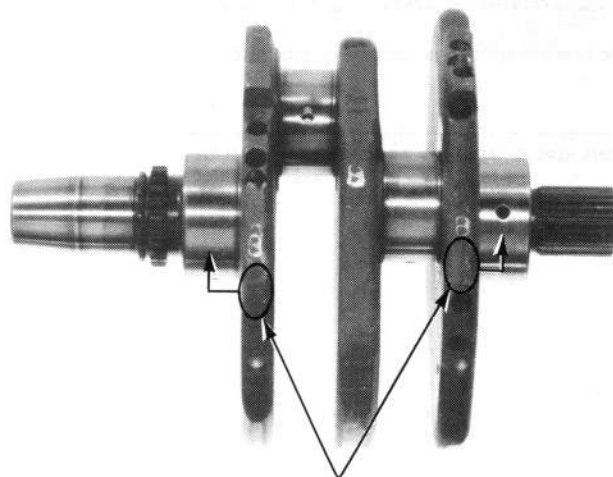
F (Pink): 1.487–1.491 mm (0.0585–0.0587 in)

MAIN BEARING INSERTS

Determine and record the corresponding main journal O.D. codes, (or measure the main journal O.D.).

NOTE:

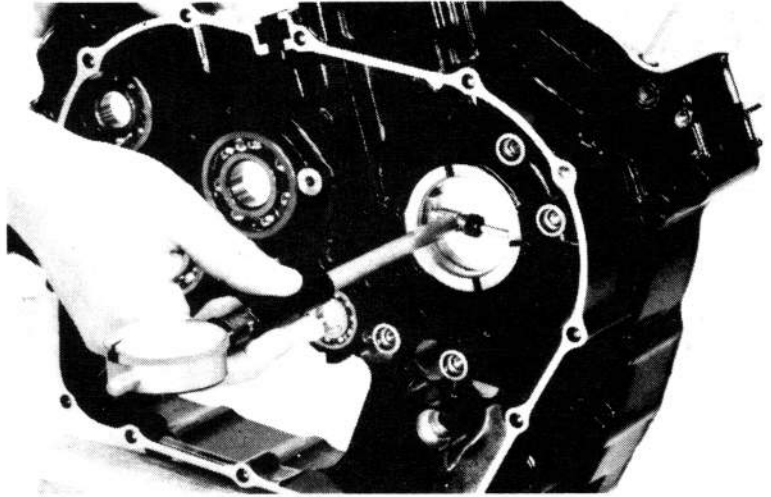
Letters 1 or 2 on each crank weight are the codes used for each main journal O.D.



MAIN JOURNAL O.D.

CRANKSHAFT/TRANSMISSION

Measure the crankcase main journal I. D. and record it.



Cross reference the case I. D. and journal code to determine the replacement bearing.

| | | MAIN JOURNAL O.D. CODE | | NEW |
|-------------------------|--|--|--|-----|
| | | 1 | 2 | |
| | | 49.992–50.000 mm (1.9682–1.9685 in) | 49.984–49.992 mm (1.9679–1.9682 in) | |
| CRANK- CASE I. D. | 53.970–53.980 mm (2.1248–2.1252 in) | BROWN | BLACK | |
| | 53.980–53.990 mm (2.1252–2.1256 in) | BLACK | BLUE | |

MAIN BEARING INSERT THICKNESS:

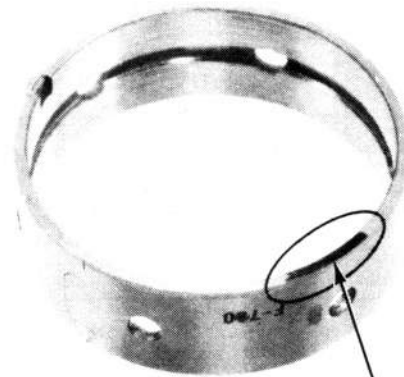
BROWN: 1.989–1.999 mm (0.0783–0.0787 in)
 BLACK: 1.994–2.004 mm (0.0785–0.0798 in)
 BLUE: 1.999–2.009 mm (0.0787–0.0791 in)

MAIN JOURNAL BEARING REMOVAL

Press the main bearing out of the crankcase.

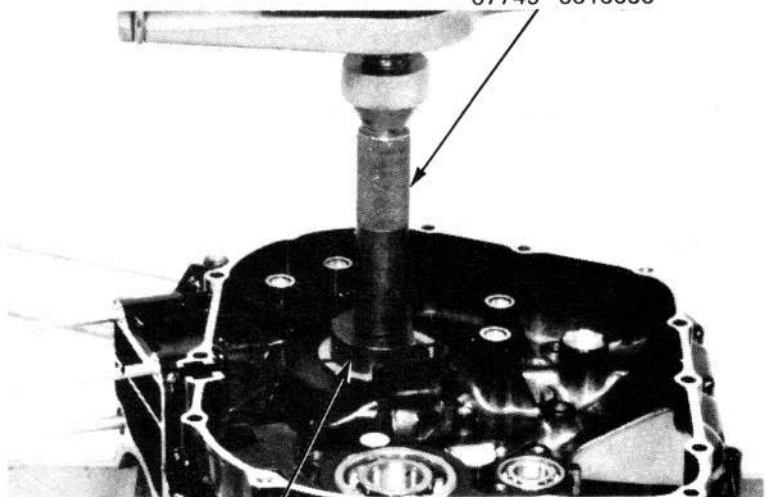
NOTE:

Always use a press to remove the main bearings.



COLOR CODE

DRIVER
07749-0010000



MAIN BEARING REMOVER ATTACHMENT
07946-ME90100

MAIN BEARING INSTALLATION

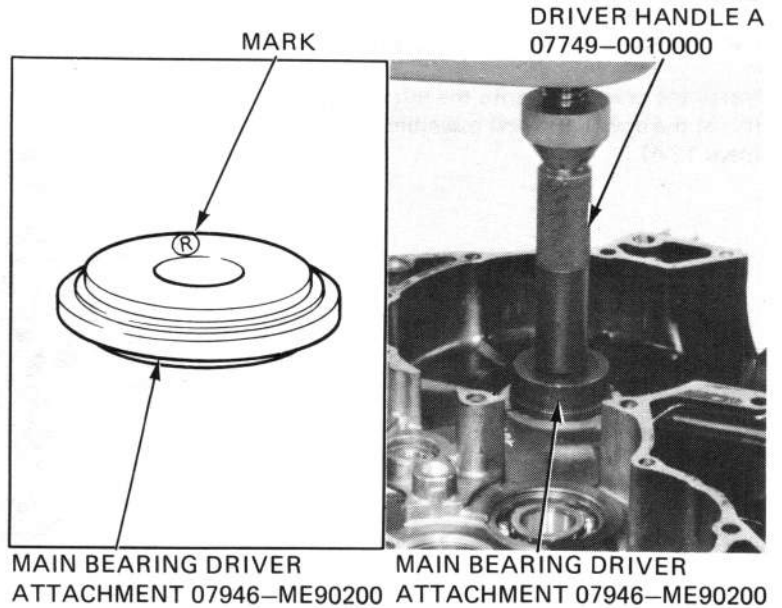
Apply molybdenum disulfide grease to the outer surface of the main bearings.
Align the tab on the bearing with the groove in the crankcase and press the bearing into the crankcase.

CAUTION:

Be careful not to damage the bearings.

NOTE:

The marks on both side of Main Bearing Driver Attachment means:
"R" → Use for right side bearing.
"L" → Use for left side bearing.

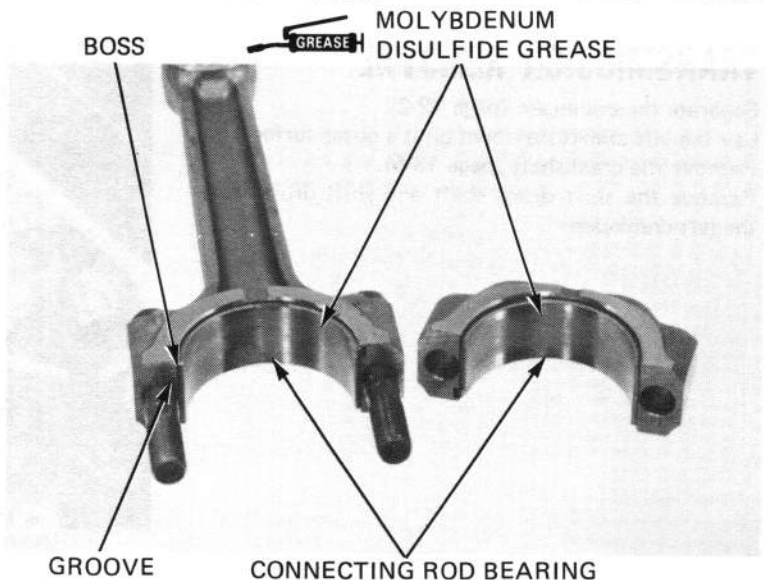


CONNECTING ROD INSTALLATION

Install the bearing inserts on the rods and caps.

NOTE:

- Align the boss on the bearing with the groove in the rod or cap.
- Apply molybdenum disulfide grease to the bearings.



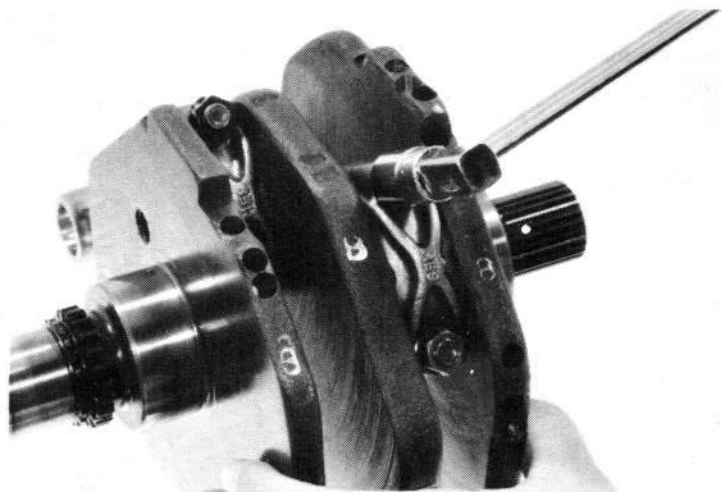
Install the rods and caps on the crankshaft. Be sure each part is installed in its original position, as noted during removal.

Tighten the cap nuts.

TORQUE: 41-45 N·m (4.1-4.5 kg·m, 30-33 ft·lb)

NOTE:

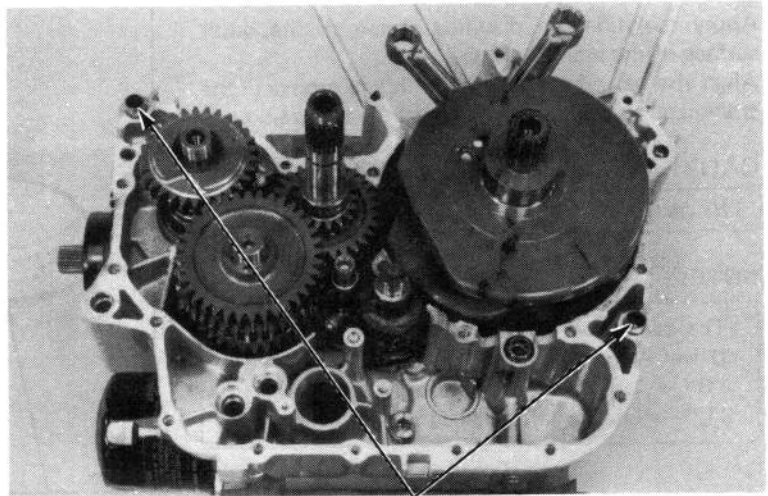
- Align the I.D. code on the cap and rod.
- Tighten the nuts in two or more steps.
- After tightening the nuts, check that the rods move freely without binding.



CRANKSHAFT/TRANSMISSION

CRANKSHAFT INSTALLATION

Install the crankshaft onto the left crankcase.
Install the dowel pins and assemble the crankcase
(page 12-4).

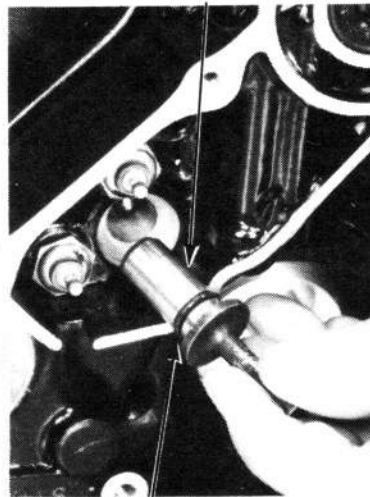


DOWEL PINS

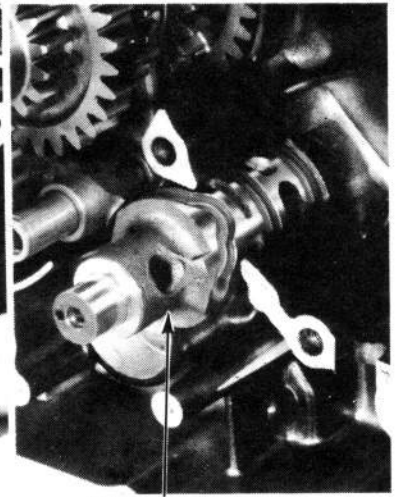
TRANSMISSION REMOVAL

Separate the crankcase (page 12-2).
Lay the left crankcase down on its outer surface.
Remove the crankshaft (page 13-5).
Remove the shift drum shaft and shift drum from
the left crankcase.

SHIFT DRUM SHAFT

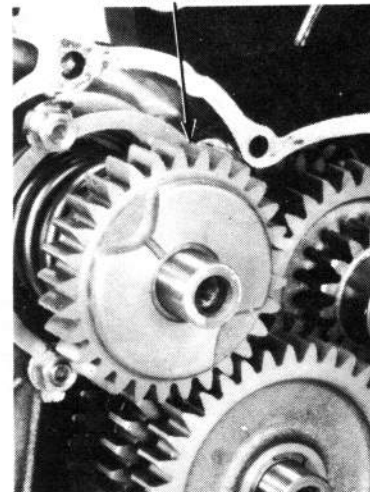


O-RING

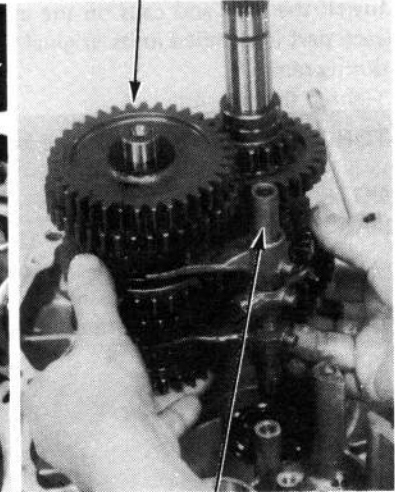


SHIFT DRUM

FINAL GEAR



COUNTERSHAFT

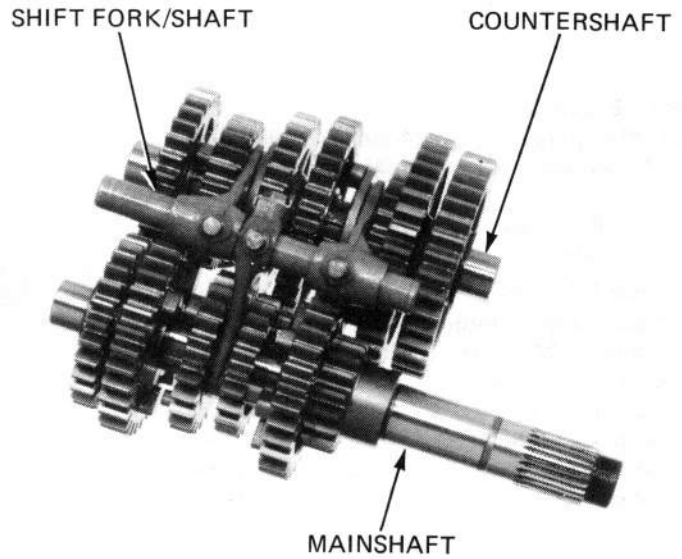


SHIFT FORK

Remove the final gear.
Remove the mainshaft, countershaft, and shift fork
together.

TRANSMISSION DISASSEMBLY

Separate the shift forks, shaft, mainshaft and countershaft assemblies from each other.



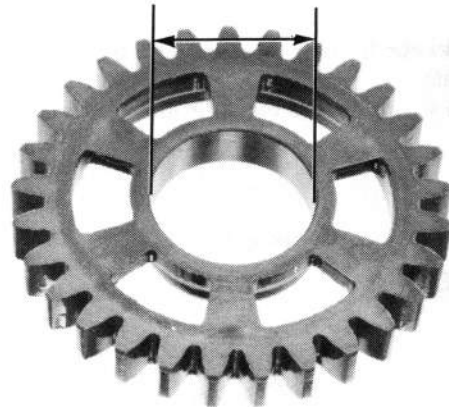
TRANSMISSION INSPECTION

Check the gear dogs, holes and teeth for excessive or abnormal wear, or evidence of insufficient lubrication.

Measure the I.D. of each gear.

SERVICE LIMIT:

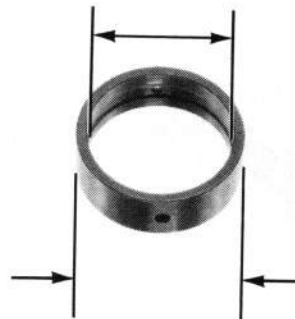
- M5, M6 gears: 28.04 mm (1.104 in)
- C1, C2, C3 gears: 28.04 mm (1.104 in)
- C4 gear: 29.04 mm (1.143 in)



Measure the I.D. and O.D. of each gear bushing.

SERVICE LIMIT:

- M5, M6 bushing O.D.: 27.94 mm (1.100 in)
- C1, C2, C3 bushing O.D.: 27.94 mm (1.100 in)
- C4 bushing O.D.: 28.94 mm (1.139 in)
- M5 bushing I.D.: 25.04 mm (0.986 in)
- C4 bushing I.D.: 25.04 mm (0.986 in)



CRANKSHAFT/TRANSMISSION

Measure the O.D. of the mainshaft and counter-shaft.

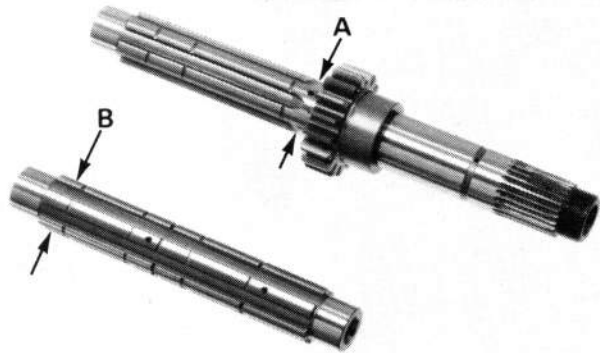
SERVICE LIMITS:

A (at M5 bushing): 24.90 mm (0.980 in)
B (at C5 bushing): 24.90 mm (0.980 in)

Calculate the clearance between the gear and gear shaft or bushing.

SERVICE LIMITS:

M5, 6 gear to M5, 6 bushing: 0.10 mm (0.004 in)
M5 bushing to M5 shaft: 0.06 mm (0.002 in)
C1 gear to C1 bushing: 0.10 mm (0.004 in)
C1 bushing to C1 shaft: 0.10 mm (0.004 in)
C2 gear to C2 bushing: 0.10 mm (0.004 in)
C3 gear to C3 bushing: 0.10 mm (0.004 in)
C4 gear to C4 bushing: 0.10 mm (0.004 in)

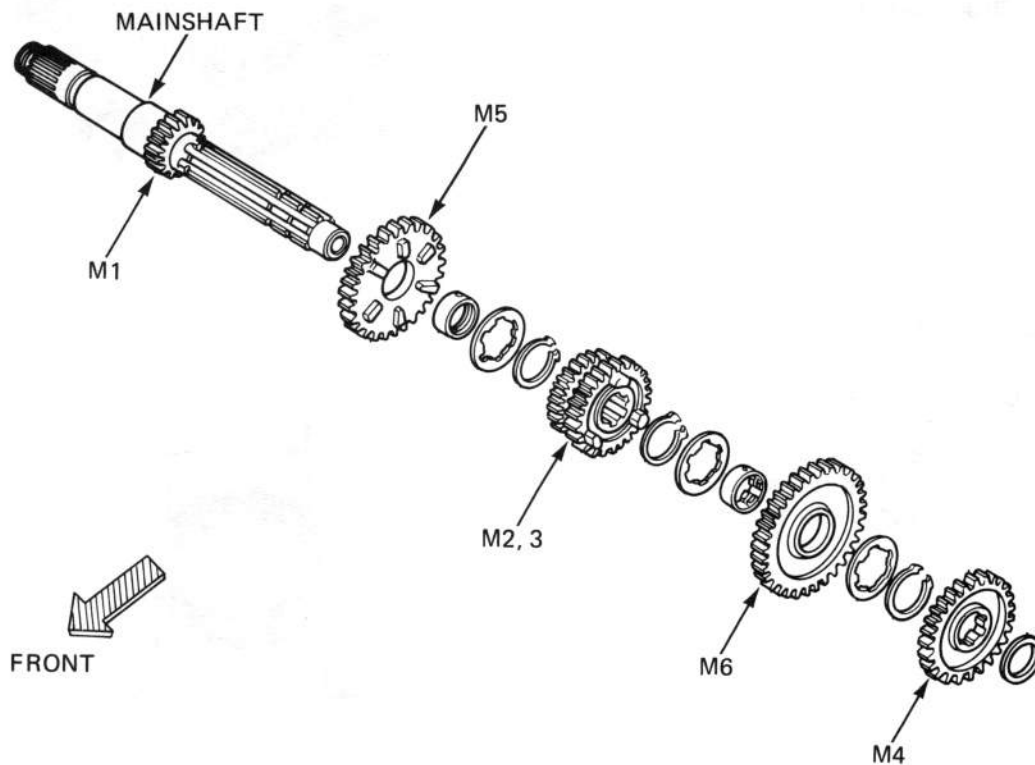


TRANSMISSION ASSEMBLY

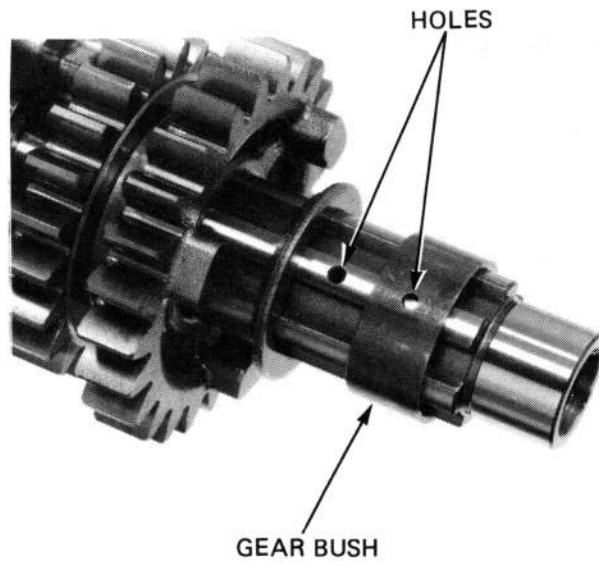
Mainshaft

Check the gears for freedom of movement of rotation on the shaft.

Check the the snap rings are seated in the grooves.



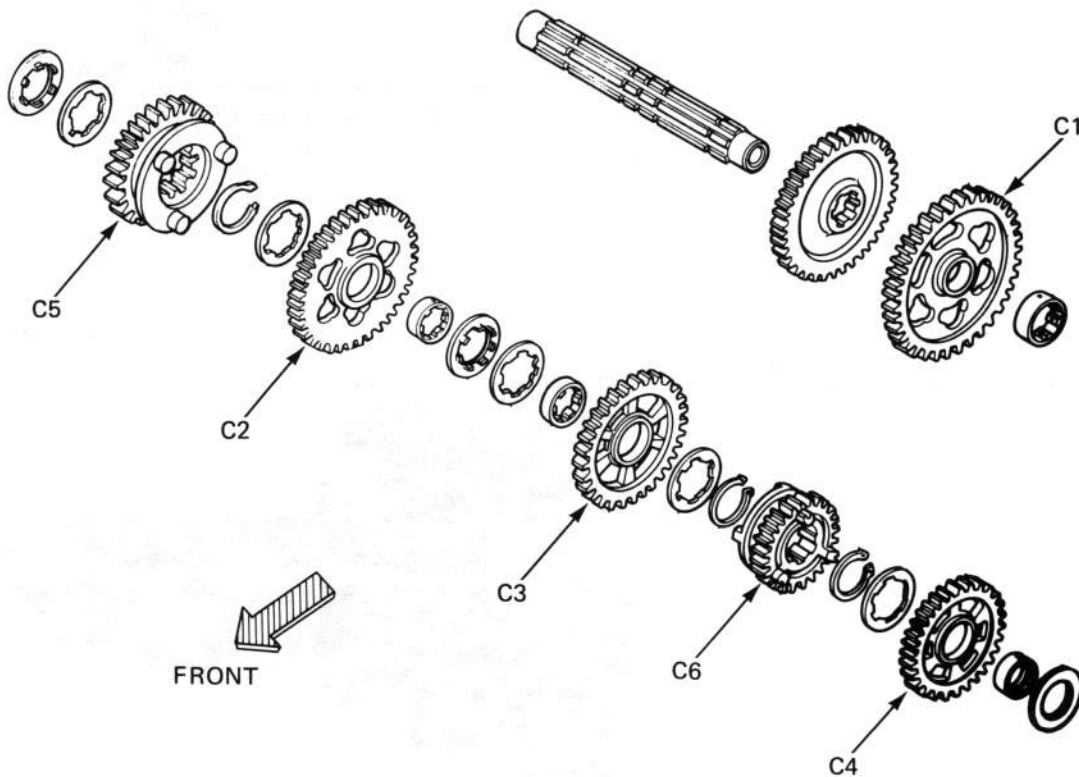
Align the hole in the M5, M6 gear bushing with the hole in the mainshaft when installing.



Countershaft

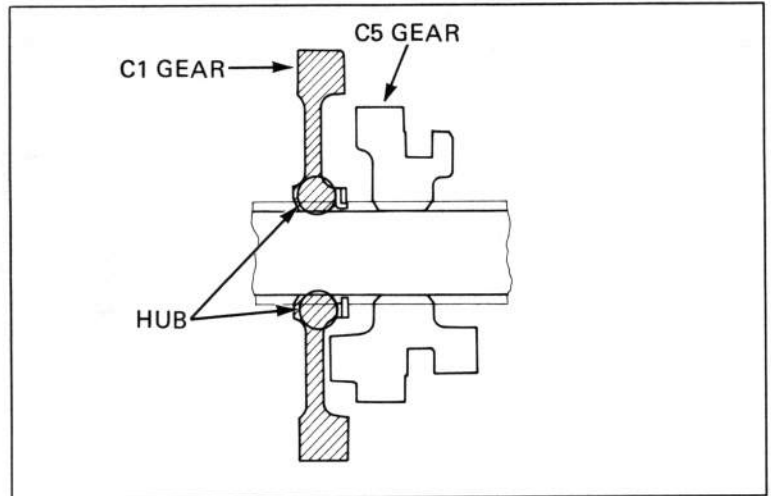
Check the gears for freedom of movement or rotation on the shaft.

Check that the snap rings are seated in the grooves.

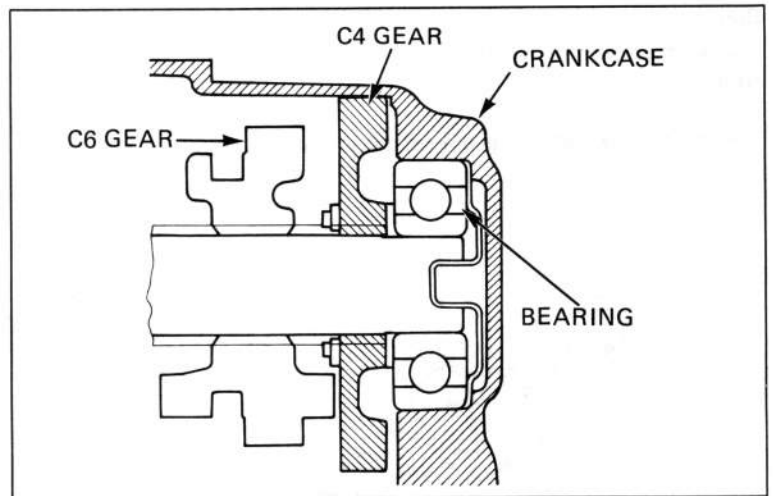


CRANKSHAFT/TRANSMISSION

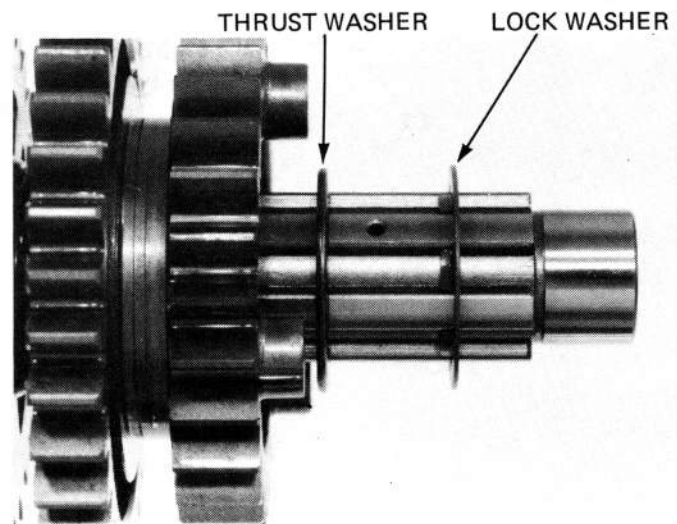
Install the C1 gear hub facing the C5 gear.



Install the C4 gear recess facing the crankcase bearing, not the C6 gear.



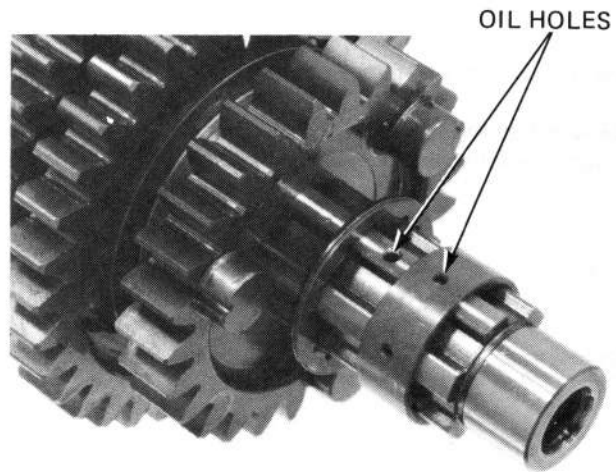
Align the lock washer tab into the thrust washer groove between the C5 and C1 gears, and the C2 and C3 gears.



Align the oil hole in the C1, 2, 3, 4 gear bushing with the hole in the countershaft.

NOTE:

Do not install the C1 bushing (6 holes) to the C4 bushing place. It is different width from the C4 bushing.



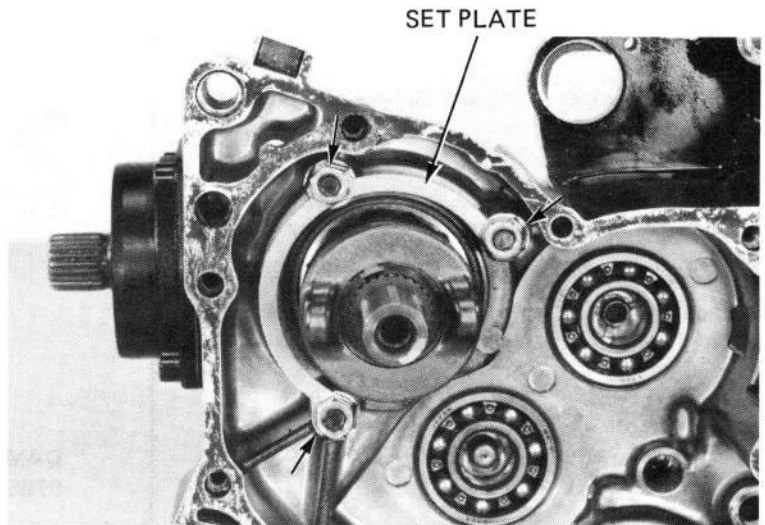
OUTPUT GEAR

OUTPUT GEAR ASSEMBLY REMOVAL

Bend the lock washer tab down, remove the nuts and the set plate.

Pull the output gear assembly off the crankcase.

Remove the gasket and dowel pin.



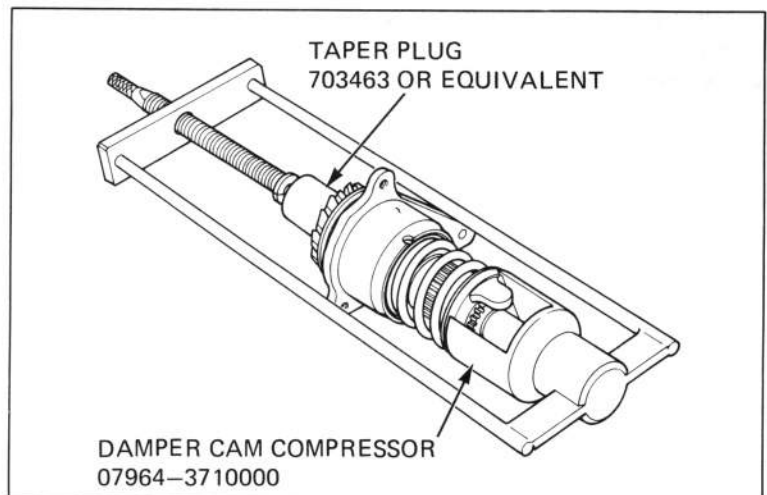
OUTPUT DRIVE GEAR DAMPER ASS'Y REMOVAL

Separate the output drive shaft and bearing holder from the output gear case.

Set the shaft and holder into the special tool and compress the damper cam.

NOTE:

Use taper plug 703463 with damper cam compressor 07964-3710000.



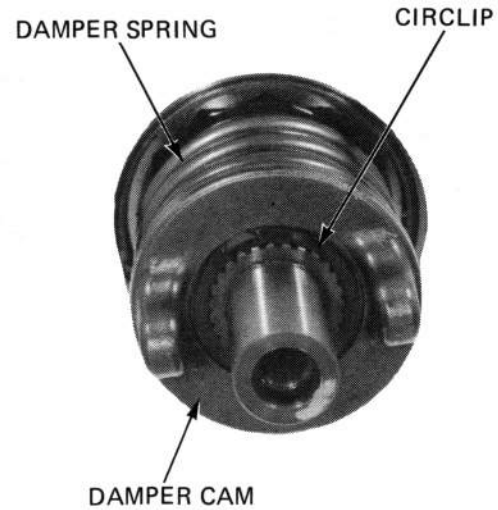
CRANKSHAFT/TRANSMISSION

Remove the circlip.
Loosen the special tool slowly to remove it.

Remove the damper cam and spring.
Check the damper cam for wear or damage.

NOTE:

Reinstall the drive shaft and bearing holder into the output gear case for removal and torquing of the output drive shaft inner bearing race lock nut.



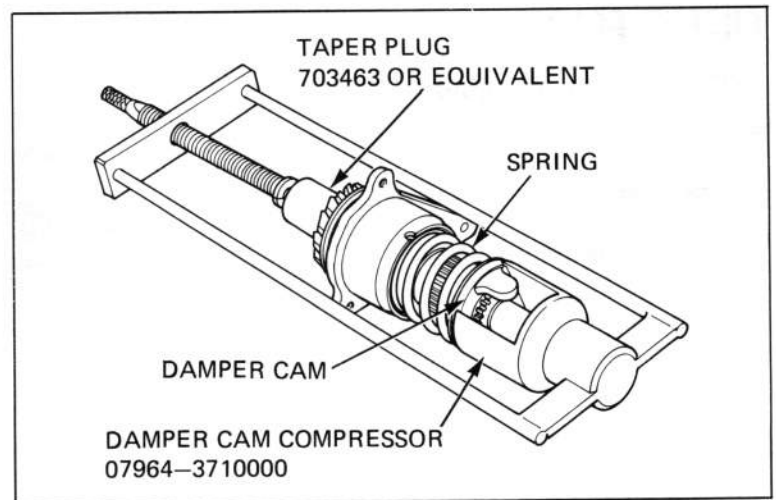
INSTALLATION

Install the damper spring and damper cam on to the output drive shaft.

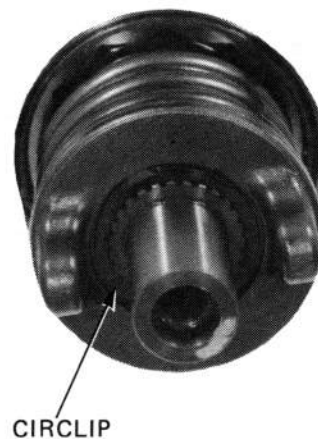
NOTE:

Seat the damper spring on the bearing lock nut.

Attach the spring compressor in the output drive shaft threads. Compress the damper cam with the special tool.



Install the circlip onto the shaft, being sure it seats in its groove.
Loosen and remove the special tool from the shaft.

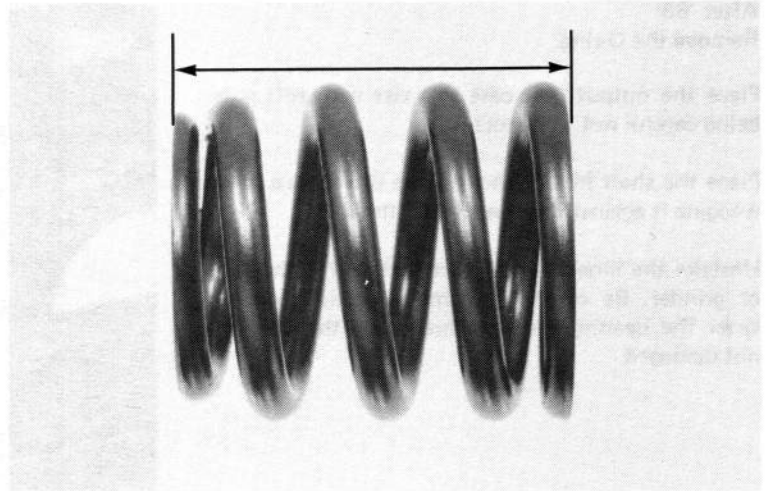


SPRING FREE LENGTH

Measure the damper spring free length.

SERVICE LIMIT: 63.8 mm (2.512 in)

Replace it if it is shorter than the service limit.



BACKLASH INSPECTION

Place the output gear case in a vise with soft jaws or a shop towel.

Set a horizontal type dial indicator on the final drive shaft as shown.

Hold the driven gear with the shaft holder and rotate the drive shaft until gear slack is taken up.

Turn the drive shaft back and forth to read backlash.

**STANDARD: 0.08–0.23 mm
(0.003–0.009 in)**

SERVICE LIMIT: 0.40 mm (0.016 in)

Remove the dial indicator. Turn the output drive shaft 120° and measure backlash. Repeat this procedure once more.

Compare the difference of the three measurements.

**DIFFERENCE OF MEASUREMENTS
SERVICE LIMIT: 0.10 mm (0.004 in)**

If the difference in measurements exceeds the limit, it indicates that the bearing is not installed squarely. Inspect the bearings and reinstall if necessary.

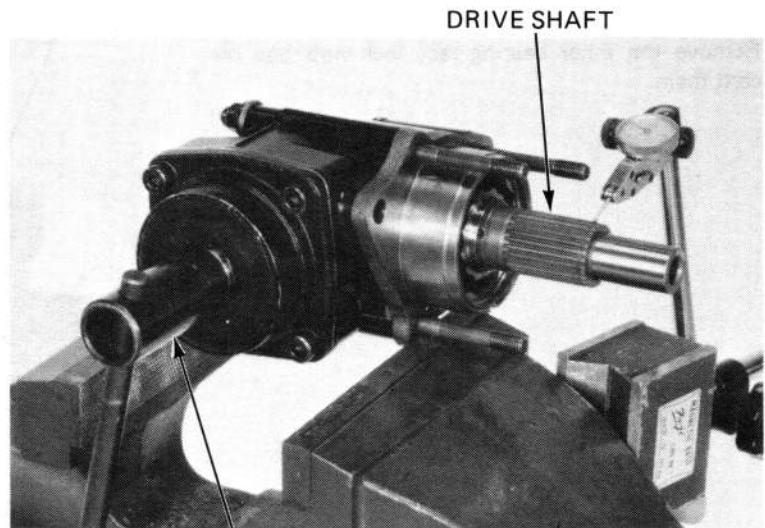
If backlash is excessive, replace the drive shaft adjustment shim with a thinner one.

If the backlash is too small, replace the drive shaft adjustment shim with a thicker one.

Backlash is changed by about 0.06–0.07 mm (0.002–0.003 in) when thickness of the shim is changed by 0.10 mm (0.004 in).

**COUNTERSHAFT/OUTPUT DRIVE GEAR
ADJUSTMENT SHIMS:**

- A: 0.40 mm (0.016 in)
- B: 0.45 mm (0.018 in)
- C: 0.50 mm (0.020 in) Standard
- D: 0.55 mm (0.022 in)
- E: 0.60 mm (0.024 in)



SHAFT HOLDER
07923–6890101

OUTPUT DRIVE SHAFT
ADJUSTMENT SHIM



CRANKSHAFT/TRANSMISSION

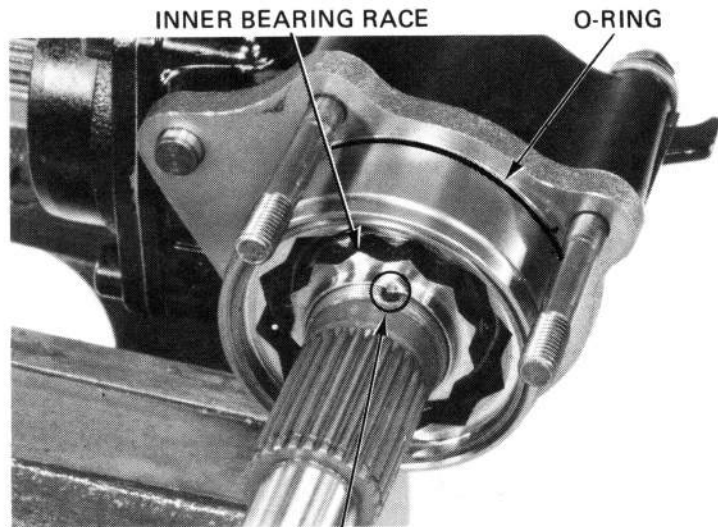
After '83:

Remove the O-ring.

Place the output gear case in a vise with soft jaws, being careful not to distort it.

Place the shaft holder tool on the driven gear shaft wedging it against the vise to lock the shaft.

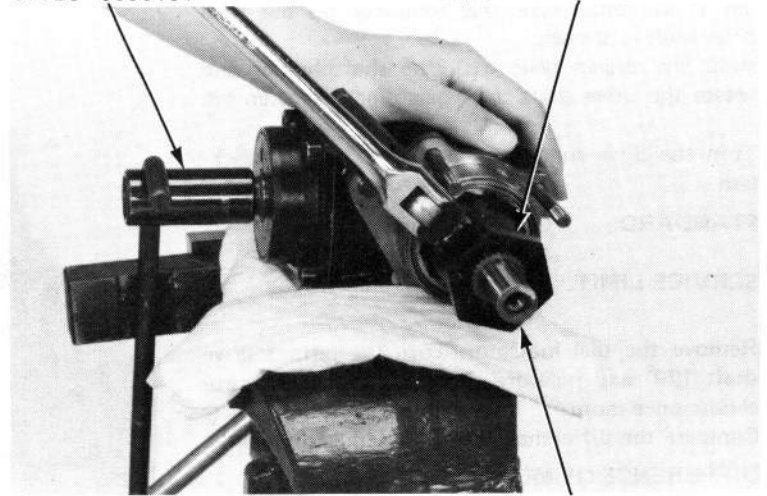
Unstake the inner bearing race lock nut with a drill or grinder. Be careful that metal particles do not enter the bearing and the threads on the shaft are not damaged.



Remove the inner bearing race lock nuts and discard them.

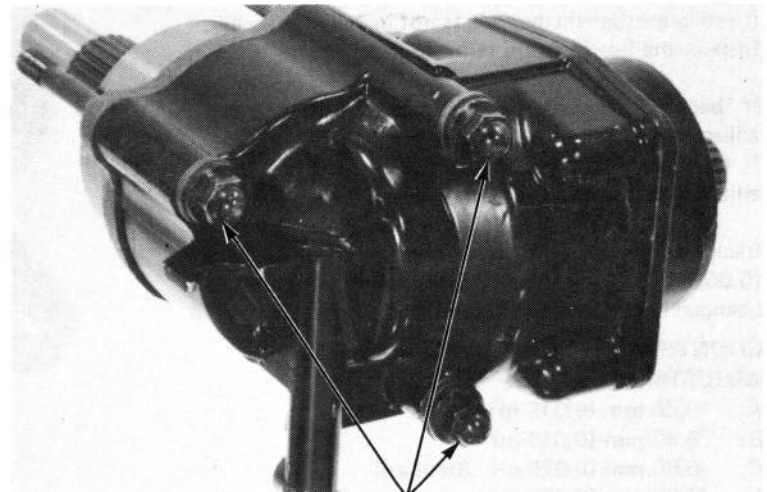
SHAFT HOLDER
07923-6890101

LOCK NUT WRENCH,
30/64 mm 07916-MB00000



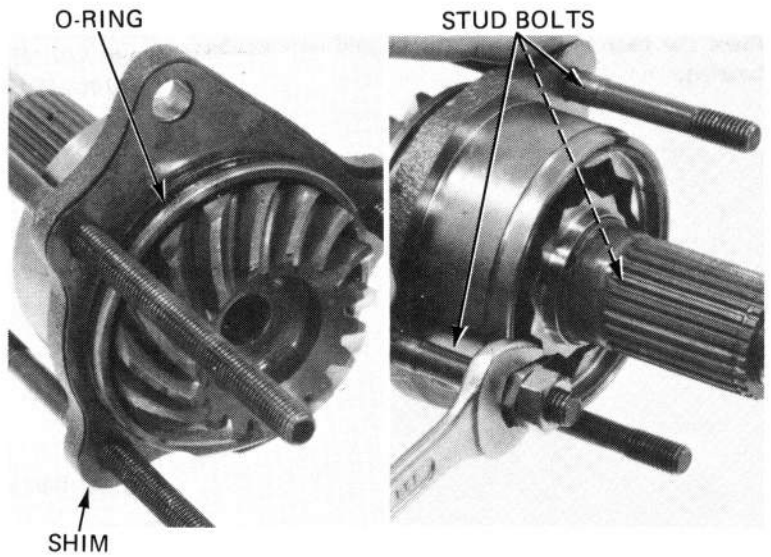
Remove the output drive shaft bearing holder nuts and sealing washers from the case.

Remove the output drive shaft.



Remove the O-ring and shim.

Lock two units together on the gear case stud bolts. Remove the studs from the bearing holder.

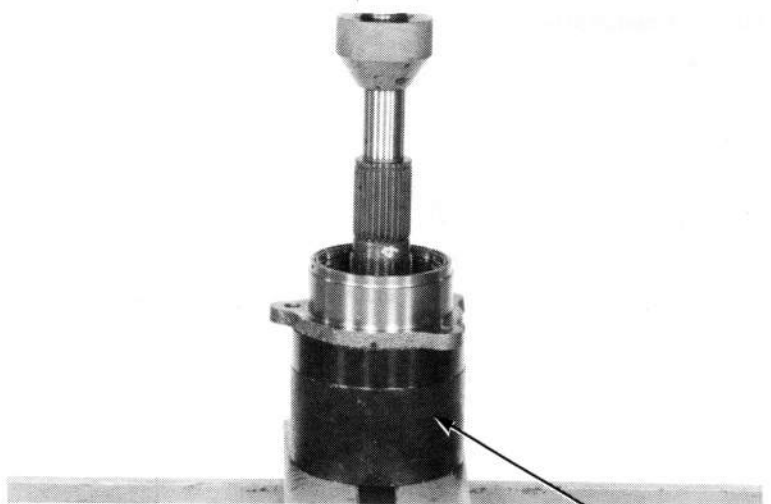


Place the output drive shaft and a disassembly tool in a press.

NOTE:

Remove the center guide from the dis/assembly tool before using it.

Press the output drive shaft out of the bearing holder.



LOCK NUT WRENCH, 30/64 mm
07916-MB0000

DIS/ASSEMBLY TOOL
07965-3710100

OUTPUT DRIVE SHAFT BEARING REPLACEMENT

NOTE:

The drive shaft must be removed before replacing the bearing.

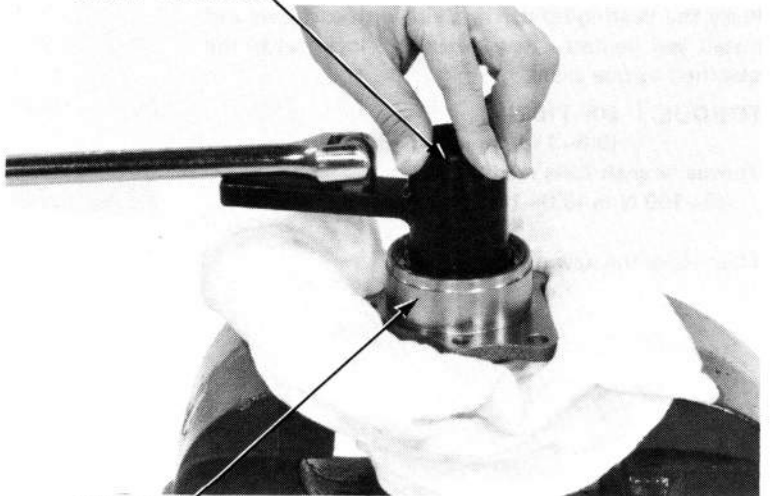
Place the bearing holder in a vise with soft jaws or a shop towel.

NOTE:

Do not damage the bearing holder, especially the crankcase mating surface.

Unstake the outer race lock nut with a punch.

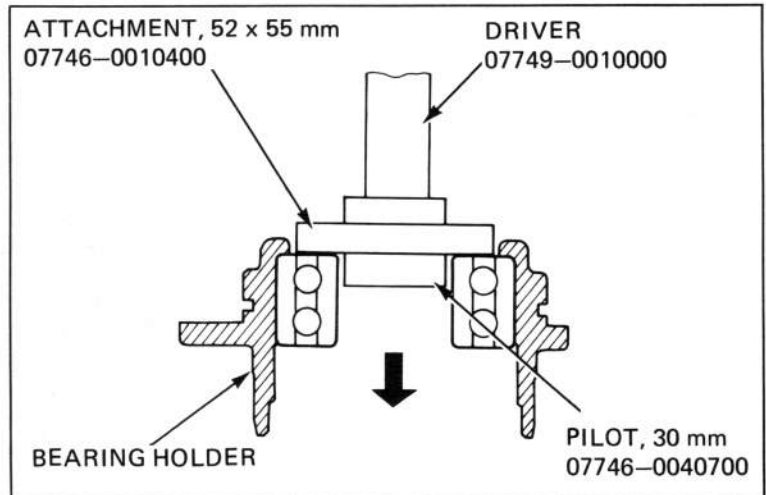
Remove the bearing outer race lock nut with a special tool and discard the lock nut.



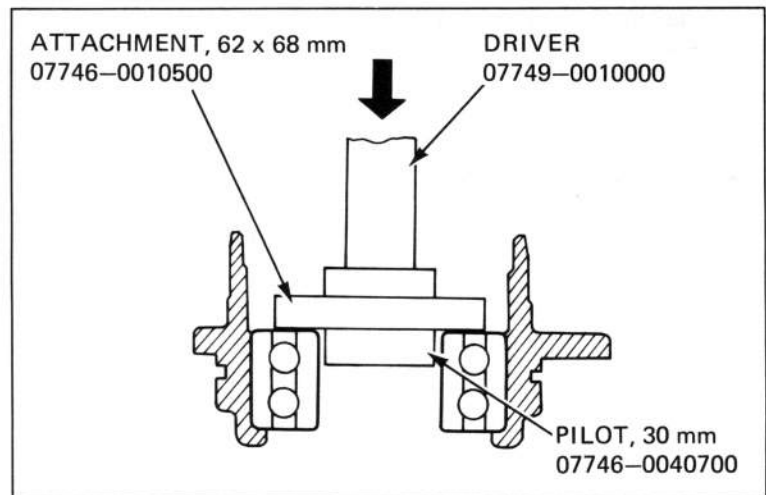
BEARING HOLDER

CRANKSHAFT/TRANSMISSION

Place the bearing holder in a press and remove the bearing.



Press in a new bearing.

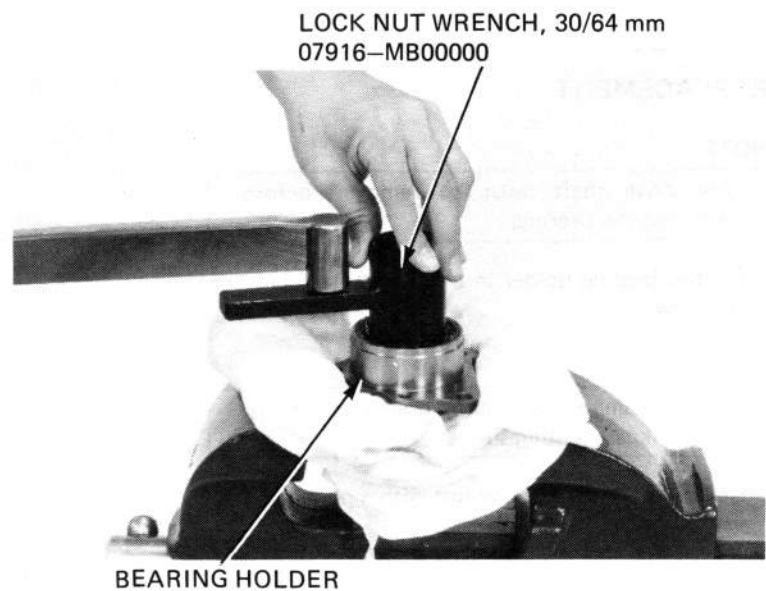


Place the bearing holder in a vise with soft jaws and install and tighten a new outer race lock nut to the specified torque value.

TORQUE: 90–110 N·m
(9.0–11.0 kg-m, 65–80 ft-lb)

Torque wrench scale reading:
80–100 N·m (8.0–10.0 kg-m, 58–72 ft-lb)

Then stake the new nut.



OUTPUT DRIVE GEAR INSTALLATION

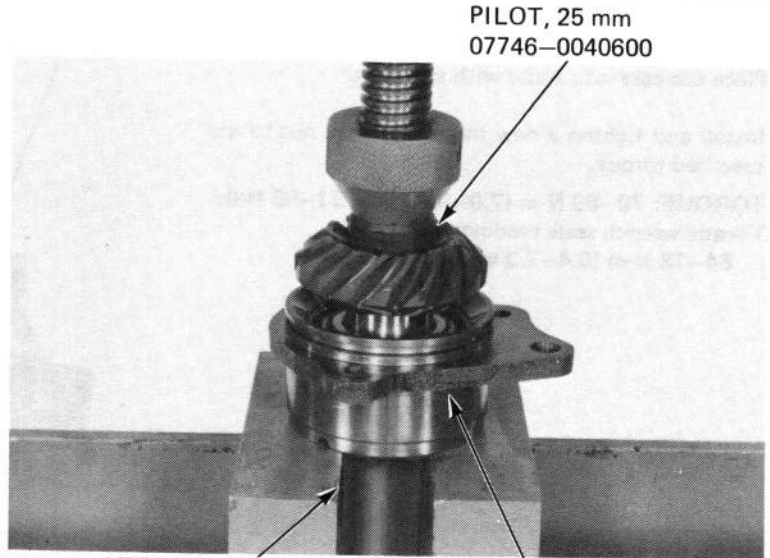
NOTE:

The output drive and driven gears must be replaced as a set if they or the gear case or bearing require replacement.

Place the output gear shaft and bearing holder into a press. Press the output drive shaft into the bearing. Support the inner bearing race using the special tools.

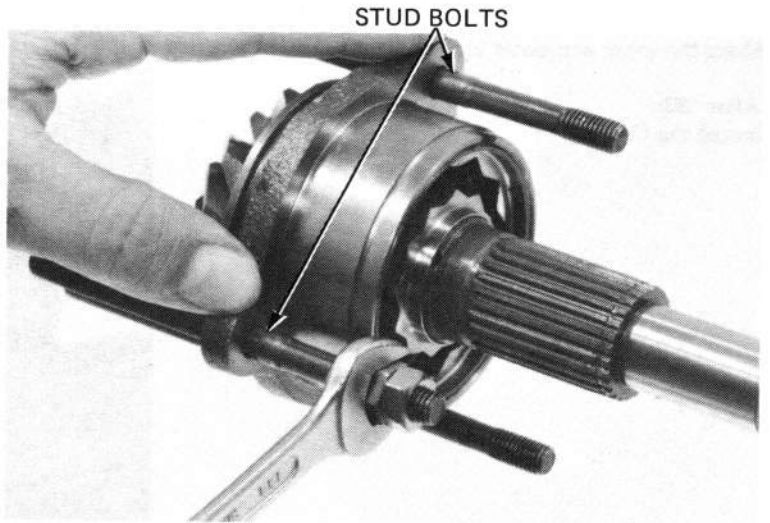
NOTE:

Place the pilot's threaded end into the final drive shaft.



ATTACHMENT 30 MM, I.D. BEARING HOLDER
07746-0030300

Install the stud bolts into the bearing holder.

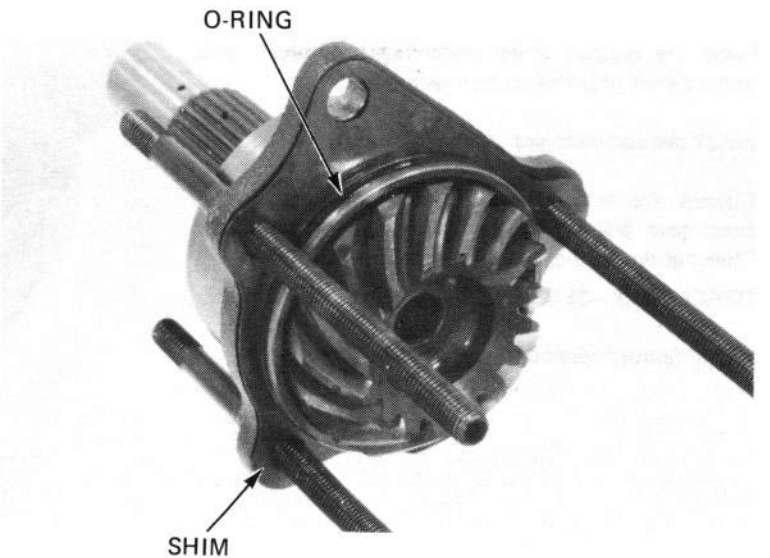


Place the adjustment shim over the bearing holder.

NOTE:

If the output gear case is replaced a new adjustment shim must be selected (page 13-19, Backlash Inspection).

Install the O-ring.



CRANKSHAFT/TRANSMISSION

Place the case into a vise with soft jaws.

Install and tighten a new inner race lock nut to the specified torque.

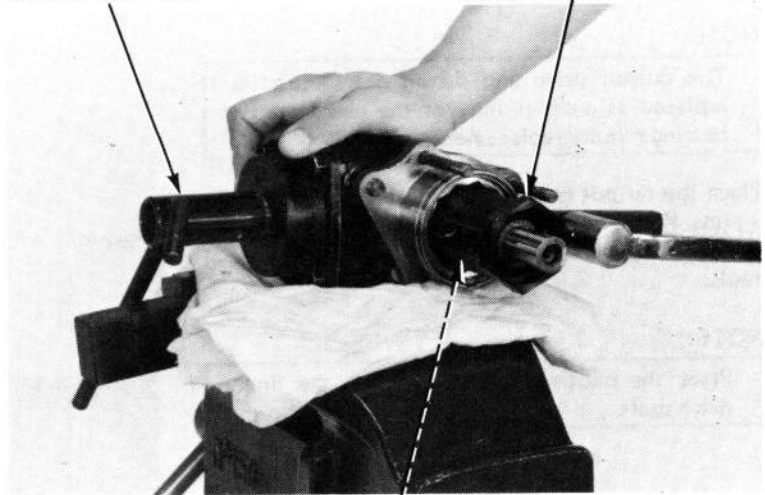
TORQUE: 70–80 N·m (7.0–8.0 kg-m, 51–58 ft-lb)

Torque wrench scale reading:

64–73 N·m (6.4–7.3 kg-m, 46–53 ft-lb)

SHAFT HOLDER
07923–6890101

LOCK NUT WRENCH,
30/64 mm 07916–MB00000

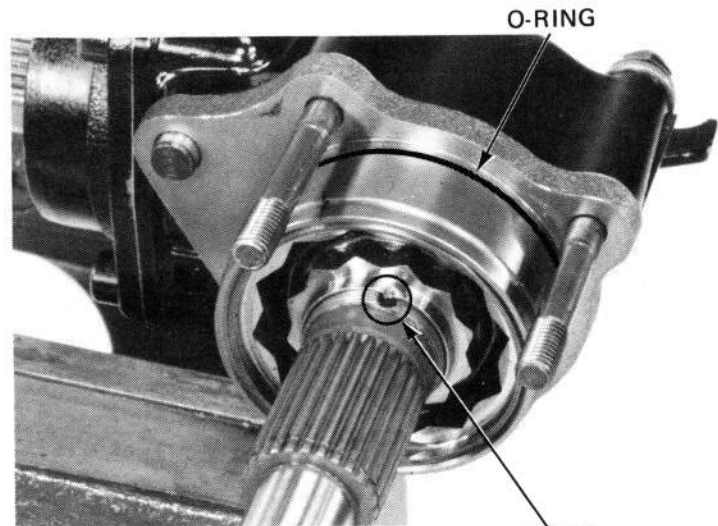


INNER RACE LOCK NUT

Stake the inner and outer lock nuts.

After '83:

Install the O-ring.



O-RING

STAKE

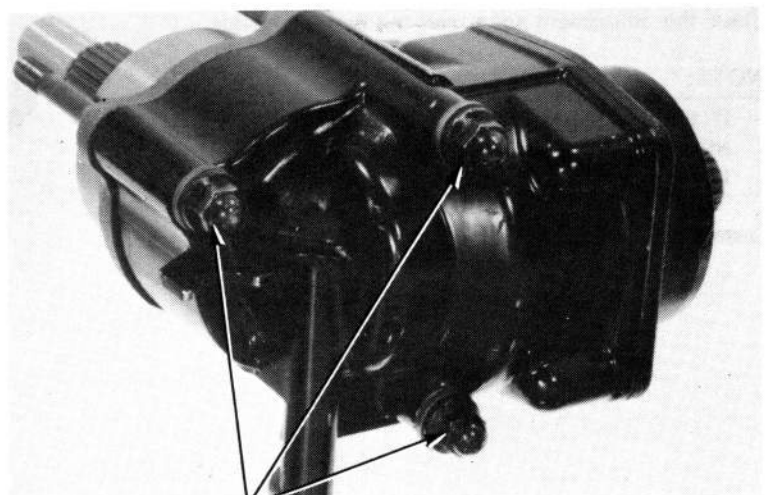
Place the output drive shaft bearing holder and correct shim into the output gear case.

Install the cap nuts and sealing washers.

Tighten the nuts in a crisscross pattern until the drive gear bearing holder seats against the case. Then tighten to the specified torque.

TORQUE: 21–25 N·m (2.1–2.5 kg-m, 15–18 ft-lb)

Install damper assembly, (page 13-18).



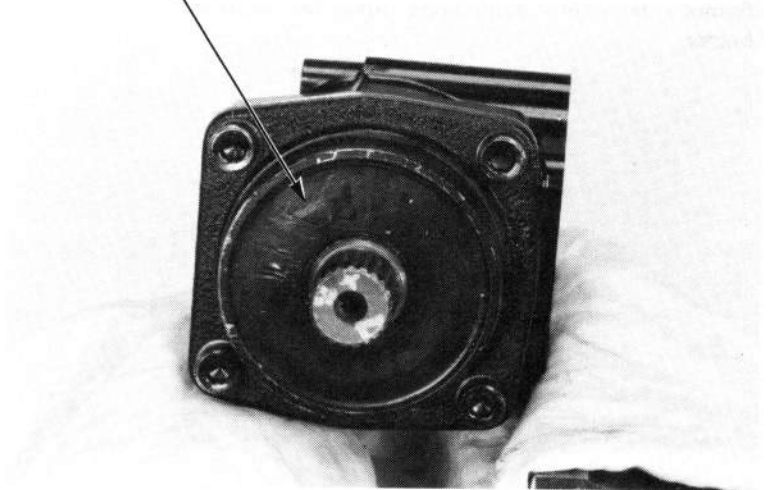
8 mm CAP NUTS/ SEALING WASHERS

OUTPUT DRIVEN GEAR REMOVAL

Remove the driven gear oil seal from the output driven gear case.

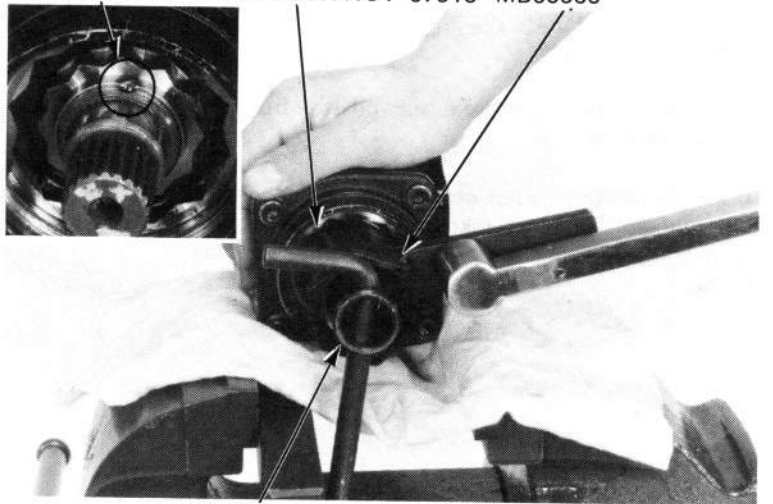
Place the output driven gear case into a vise.

OIL SEAL



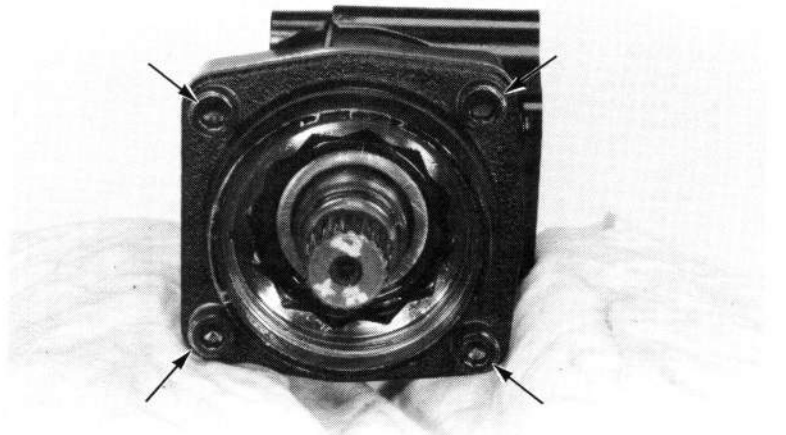
Unstake and remove the output driven gear bearing inner race lock nut.

BEARING INNER LOCK NUT WRENCH, 30/64 mm
INNER RACE RACE LOCK NUT 07916-MB00000



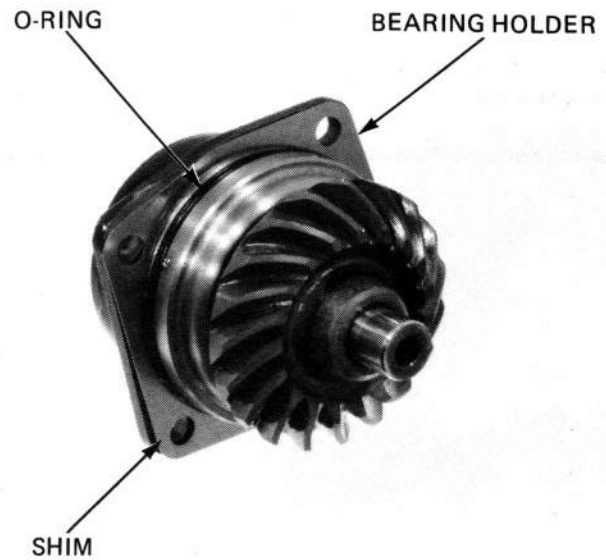
HOLDER
07923-6890101

Remove the driven gear bearing holder mounting bolts and remove the shim, gear and holder from the case.



CRANKSHAFT/TRANSMISSION

Remove the shim and O-ring from the bearing holder.

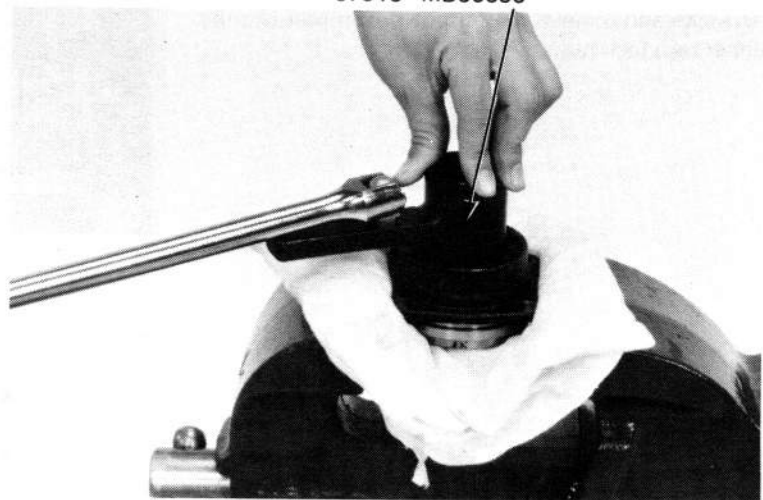


LOCK NUT WRENCH, 30/64 mm
07916-MB00000

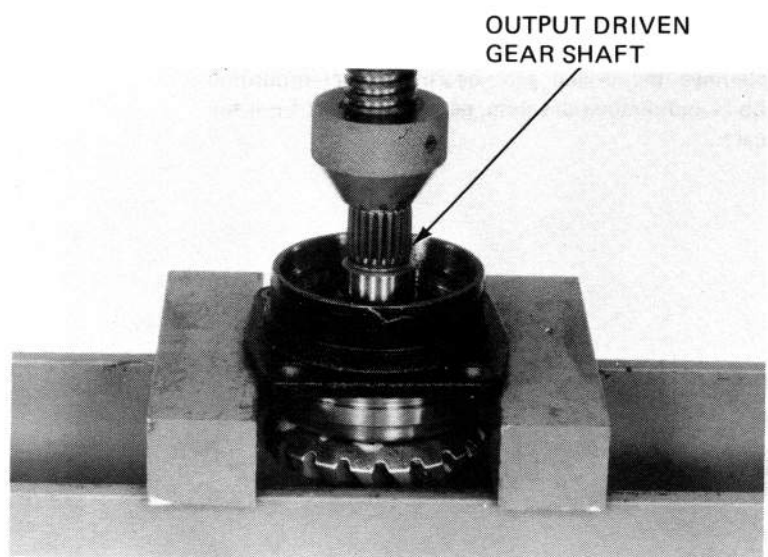
OUTPUT DRIVEN GEAR BEARING REPLACEMENT

Remove the output driven gear oil seal from the output gear case.

Place the output driven gear bearing holder into a vise with soft jaws. Unstake and remove the output driven gear bearing outer race lock nut from the holder.



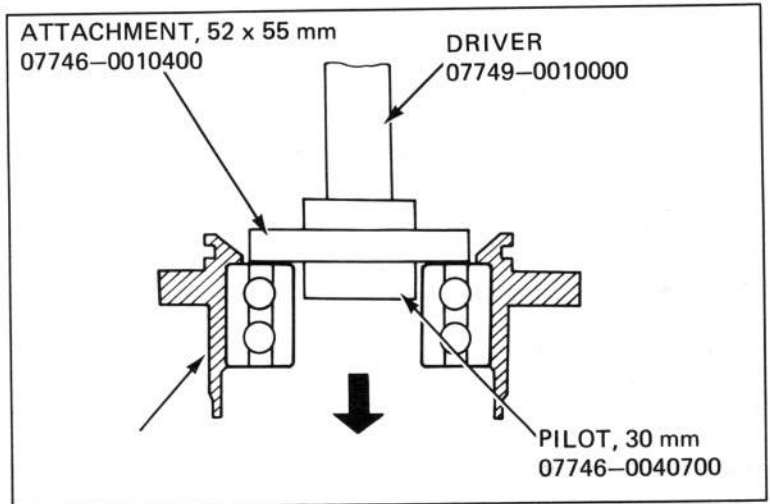
Press the output driven gear shaft from the holder.



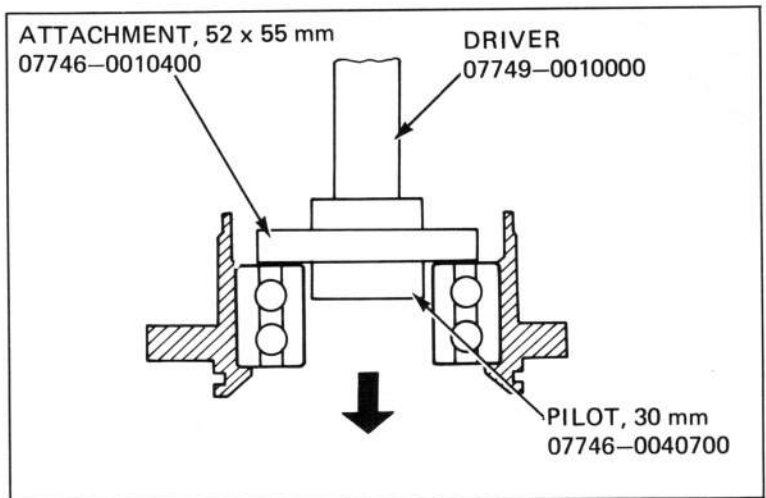
Place the bearing holder in a press and press the bearing out.

NOTE:

Be careful not to damage the bearing holder gear case mating surface.



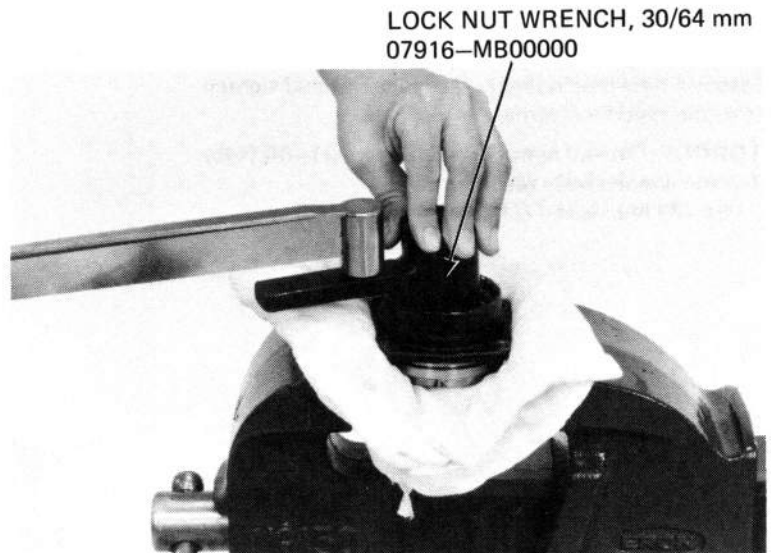
Press in a new bearing and make sure it rotates freely after installation.



Place the bearing holder into a vise with soft jaws. Install and tighten a new bearing outer race lock nut to the specified torque value.

TORQUE: 90–110 N·m
(9.0–11.0 kg·m, 65–80 ft·lb)

Torque wrench scale reading:
80–100 N·m (8.0–10.0 kg·m, 58–72 ft·lb)



CRANKSHAFT/TRANSMISSION

OUTPUT DRIVEN GEAR INSTALLATION

NOTE:

- Remove the center guide from the dis/assembly tool before using.
- When the gear set, driven gear bearing and/or gear case has been replaced, use a shim 0.30 mm (0.012 in) thick for initial reference.

Place the output driven gear bearing holder into a press.

Then press in the output driven gear.

Support the inner bearing race using the special tools.

Install the O-ring and correct shim.

Attach the bearing holder onto the gear case with the four hex bolts. Tighten the bolts in a crisscross pattern in two or more steps.

TORQUE: 30–40 N·m (3.0–4.0 kg·m, 22–29 ft·lb)

Install a new bearing inner race lock nut and tighten it to the specified torque.

TORQUE: 70–80 N·m (7.0–8.0 kg·m, 51–58 ft·lb)

Torque wrench scale reading:

64–73 N·m (6.4–7.3 kg·m, 46–53 ft·lb)

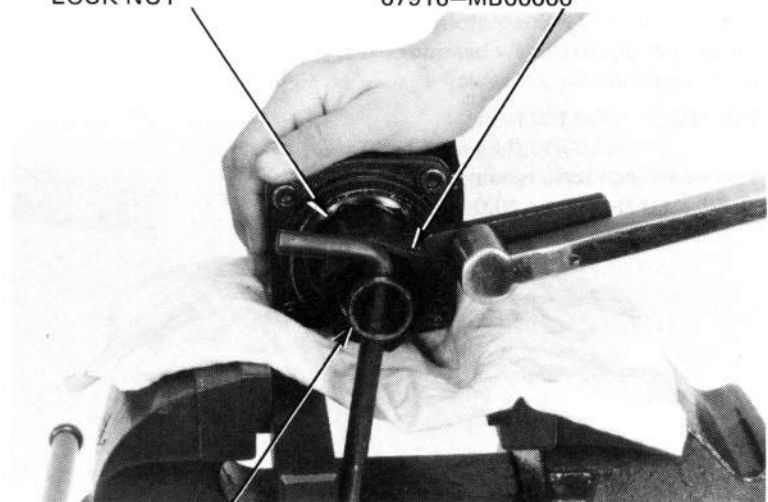


DIS/ASSEMBLY TOOL
07965–3710100



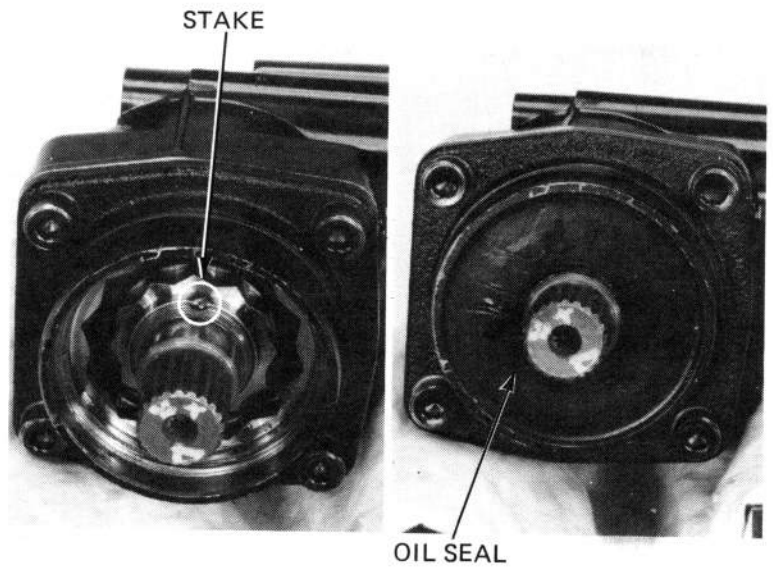
BEARING INNER RACE
LOCK NUT

LOCK NUT WRENCH, 30/64 mm
07916–MB00000



HOLDER
07923–6890101

Stake both new lock nuts and install a new oil seal.

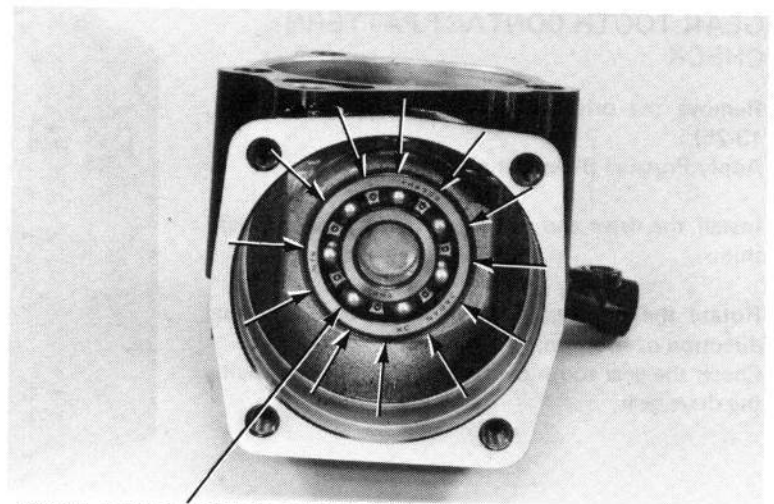


OUTPUT DRIVEN GEAR CASE BEARING REPLACEMENT

Heat the output gear case around the driven shaft bearing to 80°C (176°F).

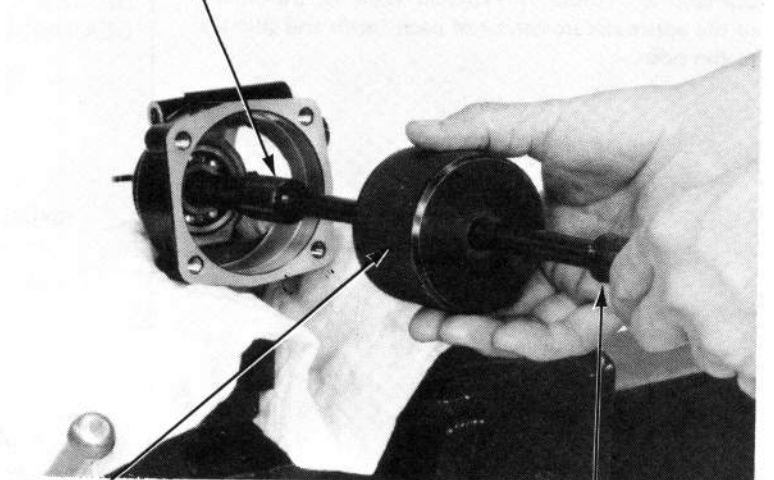
CAUTION:

Always wear gloves when handling a heated gear case.



FINAL DRIVEN SHAFT BEARING
BEARING REMOVER, 17 mm
07936-3710300

Remove the bearing with the bearing remover.

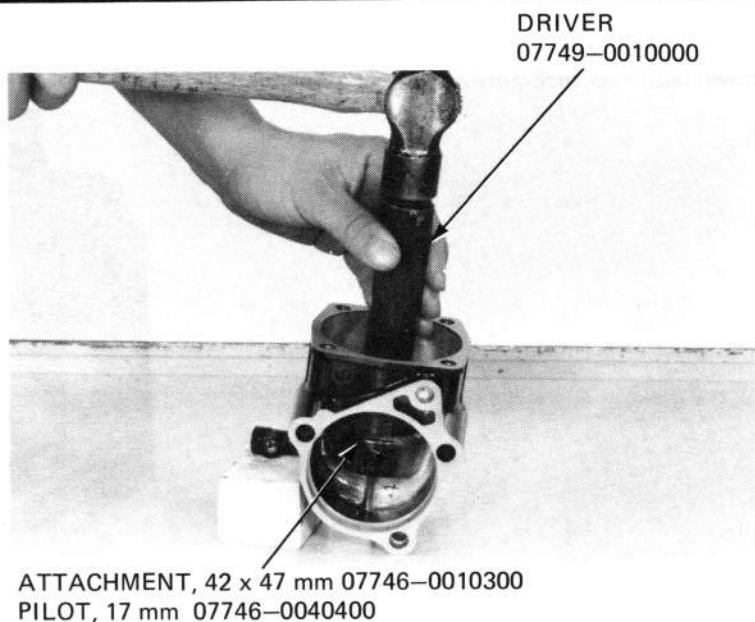


WEIGHT
07936-3710200

HANDLE
07936-3710100

CRANKSHAFT/TRANSMISSION

Drive a new bearing into the output gear case.



GEAR TOOTH CONTACT PATTERN CHECK

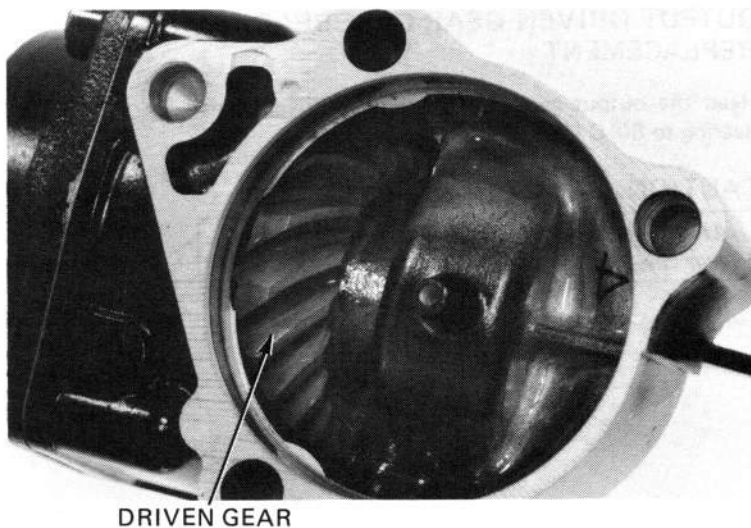
Remove the drive and driven gears (pages 13-17, 13-25).

Apply Prussian Blue to the driven gear teeth.

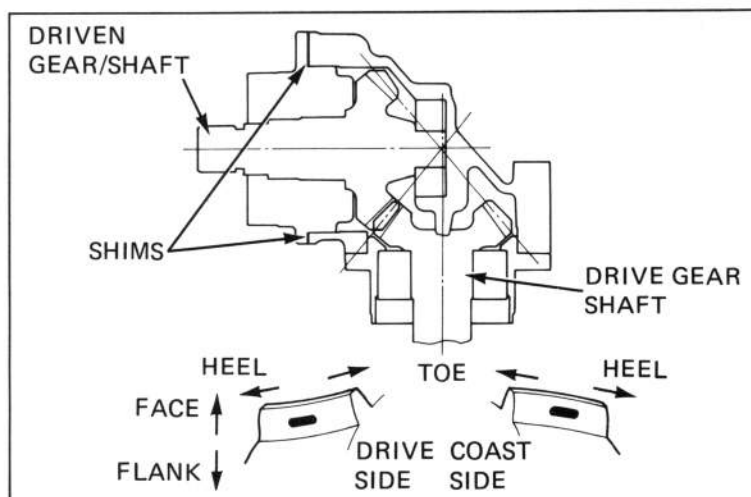
Install the drive and driven gears with the standard shims.

Rotate the drive gear several times in the normal direction of rotation.

Check the gear tooth contact pattern after removing the drive gear.

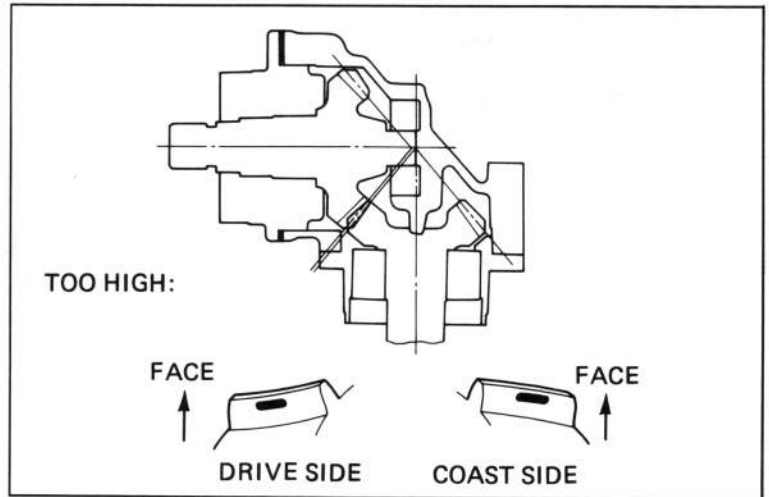


Contact is normal if Prussian Blue is transferred to the approximate center of each tooth and slightly to the side.



If the pattern is not correct, remove and replace the driven gear adjustment shim.

Replace the shim with a thinner one if the contact pattern is too high.



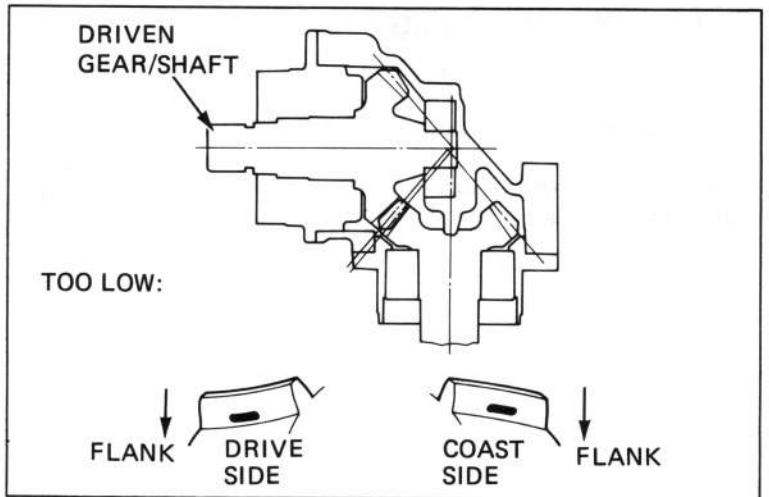
Replace the driven gear adjustment shim with a thicker one if the contact is too low.

The pattern will shift about 1.5–2.0 mm (0.06–0.08 in) when the thickness of the shim is changed by 0.10 mm (0.04 in).

OUTPUT DRIVEN GEAR ADJUSTMENT SHIM:

- A: 0.40 mm (0.016 in)
- B: 0.45 mm (0.018 in)
- C: 0.50 mm (0.020 in) STANDARD
- D: 0.55 mm (0.022 in)
- E: 0.60 mm (0.024 in)

Check the backlash (See page 13-19).



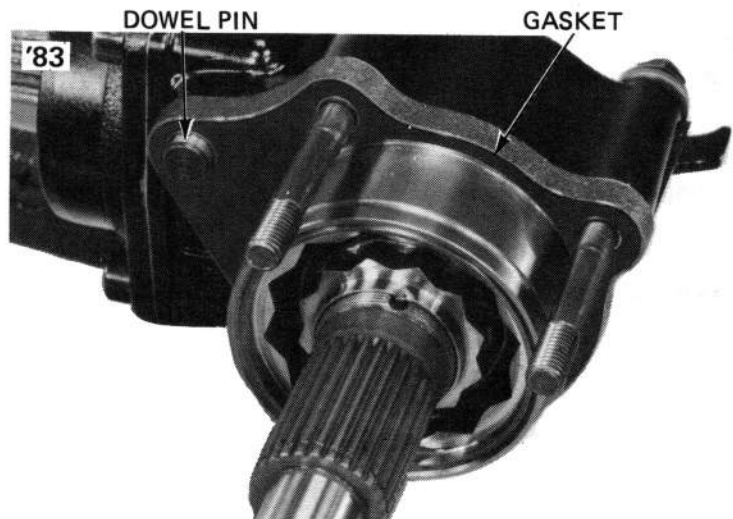
OUTPUT GEAR CASE INSTALLATION

'83:

Install the dowel pin and a new gasket over the output drive shaft bearing holder.

After '83:

Install the dowel pin.

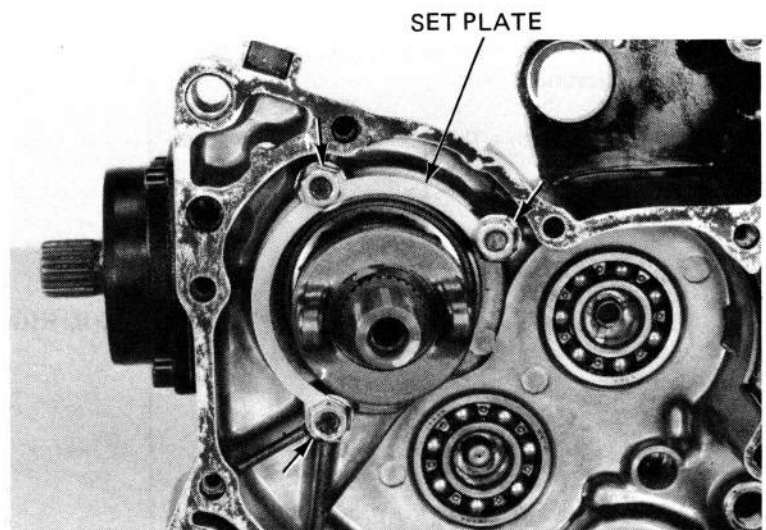


CRANKSHAFT/TRANSMISSION

Install the output gear assembly into the crankcase.
Install the set plate and 8 mm nuts.
Tighten the nuts to the specified torque.

TORQUE: 21–25 N·m (2.1–2.5 kg·m, 15–18 ft·lb)

Bend the lock tabs up.

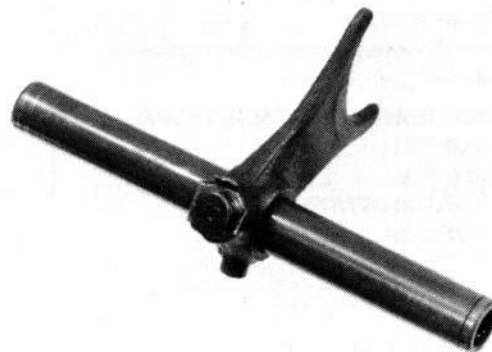


SHIFT FORK/SHIFT DRUM

SHIFT FORK DISASSEMBLY

Remove the outer shift forks from the shaft.

Bend the lock washer tab down and remove the center fork mounting bolt and fork.

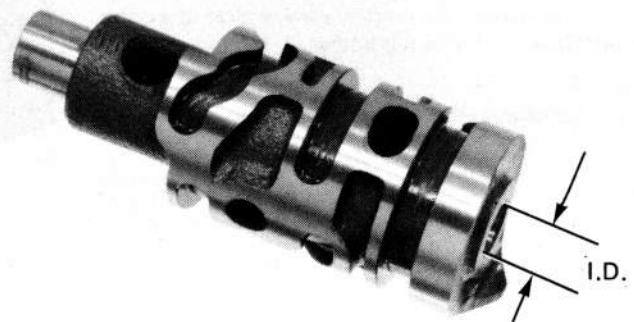


GEAR SHIFT DRUM AND SHIFT FORK INSPECTION

Inspect the shift drum end for scoring, scratches, or evidence of insufficient lubrication. Check the shift drum grooves for damage.

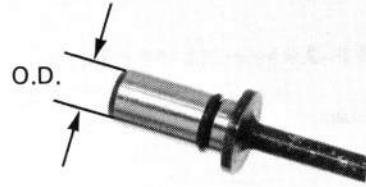
Measure the shift drum I.D.

SERVICE LIMIT: 12.55 mm (0.494 in)



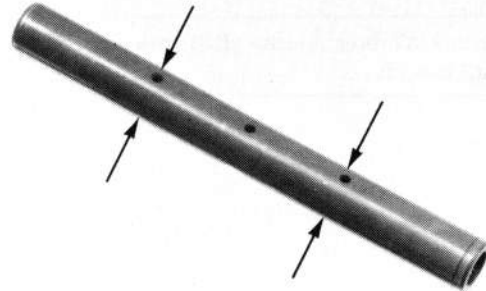
Measure the shift drum holder O.D.

SERVICE LIMIT: 12.35 mm (0.486 in)



Check for scratches, scoring or evidence of insufficient lubrication.
Measure the shift fork shaft O.D. at the right and left shift fork surfaces.

SERVICE LIMIT: 13.90 mm (0.547 in)

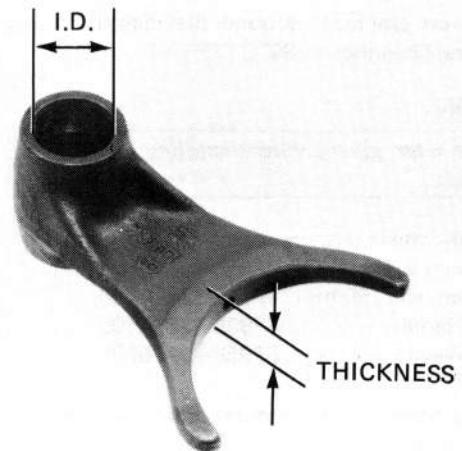


Measure the right and left shift fork I.D. and the shift fork claw thickness.

SERVICE LIMITS:

I.D. (right and left fork): 14.04 mm (0.553 in)

CLAW THICKNESS: 6.1 mm (0.24 in)



CRANKSHAFT/TRANSMISSION

SHIFT FORK ASSEMBLY

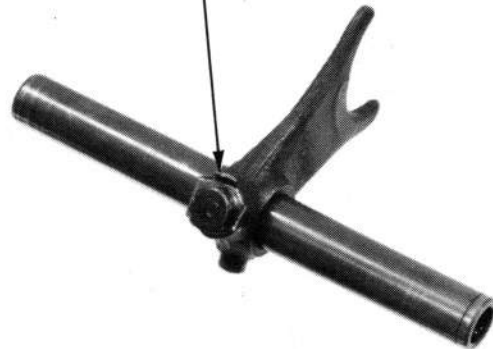
Install the center shift fork onto the shaft.

Install the lock washer and tighten the center fork bolt.

TORQUE: 16–20 N·m (1.6–2.0 kg·m, 12–14 ft·lb)

Bend the lock washer tabs up.

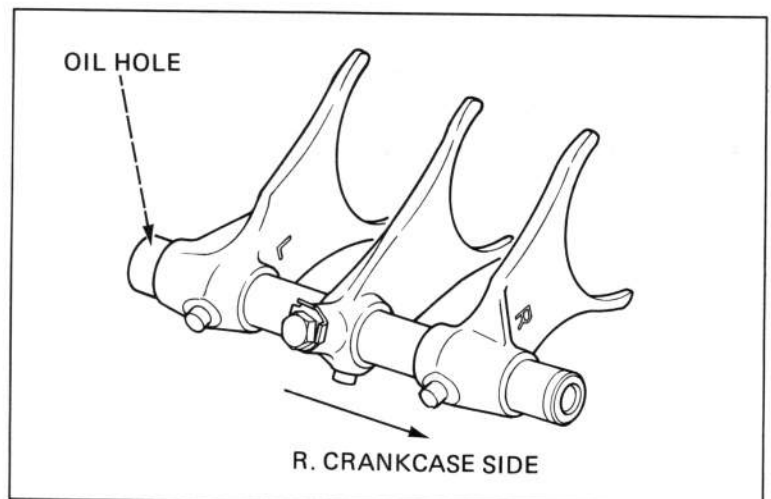
LOCK WASHER TAB



Install the R.L. forks facing as shown against the center shift fork.

NOTE:

Make sure the oil hole in the shift fork shaft toward the left.



CRANKCASE BEARINGS REPLACEMENT

LEFT CRANKCASE BEARINGS

Heat the left crankcase around the mainshaft and counter shaft bearings to 80°C (176°F).

CAUTION:

Always wear gloves when handling a heated crankcase.

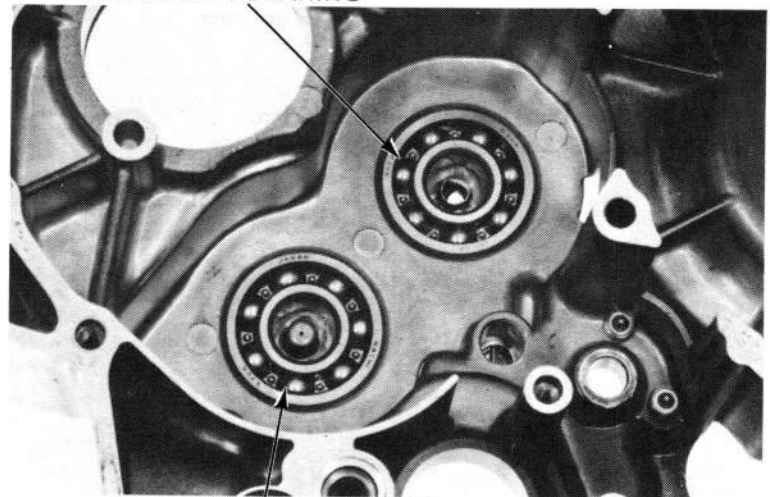
Remove the main and countershaft bearings with the following tools:

| | |
|------------------------|---------------|
| Bearing Remover, 20 mm | 07936-3710600 |
| Remover Handle | 07936-3710100 |
| Remover Weight | 07936-3710200 |

Drive a new bearing into the left crankcase with the following tools:

| | |
|------------|---------------|
| Attachment | 07946-3710200 |
| Driver | 07949-3710000 |

MAIN SHAFT BEARING



COUNTERSHAFT BEARING

RIGHT CRANKCASE BEARINGS

Heat the right crankcase around the mainshaft, countershaft, output drive shaft and shift drum bearings to 80°C (176°F).

CAUTION:

Always wear gloves when handling a heated crankcase.

Remove the bearings with the following tools:

Bearing Remover, 20 mm 07936-3710600

Remover Handle 07936-3710100

Remover Weight 07936-3710200

Drive the new bearings into the right crankcase with the following tools:

Main shaft:

Attachment, 62 x 68 mm 07746-0010500

Pilot, 25 mm 07746-0040600

Driver 07749-0010000

Counter shaft/Output drive shaft:

Driver 07749-0010000

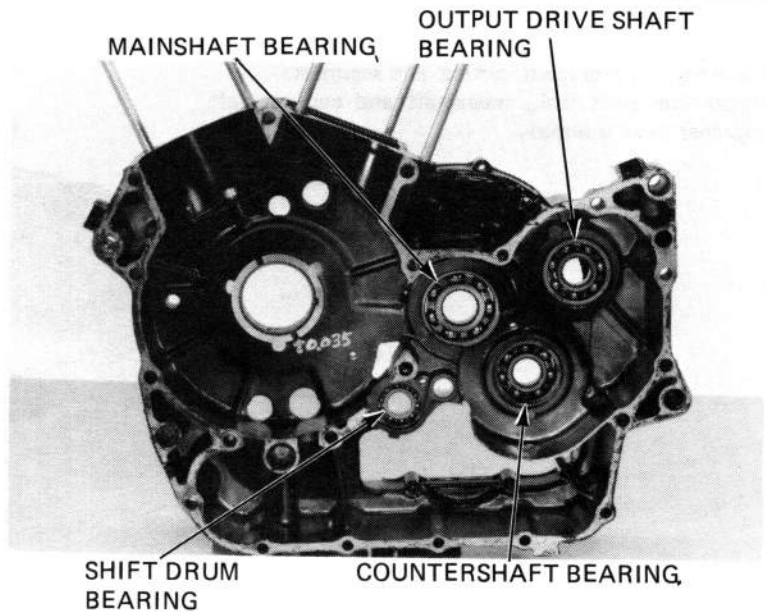
Attachment 07946-3710200

Shift Drum:

Attachment, 32 x 35 mm 07746-0010100

Pilot, 17 mm 07746-0040400

Driver 07749-0010000



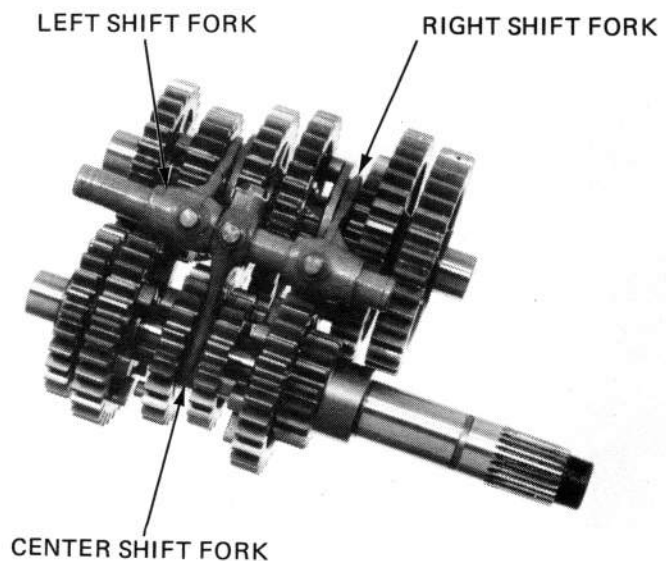
TRANSMISSION INSTALLATION

Install the shift fork onto the mainshaft and countershaft as shown:

Center shift fork to M2/3 gear groove.

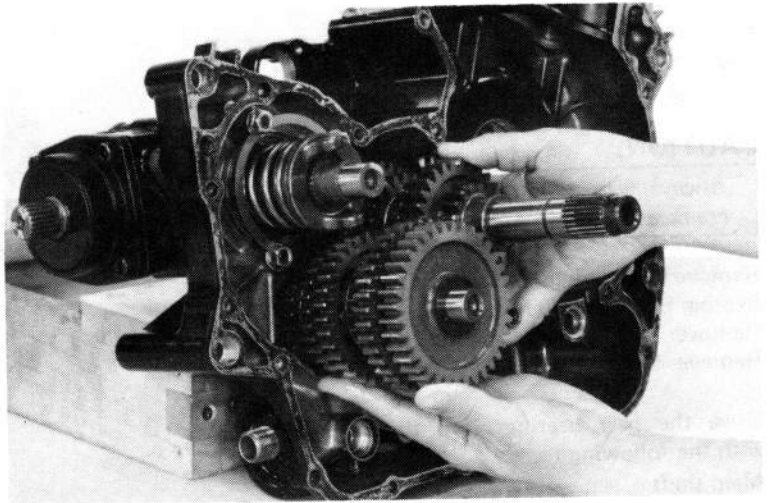
Right shift fork to C5 gear groove.

Left shift fork to C6 gear groove.



CRANKSHAFT/TRANSMISSION

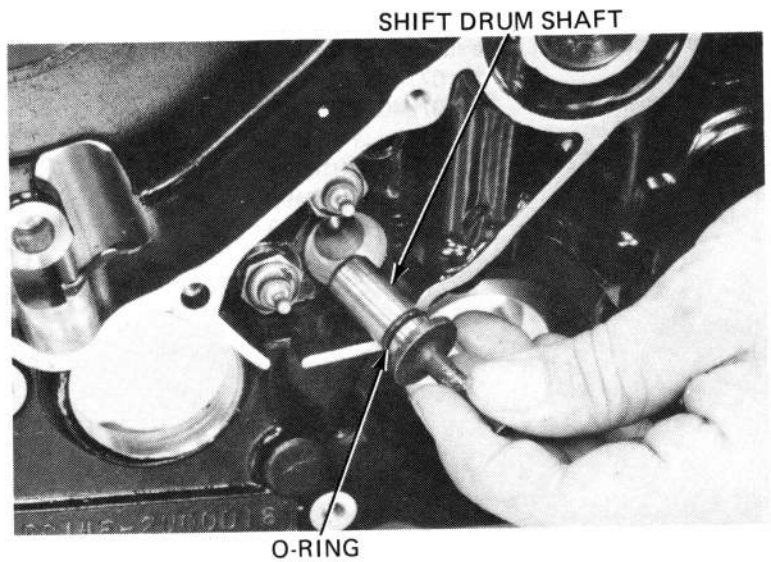
Place the left crankcase vertical and secure it.
Install the shift fork, mainshaft and countershaft together as an assembly.



Install the shift drum aligning the grooves with the boss of each shift fork.

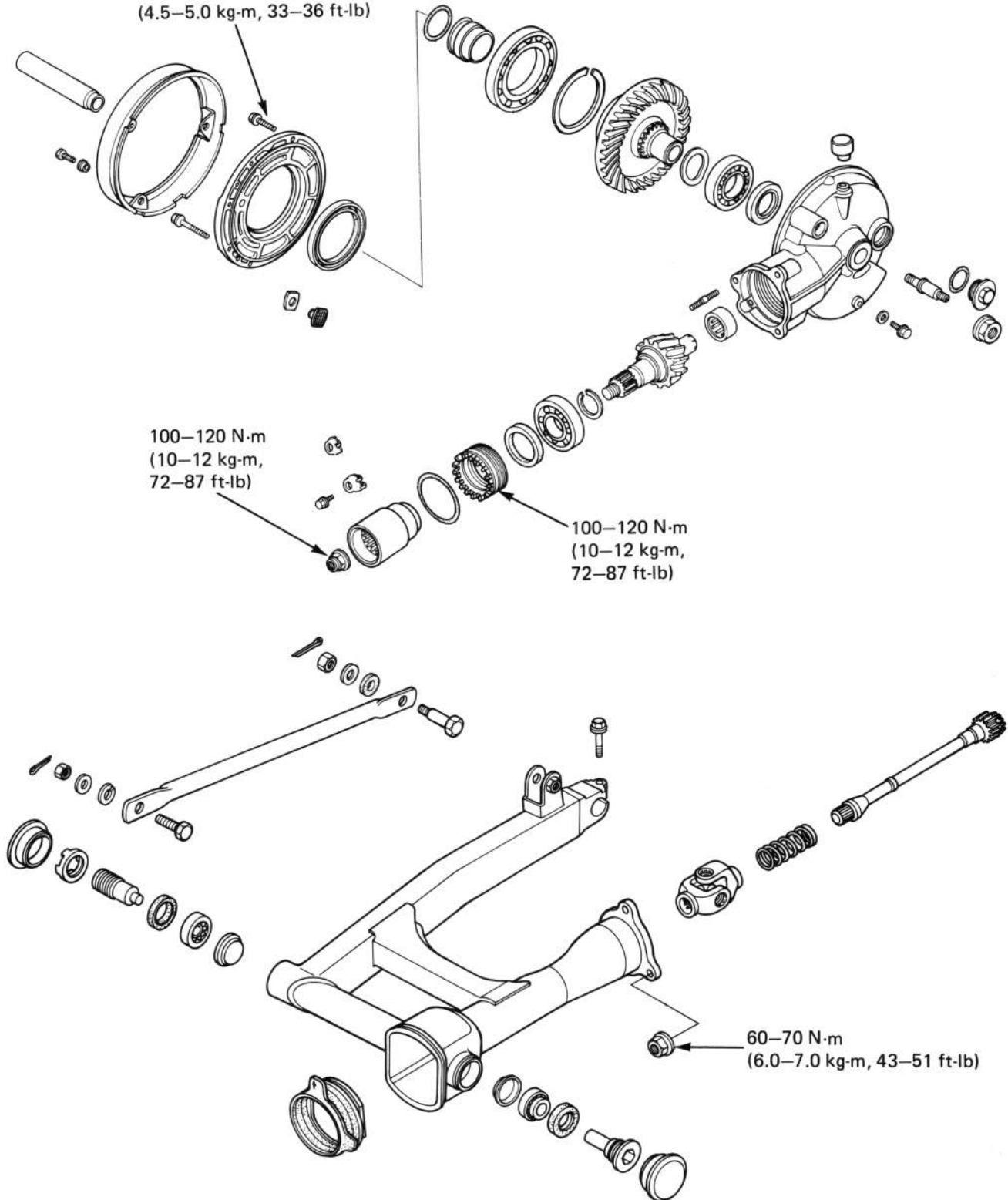
Install the shift drum shaft with a new O-ring.

Assemble the crankcase (page 12-4).



DRIVE TRAIN

8 mm: 23–28 N·m
(2.3–2.8 kg·m, 17–20 ft·lb)
10 mm: 45–50 N·m
(4.5–5.0 kg·m, 33–36 ft·lb)



14. DRIVE TRAIN

| | |
|--------------------------|-------|
| SERVICE INFORMATION | 14-1 |
| TROUBLESHOOTING | 14-2 |
| FINAL DRIVE REMOVAL | 14-3 |
| DRIVE SHAFT | 14-3 |
| UNIVERSAL JOINT | 14-4 |
| FINAL DRIVE GEAR | 14-5 |
| FINAL DRIVE INSTALLATION | 14-17 |

SERVICE INFORMATION

GENERAL

- The final drive gear assembly must be removed together with the drive shaft.
- Replace all oil seals and O-rings whenever the final drive gear assembly is disassembled.
- Check tooth contact pattern and gear backlash when the bearing, gear set and/or gear case has been replace.
- When using the lock nut wrench, use a deflecting beam type torque wrench 355–510 mm's (14–20 inches) long. The lock nut wrench increases the torque wrench's leverage, so the torque wrench reading will be less than the torque actually applied to the lock nut. The specification given is the actual torque applied to the lock nut, not the reading on the torque wrench when used with the lock nut wrench what the torque wrench scale reading should be given with the actual torque specification.

SPECIFICATIONS

| | | STANDARD | SERVICE LIMIT |
|-----------------------|-----------------|---|--------------------|
| Final gear oil | Capacity | 170 cc (5.8 ozs) | — |
| | Recommended oil | Hypoid-gear oil API, GL-5 Above 5°C/41°F SAE # 90 Below 5°C/41°F SAE # 80 | — |
| Gear backlash | | 0.08–0.18 mm (0.003–0.007 in) | 0.30 mm (0.012 in) |
| Gear assembly preload | | 0.2–0.3 N·m (2–3 kg·m, 1.7–2.6 in·lb) | — |

TORQUE VALUES

| | |
|-------------------------------|---------------------------------------|
| Pinion bearing retainer | 100–120 N·m (10–12 kg·m, 72–87 ft·lb) |
| Pinion nut | 100–120 N·m (10–12 kg·m, 72–87 ft·lb) |
| Gear case cover bolt 10 mm | 45–50 N·m (4.5–5.0 kg·m, 33–36 ft·lb) |
| 8 mm | 23–28 N·m (2.3–2.8 kg·m, 17–20 ft·lb) |
| Final gear case attaching nut | 60–70 N·m (6.0–7.0 kg·m, 43–51 ft·lb) |

DRIVE TRAIN

TOOLS

Special

| | |
|---------------------------|--|
| Attachment | 07945-3330300 |
| Attachment | 07947-6340201 |
| Lock nut wrench, 30/64 mm | 07916-MB00000 or 07910-MA10100 |
| Pinion puller | 07931-4630200 and 07931-MB00000 or 07935-MB00000 |
| Pinion joint holder | 07924-ME90000 |
| Driver | 07931-4630300 or 07947-3710101 and 07746-0010200 |
| O-ring guide | 07973-4630200 |
| Bearing remover, 35 mm | 07936-3710400 |

Common

| | |
|------------------------|---|
| Driver | 07749-0010000 |
| Attachment, 42 x 47 mm | 07746-0010300 |
| Attachment, 52 x 55 mm | 07746-0010400 |
| Attachment, 32 x 35 mm | 07746-0010100 |
| Pilot, 30 mm | 07746-0040700 |
| Driver C | 07746-0030100 |
| Attachment, 25 mm I.D. | 07746-0030200] or Driver 07945-3710200 |

TROUBLESHOOTING

Excessive noise

1. Worn or scored ring gear shaft and driven flange.
2. Scored driven flange and wheel hub.
3. Worn or scored drive pinion and splines.
4. Worn pinion and ring gears.
5. Excessive backlash between pinion and ring gear.
6. Oil level too low.

Oil leak

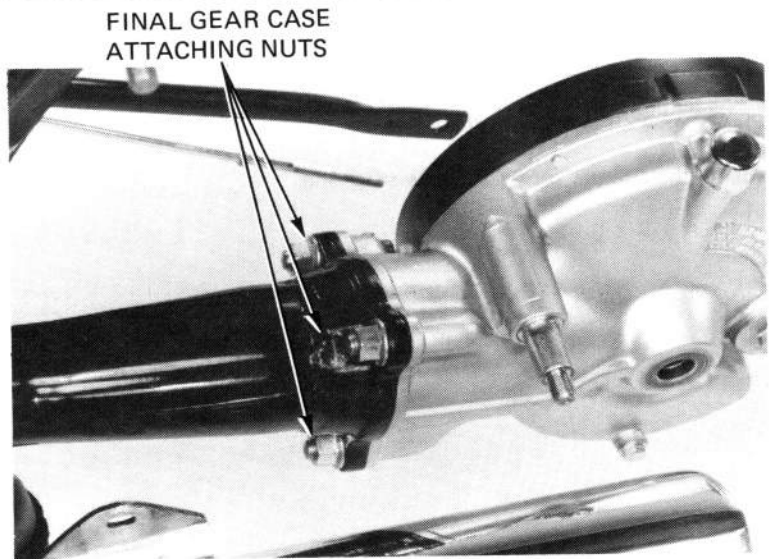
1. Clogged breather.
2. Oil level too high.
3. Seals damaged.

FINAL DRIVE REMOVAL

Place the motorcycle on its center stand. Drain the final gear oil (page 2-11) and remove the rear wheel (page 16-3).

Remove the left shock absorber (page 16-10).

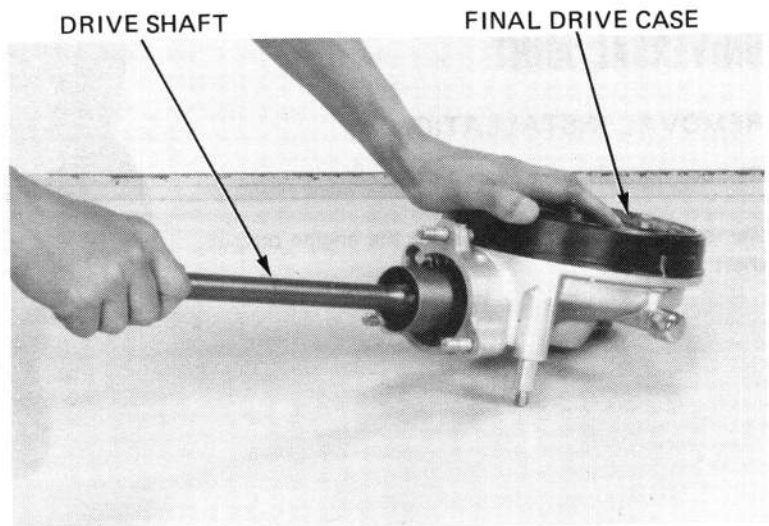
Remove the final gear case attaching nuts and remove the gear case from the swingarm.



DRIVE SHAFT

REMOVAL

Separate the drive shaft from the gear case by gently revolving the shaft in a circular motion while tugging slightly.

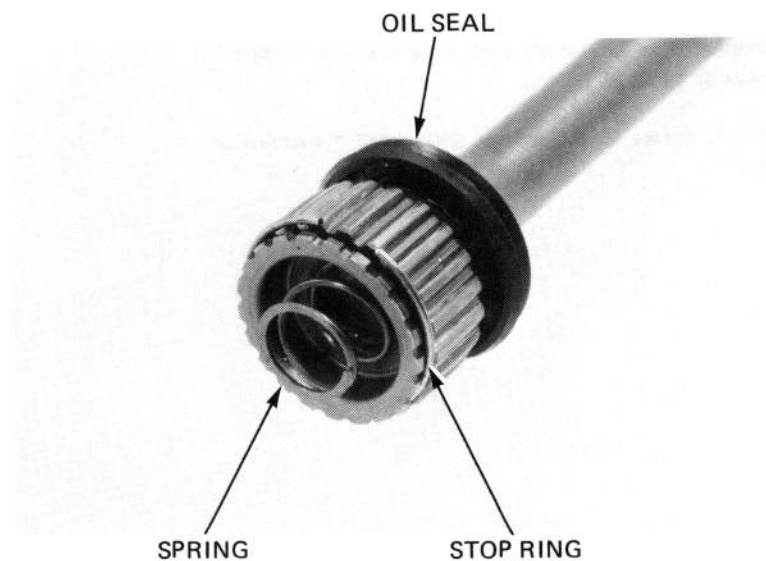


DISASSEMBLY

Remove the spring, oil seal and stop ring from the drive shaft.

NOTE:

Replace the oil seal with a new one if it is removed.

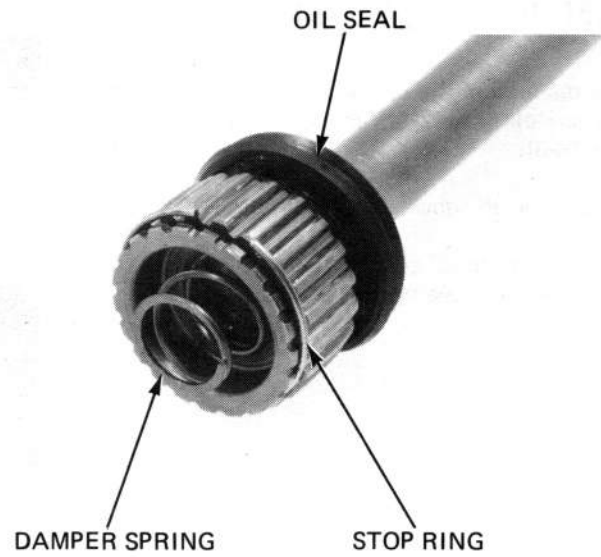


DRIVE TRAIN

ASSEMBLY

Place a new oil seal over the drive shaft.

Install the damper spring and new stop ring.

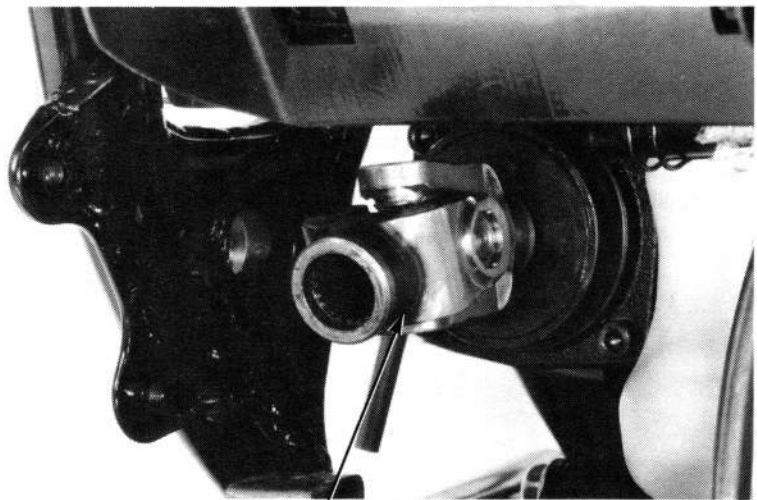


UNIVERSAL JOINT

REMOVAL/INSTALLATION

Remove the swingarm (page 16-13).

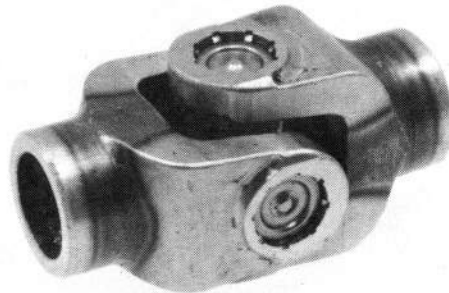
Remove the universal joint from the engine output shaft.



UNIVERSAL JOINT

Inspect the universal joint bearings for excessive play or damage.

Apply grease to the splines and install the universal joint.

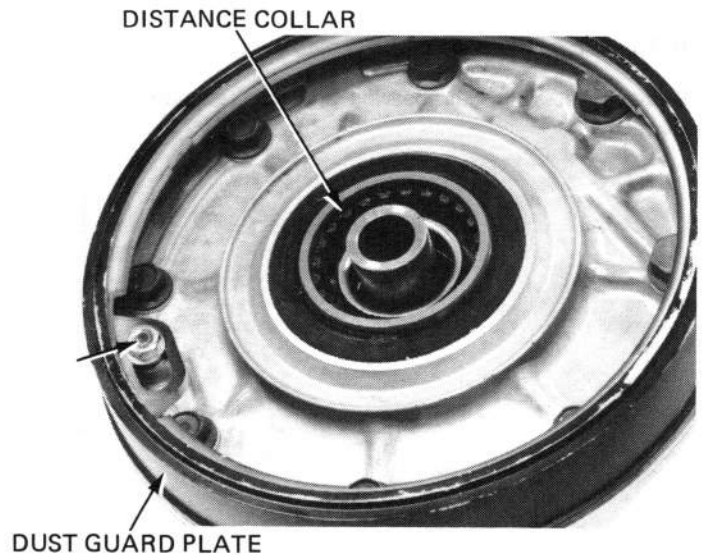


FINAL DRIVE GEAR

RING GEAR REMOVAL

Remove the distance collar.

Remove the dust guard plate bolts. Remove the dust guard plate by turning it clockwise.

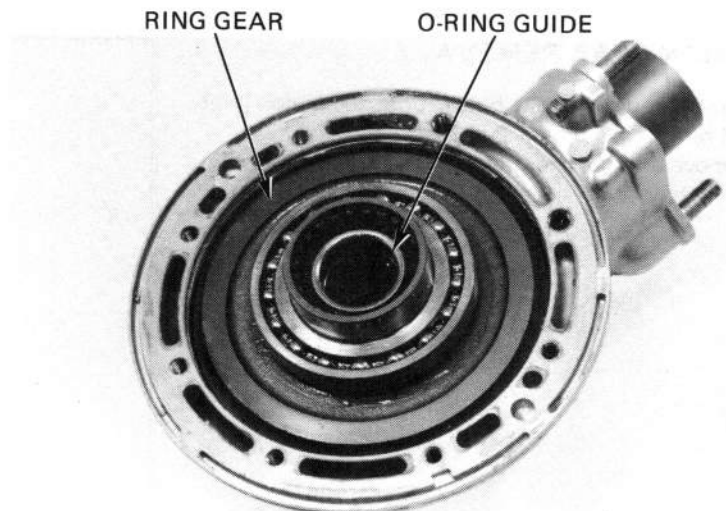


Remove the eight case cover bolts and cover. If the ring gear stays in the cover, do the following: Place the cover in a press with the ring gear down. Make sure the cover is securely supported. Press the ring gear out of the cover with driver 07749-0010000 and attachment 07746-0010100.



Remove the ring gear from the final drive case.

Remove the O-ring guide by tapping it from the opposite side.

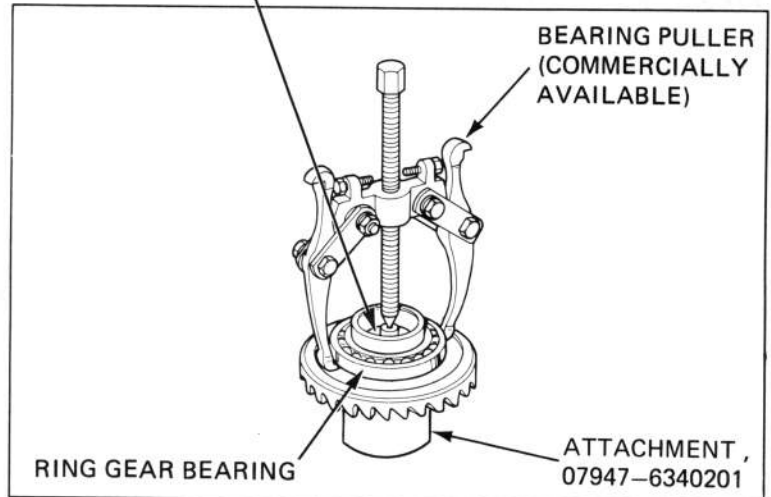


DRIVE TRAIN

ATTACHMENT, 32 x 35 mm 07746-0010100
PILOT, 30 mm 07746-0040700

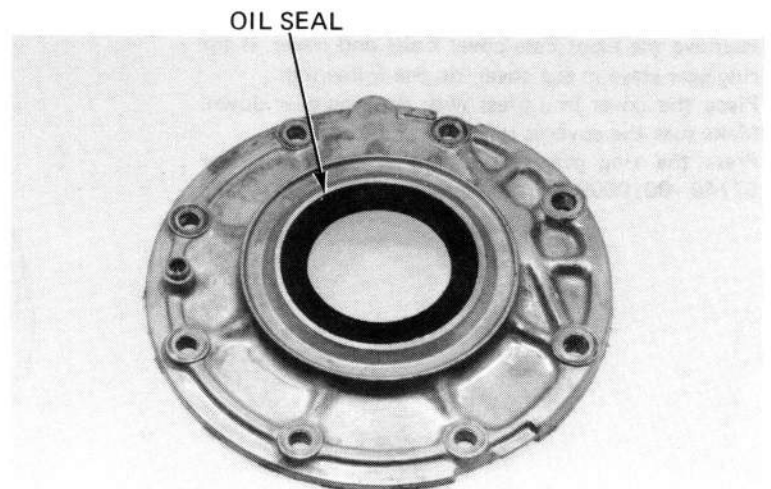
RING GEAR BEARING REMOVAL

Remove the ring gear bearing and gear adjusting spacer.



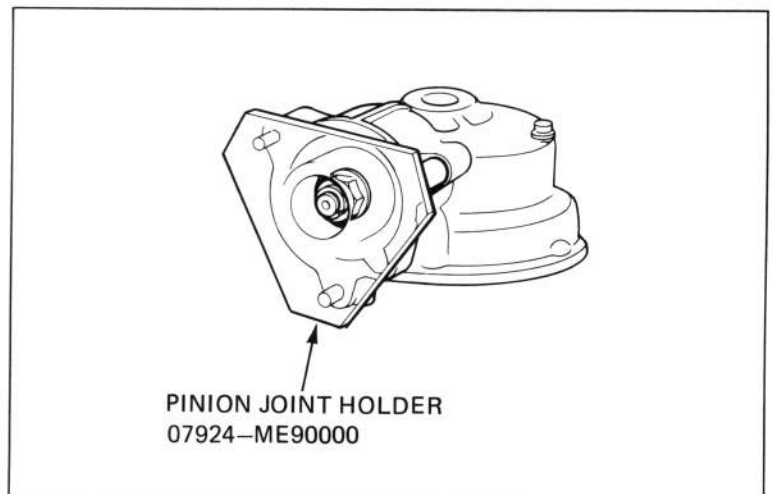
CASE COVER OIL SEAL REPLACEMENT

Remove the oil seal from the case cover and press in a new oil seal.

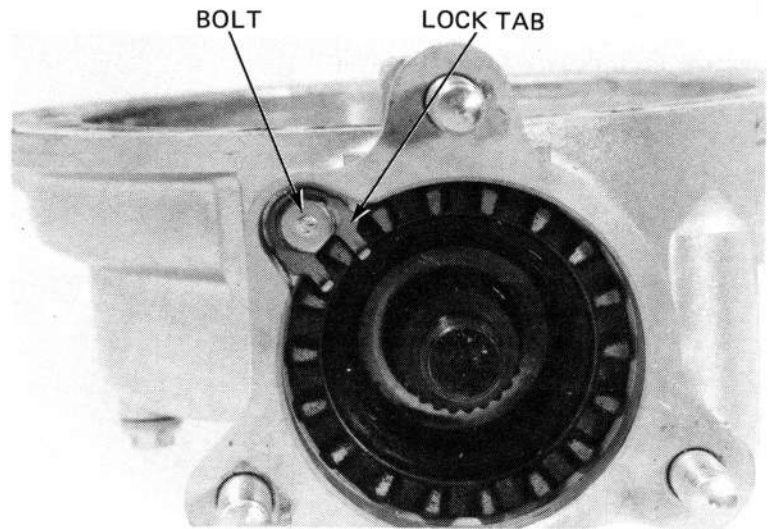


PINION GEAR REMOVAL

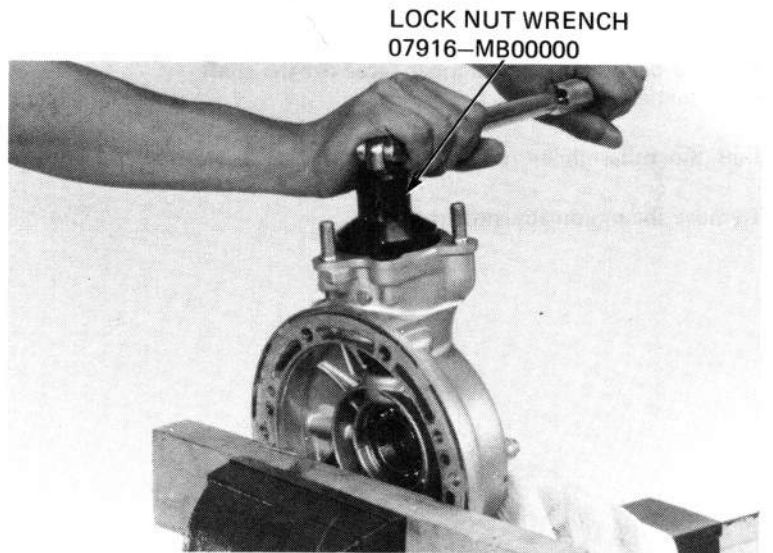
Install the pinion joint holder onto the pinion joint and remove the pinion shaft nut. Remove the tool and pinion joint.



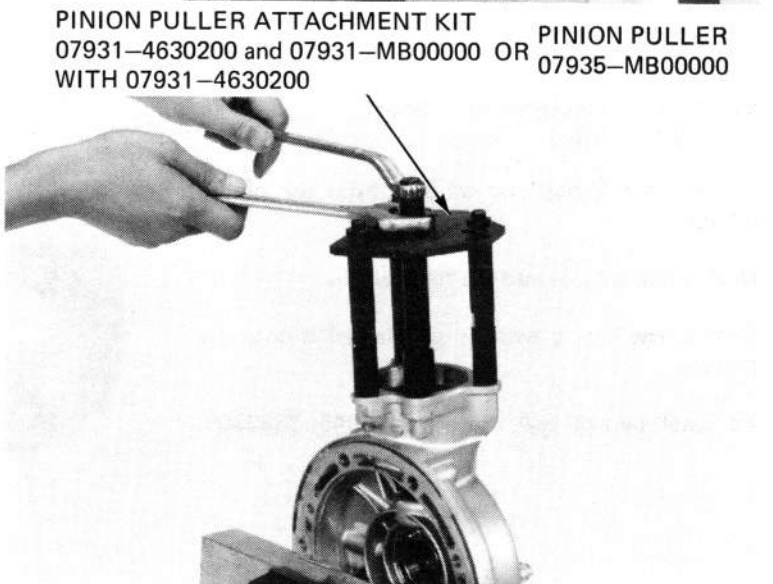
Remove the retainer lock tab.



Remove the pinion retainer with the pinion retainer wrench.



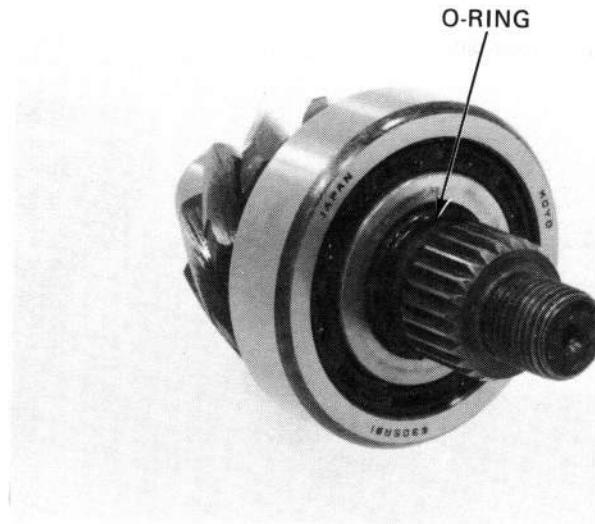
Pull the pinion assembly off with the pinion puller.



DRIVE TRAIN

PINION BEARING REMOVAL

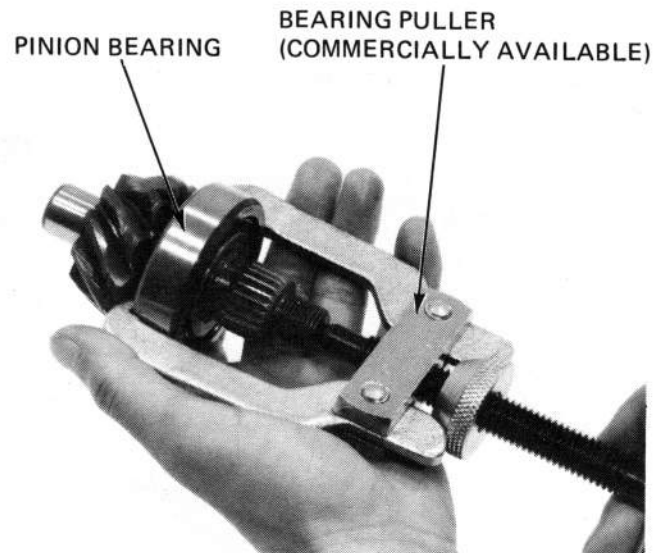
Remove the O-ring from the pinion shaft.



Pull the bearing outer and inner races off the shaft with the bearing puller.

Pull the other inner race off with the same tool.

Remove the pinion adjustment spacer.



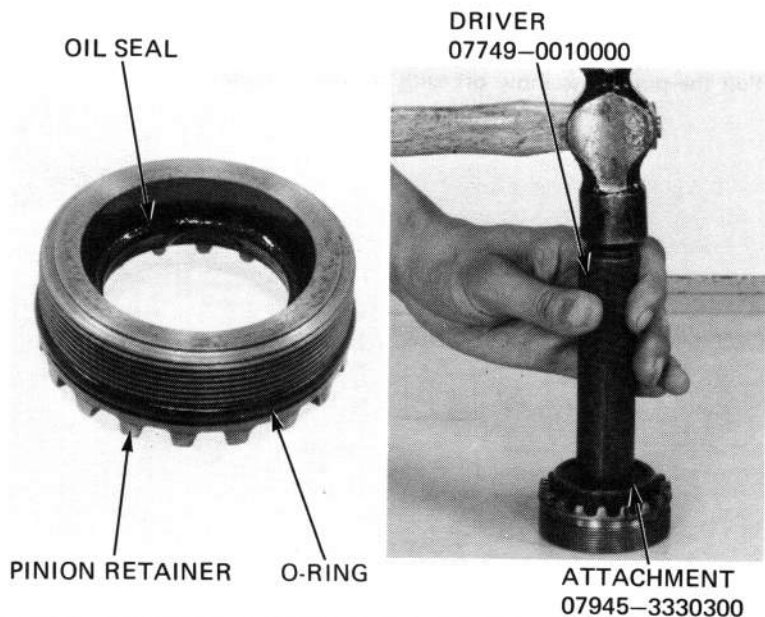
PINION RETAINER OIL SEAL REPLACEMENT

Remove the O-ring and oil seal from the pinion retainer.

Drive a new oil seal into the retainer.

Coat a new O-ring with oil and install it onto the retainer.

To install new oil seal, use driver 07945-3330300.



CASE BEARING AND OIL SEAL REPLACEMENT

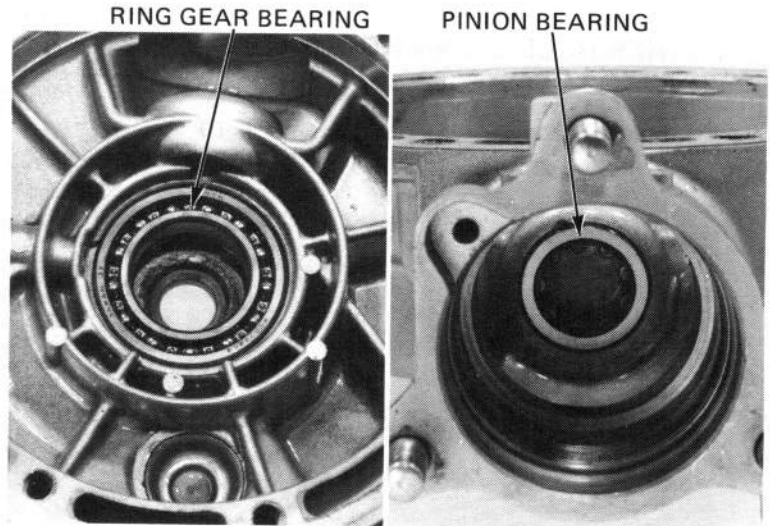
Heat the gear case 80°C (176°F). Tap the gear case with a plastic hammer and remove the ring gear and pinion bearings.

WARNING

Always wear gloves when handling the gear case after it has been heated.

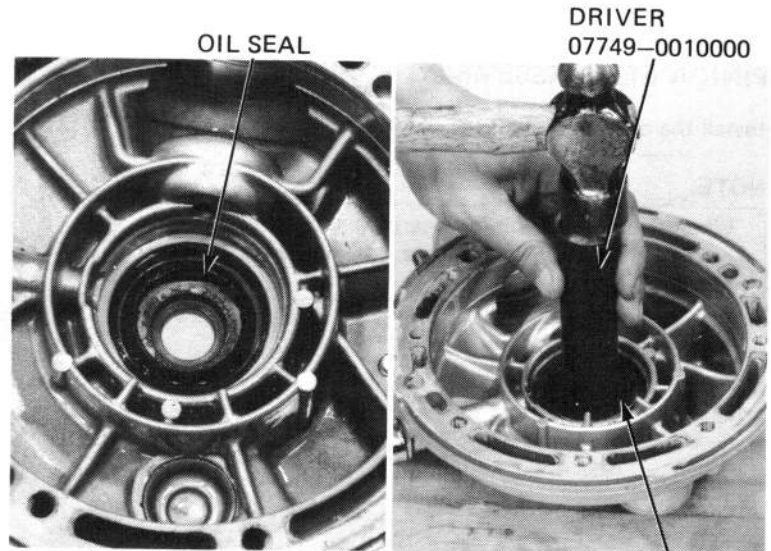
NOTE:

Use bearing remover, 35 mm, 07936-3710400 to remove ring gear case bearing.

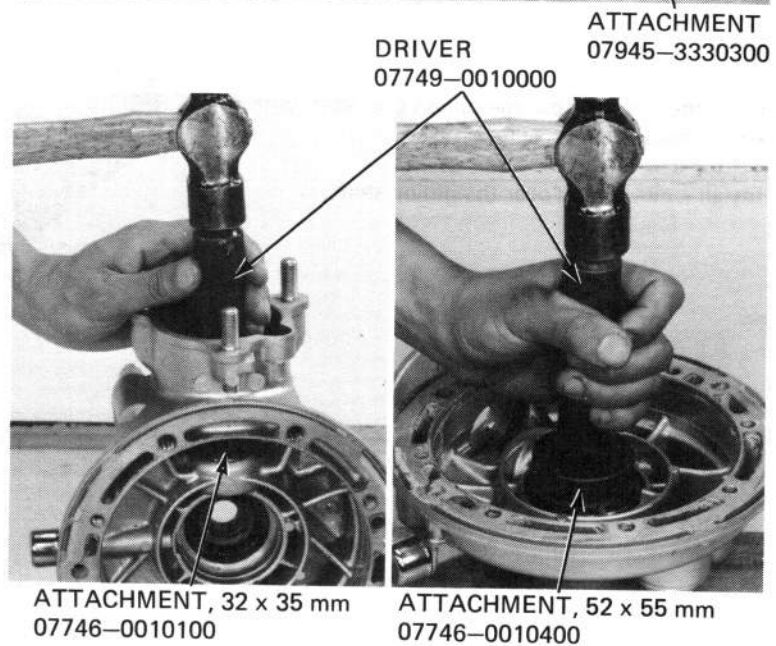


Remove the ring gear shaft oil seal.

Drive a new oil seal into the case, using the special tools.



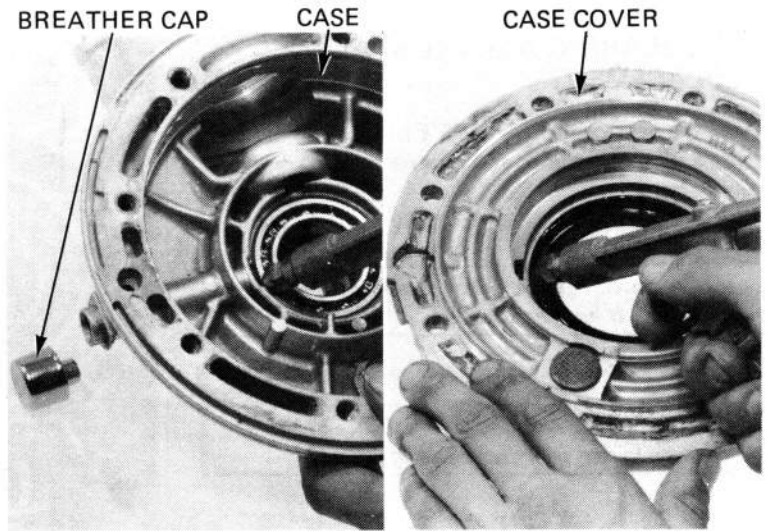
Drive new pinion and ring gear bearings into the case.



DRIVE TRAIN

BREATHER HOLE CLEANING

Remove the breather hole cap and blow through the breather hole with compressed air.

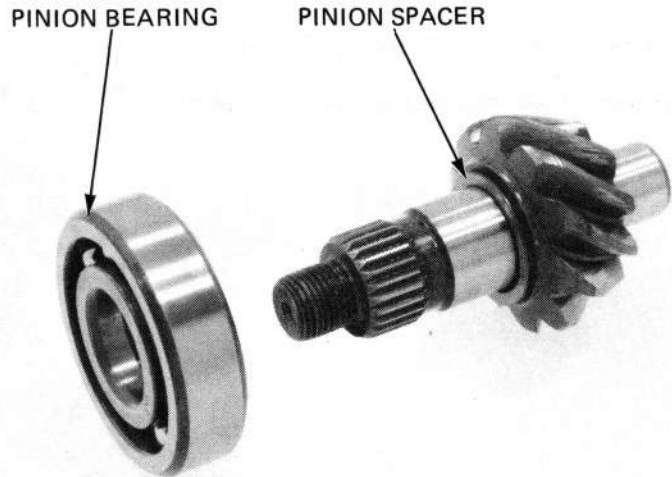


PINION GEAR ASSEMBLY

Install the original pinion gear spacer.

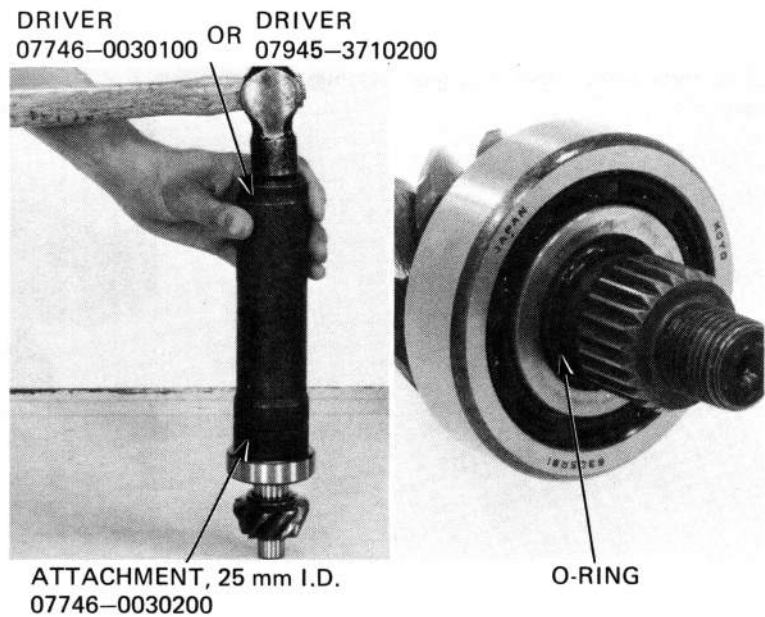
NOTE:

When the gear set, pinion bearing and/or gear case has been replaced, use a 2.0 mm thick spacer.



Press the bearing onto the pinion gear shaft with the special tools shown.

Install a new O-ring over the pinion shaft.



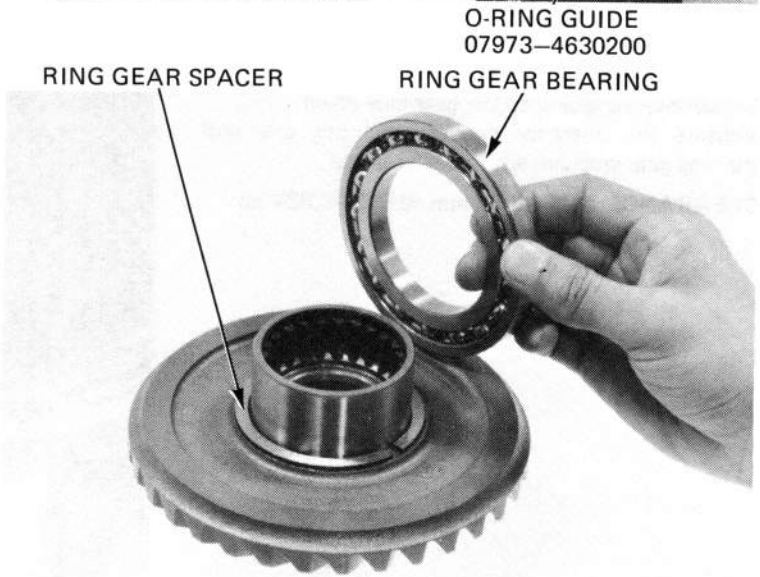
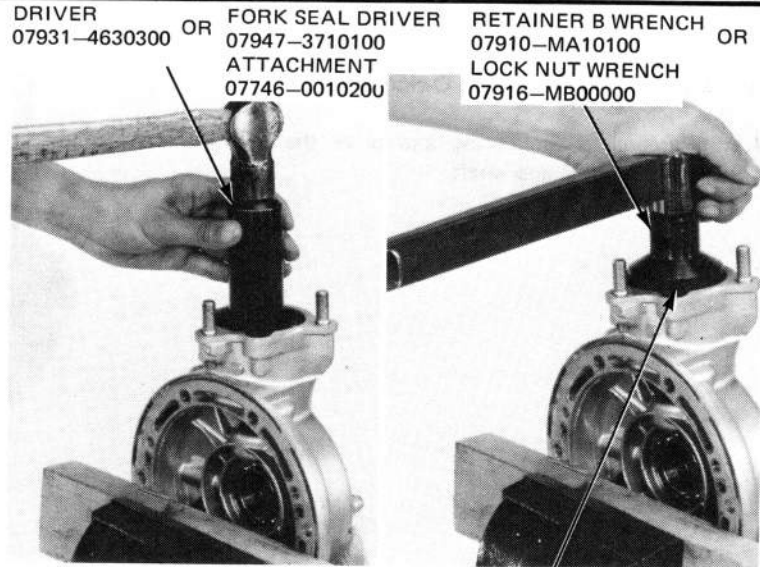
Place the pinion assembly into the gear housing. Drive the pinion assembly into the gear case until pinion retainer threads can engage with the case threads.

Apply gear oil to the O-ring and threads on the pinion retainer. Install the O-ring guide tool.

Screw in the pinion retainer to press the pinion bearing in place, then tighten it to the specified torque.

TORQUE:

100–120 N·m (10–12 kg·m, 72–87 ft·lb)



RING GEAR ASSEMBLY

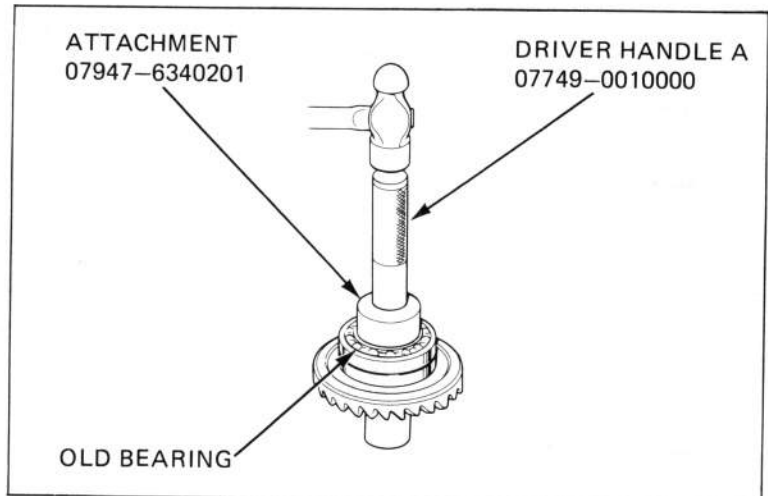
Install the original spacer onto the ring gear.

NOTE:

If the gear set, pinion bearing, ring gear bearing and/or gear case is replaced, install a 2.0 mm thick spacer.

Place the ring gear bearing over the ring gear shaft.

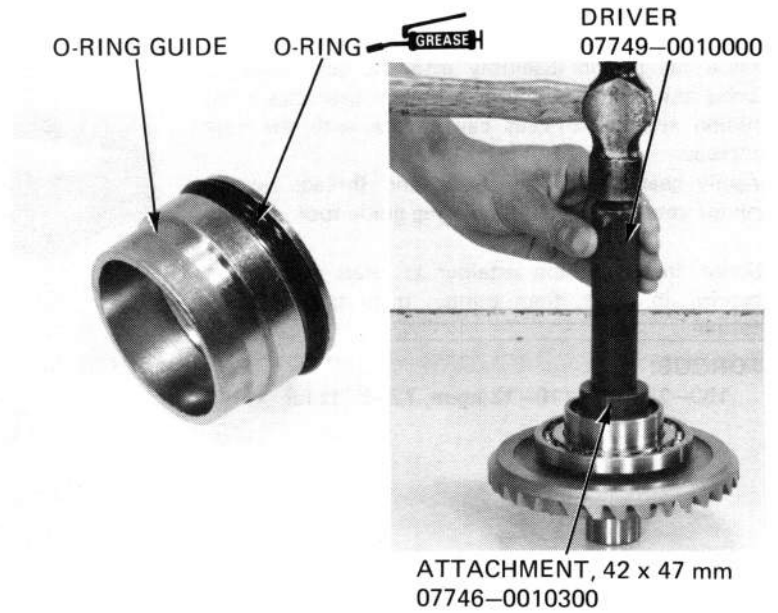
Place a new ring gear bearing on the ring gear shaft. Place the old bearing on top of it. Then, drive the new bearing onto the shaft with the old bearing and attachment. Then remove the old bearing.



DRIVE TRAIN

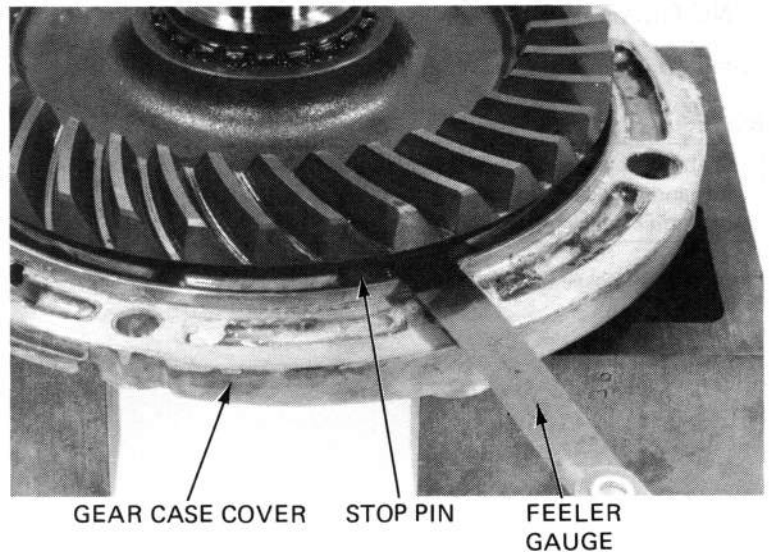
Install a new O-ring onto the O-ring guide.

Apply grease to the O-ring and drive the O-ring guide onto the ring gear shaft.



Install the ring gear into the gear case cover. Measure the clearance between the ring gear and the ring gear stop pin with a feeler gauge.

CLEARANCE: 0.30–0.60 mm (0.012–0.024 in)



Remove the ring gear. If the clearance exceeds the service limit, heat the gear case cover to approximately 80°C (176°F) and remove the stop pin by tapping the cover.

WARNING

Always wear gloves when handling the gear case after it has been heated.

Install a stop pin shim to obtain the correct clearance.

SHIM THICKNESS: A: 0.10 mm (0.004 in)
B: 0.15 mm (0.006 in)

Install the shim and drive the stop pin into the case cover.

