

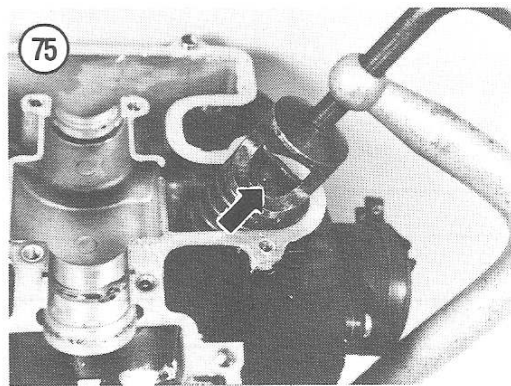
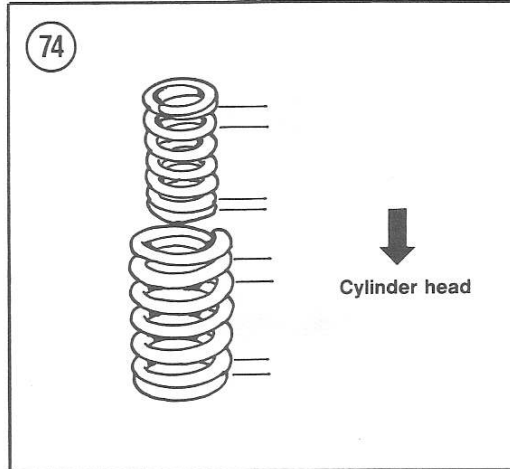
3. Install the inner and outer valve springs. Note that the coils are closer together on the bottom end (toward cylinder head) of the springs (Figure 74). Ensure that the springs are installed correctly.
4. Lubricate the valve stems with molybdenum disulfide grease such as Bel-Ray Moly Lube or equivalent and install the valves in the head.
5. Place the upper spring retainer over the valve springs. Install the spring compressor tool and tighten the compressor until the end of the valve is exposed enough to install the split keepers.
6. Apply a small amount of grease to each keeper half and stick the keeper to a small screwdriver to aid installation. Install the split keepers on the valve stem and back off the spring compressor until the split keepers secure the valve mechanism (Figure 75).
7. Remove the valve spring compressor. Use a soft drift or a soft-faced hammer and tap the end of each valve to make sure the keepers are properly seated (Figure 76).
8. Install the cylinder head as described in this chapter.

VALVE SERVICING

Valve Seal Inspection

The most accurate method for checking the seal of the valve is to use Prussian Blue or machinist's dye, available from auto part stores or machine shops.

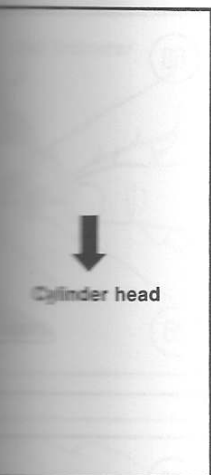
1. Remove and inspect the valves as outlined in this chapter.
2. Thoroughly clean the valve and valve seat with solvent or detergent.
3. Spread a thin layer of Prussian Blue or machinist's dye evenly on the valve face.
4. Attach a suction cup valve tool (Figure 77) to the valve and insert the valve into the guide. If such a tool is unavailable, a small length of fuel hose placed over the valve stem can also be used.



5. Tap the valve up and down in the head. Do not rotate the valve or a false indication will result.
6. Remove the valve and examine the impression left by the Prussian Blue or dye. If the impression (on the valve or in the head) is not even and continuous and the valve seat width (Figure 68) is not within the tolerance specified in Table 4, the seat in the cylinder head must be reconditioned. Refer to *Valve Seat Reconditioning* in this chapter.
7. If the valve seat width is within the specified tolerance, install the valves.

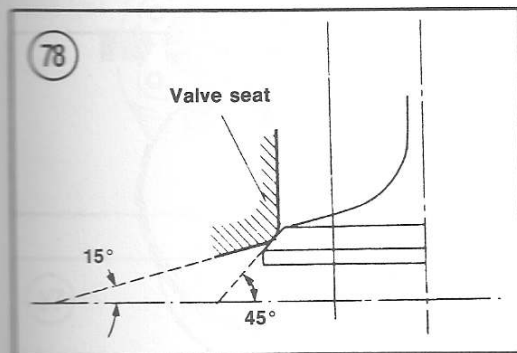
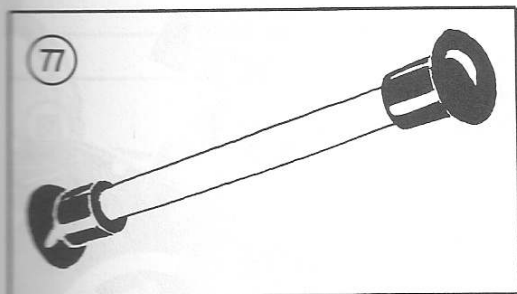
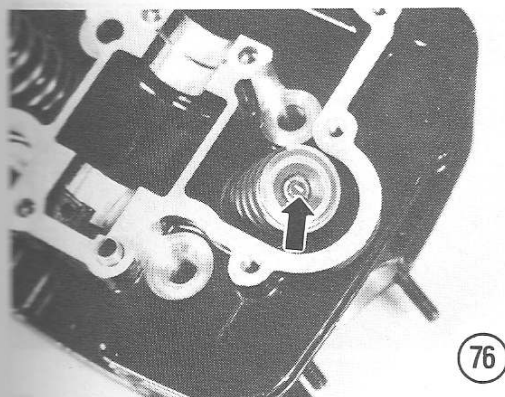
Valve Guide Replacement

When valve guides are worn so that there is excessive stem-to-guide clearance or valve tipping, the guides must be replaced. Both guides should be replaced, even if only one is worn excessively. Guide replacement requires special tools as well as considerable expertise. If guide replacement is required, refer the task to an authorized dealer or machine shop.



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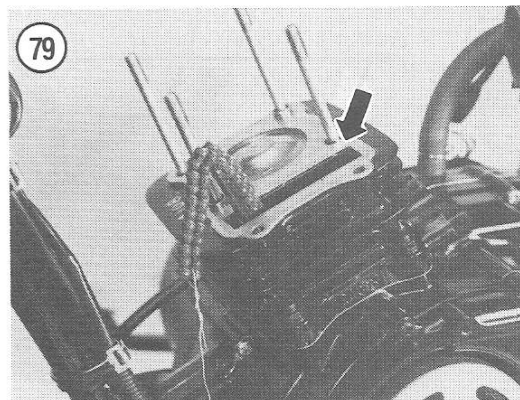
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Valve Seat Reconditioning

Special valve cutter tools and considerable skill are required to properly recondition the valve seats in the cylinder head. You can save considerable money by removing the cylinder head and taking just the head to a dealer or machine shop. The following procedure is provided in the event that you are not near a dealer and the local machine shop is not familiar with the cutting process used on LT/ALT engines. Refer to Figure 78 for the following procedure.

1. Use a 45 degree cutter to descale and clean the valve seat with one or two turns.



2. Measure the valve seat as outlined in *Valve Seal Inspection*. The seat width should be as specified in Table 4. If the seat is burned or pitted, additional turns with the 45 degree cutter are required.

NOTE

Measure the valve seat contact area after each cut to prevent removing too much material.

- If the seat contact area is too low or too narrow, the 45 degree cutter must be used to raise and widen the contact area.
- If the seat contact area is too high or too wide, the 15 degree cutter must be used to lower and narrow the contact area.
- Recheck the seat width and recut the seat with the 45 degree cutter if necessary.
- Check that the finished valve seat has a smooth and velvety surface.

CAUTION

Do not lap the finished seat. The final seating of the valve will take place when the engine is first run.

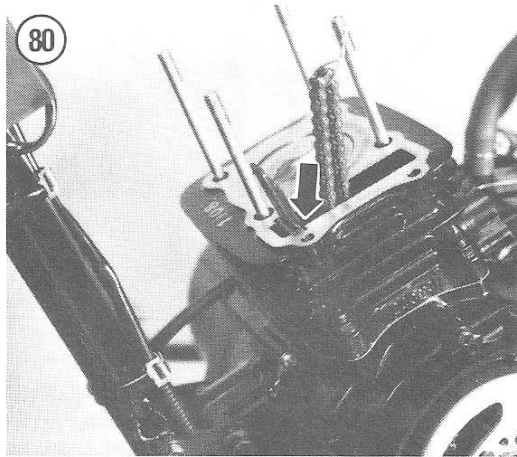
7. Thoroughly clean all valve components and the cylinder head in solvent or detergent and hot water. Install the valves and fill the ports with solvent to check for leaks. If any leaks are present the valve seats must be inspected for foreign material or burrs that can prevent a proper seal.

CYLINDER

The cylinder can be removed with the engine installed in the frame.

Removal

- Remove cylinder head as outlined in this chapter.
- Remove and discard the old head gasket (Figure 79).



3. Lift out and remove the internal cam chain slipper (Figure 80).

4. Remove the nuts securing the cylinder to the crankcase (Figure 81).

5. Tap around the base of the cylinder with a rubber mallet or plastic hammer to break the cylinder loose from the crankcase.

CAUTION

Take care when tapping the cylinder with a mallet or damage to the cam chain tunnel or cooling fins may result.

6. Carefully lift off the cylinder (Figure 82). Note that the arrow on the piston points forward (Figure 83).

CAUTION

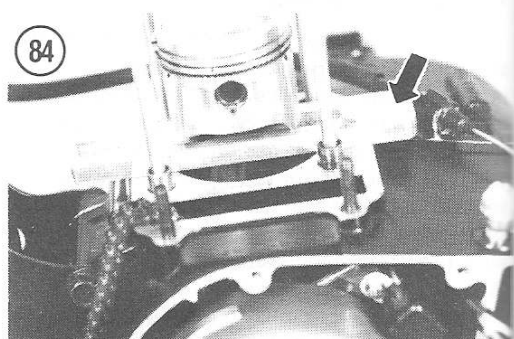
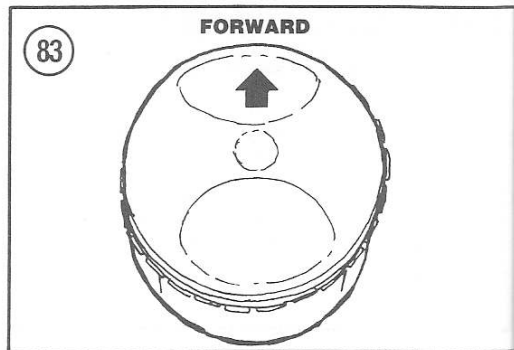
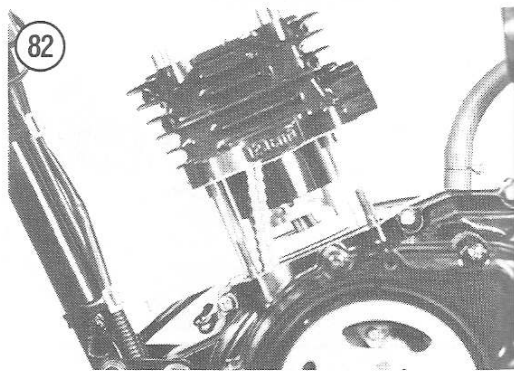
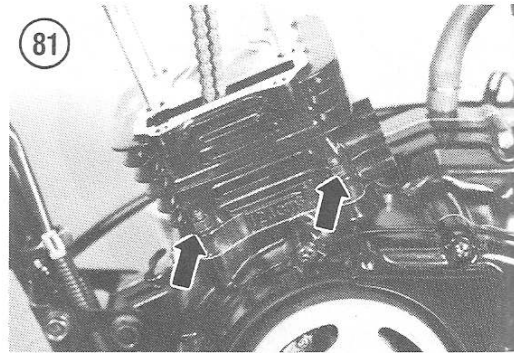
Do not twist or rotate the cylinder during removal or the piston rings may be damaged or broken.

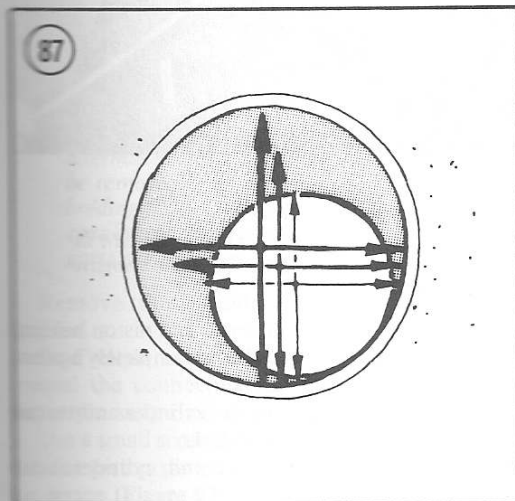
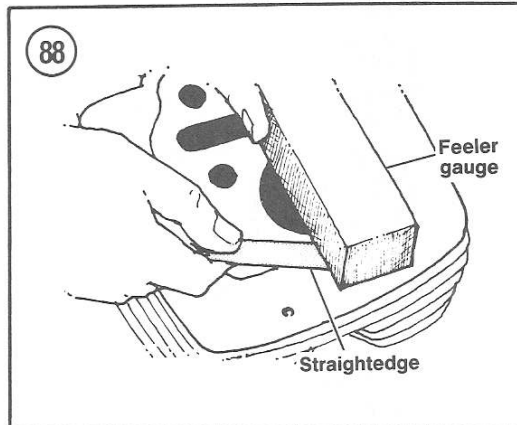
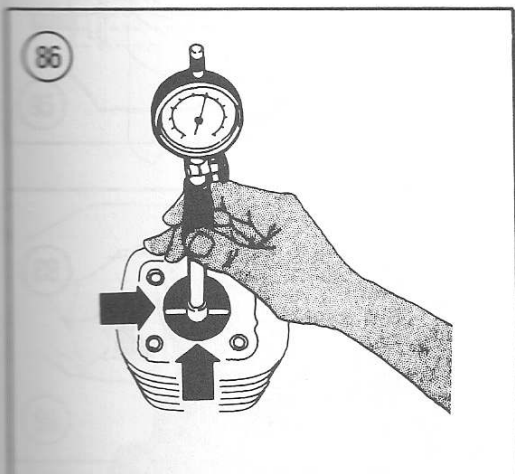
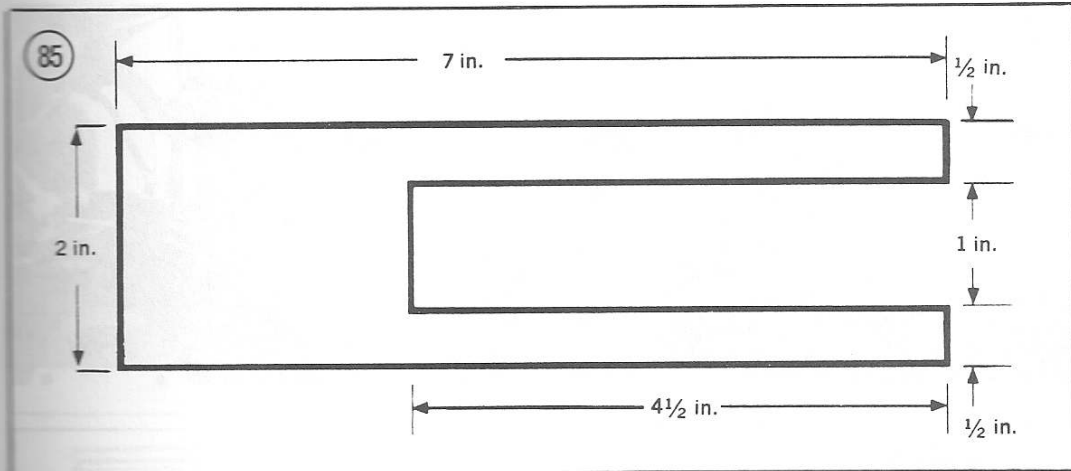
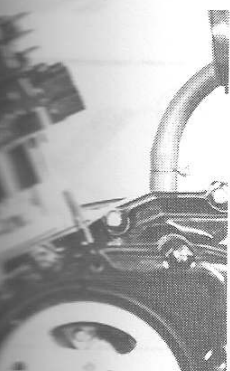
7. Remove and discard the cylinder base gasket.
8. Install a piston holding fixture under the piston (Figure 84) to protect the piston skirt from damage. This fixture can be purchased or may be a homemade unit of wood. See Figure 85.

Inspection

The following procedure requires the use of highly specialized and expensive measuring equipment. If such equipment is not available, have a dealer or machine shop perform the measurements.

1. Use an inside micrometer or cylinder bore gauge to measure the cylinder bore (Figure 86). Measure the bore at 3 locations as shown in Figure 87 and in 2 positions, 90° apart. Compare the measurements with the specifications in Table 5 and rebore the cylinder if necessary.



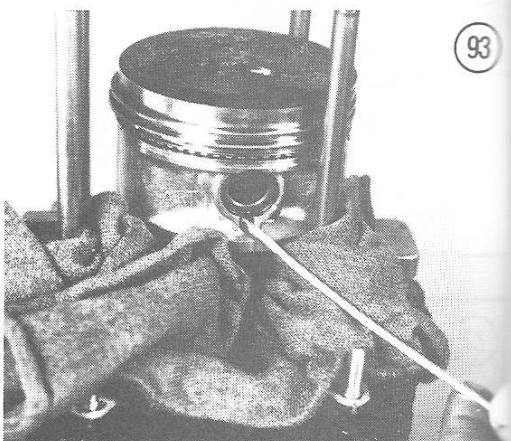
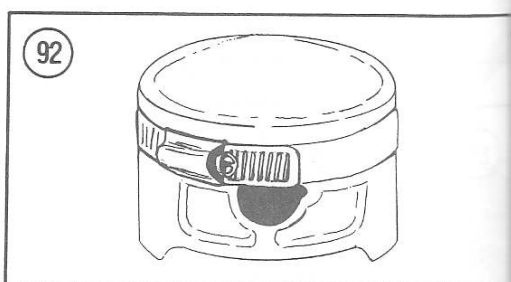
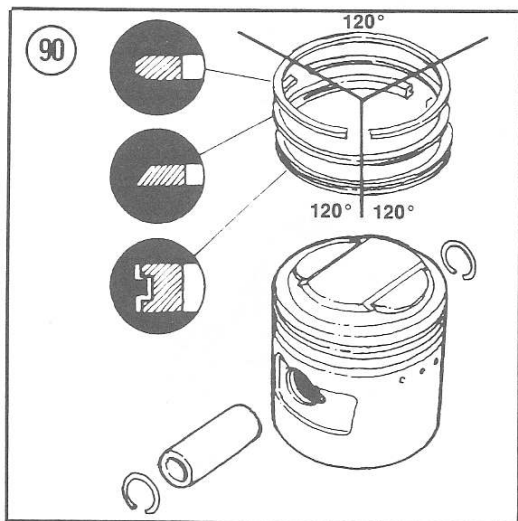
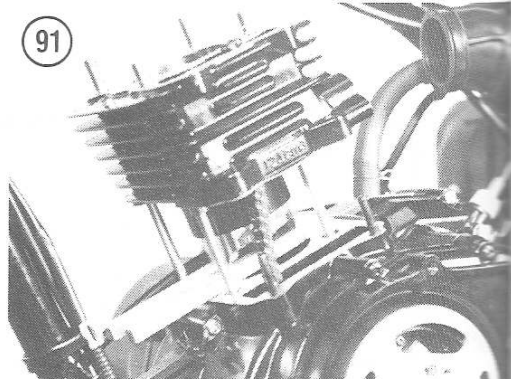
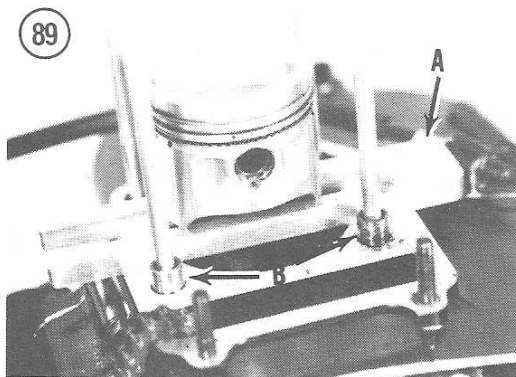


2. Examine the condition of the cylinder bore. The cylinder should be rebored if the surface is scored or abraded. Pistons are available in oversize increases of 0.5 mm and 1.0 mm. Purchase the oversize piston before having the cylinder bored. The piston must first be measured and the cylinder bored to match it in order to maintain the specified piston-to-cylinder clearance.

3. Use a straightedge and check the gasket surfaces of the cylinder with a feeler gauge in several places as shown in **Figure 88**. Such an inspection might be best performed by a dealer or machine shop. Replace the cylinder if any measurement indicates warpage of more than 0.05 mm (0.002 in.).

Installation

1. Remove any old gasket residue that may be stuck to the gasket surfaces on the cylinder and the crankcase. Wipe the surfaces clean with solvent or lacquer thinner.



2. Install a piston holding fixture under the piston (A, Figure 89).
3. Install a new base gasket and make sure that both dowel pins are properly positioned in the crankcase (B, Figure 89).
4. Stagger the rings on the piston so that the end gaps are approximately 120° from each other (Figure 90).

CAUTION

Do not line up any ring end gaps or the engine may have lower than normal compression and burn oil.

5. Oil the piston and the cylinder bore with assembly oil or engine oil. Feed the cam chain up through the chain tunnel and start the cylinder down over the studs (Figure 91). Compress the rings with your fingers or a ring compressor and carefully slide the cylinder over the piston until it contacts the piston holding fixture.

NOTE

A large hose clamp (Figure 92) can be used for an effective and inexpensive ring compressor.

6. Remove the ring compressor and piston holding fixture. Push the cylinder down completely against the gasket.
7. Install the nuts securing the cylinder and torque to the value specified in Table 1.
8. Install the cylinder head and cylinder head cover.

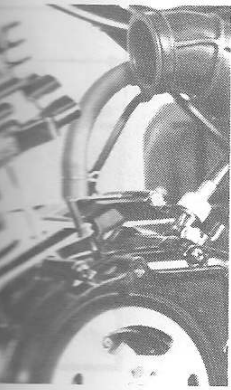
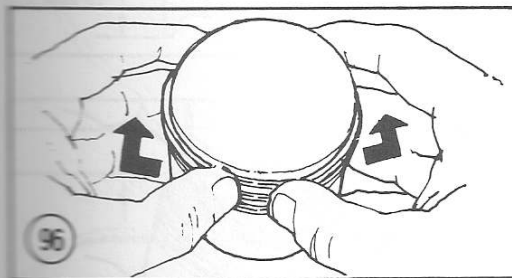
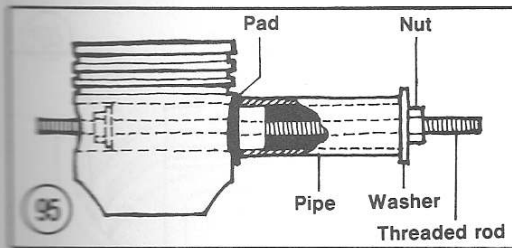
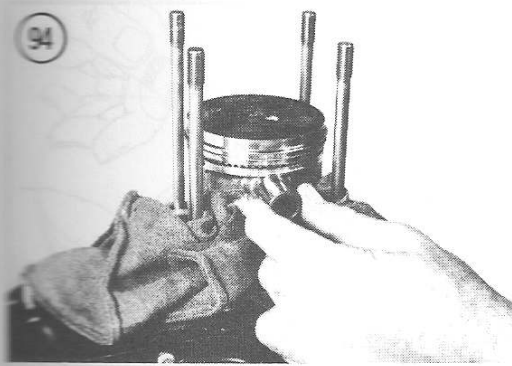


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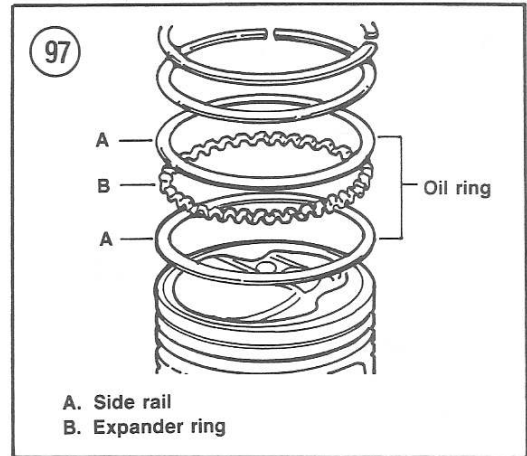
PISTON AND RINGS

Piston Removal

NOTE

Do not remove the piston if the engine is to be further disassembled and the alternator rotor and primary drive must be removed. The piston, with a simple holding fixture, can be used to hold the crankshaft from turning while these parts are removed.

1. Remove the cylinder as described in this chapter.
2. Stuff clean rags into the crankcase opening around the connecting rod to prevent dirt and piston pin snap rings from falling into the engine.
3. Use a small screwdriver or awl and carefully pry out one piston pin snap ring through the notch in the piston (Figure 93). Partially cover the opening



in the piston with your thumb to prevent the snap ring from flying out. Discard the old snap ring.
4. Use a wooden dowel or socket extension and push out the piston pin. Remove the pin and lift off the piston (Figure 94).

CAUTION

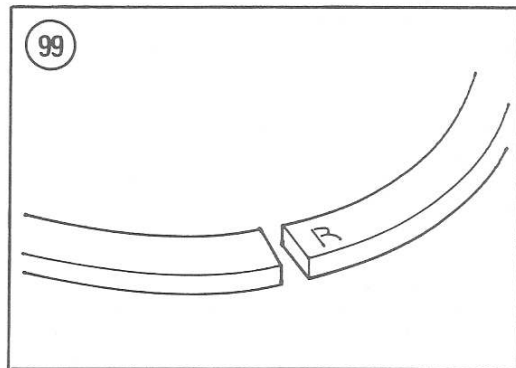
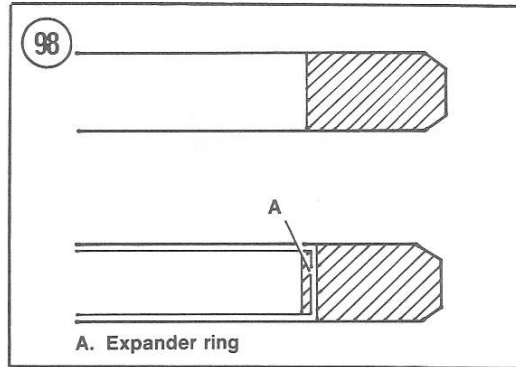
On some engines (particularly those with heavy use), the piston pin may be difficult to remove. Do not attempt to drive out the pin or connecting rod damage may result. If the piston pin cannot be pushed or gently tapped out, use a piston pin extractor tool. Refer to Figure 95 for an example of a homemade type. If such a tool is not available, have a dealer remove the piston pin. It is a quick and inexpensive job with the right tools and will prevent expensive engine damage.

Piston Ring Removal/Installation

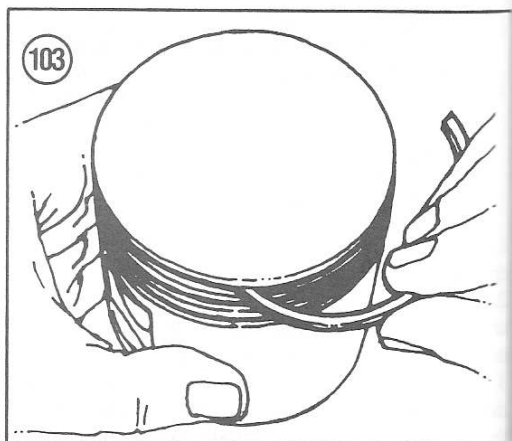
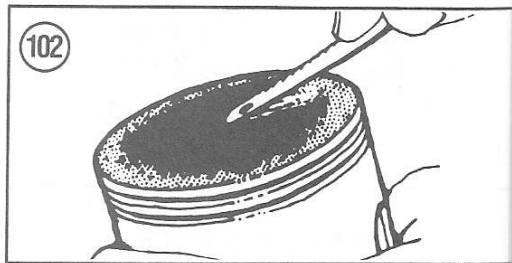
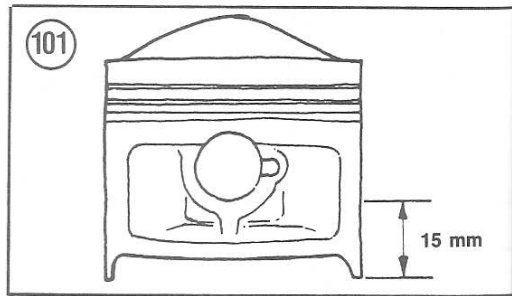
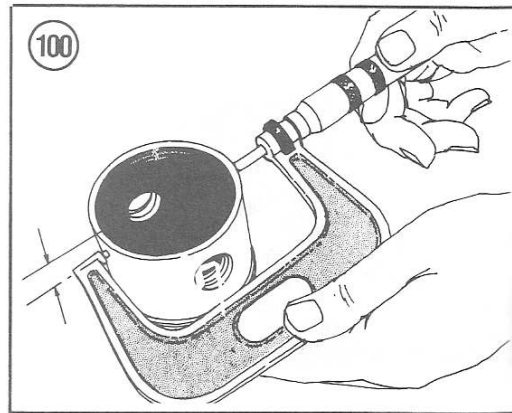
WARNING

The edges and ends of the piston rings are very sharp. Take care when handling the rings to avoid cut fingers.

1. To remove the piston rings, carefully spread the ring ends with your fingers as shown in Figure 96. Remove the rings over the top of the piston in the order they are installed.
2. Installation is the reverse of removal. Keep the following points in mind:
 - a. Install the oil ring spacer first, then install the side rails (Figure 97). New side rails do not have top and bottom designations. If reassembling used parts, install the side rails as they were removed.
 - b. The edge of the top ring is chrome plated and is brighter than the second ring.

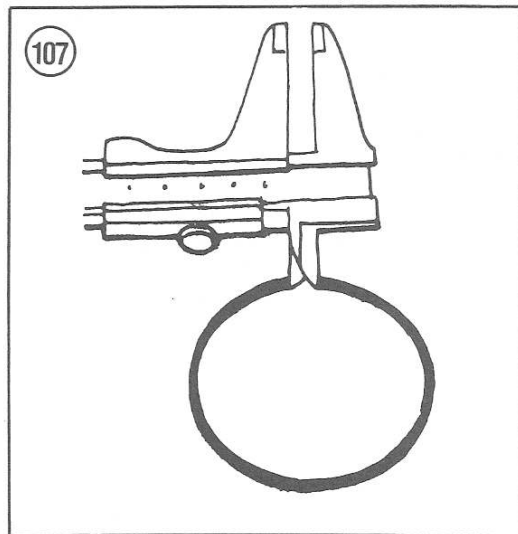
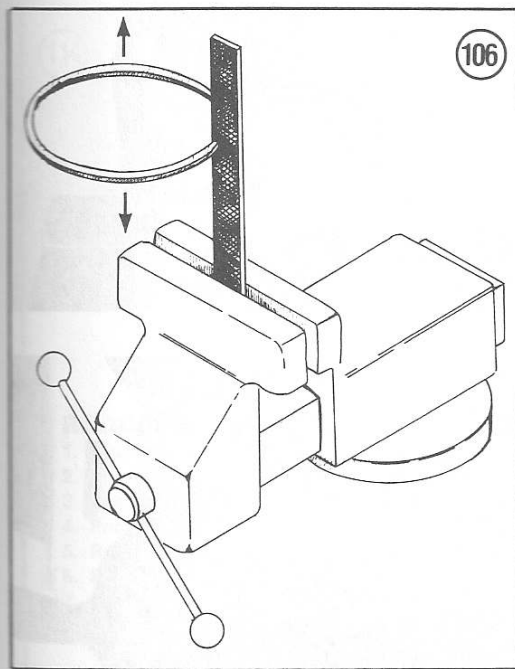
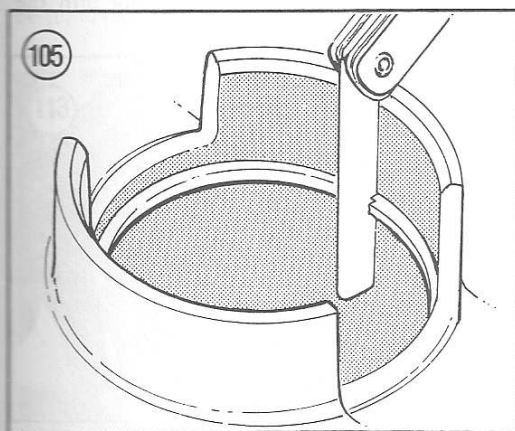
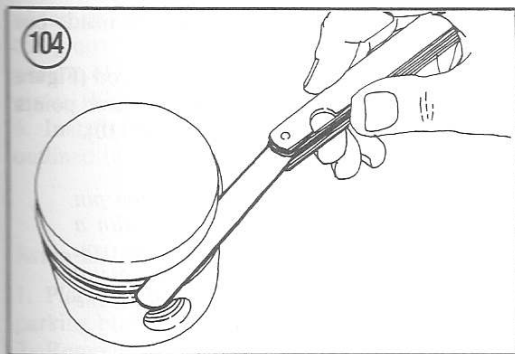
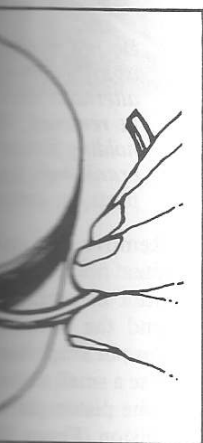
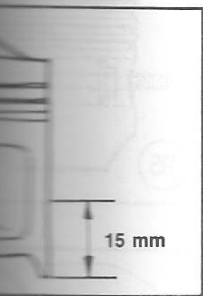


- c. The shapes of the top and second ring are different as shown in **Figure 98**.
- d. Install the expander ring into the second ring groove before installing the second ring.
- e. The top and second rings have an identifying letter on the ring ends (**Figure 99**). Always install the rings so the letters face toward the top of the piston.



Piston and Ring Inspection

1. Measure the outside diameter of the piston at right angles to the piston pin as shown in **Figure 100**. Measure the piston at a distance of 15 mm (0.59 in.) up from the bottom of the piston skirt (**Figure 101**). If the diameter of the piston is not within the tolerance specified in **Table 5** it must be replaced.
2. Clean the top of the piston with a soft metal scraper to remove carbon (**Figure 102**). Use a piece of old piston ring to clean the ring grooves (**Figure 103**). Thoroughly clean the piston in solvent or detergent and hot water.
3. Use a feeler gauge and check the side clearance of the rings in the piston grooves (**Figure 104**). If the clearance is greater than that specified in **Table**



6. measure the ring thickness, then the groove width to determine which part is worn. All parts worn beyond their respective service limits must be replaced. Ring thickness and groove width specifications are also shown in **Table 6**.

4. Place the 2 top piston rings, one at a time, into the cylinder bore and measure the ring end gap (**Figure 105**). Use the piston to push the ring squarely into the cylinder bore approximately 25 mm (1 in.). This measurement is required for new rings as well as old ones. Compare the actual ring gap to **Table 6** and replace the old rings if their gap is greater than the specified service limit. For new rings it is more likely that the gap will be less than minimum. If such is the case, clamp a fine file in a vise and carefully file the ring ends as shown in **Figure 106**.

5. Measure the free-state ring gap as shown in **Figure 107**. If the free-state ring gap is less than specified, the ring will not seal well and should be replaced.

6. Existing rings that are oversize can be identified in the following manner:

- The top 2 rings are stamped with code numbers next to the letter on the ring end. A 0.5 mm oversized ring is stamped "50" while a 1.0 mm oversized ring is stamped "100."
- An oversized oil ring spacer is identified by color codes. A 0.5 mm oversized spacer is painted red while a 1.0 mm oversized spacer is painted yellow.
- Oversized oil ring side rails must be measured with a caliper to determine their size. Oversized oil ring side rails are 0.5 mm or 1.0 mm larger than the standard size oil side rails.

7. Carefully examine the piston around the area of the skirt, pin and ring grooves for signs of cracks, stress or metal fatigue (Figure 108). Check the piston skirt for galling and abrasion which are usually caused by piston seizure due to lack of oil. If light galling is present, smooth the affected area with No. 400 emery paper and oil or a fine oilstone. If the galling is severe or if the piston is deeply scored, it must be replaced. Always replace the piston if any signs of abnormal wear are present or if there is any doubt as to its serviceability.

Piston Installation

1. Install the piston rings on the pistons as described in this chapter. Ensure that the identifying letters on the ring ends face toward the top of the piston.
2. Install one new snap ring into the piston pin groove.

CAUTION

If possible, always use new snap rings to secure the piston pin. An old snap ring could work out and cause serious and expensive engine damage.

3. Apply molybdenum disulfide grease such as Bel-Ray Moly Lube to the inside bore of the

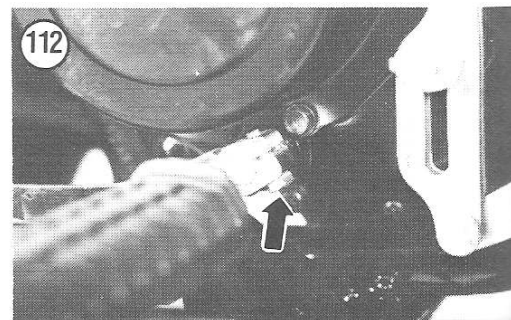
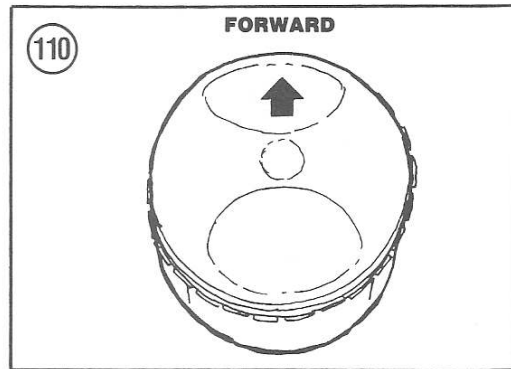
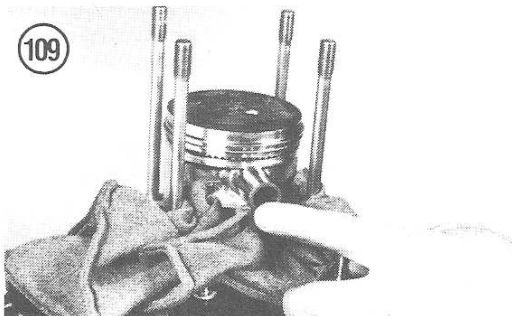
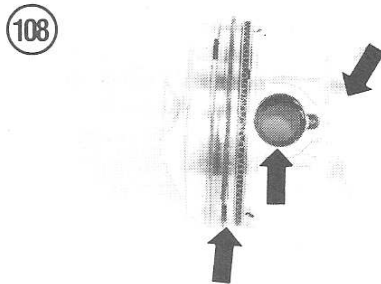
connecting rod, the piston pin and the inside pin bosses in the piston.

4. Install the piston on the connecting rod (Figure 109). Make sure that the arrow on the piston points toward the front of the engine (Figure 110).

CAUTION

If it is necessary to tap the piston pin into the connecting rod, do so with a soft-faced hammer. Make sure you support the piston to prevent the lateral shock from being transmitted to the lower connecting rod bearing.

5. Partially hold a new snap ring in position with your thumb and install the snap ring into the



piston groove. Make the groove. Then install the piston (Figure 110). Install the piston on the connecting rod.

Remove the Piston

1. Place the connecting rod on a clean surface.
2. Remove the piston from the connecting rod.
3. Remove the piston from the connecting rod.



- ### RECOIL SPRING
1. Check
 2. Thrust wash
 3. Piston pin
 4. Piston pin
 5. Return spring
 6. Retainer
 7. Seal
 8. Recoil spring

and the inside pin
connecting rod (Figure
on the piston points
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piston groove. Make sure the snap ring locks into the groove. Rotate the snap ring so that a solid portion of the snap ring is opposite the notch in the piston (Figure 111).

6. Install the cylinder and cylinder head as outlined in this chapter.

RECOIL STARTER

Removal/Installation

1. Place the machine on level ground and set the parking brake.
2. Remove the bolt securing the gearshift lever and remove the lever (Figure 112). The bolt must be removed completely, not just loosened.

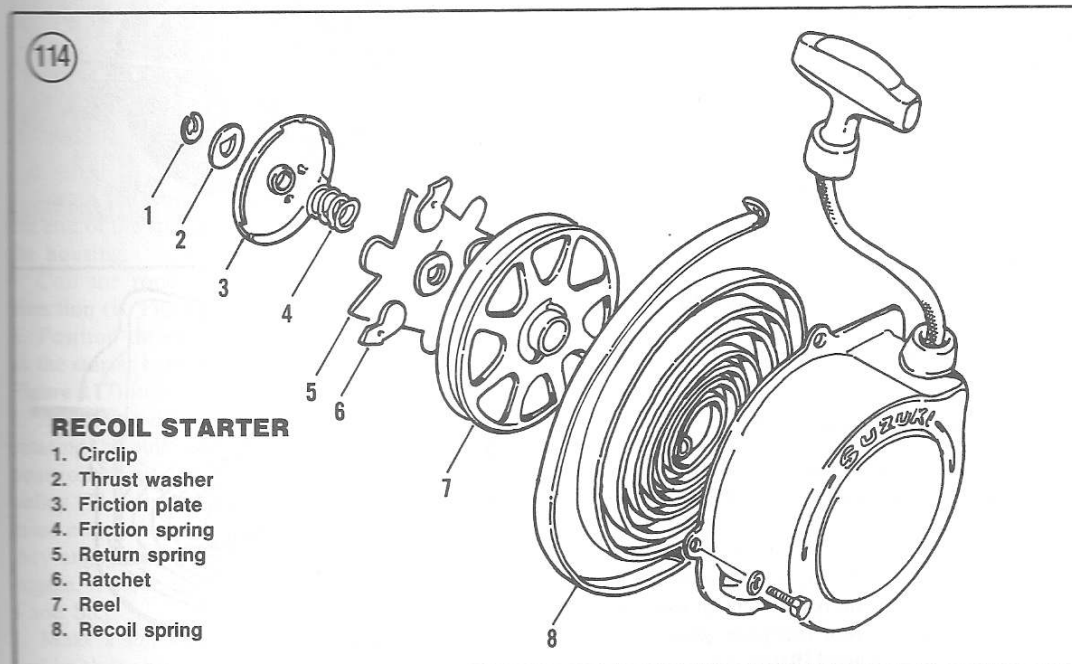
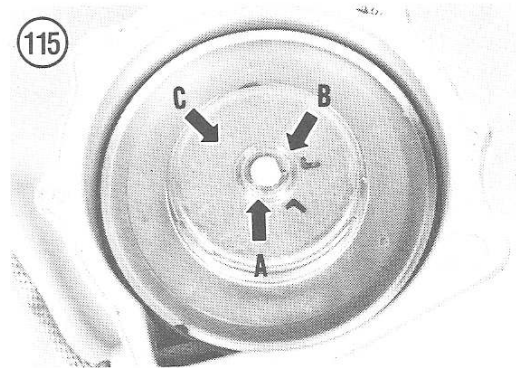
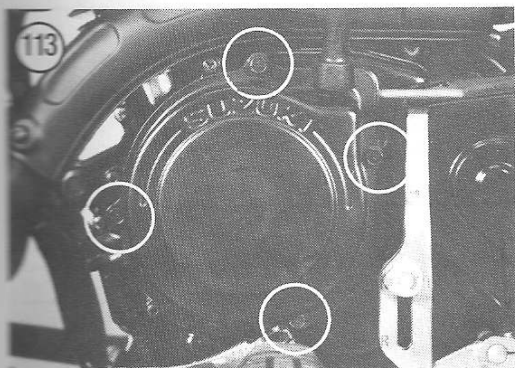
3. Remove the bolts securing the recoil starter unit and remove the starter (Figure 113).
4. Installation is the reverse of these steps.

Disassembly and Starter Rope Removal

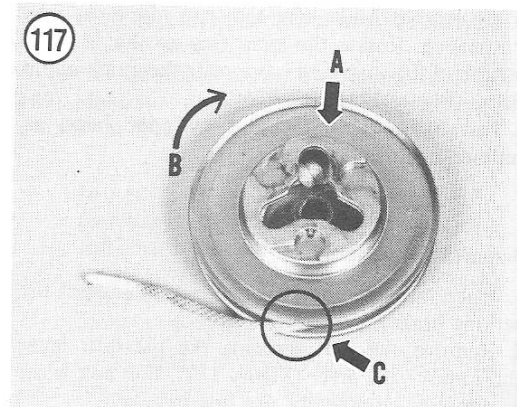
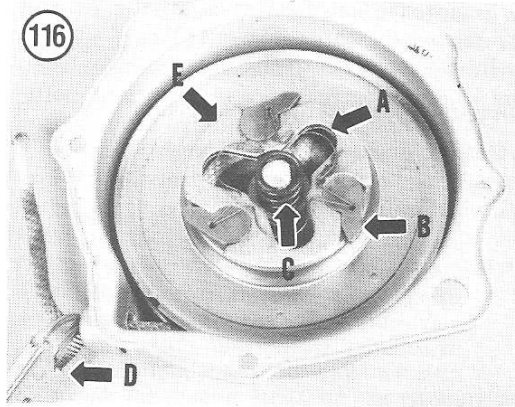
Refer to Figure 114 for this procedure.

WARNING

The starter return spring is under pressure and may jump out during the disassembly procedure. It is not a strong spring but has sharp edges that may cause cuts or eye damage. Always wear safety glasses and gloves when disassembling or reassembling the starter unit.



4



1. Remove the circlip and thrust washer (A and B, Figure 115). Lift off the ratchet cover (C, Figure 115).
2. Remove the ratchet springs (A, Figure 116), ratchets, (B, Figure 116), coil spring and washer (C, Figure 116).
3. Remove the rope handle from the rope and hold the rope with Vise Grip pliers (D, Figure 116).
4. Remove the Vise Grip pliers and slowly release the starter rope in the housing.

WARNING

The return spring may jump out at this time—protect yourself accordingly.

5. Remove the drive pulley (E, Figure 116).
6. Untie and remove the rope from the drive pulley.

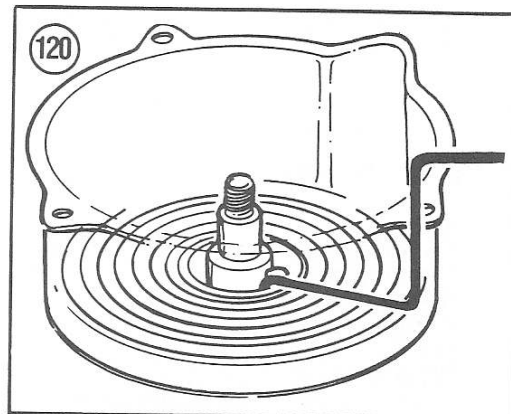
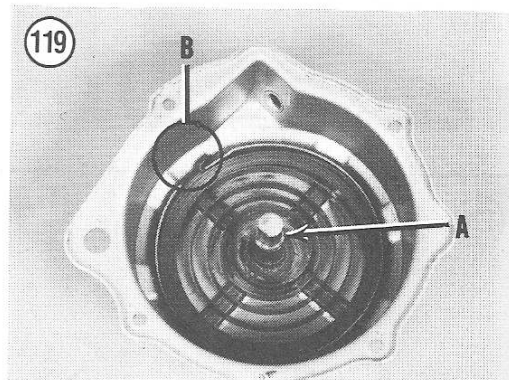
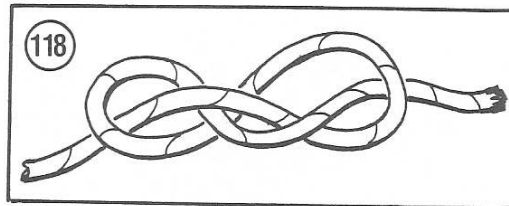
NOTE

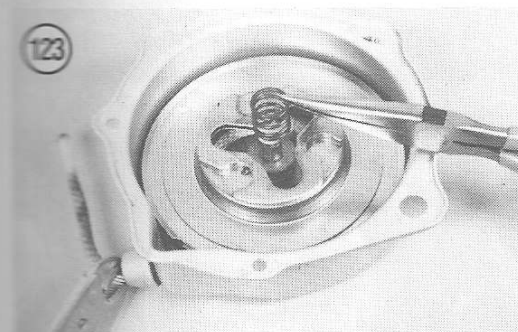
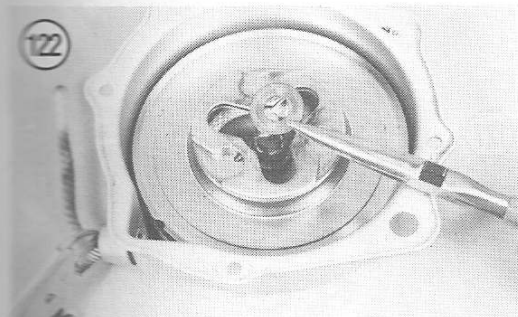
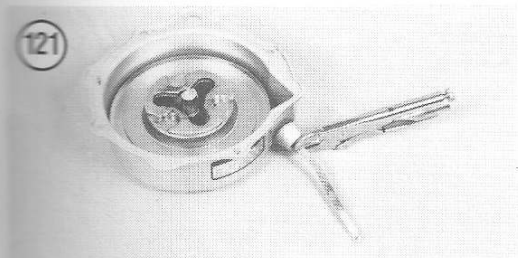
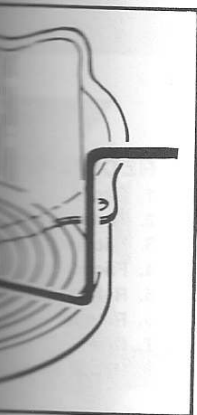
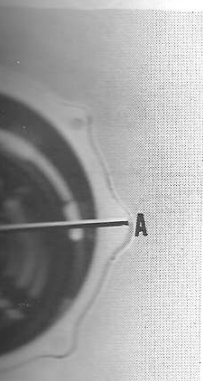
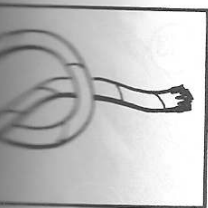
If the recoil starter is being disassembled for some malfunction other than rope replacement, it is a good idea to replace the rope as well and perhaps save repeating the job later.

7. Clean all the parts in solvent and dry them thoroughly.
8. Inspect all the parts and replace any that show signs of wear or damage.

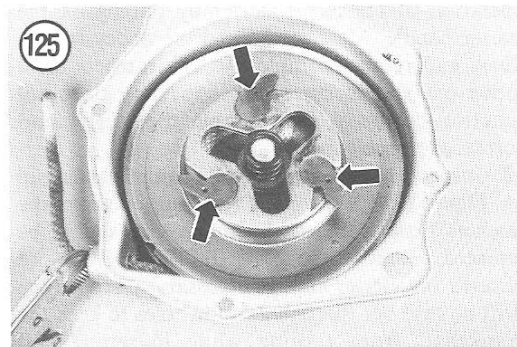
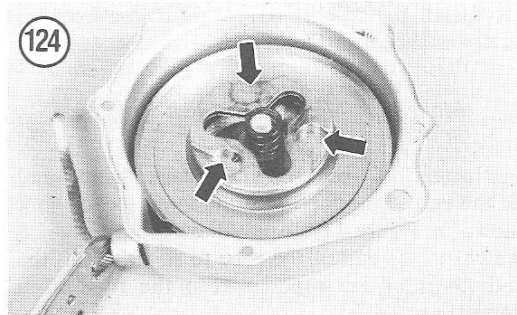
Assembly and Starter Rope Installation

1. Install a new rope in the drive pulley (A, Figure 117). Tie a special knot in the end as shown in Figure 118.
2. Apply heat (from a lighted match) to the end of the rope to slightly melt the end fibers of the nylon rope. This will keep the rope from unraveling.
3. Apply a film of multipurpose grease to the housing shaft (A, Figure 119).





4. Install the recoil spring into the housing. Hook the end of the spring on the hook (B, **Figure 119**) in the housing.
5. Coil the rope onto the ratchet in a *clockwise* direction (B, **Figure 117**).
6. Position the end of the rope in the drive pulley so the starter handle end is located in the notch (C, **Figure 117**) in the drive pulley.
7. Install the drive pulley into the housing while rotating the pulley *clockwise*. Make sure the rope is positioned up through the notch in the drive pulley. The pin on the bottom of the drive pulley must engage with the end of the recoil spring. If they engage, proceed to Step 10. If they will not engage, remove the drive pulley and perform Step 8 and Step 9.
8. Make a *soft* wire hook (do not use a stiff wire) and hook it onto the inner end of the return spring



- as shown in **Figure 120**. The other end of the hook must lay flat on top of the spring coils to allow the drive pulley to drop into position. The wire must be long enough so it can be pulled on.
9. Reinstall the drive pulley into the housing while turning the pulley *clockwise*. Make sure the rope is positioned up through the notch in the drive pulley. When the drive pulley comes into contact with the recoil spring, pull sideways on the hook to bring the inner end of the return spring away from the shaft in the housing. Continue to rotate the drive pulley and push it the rest of the way down until it seats and engages with the spring hook. Pull the soft wire hook out from between the drive pulley and the spring.
10. After engagement with the spring, rotate the drive pulley 2 turns *counterclockwise* to preload the return spring.
11. Hold onto the drive pulley and feed the rope out through the hole in the housing. Secure the rope with Vise Grip pliers (**Figure 121**).
12. Apply a light film of multipurpose grease to the washer and install the washer (**Figure 122**) and coil spring (**Figure 123**).
13. Apply a light film of grease to the contact areas where the ratchets ride (**Figure 124**).
14. Install the ratchets as shown in **Figure 125**. Install the ratchet springs (**Figure 126**).

15. Install the ratchet cover, thrust washer and circlip as shown in **Figure 115**.

NOTE

Make sure the circlip is seated correctly in the shaft groove.

16. Install the rope through the starter handle and tie the end of the rope with the same special knot shown in **Figure 118**. Apply heat (from a lighted match) to the end of the rope to *slightly* melt the end fibers of the rope to keep the rope from unraveling.

17. After completing assembly, check the operation of the recoil starter by pulling on the starter handle. Make sure the drive pulley rotates freely and returns completely. The ratchets must move out and in correctly. If the unit does not function correctly, disassemble the starter and correct the problem.

18. Inspect the rectangular holes in the starter cup (**A**, **Figure 127**). If the holes are damaged where the ratchets make contact, the starter cup should be replaced. Remove the bolts (**B**, **Figure 127**) and remove the starter cup. If necessary, place a long drift or steel bar through 2 of the holes to keep the crankshaft from turning while loosening and tightening the starter cup bolts.

CAUTION

Never place the drift or steel bar against the gearshift shaft to hold it in place while removing the starter cup bolts. The gearshift shaft may be bent.

MAGNETO

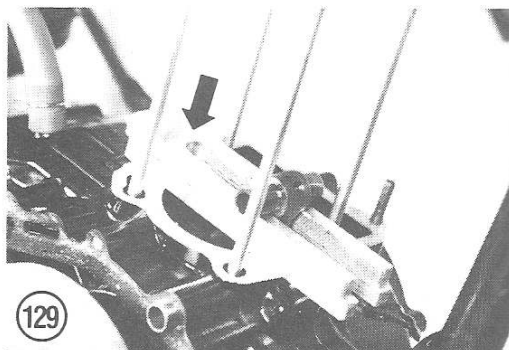
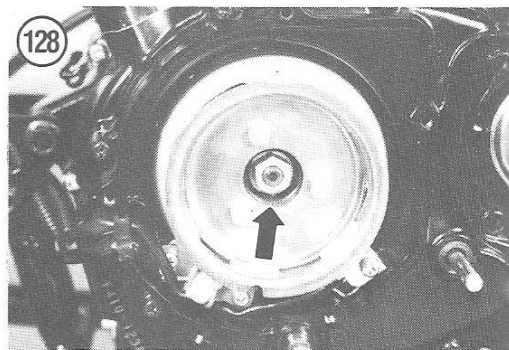
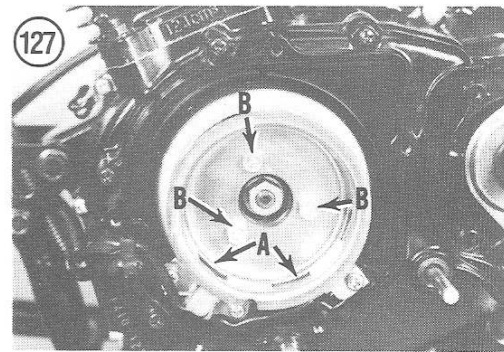
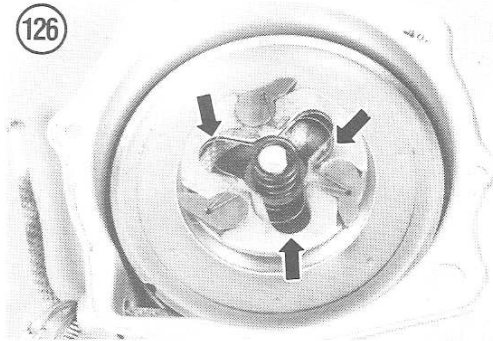
Flywheel Removal/Installation

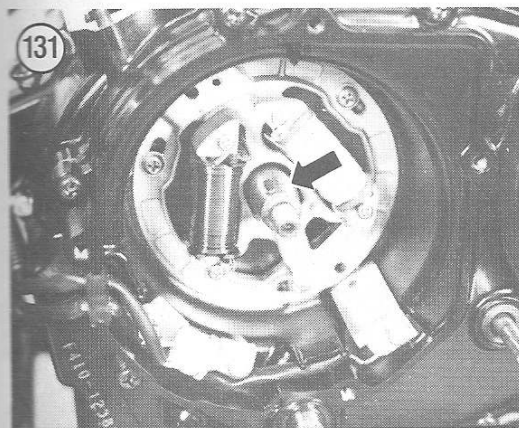
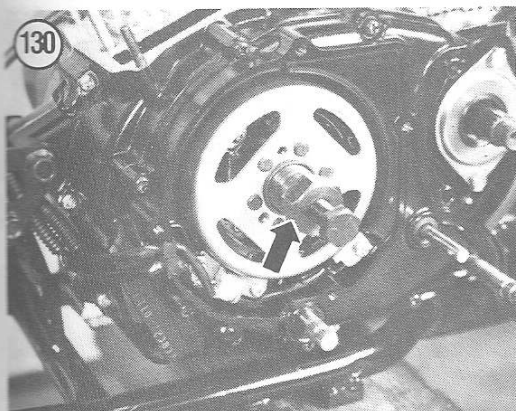
1. Remove the recoil starter assembly as outlined in this chapter.
2. Remove the nut, lockwasher and flat washer securing the flywheel (**Figure 128**). Use one of the following techniques to keep the crankshaft from turning while loosening the flywheel nut:
 - a. If the cylinder and/or piston have not been removed, insert a long drift or metal bar through the slots in the starter cup.

CAUTION

Do not place the metal bar or drift against the gearshift shaft to hold the tool in place while loosening the flywheel nut. The gearshift shaft may bend.

- b. If the cylinder and/or piston have been removed, use the holding fixture (**Figure 129**). The holding fixture can be homemade as





described under *Cylinder Removal* in this chapter.

3. Install a flywheel removal tool into the flywheel. Use the Suzuki slide-hammer attachment (part No. 09930-30161) or a K & N flywheel puller (part No. T-100/1). See **Figure 130**. The inner threads in the flywheel are left-handed. If using the K & N puller, remove the bolts securing the starter cup (B, **Figure 127**) and remove the cup to gain more room to operate the puller.

CAUTION

Do not try to get by without the necessary puller as any attempt to remove the flywheel without the proper tool will ultimately lead to some form of engine or flywheel damage. The K & N aftermarket pullers are available from most motorcycle shops or tool suppliers. The cost of these pullers is usually low and they make an excellent addition to any mechanic's tool box. If you can't buy or borrow a puller, have a dealer remove the flywheel.

4. Remove the flywheel as follows:
 - a. If using the Suzuki slide-hammer, operate the hammer with a few quick strokes until the flywheel is loose on the crankshaft.
 - b. When using the K & N puller, hold the outside of the puller with a wrench and gradually tighten the center bolt until the flywheel is loose on the crankshaft.

NOTE

If the flywheel is difficult to remove, tighten the puller bolt to apply pressure then strike the puller bolt smartly with a hammer. This technique will remove most stubborn flywheels.

CAUTION

If normal attempts to remove the flywheel fail, do not force the puller or improvise new removal methods. The threads in the flywheel may strip resulting in expensive damage. Refer the job to a dealer and have the flywheel removed.

- c. Remove the flywheel from the crankshaft and place it on a clean cloth. The magnets inside the flywheel will pick up small nuts and bolts.
 - d. Take care not to lose the Woodruff key (**Figure 131**). Remove the puller tool from the flywheel.
5. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Make sure the Woodruff key is installed in the crankshaft (**Figure 131**).

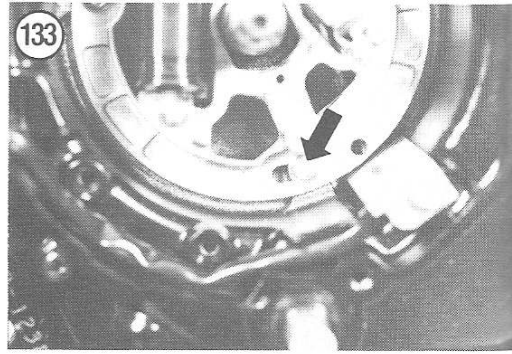
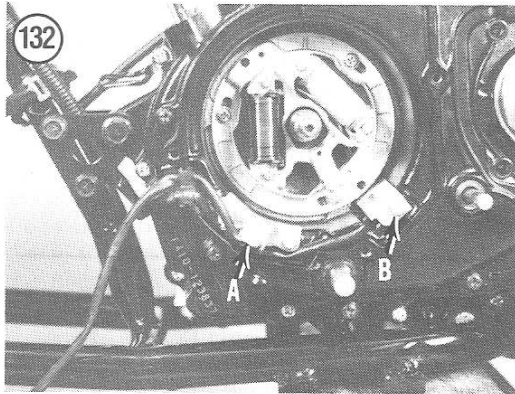
CAUTION

Carefully inspect the inside of the flywheel for small bolts, washers or other metal "trash" that may have been picked up by the flywheel magnets. If not removed, these metal bits will cause severe damage to an expensive magneto stator assembly.

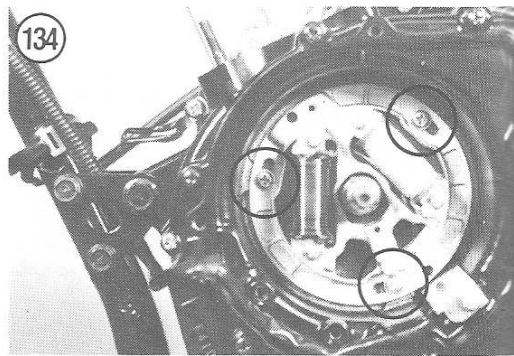
- b. Install the lockwasher and flat washer with the flywheel nut.
- c. Use the same technique to hold the crankshaft as performed during flywheel removal and tighten the flywheel nut to the torque value specified in **Table 1**.
- d. Install the recoil starter assembly.

Stator Removal/Installation

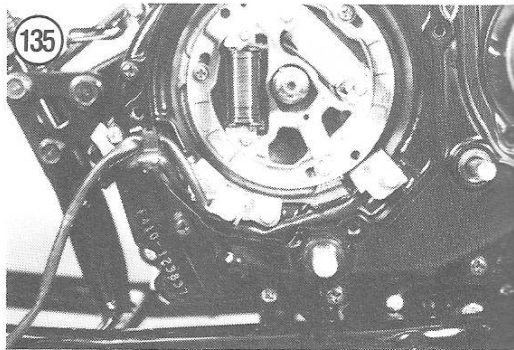
1. Remove the magneto rotor as outlined in this chapter.



2. Remove the screws securing the ignition pickup (A, **Figure 132**). Note how the wiring is routed.
3. Remove the screws securing the stator lead clamp (B, **Figure 132**).
4. Note the position of the stator in relation to the mounting screws with a scribe or felt tip pen so the stator assembly can be installed exactly as removed (**Figure 133**).
5. Remove the screws securing the stator assembly (**Figure 134**). Observe the following during removal:



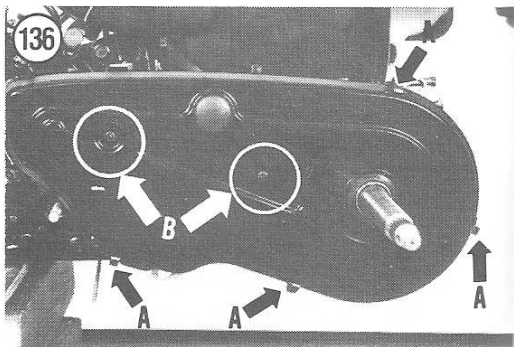
- a. Note how the stator wiring is routed around the edge of the magneto housing.
 - b. Note the position of the grommet securing the stator wiring to the housing.
6. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Install the stator assembly exactly as removed (**Figure 133**).
 - b. Route the ignition pickup and stator assembly wiring as shown in **Figure 135**. Make sure the grommets and the stator lead clamp secure the wiring as shown.

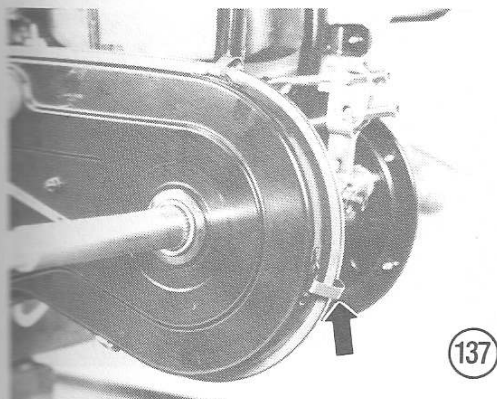


OUTER CHAIN CASE

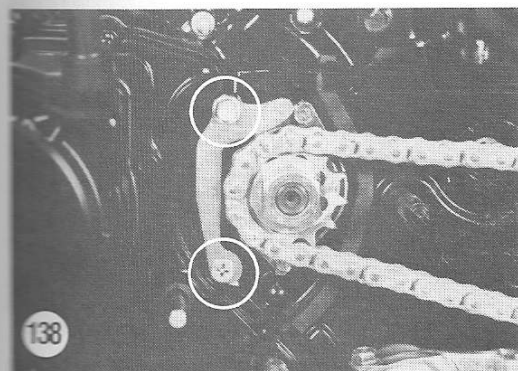
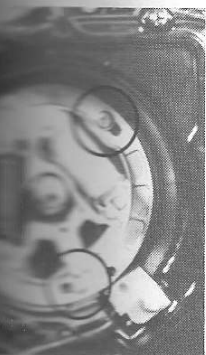
Removal/Installation

1. If the outer chain case is to be removed completely, refer to Chapter Nine and remove the left rear wheel and hub.
2. Release the clamps (A, **Figure 136**) securing the edges of the chain case.
3. Remove the nuts and washers securing the center of the chain case (B, **Figure 136**).
4. Slide the outer chain case back and clear of the inner case. Take care not to damage the dust seal around the axle hole in the chain case.
5. Installation is the reverse of these steps. Keep the following points in mind:

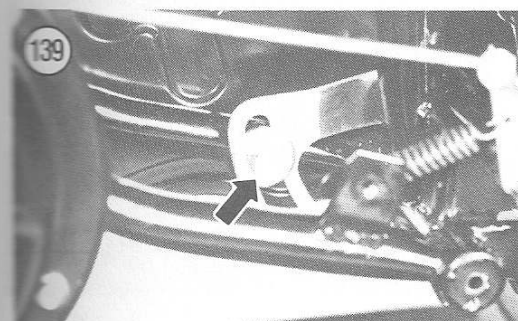




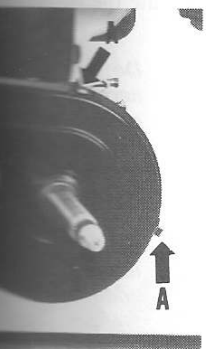
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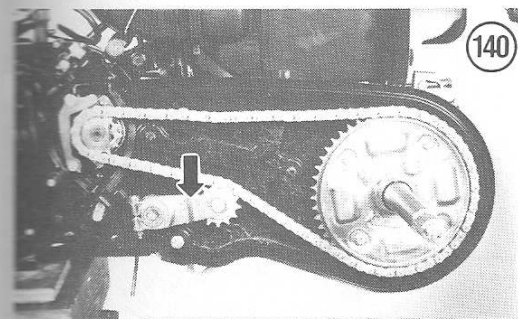
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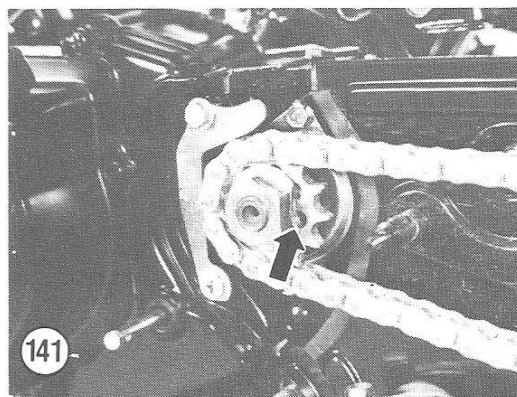
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A



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141

- Always check the condition, lubrication and slack of the drive chain whenever the outer chain case is removed. Refer to Chapter Three for chain lubrication and adjustment procedures.
- Inspect the rubber seal around the edge of the outer chain case. The seal must be in perfect condition or sand, dirt and water will enter the chain case and significantly shorten the life of the drive chain. Always replace the seal if any tears or splits are present.
- Install the outer case and snap the retaining clamps into place. Make sure each clamp snaps firmly over the edge of the inner chain case and locks into place (Figure 137).
- Install the washers and nuts to secure the center of the chain case. Do not overtighten the bolts or the chain cases may be damaged.

ENGINE SPROCKET

Removal/Installation

- Remove the seat and rear fender as outlined in Chapter Ten.
- Remove the outer chain case as outlined in this chapter.
- Remove the bolt and countersunk screw securing the case saver plate and remove the plate (Figure 138).
- Loosen the drive chain tensioner bolt (Figure 139, fuel tank removed for clarity). Pull down on the chain tensioner assembly (Figure 140) to provide as much slack in the drive chain as possible.
- Bend back the tab on the folding lockwasher securing the engine sprocket nut (Figure 141).
- Have an assistant hold on the brake or set the parking brake lever. Use a 27 mm socket and remove the engine sprocket nut. Note that the

recess in the nut is located against the sprocket (Figure 142). Remove the lockwasher.

7. Slide the sprocket off the drive shaft or roll the drive chain off the engine sprocket and remove the sprocket.

NOTE

The drive chain is an endless O-ring type without a master link. If the chain is new and not stretched, it may be necessary to remove the bolts securing the rear sprocket and slide both sprockets and the drive chain off at the same time. Refer to Chapter Nine for rear sprocket removal.

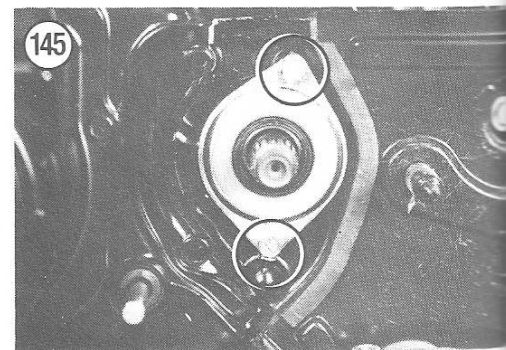
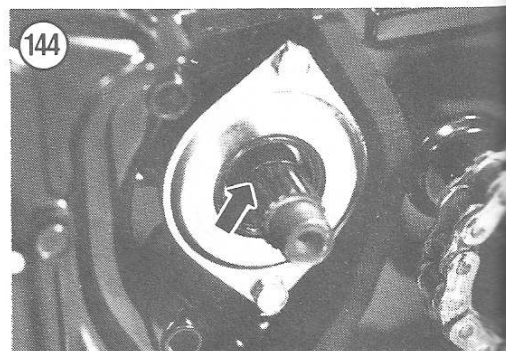
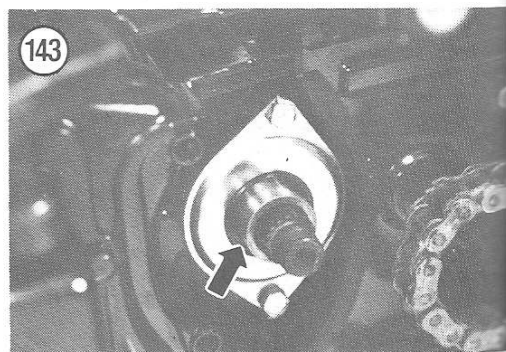
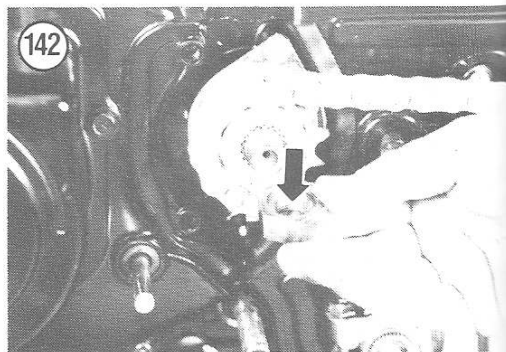
8. If the drive shaft seal is leaking it can be replaced without disassembling the engine. Refer to *Drive Shaft Seal Replacement* in this chapter.

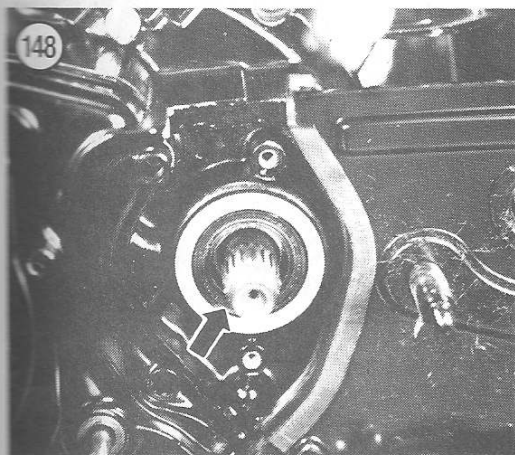
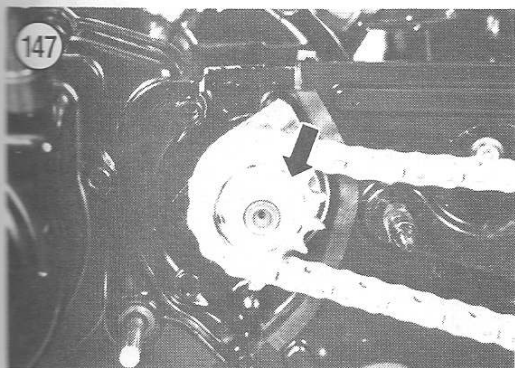
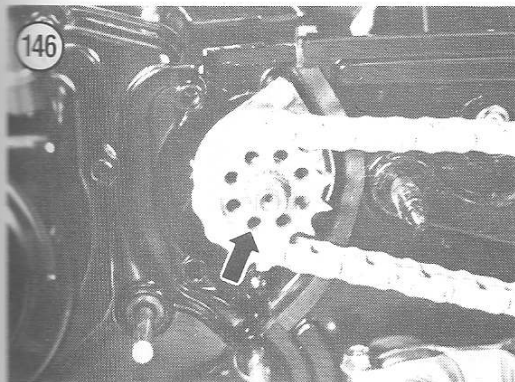
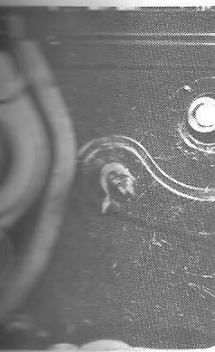
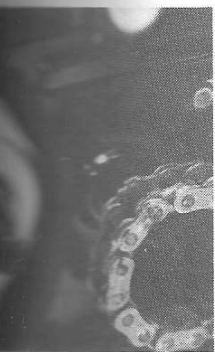
9. If the engine is being disassembled, perform the following steps. If only sprocket replacement is desired, proceed to Step 10.

- a. Remove the drive shaft spacer (Figure 143).
 - b. Remove the O-ring behind the drive shaft spacer (Figure 144).
 - c. Fold back the tabs securing the seal retainer bolts (Figure 145).
 - d. Remove the bolts securing the drive shaft seal retainer and remove the retainer.
10. Installation is the reverse of these steps. Keep the following points in mind:
- a. Install the drive shaft seal retainer, a new O-ring and the drive shaft spacer, if removed (Figure 144 and Figure 143). Make sure you fold the tabs over to secure the retainer bolts as shown in Figure 145.
 - b. Install the sprocket into the drive chain and slide the sprocket over the drive shaft (Figure 146).
 - c. Install the locking washer and sprocket nut (recess toward the sprocket) and torque the nut to the value specified in Table 1 (Figure 147).
 - d. Fold the tab of the locking washer over to secure the nut as shown in Figure 141.
 - e. Install the case saver plate with the bolt and countersunk screw as shown in Figure 138.
 - f. Install the outer chain case as outlined in this chapter.
 - g. Install the rear fender and seat.

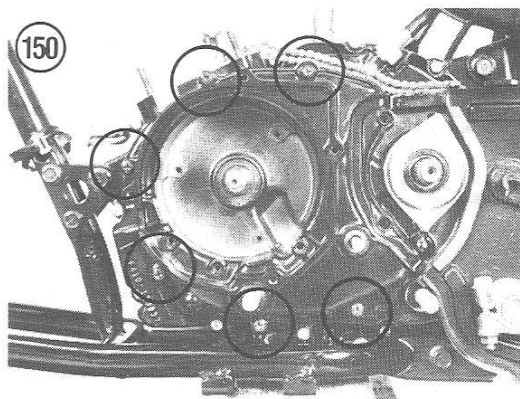
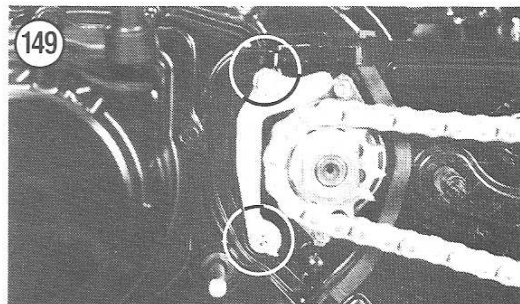
Drive Shaft Seal Replacement

1. Remove the engine sprocket, sprocket spacer, O-ring and seal retainer as described in this chapter.
2. Carefully pry the seal out of the crankcase (Figure 148).





3. If the seal is difficult to remove, refer to *Bearing and Seal Replacement* in this chapter.
4. Lightly grease the outside of the new seal and carefully tap the seal into place. Make sure the seal is flush with the outside edge of the crankcase.
5. Install the seal retainer, O-ring, sprocket spacer and engine sprocket as previously described.



MAGNETO HOUSING

Removal/Installation

1. Remove the seat and front fender as outlined in Chapter Ten.
2. Drain the engine oil as outlined in Chapter Three.
3. Remove the reverse gearshift mechanism as outlined in Chapter Five.
4. Remove the outer chain case as outlined in this chapter.
5. Remove the bolt and countersunk screw securing the case saver plate and remove the plate (Figure 149).
6. Remove the magneto flywheel and stator as outlined in this chapter.
7. Remove the bolts securing the magneto housing (Figure 150). Tap around the edge of the magneto housing with a rubber or plastic mallet to help break the housing loose from the engine and remove the housing. Have a few rags ready as some engine oil may run out. Remove the old gasket.
8. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Make sure that all gasket residue is removed from the sealing surfaces on the engine and magneto housing.

- b. If the engine was disassembled, make sure the reverse gears are correctly installed and aligned as shown in **Figure 151**.
- c. Install a new gasket *without sealer* on the engine. Locate the gasket over the dowel pins as shown in **Figure 152**.
- d. Install the magneto housing and tighten all the screws gradually and evenly.
- e. Install the magneto stator and flywheel.
- f. Install the case saver plate. Note that the countersunk screw is located in the lower hole.
- g. Install the outer chain case as outlined in this chapter.
- h. Install the reverse gearshift mechanism as outlined in Chapter Five.
- i. Install the front fender and seat.

OIL PUMP

The LT/ALT engine is equipped with a low pressure, high volume oil pump. The pump is not repairable and should be carefully inspected or replaced if the engine is undergoing a complete rebuild.

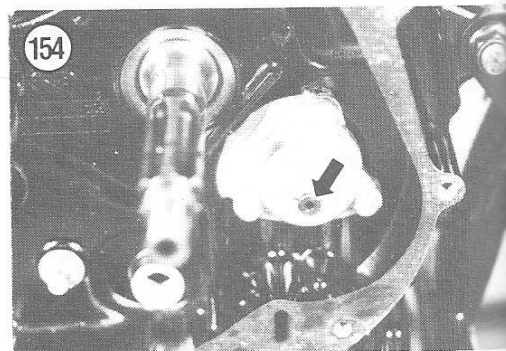
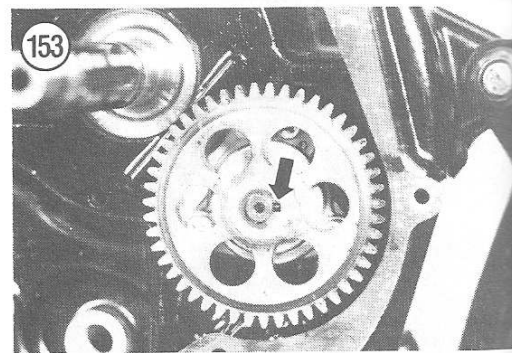
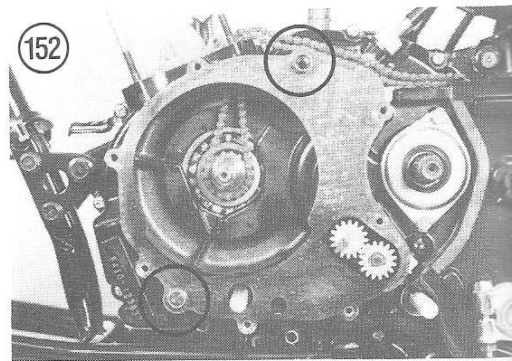
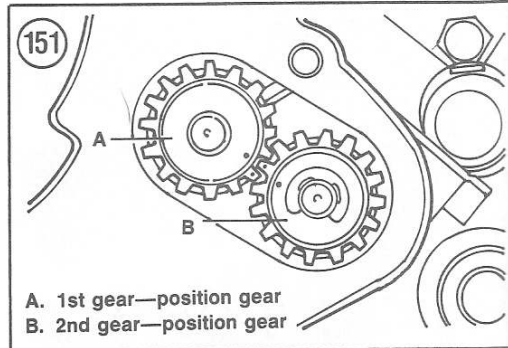
If abnormal oil pressure is suspected, have the pressure checked by a dealer; a special low pressure gauge is required to perform the task.

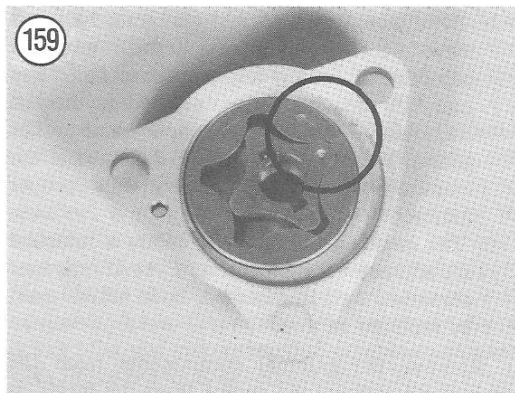
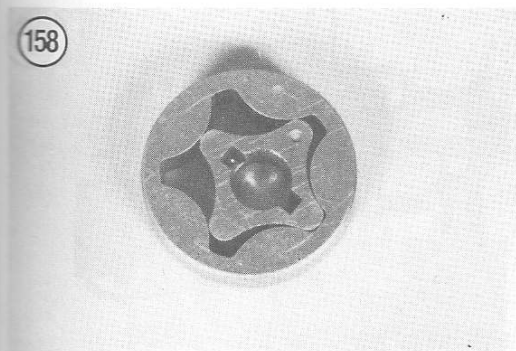
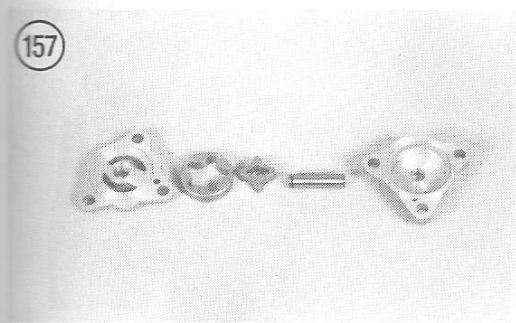
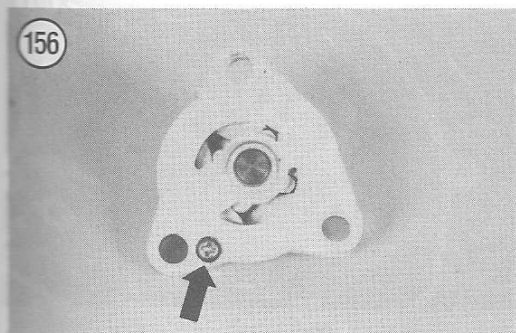
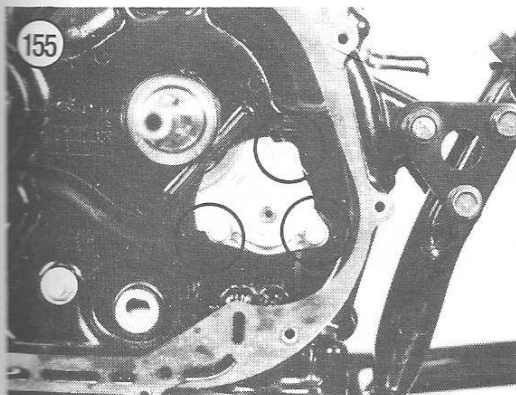
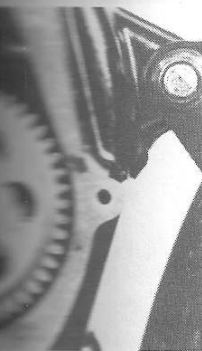
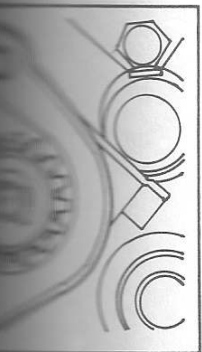
Removal/Installation

1. To gain access to the oil pump, refer to Chapter Five and remove the clutch.
2. Remove the E-clip securing the oil pump driven gear and remove the gear (**Figure 153**). Take care not to lose the drive pin from the pump shaft (**Figure 154**).
3. Remove the screws securing the oil pump and remove the pump (**Figure 155**).
4. Installation is the reverse of these steps. Use blue Loctite (Lock N' Seal No. 2114) on the screws securing the pump. Ensure that the pump driven gear is installed as shown in **Figure 153**.

Disassembly/Inspection/Assembly

1. Remove the screw securing the oil pump body halves (**Figure 156**).
2. Push the shaft back through the pump body and disassemble the pump inner and outer rotors from the pump body (**Figure 157**).
3. Clean the pump components in solvent and carefully examine the inner and outer surfaces of both pump rotors (**Figure 158**). Replace the pump if any signs of galling or wear are visible.
4. Inspect the inner surfaces of both pump body halves. Replace the pump if any visible signs of scoring or damage are present.





5. Reassemble the pump rotors into the pump body. Make sure the 2 punch marks on the inner and outer rotors are aligned as shown in **Figure 159**.

6. Install the pump shaft and drive pin. Ensure that the rear drive pin engages the inner rotor.

7. Install the rear half of the pump body. Apply blue Loctite (Lock N' Seal No. 2114) to the pump body screw and install the screw (**Figure 156**).

CRANKSHAFT AND CRANKCASE

The crankshaft assembly is made up of 2 full-circle flywheels pressed together on a crankpin. The connecting rod big-end bearing on the crankpin is a needle bearing assembly. The complete crankshaft assembly is supported in 2 roller bearings in the crankcase.

The 2-piece crankcase splits vertically along the centerline of the connecting rod. Disassembling (splitting) the crankcase provides access to the crankshaft, transmission and internal gearshifting components.

The following procedures represent a complete, step-by-step process that should be followed if an engine is to be completely reconditioned. However, if you are replacing a known failed part, the disassembly need only to be carried out until the failed part is accessible. Further disassembly is unnecessary as long as you know that the remaining components are in good condition and that they were not affected by the failed part.

Disassembly

Keep the following important items in mind when the crankcase is separated or serious and expensive engine damage may result:

- a. *Never* attempt to pry the crankcase halves apart with a screwdriver or similar sharp instrument or the sealing surfaces of the crankcase halves will be damaged.

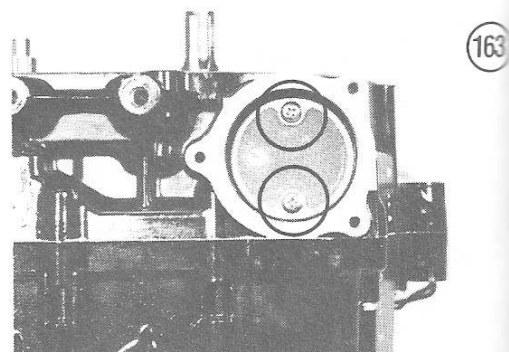
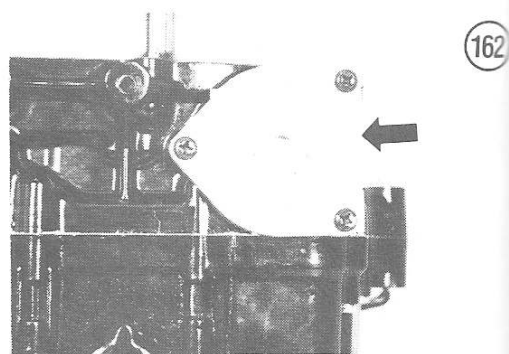
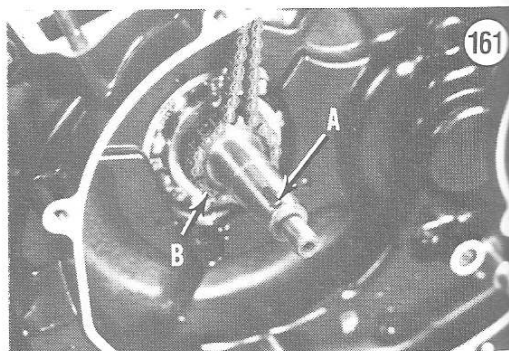
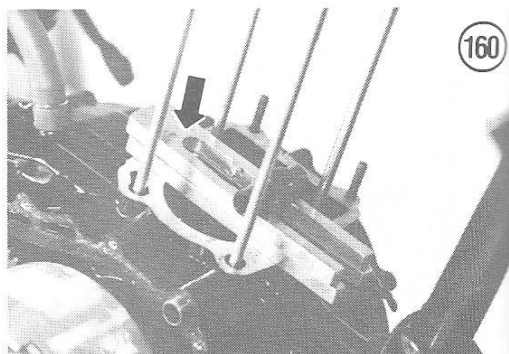
- b. Always remove the right crankcase half and leave the transmission and gearshift components in the left crankcase half. The gearshift cam stopper is installed in the left crankcase. The cam stopper and other gearshift components can be damaged if the crankcase is not separated in the proper manner.
- c. The engine crankcase halves are a matched set and are very expensive. Even if only one crankcase half is damaged, both halves must be replaced as a set.

1. Remove the external components from the engine and remove the engine from the frame as outlined in this chapter.
2. Install the engine on an engine stand or use a holding fixture. If an engine stand is not available make a simple holding fixture from 2×4 inch wood.

NOTE

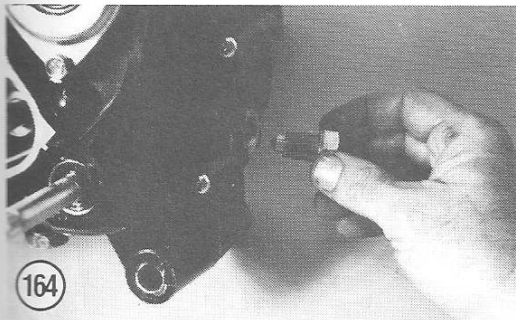
If the nuts securing the engine sprocket and/or the magneto flywheel were not loosened during engine removal, 2 methods may be used to hold the crankshaft from turning when the engine is removed from the frame. A simple piston holding fixture as described during piston removal in this chapter (Figure 160) can be used to hold the connecting rod while loosening the magneto flywheel nut. To loosen the engine sprocket nut, place a copper washer (or a penny) between the primary drive and driven gears.

3. Remove the engine sprocket and/or the magneto flywheel as outlined in this chapter. Remove the magneto stator and magneto housing if not previously removed.
4. Remove the Woodruff key from the crankshaft (A, Figure 161).
5. Remove the cam chain from the lower sprocket (B, Figure 161).
6. Remove the screws securing the oil sump cover (Figure 162) and remove the cover.
7. Remove the screws securing the oil sump screen and remove the screen (Figure 163).
8. Remove the spring-loaded neutral detent (Figure 164).
9. Use a hammer-driven impact tool and loosen the screws securing the crankcase halves (Figure 165).
10. Before removing the crankcase screws, cut a cardboard template approximately the size of the crankcase and punch holes in the template for each





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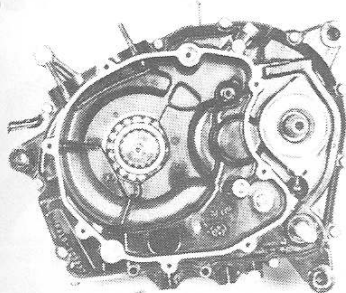


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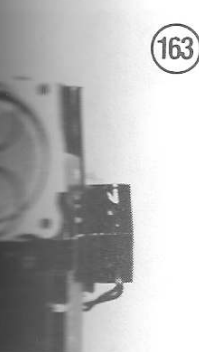
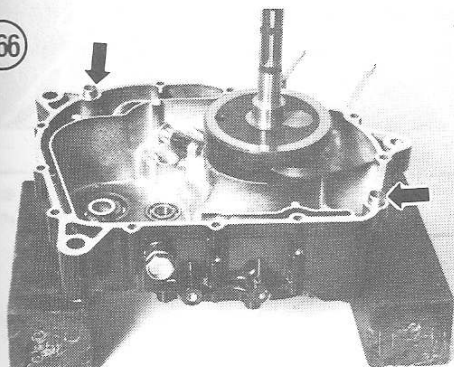
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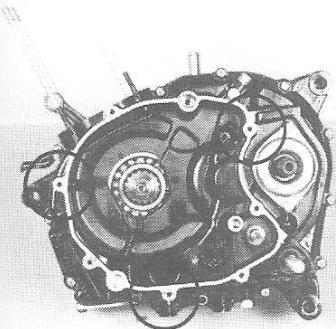
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163

167



screw location. Place each screw in a template hole as it is removed. This will greatly speed up the assembly time by eliminating the search for the correct length screw.

11. Use a plastic or rubber mallet and tap around the seam of the crankcase halves to help break the seal loose. If the crankcase halves are difficult to separate, it may be necessary to use a puller to remove the right crankcase half. Many universal type pullers will work or use the Suzuki puller (part No. 09920-13111). If the proper tools are not available, have the crankcases separated by a dealer. Do not risk expensive crankcase damage with improper tools or techniques.

12. Take care not to lose the locating dowel pins (Figure 166). The pins may be in either crankcase half. If the pins are secure, it is not necessary to remove them.

13. The crankshaft can be removed at this time, if desired. The crankshaft is installed in the left crankcase main bearing with a press fit. Install the same puller used during crankcase separation in the threaded holes in the left crankcase (Figure 167) and carefully push the crankshaft out of the left main bearing.

CAUTION

Do not attempt to drive the crankshaft out of the main bearing with a hammer or crankshaft alignment may be disturbed.

14. At this point of disassembly, major service can be performed on any part of the crankcase assembly. Crankshaft and transmission seals and bearings can be removed and installed and all critical inspections can be performed. The crankshaft seals should always be replaced each time the crankcase is disassembled. Refer to *Bearing and Seal Replacement* in this chapter.

Inspection

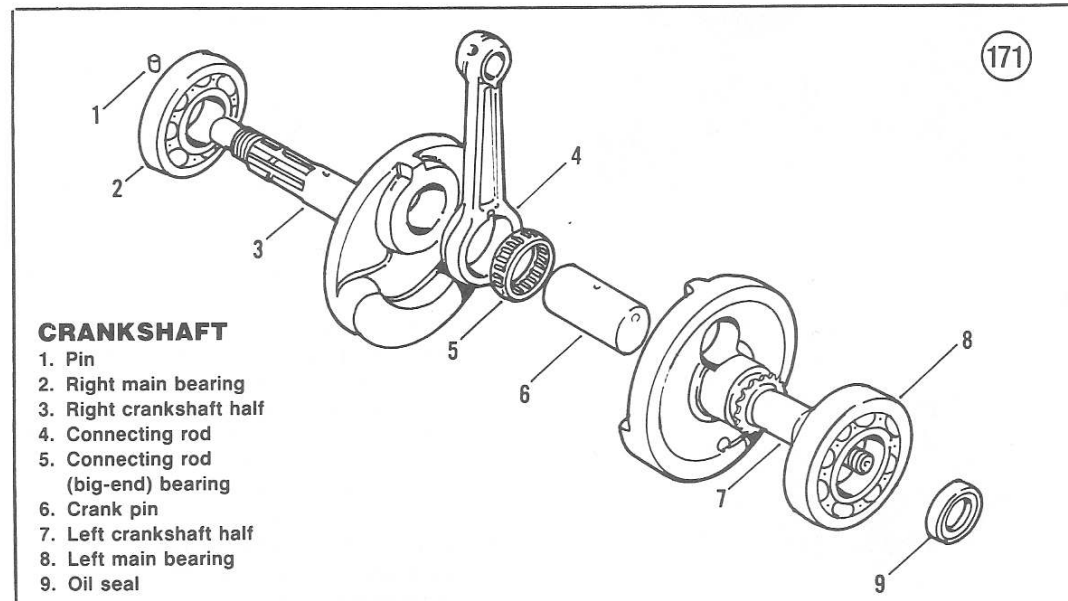
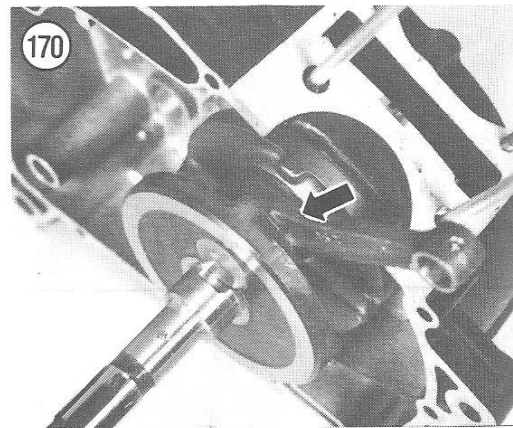
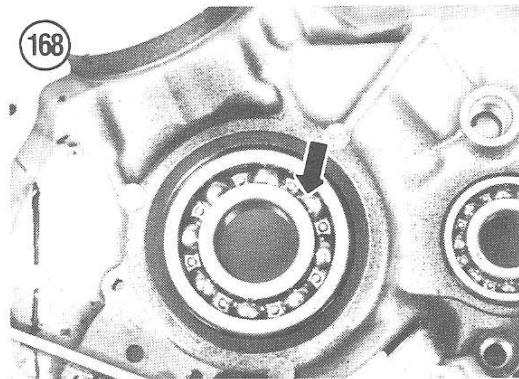
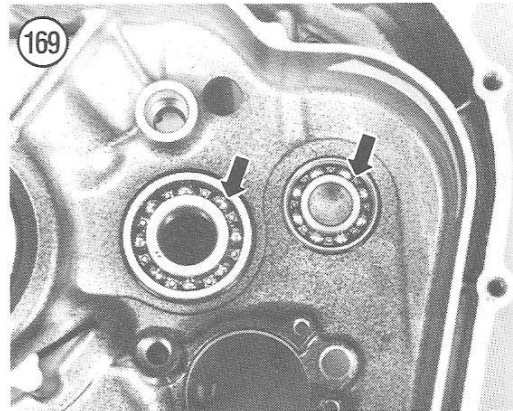
Except for preliminary checks, all crankshaft service and repair should be entrusted to a dealer. The crankshaft is pressed together and requires a heavy duty hydraulic press to separate and assemble it as well as considerable experience and know-how to correctly align it.

1. Carefully examine the crankshaft main bearings (Figure 168) and transmission bearings (Figure 169) in both crankcase halves. The bearings must spin freely without excessive play or roughness. If there is any roughness or discoloration or if you have any doubt as to the condition of the bearings, have them inspected and/or replaced by a dealer.

2. Measure the big end side clearance on the connecting rod with a feeler gauge. This can be performed with the crankshaft still installed in the left main bearing in the crankcase (Figure 170). Clearance should be as specified in Table 7. If the side clearance is out of tolerance, refer the crankshaft to a dealer or machine shop for repair. See Figure 171.

3. If the crankshaft is removed, have a dealer or machine shop check the following:

- Inspect the connecting rod deflection and crankshaft runout with a dial indicator and V-blocks. Refer to Table 7 for crankshaft service specifications.
- Measure the width of the crankshaft (Figure 172). The crankshaft width must be within the tolerance specified in Table 7. This is



particularly on
been rebuilt.

4. Check the crank
Figures 173 for con-
with, around the
holes. While the
it should be checked
major malfunctions
failure or after a cold
found, they should
welding shop expert
aluminum castings.

5. Make sure the
crankshaft are clean
them out with com-

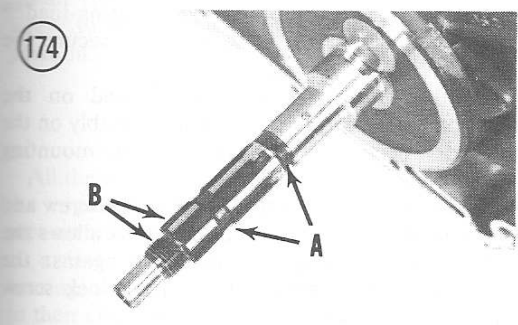
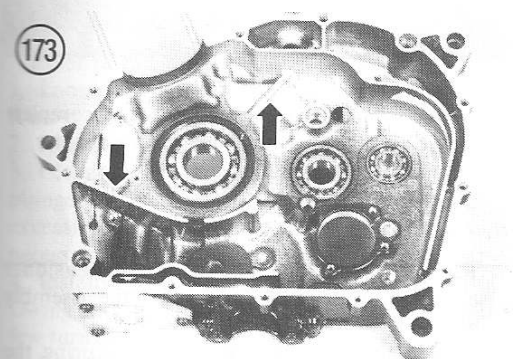
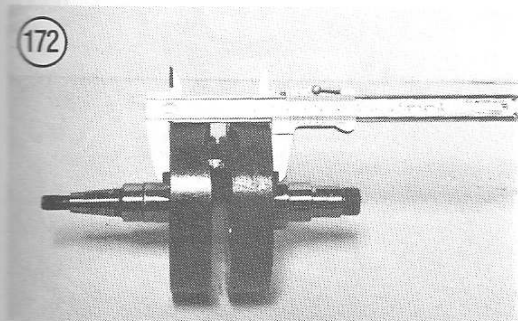




particularly important if the crankshaft has been rebuilt.

4. Check the crankcase halves inside and outside (Figure 173) for cracks or fractures in the stiffening webs, around the bearing bosses and at threaded holes. While the likelihood of such damage is rare, it should be checked for, particularly following a major malfunction such as a bearing, piston or gear failure or after a collision. If cracks or fractures are found, they should be repaired (if possible) by a welding shop experienced in repairs on precision aluminum castings.

5. Make sure the oil holes in the end of the crankshaft are clean and free (A, Figure 174). Blow them out with compressed air.



6. Examine the threads and splines on the end of the crankshaft (B, Figure 174). If the threads are only slightly damaged, a machine shop may be able to repair them. If the splines are damaged, the defective half of the crankshaft will have to be replaced.

7. Refer to Chapter Five for inspection procedures on all clutch, transmission, gearshift and primary gear components.

Assembly

1. Make sure all engine parts are clean and all fasteners are in good condition. Replace all bolts, nuts, and screws that have damaged heads or threads.

2. Carefully remove all traces of old sealant residue from the sealing surfaces on both crankcase halves (Figure 175). Use a wooden scraper or similar device to clean off the old sealant. Never use a metal scraper or the sealing surfaces may be damaged. Wipe the surfaces clean with solvent or lacquer thinner.

3. Install new seals in both crankcase halves. Lightly grease the lips of all seals.

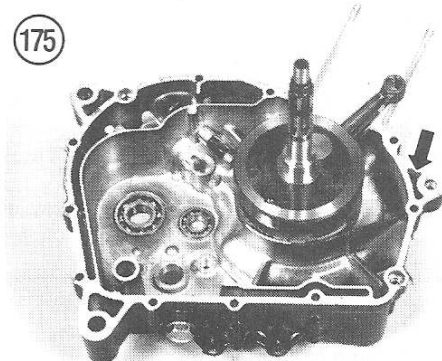
NOTE

Always install new seals whenever the engine is disassembled. The cost of the new parts is nominal when compared to the extra work and aggravation required to repeat the job later for a leaky seal.

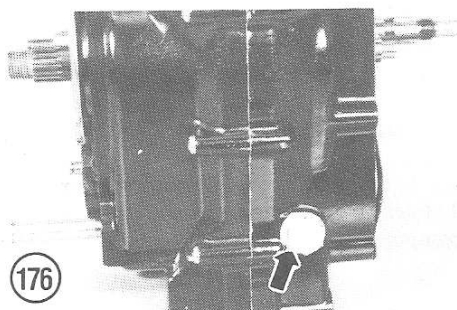
4. If the crankshaft was removed, have it installed by a dealer. A special tool (Suzuki part No. 09910-32812) is necessary to pull the crankshaft into the left main bearing.

CAUTION

Do not attempt to drive the crankshaft into the left main bearing with a mallet or the crankshaft alignment will be disturbed.



4



5. Check that both dowel pins are installed in one crankcase half (Figure 166).
6. If transmission or internal gearshift components were removed for repair, install them at this time. Refer to Chapter Five for installation procedures. Ensure that all parts are correctly installed and all thrust washers are properly positioned.

CAUTION

During all steps of engine assembly, frequently rotate the crankshaft and other moving parts. If any binding or stiffness is present, find out why and correct the problem before continuing the assembly. An engine that feels rough when rotated by hand will not "wear in." Such an engine will usually fail and cause expense damage if run.

7. Carefully apply a small amount of Suzuki Bond No. 1215 (or equivalent) to the sealing surfaces on both crankcase halves.
8. Install the right crankcase half and tap it gently into place. The dowel pins should align and both sealing surfaces should fit together. If the crankcase half does not fit down fully, stop and investigate the problem.

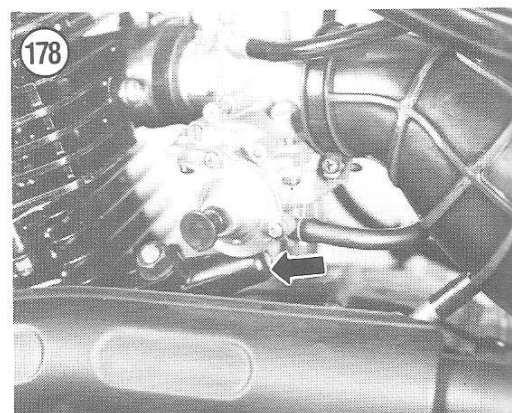
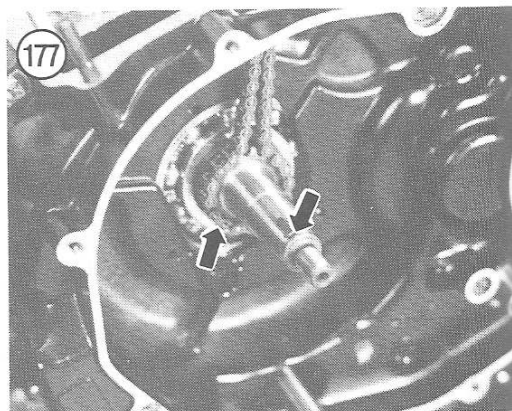
CAUTION

The crankcase halves should fit together without force. If they do not fit together fully, do not attempt to pull them together with the crankcase screws or the crankcase halves will be warped and damaged.

9. When the crankcase halves are properly fitted, install the crankcase screws. Tighten the screws gradually and evenly in a crisscross pattern.
10. Install the neutral detent (Figure 176).
11. Install the cam chain and Woodruff key as shown in Figure 177.

NOTE

On engines undergoing a complete rebuild, it is recommended that a new cam chain be installed.



12. Install the engine in the frame and complete the engine assembly as outlined in this chapter.

CAM CHAIN TENSIONER

Removal/Installation

1. Remove the bolts securing the tensioner assembly to the cylinder and remove the assembly (Figure 178).
2. Loosen the locknut (Figure 179) securing the plunger lock screw.
3. Completely compress the spring-loaded plunger. Tighten the lock screw to secure the plunger.
4. Make sure the gasket is installed on the tensioner assembly and install the assembly on the cylinder. Secure the tensioner with the mounting bolts.
5. Loosen the locknut securing the lock screw and back off the lock screw one turn. This allows the spring-loaded plunger to move in against the internal chain tensioner. Tighten the lock screw and secure the screw with the locknut.

Disassembly/Assembly

- Refer to Figure 180 for:
1. Loosen the locknut and remove the lock screw.
 2. Remove the plunger.
 3. Clean the parts in plunger and tensioner for excessive wear. Replace if necessary.
 4. Install a new O-ring (O-ring and lock screw a few turns into the tensioner).
 5. Lightly grease the plunger. Install the spring and lock screw to secure the plunger in position.

BEARING REPLACEMENT

All the engine seals should be replaced when the engine is completely rebuilt to prevent an oil leak and to extend the life of the engine at a later date. Crankshaft bearings should be replaced if they are worn to their condition.



... and complete
... in this chapter.

TENSIONER

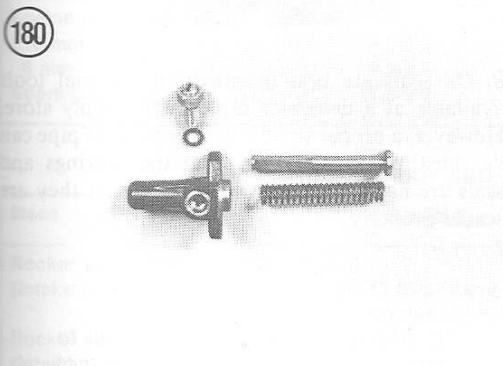
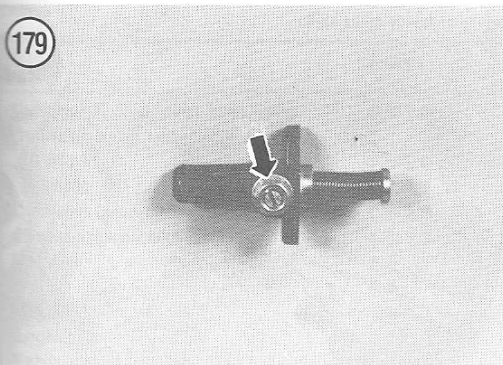
... the tensioner
... the assembly

... (179) securing the

... the spring-loaded
... screw to secure the

... installed on the
... the assembly on the
... with the mounting

... the lock screw and
... This allows the
... in against the
... the lock screw
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Disassembly/Assembly

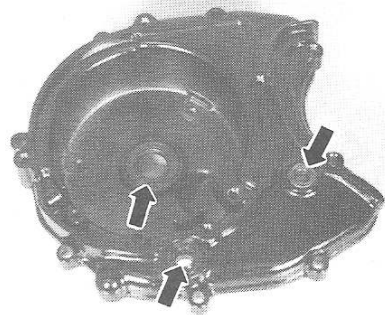
Refer to **Figure 180** for this procedure.

1. Loosen the locknut securing the lock screw and remove the lock screw from the tensioner body.
2. Remove the plunger, spring and O-ring.
3. Clean the parts in solvent and inspect the plunger and tensioner body for damage or excessive wear. Replace the worn parts as necessary.
4. Install a new O-ring on the lock screw. Oil the O-ring and lock screw and install the lock screw a few turns into the tensioner body.
5. Lightly grease the plunger and tensioner body. Install the spring and plunger. Tighten the lock screw to secure the plunger in the compressed position.

BEARING AND SEAL REPLACEMENT

All the engine seals should be replaced whenever the engine is completely disassembled. It may prevent an oil leak and the labor to perform the job at a later date. Crankshaft and transmission bearings should be replaced if there is any doubt as to their condition.

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1. The bearings and seals are installed in the crankcases with an interference fit. Place the crankcases (one at a time) in an oven and heat them to about 100° C (212° F). An easy way to check the proper temperature is to drop tiny drops of water on the crankcase; if they sizzle and evaporate immediately, the temperature is correct.

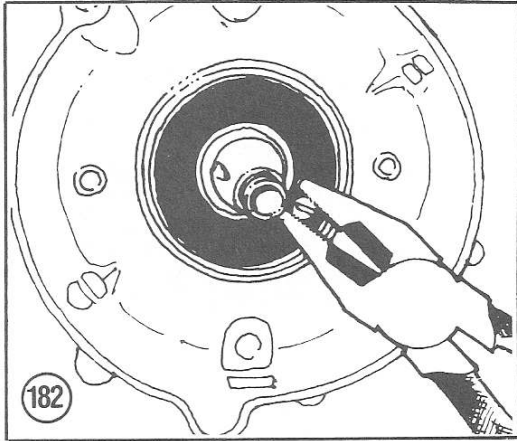
CAUTION

*Heating the crankcases should only be done in an oven, **never** use a torch (propane or acetylene). It is impossible to uniformly heat the crankcases with a torch and the crankcases could easily be warped by the uneven heat. Direct heat on a bearing could also destroy the hardness of the bearing material.*

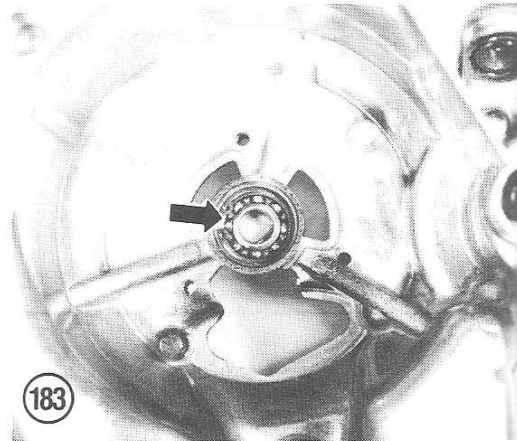
2. When the crankcase is properly heated, use kitchen pot holders or gloves and remove the crankcase half from the oven—remember, it is *hot*.
3. Carefully pry out the old seals. See **Figure 181** for a typical example. If any seal is particularly stubborn to remove, use an awl to punch a small hole in the steel backing of the seal. Install a small sheet metal screw into the seal and pull the seal out as shown in **Figure 182**. Make sure you do not install the screw too deep or it may contact the bearing behind it.
4. When removing bearings, first remove any bearing retainers such as the snap ring securing the bearing in the clutch cover (**Figure 183**). Heat the case as described in Step 1 and tap the case sharply on a piece of soft wood to release the bearing. Continue to tap until the bearing(s) fall out. Repeat for the other crankcase half.

CAUTION

*Make sure you tap the crankcase squarely on **soft** wood. Avoid damaging the sealing surfaces on the crankcases.*



5. If the bearings are stubborn to remove, they can be gently tapped out with a socket or piece of pipe the same size as the bearing outer race.
6. While heating the crankcases in the oven, place the new bearings in a freezer, if possible. Chilling the bearings will slightly reduce their overall diameter, while the hot crankcase is slightly larger due to heat expansion. This will make installation of the bearings much easier.
7. While the crankcase is still hot, press each new bearing into place in by hand until it seats completely. Do not hammer it in. If the bearing will not seat, remove it and cool it again. Reheat the crankcase and install the bearing again.



8. Oil seals are best installed with special tools available at a dealer or motorcycle supply store. However, a proper sized socket or piece of pipe can be substituted. Make sure that the bearings and seals are not cocked in the hole and that they are seated properly.

CAUTION

If bearings or seals are difficult to remove or install, do not take a chance on expensive crankcase damage. Have the work performed by a dealer or competent machine shop.

Tables are on the following pages.

Item	Tolerance
Cylinder head cover to	
Cylinder head nut	
(8 mm)	
(8 mm)	
Cylinder base nut	
Crankshaft sprocket bolt	
Magneto flywheel nut	
Clutch sleeve hub nut	
Engine oil drain plug	
Engine sprocket nut	
Exhaust pipe clamp nut	
Muffler mounting bolt	
Engine mounting bolts	
18 mm	
8 mm	
Spark plug	

Item	Tolerance
Rubber arm inside diam	
(intake and exhaust)	
Rubber shaft outside diam	
(intake and exhaust)	

Item	Tolerance
Cam lobe height (intake)	
Crankshaft deflection	
Crankshaft journal clear	
Crankshaft journal outside	
Crankshaft bearing journal	

Item	Tolerance
Valve stem deflection	
Valve head deflection	

Table 1 ENGINE TORQUE SPECIFICATIONS

Item	mkg	ft.-lb.
Cylinder head cover bolt	0.9-1.0	6.5-7.0
Cylinder head nut (8 mm)	1.5-2.0	11.0-14.5
(6 mm)	0.7-1.1	5-8
Cylinder base nut	0.7-1.1	5-8
Camshaft sprocket bolt	1.1-1.3	7.0-9.5
Magneto flywheel nut	5-6	36.0-43.5
Clutch sleeve hub nut	4-6	29.0-43.5
Engine oil drain plug	1.8-2.0	13-14
Engine sprocket nut	8-10	58.0-72.5
Exhaust pipe clamp nut	0.9-1.2	6.5-8.5
Muffler mounting bolt	1.8-2.8	13-20
Footrest mounting bolts	2.0-3.1	14.5-22.5
Engine mounting bolts		
10 mm	8.0-9.5	58.0-68.5
8 mm	2.8-3.4	20.0-24.5
Spark plug	1.5-2.0	11-14

Table 2 ROCKER ARM AND ROCKER SHAFT SPECIFICATIONS

Item	Standard	Service limit
Rocker arm inside diameter (intake and exhaust)	12.000-12.018 mm (0.4724-0.4731 in.)	-
Rocker shaft outside diameter (intake and exhaust)	11.977-11.995 mm (0.4715-0.4722 in.)	-

Table 3 CAMSHAFT SPECIFICATIONS

Item	Standard	Service limit
Cam lobe height (intake and exhaust)	32.400-32.440 mm (1.2756-1.2772 in.)	32.100 mm (1.2638 in.)
Camshaft deflection	-	0.10 mm (0.004 in.)
Camshaft journal clearance	0.021-0.055 mm (0.0008-0.0022 in.)	0.150 mm (0.0059 in.)
Camshaft journal outside diameter	21.970-21.991 mm (0.8649-0.8658 in.)	-
Camshaft bearing journal inside diameter	22.012-22.025 (0.8666-0.8671 in.)	-

Table 4 VALVE SPECIFICATIONS

Item	Standard	Service limit
Valve stem deflection	-	0.05 mm (0.02 in.)
Valve head deflection	-	0.03 mm (0.001 in.)

(continued)

Table 4 VALVE SPECIFICATIONS (continued)

Item	Standard	Service limit
Valve guide-to-stem clearance		
Intake	0.010-0.037 mm (0.0004-0.0015 in.)	0.35 mm (0.014 in.)
Exhaust	0.030-0.057 mm (0.0012-0.0022 in.)	0.35 mm (0.014 in.)
Valve stem outside diameter		
Intake	5.475-5.490 mm (0.2155-0.2161 in.)	-
Exhaust	5.445-5.470 mm (0.2148-0.2153 in.)	-
Valve seat width	0.9-1.1 mm (0.035-0.043 in.)	-
Valve spring free length (intake and exhaust)		
Inner	-	35.1 mm (1.38 in.)
Outer	-	39.8 mm (1.57 in.)
Valve spring tension (intake and exhaust)		
Inner (@ 32.5 mm)	7.1-8.3 kg (15.7-18.3 lb.)	-
Outer (@ 36.0 mm)	17.0-20.3 kg (37.5-44.8 lb.)	-
Valve face	-	0.5 mm (0.02 in.)

Table 5 PISTON AND CYLINDER SPECIFICATIONS

Item	Standard	Limit
Piston pin bore	14.002-14.008 mm (0.5513-0.5515 in.)	14.030 mm (0.5524 in.)
Piston pin diameter	13.995-14.000 mm (0.5510-0.5512 in.)	13.980 mm (0.5504 in.)
Piston diameter	56.960-56.975 mm (2.2425-2.2431 in.)	56.880 mm (2.2394 in.)
Piston measuring point	15 mm (0.6 in.) from piston skirt end	
Cylinder inner diameter	57.000-57.015 mm (2.2421-2.2447 in.)	57.095 mm (2.2478 in.)
Piston-to-cylinder clearance	0.035-0.045 mm (0.0014-0.0018 in.)	0.120 mm (0.0047 in.)
Cylinder distortion	-	0.05 mm (0.002 in.)

Table 6 PISTON RING SPECIFICATIONS

Item	Standard	Service limit
Ring-to-groove clearance		
Top ring	-	0.180 mm (0.0071 in.)
Middle ring	-	0.150 mm (0.0059 in.)
(continued)		

Table 6 PISTON RING SPECIFICATIONS (continued)

Item	Standard	Service limit
Ring thickness		
Top ring	1.175-1.190 mm (0.0463-0.0469 in.)	-
Middle ring	1.170-1.190 mm (0.0461-0.0469 in.)	-
Ring groove width		
Top and middle ring	1.21-1.23 mm (0.047-0.048 in.)	-
Oil ring	2.51-2.53 mm (0.099-0.100 in.)	-
Ring end gap		
Top and middle rings	0.10-0.25 mm (0.004-0.010 in.)	0.7 mm (0.028 in.)
Ring free end gap		
Top ring	Approx. 7.0 mm (0.28 in.)	5.6 mm (0.22 in.)
Middle ring	Approx. 7.5 mm (0.30 in.)	6.0 mm (0.24 in.)

Table 7 CRANKSHAFT SPECIFICATIONS

Item	Standard	Service limit
Crankshaft runout	-	0.05 mm (0.002 in.)
Connecting rod small end inside diameter	14.006-14.014 mm (0.5513-0.5517 in.)	14.040 mm (0.5528 in.)
Connecting rod deflection	-	3.0 mm (0.12 in.)
Connecting rod big end side clearance	0.10-0.45 mm (0.004-0.018 in.)	1.00 mm (0.039 in.)
Connecting rod big end width	15.95-16.00 mm (0.628-0.630 in.)	-
Crankshaft web-to-web width	52.9-53.1 mm (2.08-2.09 in.)	-

4

NOTE: If you own a 1984 or later model, first check the Supplement at the back of the book for any new service information.

CHAPTER FIVE

CLUTCH, TRANSMISSION AND GEARSHIFT MECHANISM

This chapter provides maintenance procedures for the clutch, transmission and gearshift mechanism.

All clutch components and some gearshift components can be removed with the engine installed in the machine. To remove the transmission and internal components of the gearshift mechanism, it is necessary to remove and disassemble the engine. Refer to Chapter Four for engine removal and disassembly procedures.

Table 1 and Table 2 are at the end of the chapter.

CLUTCH

The clutch unit used on all ALT and LT models is actually two clutches within one housing, a centrifugal clutch and a friction plate clutch. The centrifugal unit is installed within the sleeve hub and consists of spring-retained weights coated with a friction material. When the engine speed reaches approximately 2,000 rpms, centrifugal effect causes the weights to swing out and contact the inner surface of the sleeve hub. As this occurs, power delivery from the engine to the transmission begins. Full clutch engagement occurs at approximately 3,400 rpm. Below 2,000 rpm, no power is transmitted from the engine.

The second clutch (friction plate clutch) is used to provide smooth gearshifts when the engine speed is above 2,000 rpm and the centrifugal unit is already engaged. When the gearshift lever is moved up or down for a gear change, the clutch

release arm is actuated from the clutch end of the gearshift shaft. The release arm causes the release mechanism to press inward on the pressure plate. This action relaxes the spring tension on the friction plates and interrupts the power flow from the engine to the transmission. The friction clutch will stay released as long as the gearshift lever is the full up or down position.

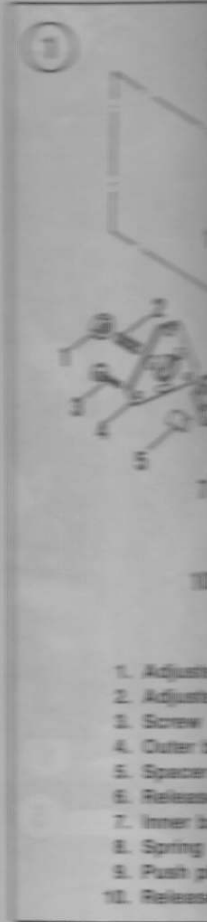
If the clutch slips or does not engage smoothly and gradually, perform the *Operational Checks* to determine if both inner clutch units are operating correctly.

Operational Checks

The following checks require an accurate tachometer. If one is not available, have a dealer perform these checks.

Initial engagement

1. Connect the tachometer to the engine according to the manufacturer's instructions.
2. Check the engine oil level. Start and completely warm up the engine.
3. Sit on the machine and shift into 1st (low) gear.
4. Slowly increase the engine speed with the throttle. The engine speed should be 1,800-2,200 rpms when the machine starts to move. If the machine does not start to move in the specified rpm range, disassemble the clutch and inspect or replace the centrifugal clutch unit.
5. Shut off the engine and remove the tachometer.

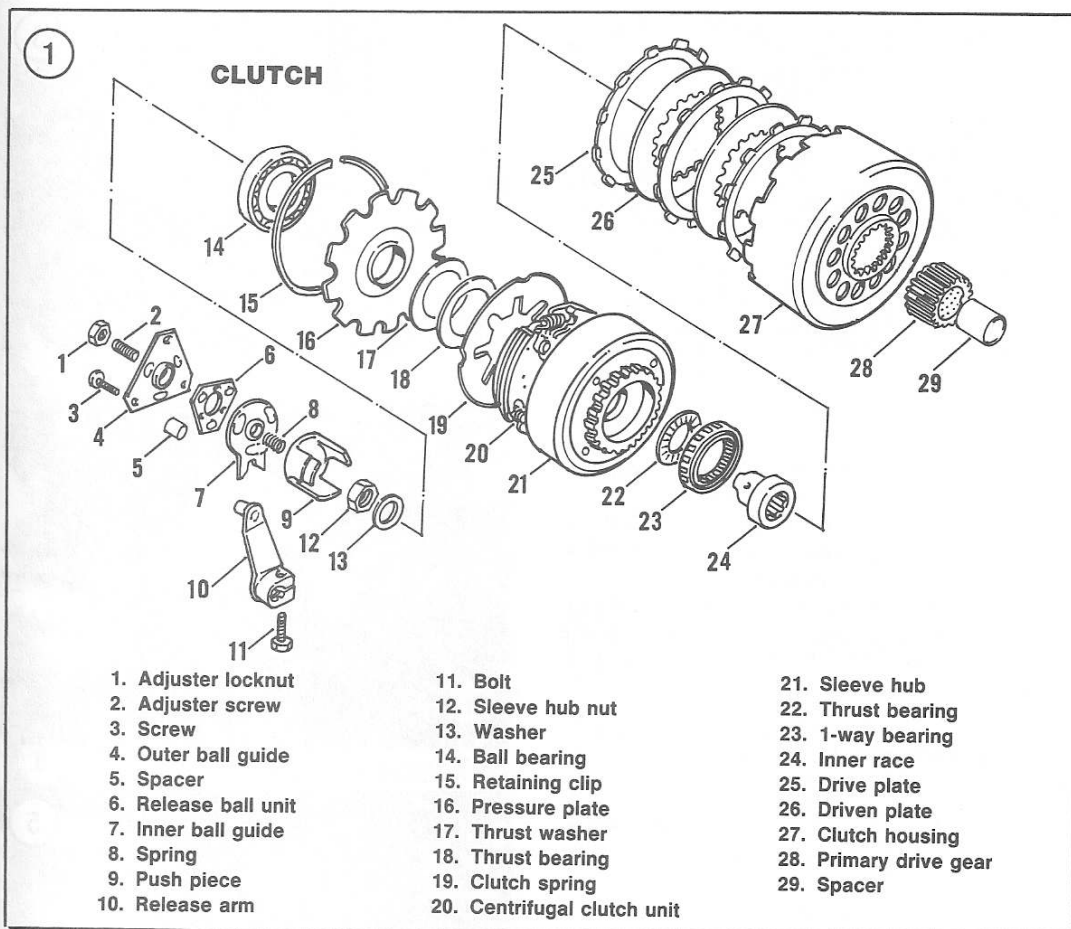


Clutch Lock-up

1. Connect the tachometer to the engine according to the manufacturer's instructions.
2. Check the engine oil level. Start and completely warm up the engine.
3. Position the front wheel on the parking brake and set the parking brake.
4. Sit on the machine and shift into 1st (low) gear.
5. Briefly open the throttle. The engine speed should be 1,800-2,200 rpms when the machine starts to move.

Do not run the engine at more than 3,000 rpm during this check or engine damage may result.

6. If the engine does not start to move in the specified rpm range, disassemble the clutch and inspect or replace the centrifugal clutch unit.
7. Shut off the engine and remove the tachometer.



Clutch Lock-up

1. Connect the tachometer to the engine according to the manufacturer's instructions.
2. Check the engine oil level. Start and completely warm up the engine.
3. Position the front of the machine against a wall and set the parking brake.
4. Sit on the machine and shift into 1st (low) gear.
5. Briefly open the throttle completely and check the maximum engine rpm on the tachometer. It should be 3,200-3,600 rpm.

CAUTION

Do not run the engine at full throttle for more than 10 seconds or clutch and engine damage may result.

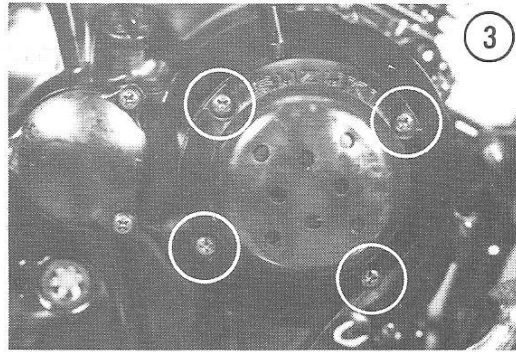
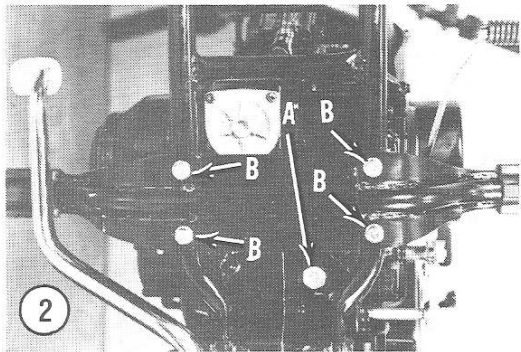
6. If the engine does not operate at the specified rpm during this check, disassemble the clutch and inspect or replace the centrifugal clutch unit.
7. Shut off the engine and remove the tachometer.

Removal

The clutch can be removed, inspected and installed with the engine in the frame. Refer to **Figure 1** for this procedure. Pay particular attention to the location of thrust washers and spacers.

1. Thoroughly clean the machine with a coin-operated car wash or with detergent and a hose. Make sure the engine and all nuts and bolts are as clean as possible. A clean machine is not only more pleasant to work on, it helps prevent contamination of vital moving parts. Make sure you clean the underside of the engine to expose the lower clutch cover screws and the engine drain plug.

2. Place a drain pan under the engine. Use a socket and remove the drain plug (A, **Figure 2**). Allow several minutes for the oil to drain completely.
3. Remove the bolts securing the footrest unit (B, **Figure 2**) and remove the footrest unit. Note that it



is slightly longer on the clutch side of the engine to clear the clutch cover.

4. Remove the screws securing the clutch adjuster cover (Figure 3) and remove the cover.

5. Remove the screws securing the clutch adjuster assembly (Figure 4) and remove the assembly. Take care not to lose the spacers.

6. Pull out and remove the push piece (Figure 6).

7. Use a hammer driven impact tool and remove the screws securing the clutch cover (Figure 7).

NOTE

The screw in the lower rear location of the clutch cover (A, Figure 7) is 6×45 mm. All other screws are 6×30 mm.

8. Wedge a screwdriver between the rear of the brake pedal and the frame to hold the brake pedal down and clear of the clutch cover.

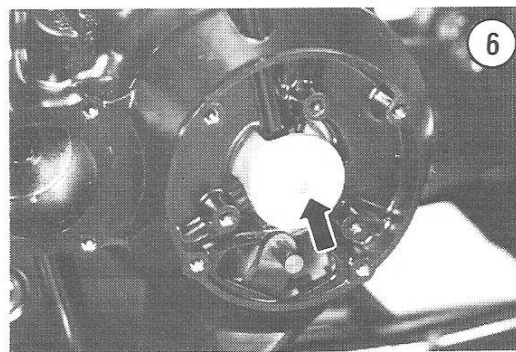
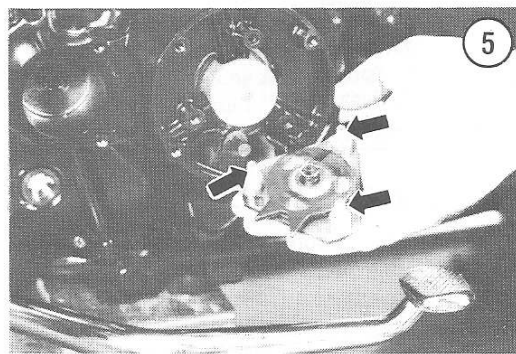
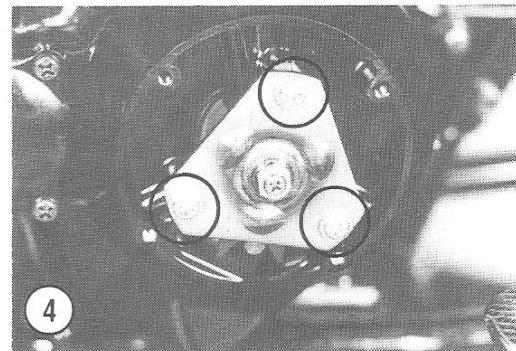
9. Tap around the edge of the clutch cover with a rubber or plastic mallet to help break the cover loose from the engine and remove the cover. Have a few rags handy as some oil is bound to run out.

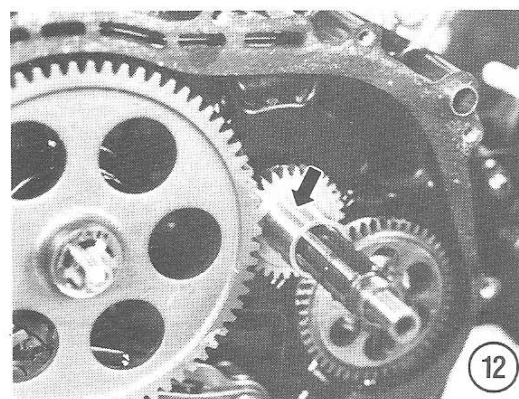
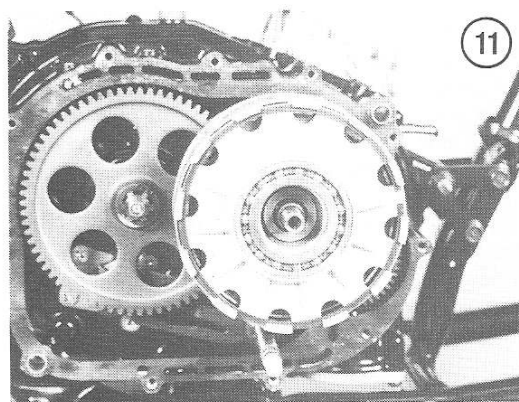
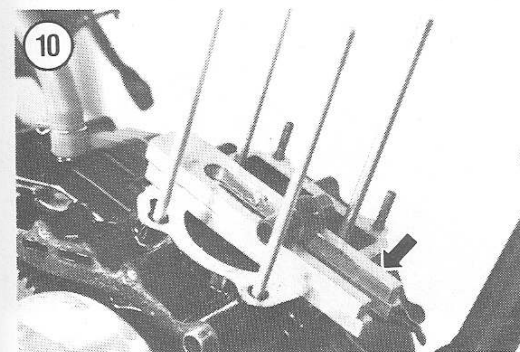
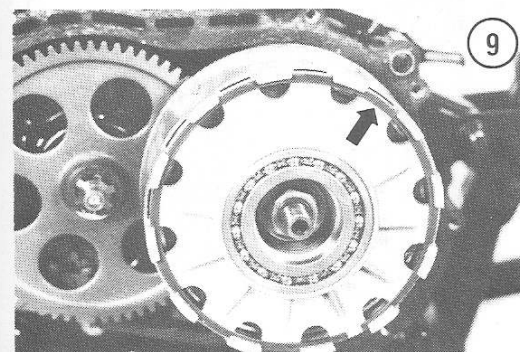
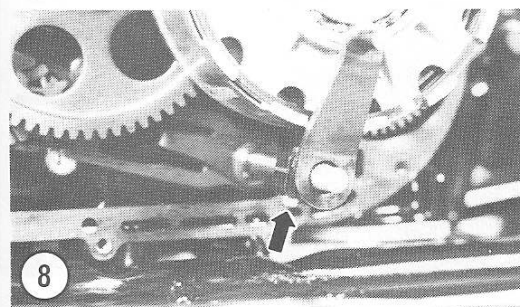
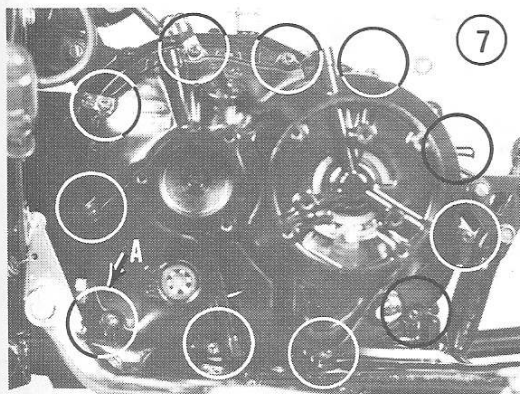
10. Remove the bolt securing the release arm to the gearshift shaft (Figure 8) and remove the arm. Note that the tip of the release arm is aligned with the end of the crankshaft.

WARNING

Never attempt to disassemble the clutch while it is still installed on the crankshaft. The internal spring must be compressed with a vise or special tool in order to remove the outer retaining clip (Figure 9). If removal of the retaining clip is attempted on the engine, the clutch unit may spring apart and cause an injury. Serious damage to the clutch components may also result.

11. Use an air or electric impact tool to remove the sleeve hub nut or use one of the following methods to keep the crankshaft from turning while removing the nut:





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- a. If the cylinder head and cylinder have been removed, set up a holding fixture as shown in **Figure 10**.
- b. If the cylinder has not been removed, wedge a copper washer (or a copper penny) between the primary drive and driven gears (the small gear behind the clutch and the large gear driven by it).

CAUTION

Do not use a steel washer or the gears may be damaged. Always use a softer metal such as copper or aluminum.

- 12. Remove the nut and washer securing the clutch assembly and carefully slide the clutch assembly off the crankshaft (**Figure 11**). The small primary drive gear usually comes off with the clutch assembly.
- 13. Remove the spacer from the crankshaft (**Figure 12**).
- 14. If clutch component inspection or repair is required, perform *Clutch Disassembly* in this chapter.

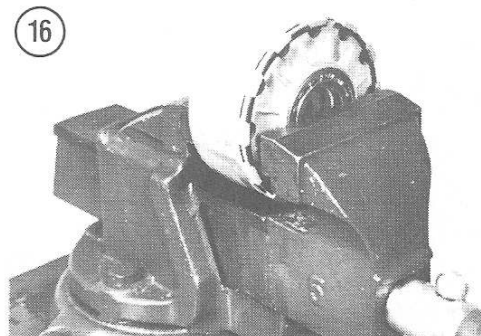
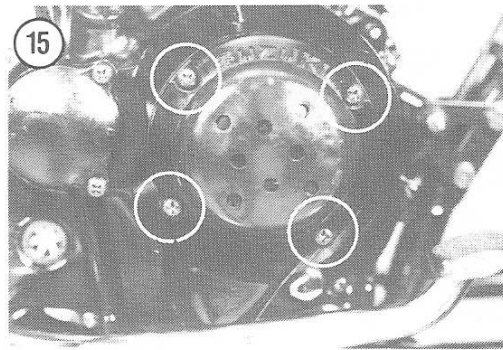
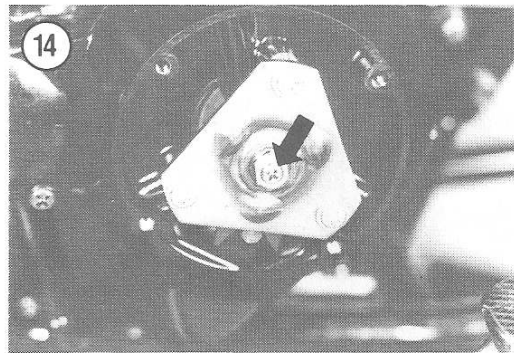
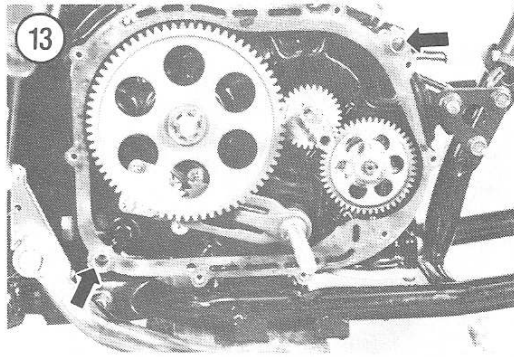
Installation

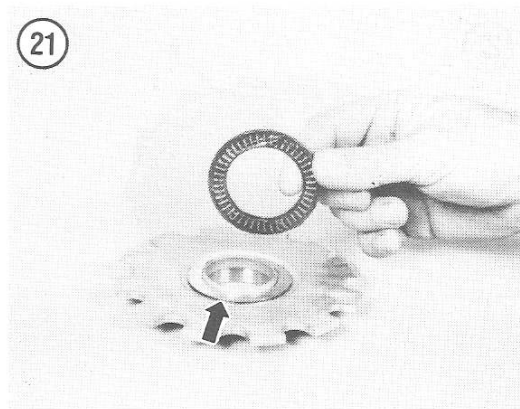
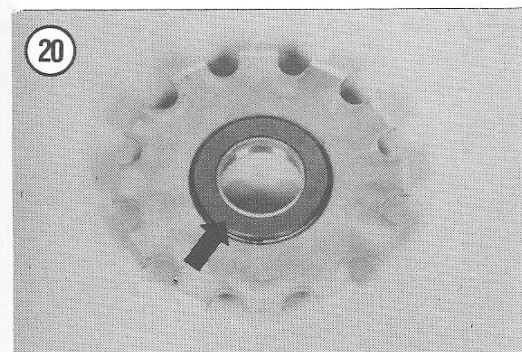
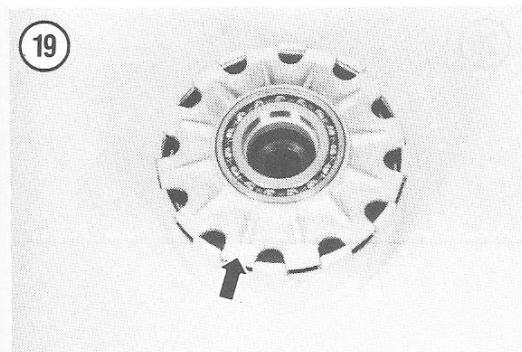
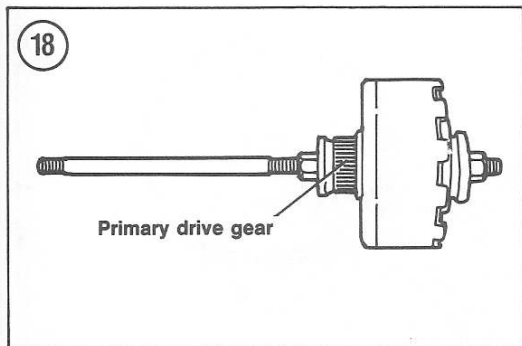
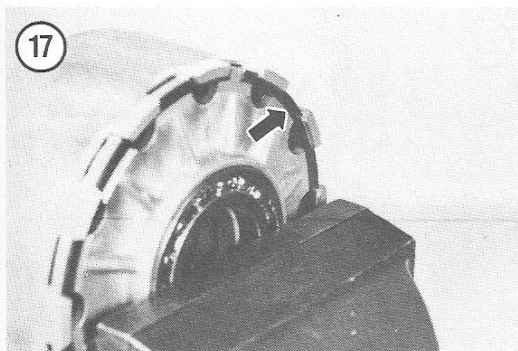
1. Install the primary driven gear and oil pump drive gear if they were removed.
2. Carefully clean the gasket surfaces on the clutch cover and the engine crankcase. Make sure the dowel pins are in place and install a new clutch cover gasket (**Figure 13**).
3. Install the spacer on the crankshaft (**Figure 12**).
4. Slide the primary drive gear into the back of the clutch unit. Oil the inner bushing on the primary drive gear and carefully slide the clutch unit on the crankshaft. Make sure the primary drive and driven gears mesh together correctly.

CAUTION

*If the clutch does not slide on the crankshaft completely and easily, do not force it or damage to the crankshaft or clutch will result. If the clutch has been disassembled for any reason, the inner parts may not be aligned with the outer clutch housing. Refer to **Clutch Assembly** in this chapter for instructions on how to align the inner and outer clutch components.*

5. Install the washer and nut securing the clutch assembly. Set up a crankshaft holding device as outlined during removal and torque the sleeve hub nut to 4.0-6.0 mkg (29.0-43.5 ft.-lb.).
6. Install the clutch release arm on the gearshift shaft so that the end of the release arm is aligned with the end of the crankshaft as noted during removal. Apply a small amount of blue Loctite (Lock N'Seal No. 2114) to the bolt and tighten the bolt to secure the arm to the gearshift shaft (**Figure 8**).
7. Install the clutch cover. Install the 6×45 mm screw in the lower rear location (A, **Figure 7**). All other screws are the same length. Tighten all the screws gradually and evenly in a crisscross pattern.
8. Install the push piece into the clutch as shown in **Figure 6**.
9. Install the spacers over each screw in the clutch release mechanism (**Figure 5**) and install the mechanism.
10. Loosen the locknut securing the adjuster screw (**Figure 14**). Back out the adjuster screw slightly then tighten the screw until resistance is felt as the adjuster contacts the end of the push piece. Back out the adjuster screw 1/8 turn. Hold the screw and tighten the locknut to secure the adjustment.
11. Install the clutch adjustment cover and secure with the screws (**Figure 15**).
12. Install the footrest unit and tighten the bolts to 1.8-2.8 mkg (13-20 ft.-lb.).
13. Refer to Chapter Three and add engine oil.





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Disassembly

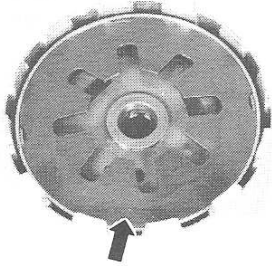
Refer to **Figure 1** for this procedure.

WARNING

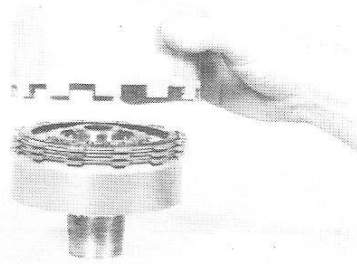
Never attempt to remove the retaining clip securing the pressure plate without a vise or special tool. The clutch unit may spring apart and cause an injury. Serious damage to the clutch components may also result.

1. The clutch unit must be compressed with a vise or special tool to compress the internal spring enough to remove the outer retaining clip. Use one of the following techniques to compress the internal spring:
 - a. Lift out the primary drive gear from the rear of the clutch unit. Pad the jaws of a vise with rags or pieces of aluminum and carefully install the clutch assembly in the vise as shown in **Figure 16**. Gradually tighten the vise until the internal spring tension is released enough to remove the retaining clip from the grooves in the clutch housing (**Figure 17**). Remove the clutch unit from the vise.
 - b. Install the Suzuki special tool (part No. 09941-34513 bearing installer) in the clutch unit as shown in **Figure 18**. In place of the Suzuki tool, a piece of threaded rod with 2 nuts and large washers can be used. Tighten one nut on the tool until the internal spring tension is released enough to remove the retaining clip from the grooves in the clutch housing. Remove the tool from the clutch unit.
2. Lift the pressure plate out of the clutch housing (**Figure 19**).
3. Remove the outer thrust washer (**Figure 20**), thrust bearing (**Figure 21**) and inner thrust washer from the pressure plate.

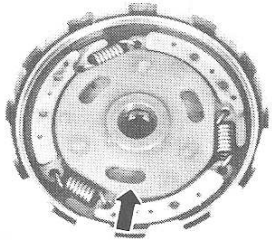
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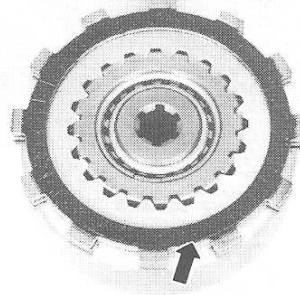
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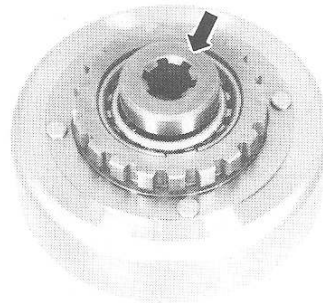
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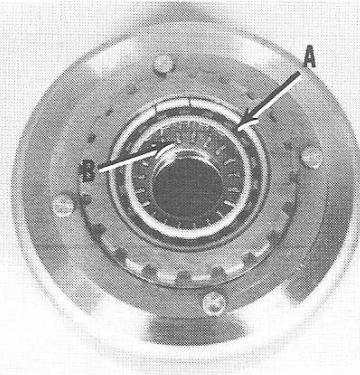
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4. Lift out the diaphragm type clutch spring (Figure 22). Note that the “fingers” on the spring point out.

5. Lift out the centrifugal clutch unit (Figure 23).

6. Carefully turn the clutch assembly over and lift the clutch housing off the sleeve hub as shown in Figure 24.

7. Remove the drive and driven plates from the sleeve hub (Figure 25).

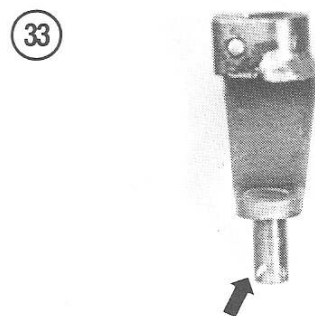
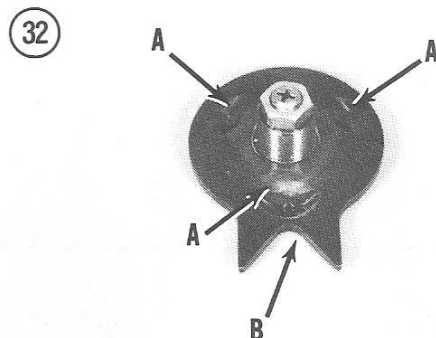
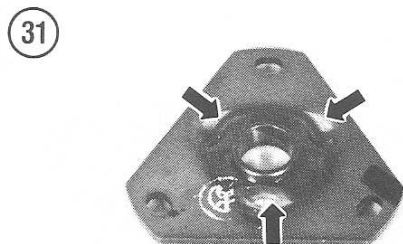
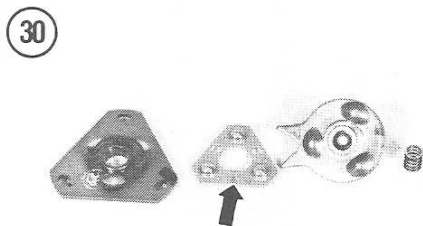
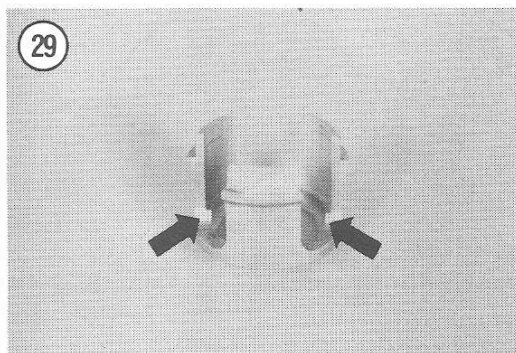
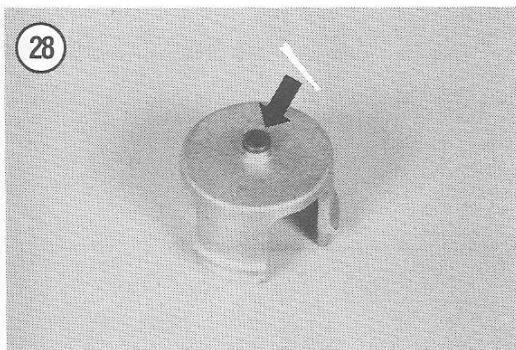
8. Rotate and lift out the inner race (Figure 26). The inner bearing in the sleeve hub is a 1-way bearing. The inner race can only be rotated in one direction.

9. Rotate and remove the 1-way bearing from the sleeve hub (A, Figure 27). Remove the thrust bearing under the 1-way bearing (B, Figure 27).

Inspection

Refer to Table 1 for clutch component specifications.

1. Inspect the contact end of the push piece (Figure 28). If the end is worn or damaged, replace the push piece.



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2. Examine the edges of the push piece (Figure 29) for wear or damage that may have resulted from harsh clutch engagement or improper clutch adjustment. Replace the push piece if worn or damaged.

3. Disassemble the clutch release mechanism as shown in Figure 30. Carefully inspect the ramps in the inner and outer ball guides where the balls of the release ball unit operate (Figure 31 and A, Figure 32). If the ramps are worn with deeply grooved tracks, both ball guides should be replaced as a set.

4. Inspect the balls and cage of the release ball unit (A, Figure 30). If the unit shows any signs of wear or damage it must be replaced.

5. Examine the engagement end of the clutch release arm (Figure 33). If deep wear marks are evident from contact with the outer ball guide, the release arm should be replaced.

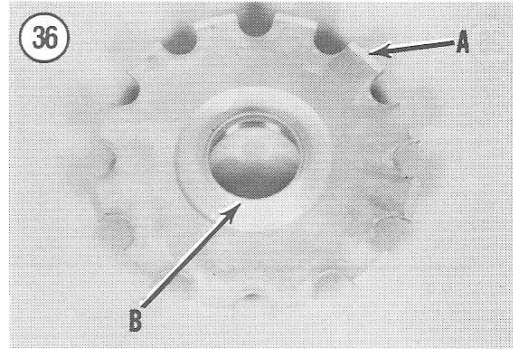
6. Inspect the outer ball guide release ramp (B, Figure 32) where it contacts the end of the release arm. If the ramp is worn the ball guide should be replaced.

7. Examine the clutch spacer (Figure 34). Replace the spacer if signs of wear or damage are present.

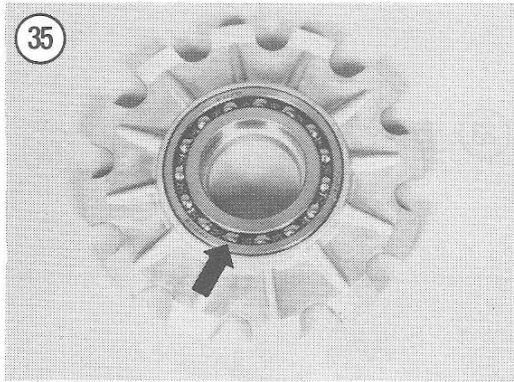
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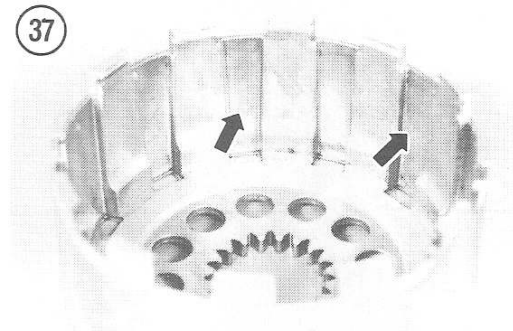
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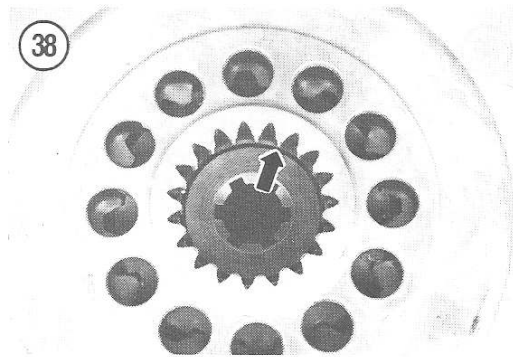
8. Inspect the ball bearing in the pressure plate for signs of damage or wear (Figure 35). The inner race of the bearing should turn freely without any tight spots or roughness. The bearing should be replaced if not in perfect condition. Refer to *Bearing and Seal Replacement* in Chapter Four for bearing replacement techniques.

9. Examine the back side of the pressure plate for wear or damage on the ends (A, Figure 36) or the inner thrust bearing groove (B, Figure 36). Replace the pressure plate if worn or damaged.

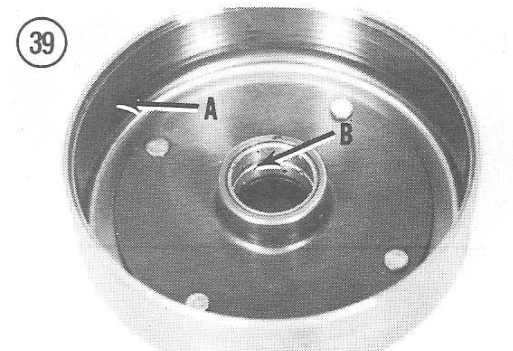
10. Carefully inspect the sides of the clutch plate grooves in the clutch housing (Figure 37). Notches or other types of uneven wear will cause improper clutch operation. Temporarily install the drive plates into the housing. Move the plates in and out a small amount to duplicate the action of the clutch. Replace the clutch housing if the wear notches are deep enough to snag the drive plates as they are moved.

11. Examine the teeth in the back of the clutch housing that engage the primary drive gear (Figure 38). If the gear teeth in the housing show signs of wear or distortion from the primary drive gear, the housing must be replaced. Such damage is usually caused by acceleration and deceleration of the engine when the clutch assembly is slightly loose on the crankshaft.

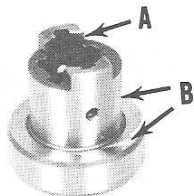
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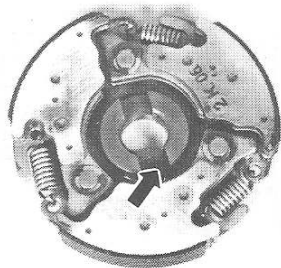
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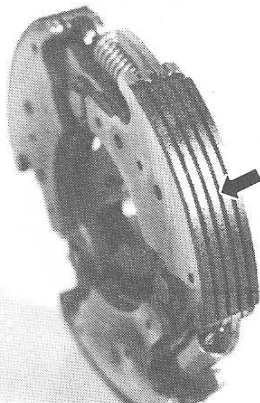
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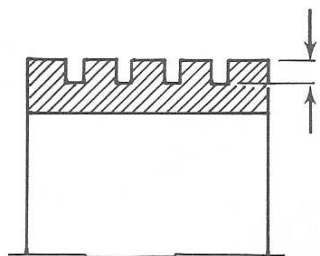
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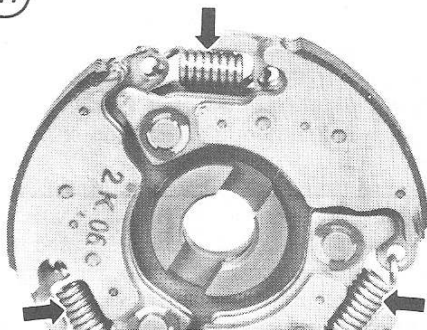
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12. Inspect the clutch surface (A, Figure 39) in the sleeve hub. The clutch surface must be smooth without any signs of wear, grooves, scratches or other damage. Abnormal wear is unlikely unless the friction surface of the centrifugal clutch shoes is worn past the limit and metal-to-metal contact has occurred. Replace the sleeve hub if the clutch surface is not in perfect condition.

13. Examine the bushing in the sleeve hub (B, Figure 39) for wear or damage. Replace the sleeve hub if the bushing is damaged or shows signs of wear.

14. Check the engagement dogs on the end of the bearing inner race (A, Figure 40). The dogs engage with the center of the centrifugal clutch unit. If the dogs are damaged or worn in any way, the bearing inner race must be replaced or the clutch will not operate smoothly.

15. Check the side and thrust bearing contact areas on the bearing inner race (B, Figure 40). If signs of wear or damage are present, replace the inner race.

16. Inspect the engagement dogs on the back side of the centrifugal clutch unit (Figure 41). If the dogs are damaged or worn in any way, the centrifugal clutch unit must be replaced or the clutch will not operate smoothly.

17. Examine the friction facing on the centrifugal clutch shoes (Figure 42). If the shoes are worn so that none of the grooves in the friction material remain (Figure 43), the centrifugal clutch unit must be replaced.

18. Check the condition of the springs on the centrifugal clutch unit (Figure 44). If the springs are stretched or distorted in any way, the centrifugal clutch unit must be replaced.

19. Carefully inspect the edges of the clutch spring fingers (Figure 45) for hairline cracks or signs of metal fatigue. Replace the spring if not in perfect condition. A weak or damaged spring will prevent proper clutch operation.

20. Check the 1-way bearing (A, **Figure 46**) and the thrust bearing (B, **Figure 46**) in the back of the sleeve hub. The bearing rollers must be in perfect condition without any visible signs of wear or damage. The 2 splits in the outer race of the 1-way bearing (C, **Figure 46**) are part of the bearing construction and are not an indication of bearing damage.

21. Examine the thrust washers and thrust bearing used with the pressure plate (**Figure 47**). Make sure all the rollers in the bearing move freely and have no signs of damage or corrosion. The bearing surfaces on the thrust washers must be smooth without wear marks or grooves.

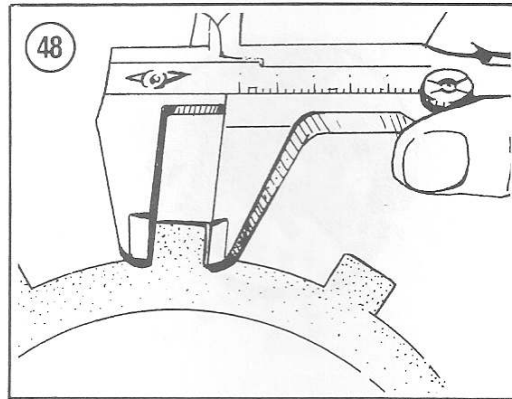
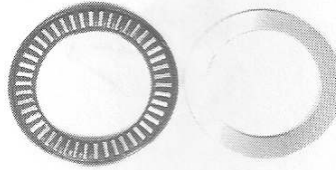
22. Measure the width of the claws on each drive plate as shown in **Figure 48**. Replace any drive plates worn beyond the service limits specified in **Table 1**.

23. Examine the overall condition of the clutch drive plates (**Figure 49**). Replace the plates if the friction material on the plates is deeply scored or damaged.

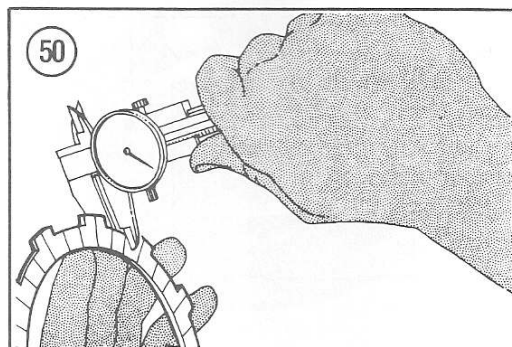
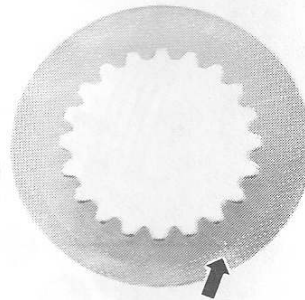
24. If the drive plates appear serviceable, measure the thickness of the plates as shown in **Figure 50**. Replace any plates worn beyond the specified service limits.

25. Inspect the overall condition of each driven plate (**Figure 51**). If the plates are deeply scored,

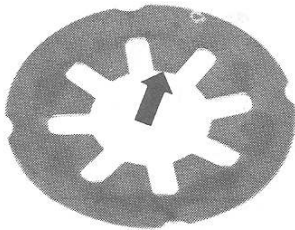
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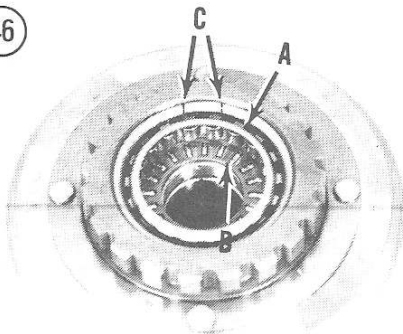
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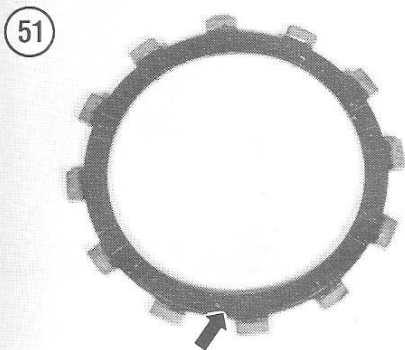
CLUTCH TR...

51

52

53

1. Adjuster
2. Adjuster
3. Screw
4. Outer ball
5. Spacer

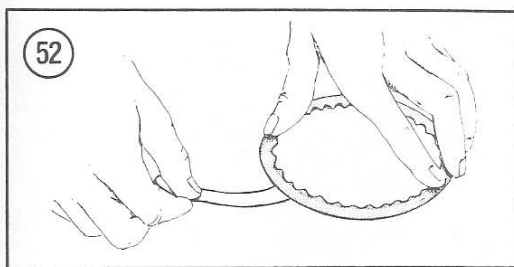


warped or discolored blue (from excessive heat), they must be replaced.

26. If the driven plates appear serviceable, measure each plate for distortion with a feeler gauge on a piece of plate glass as shown in Figure 52. Replace any plate that is warped beyond the limits specified in Table 1.

NOTE

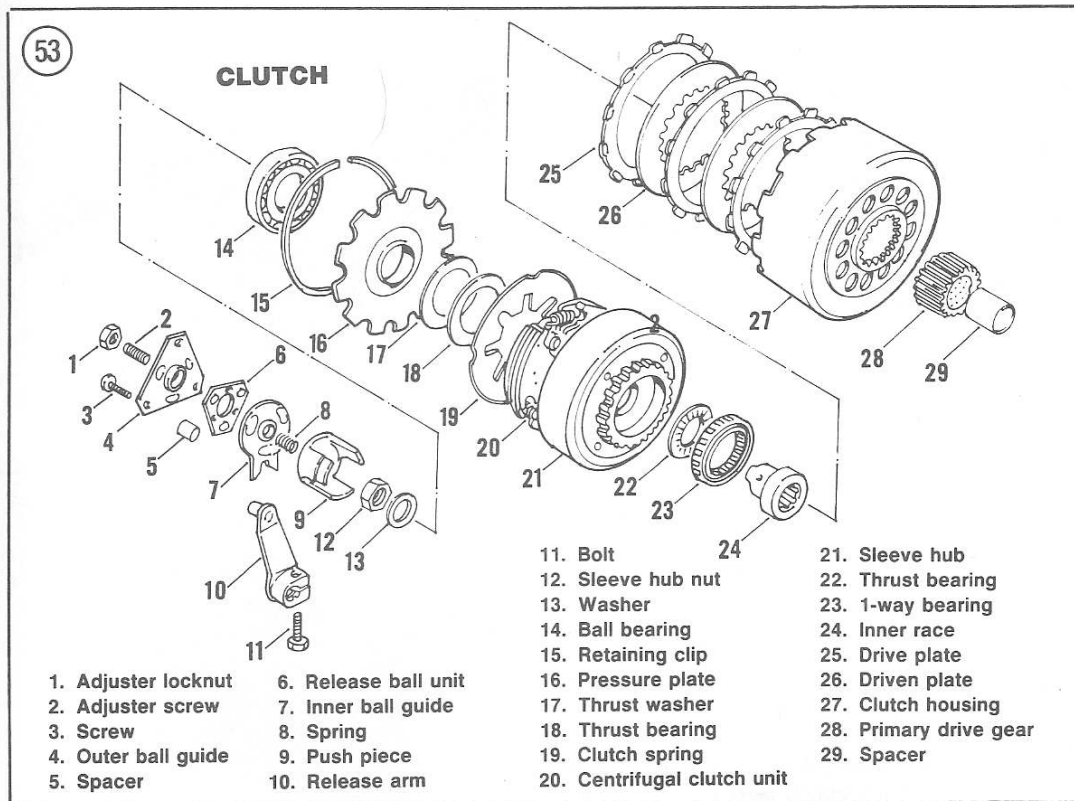
If any of the drive or driven plates must be replaced, consider replacing them all as a set to maintain peak clutch performance.



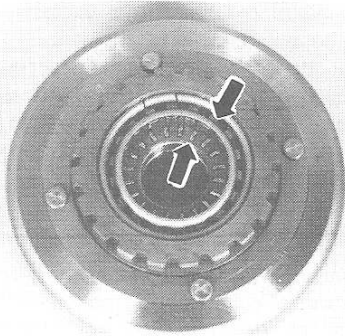
Assembly

Refer to Figure 53 for this procedure.

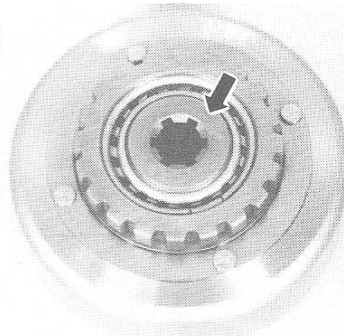
1. Install the inner thrust bearing and the 1-way bearing into the sleeve hub as shown in Figure 54.
2. Start the bearing inner race into the 1-way bearing as shown in Figure 55. Press down and rotate the inner race counterclockwise until the inner race is fully installed into the sleeve hub (Figure 56).



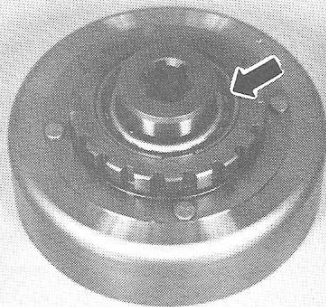
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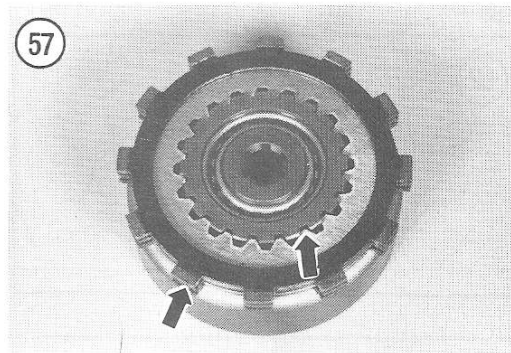
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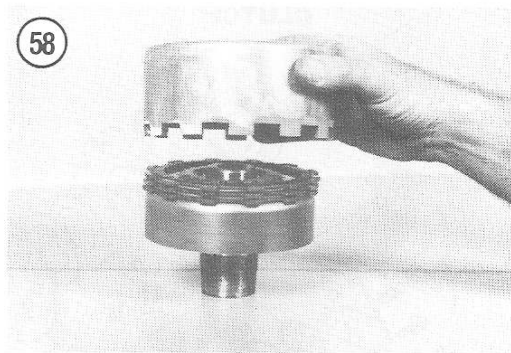
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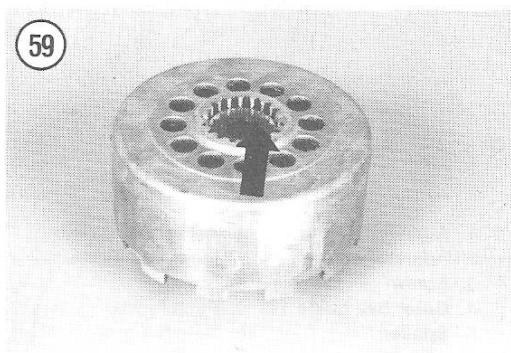
57



58



59



3. Lay the clutch plates carefully on the sleeve hub as shown in **Figure 57**. The first and last plates are friction (drive) plates. Make sure all the teeth on the driven plates engage the teeth in the back of the sleeve hub. Carefully align all the claw ends of the drive plates as shown.

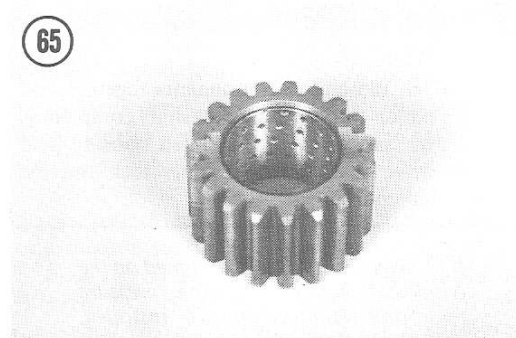
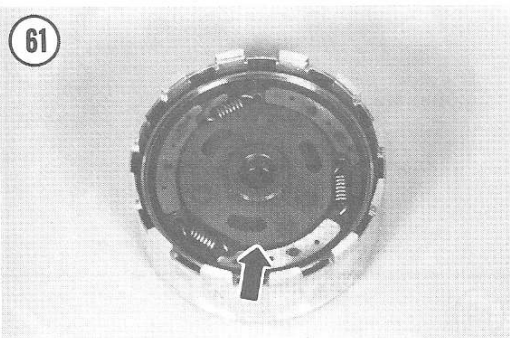
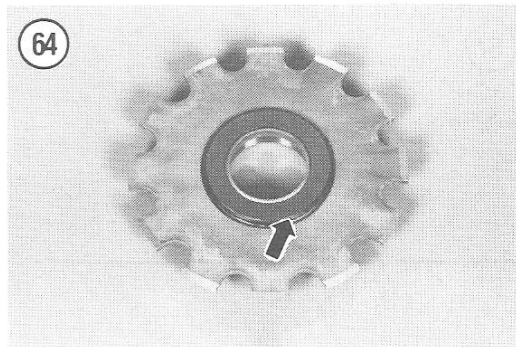
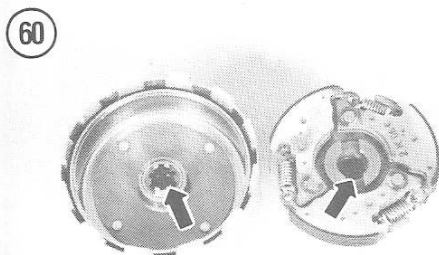
4. Use a large socket or similar tool to support the sleeve hub a few inches above the work surface. Align the grooves in the clutch housing with the ends of the drive plates and carefully slide the housing over the sleeve hub as shown in **Figure 58**. Make sure the housing bottoms completely against the sleeve hub (**Figure 59**).

NOTE

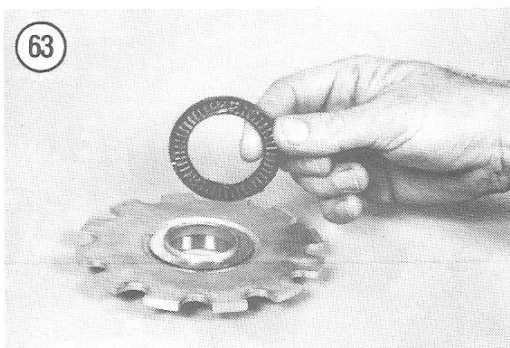
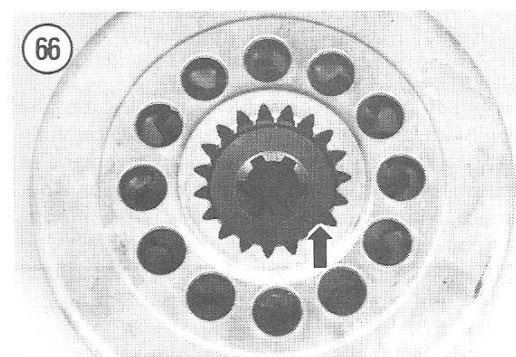
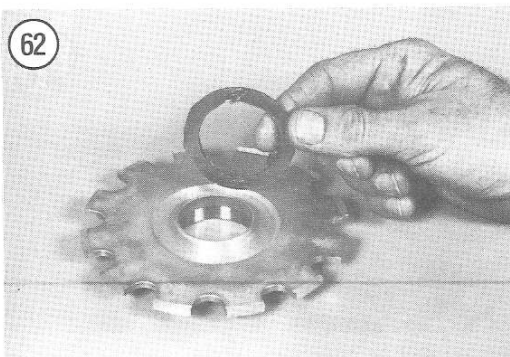
If the sleeve hub is not supported a few inches above the work surface, the clutch housing will not slide down completely over the sleeve hub. This will cause the driven plates to become disengaged from the teeth in the back of the sleeve hub when the clutch unit is turned over for further assembly.

5. Hold the sleeve hub into the clutch housing and carefully turn the clutch unit over on the work bench.

6. Align the dogs of the inner race with the dogs of the centrifugal clutch unit (**Figure 60**) and install



5

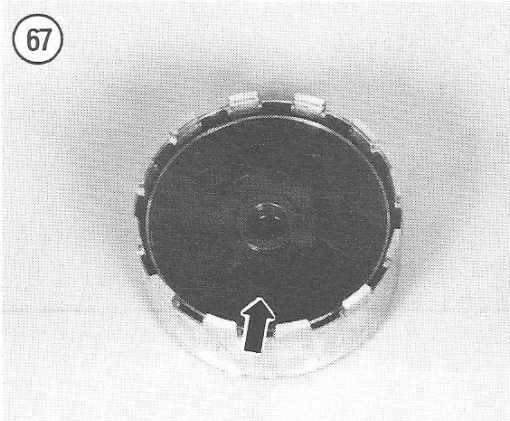


the centrifugal clutch unit. Ensure that the dogs engage and the clutch unit fits fully into the sleeve hub as shown in **Figure 61**.

7. Apply a little grease to the inner thrust washer and install the washer in the pressure plate groove (**Figure 62**).

8. Grease the thrust bearing and install it with the bearing rollers against the pressure plate thrust washer as shown in **Figure 63**. Grease the outer thrust washer and install it over the thrust bearing (**Figure 64**).

9. Install the primary drive gear (**Figure 65**) into the back of the clutch housing (**Figure 66**).



10. Hold all the clutch components together and slide the clutch unit on the crankshaft completely. This is necessary to align the clutch housing (and primary drive gear) with the inner race and the inner clutch components.

NOTE

If these parts are not first aligned on the crankshaft before the spring, pressure plate and retaining clip are installed, clutch installation on the engine can be (at the very least) difficult and aggravating. If the alignment is too far off, clutch installation will be impossible.

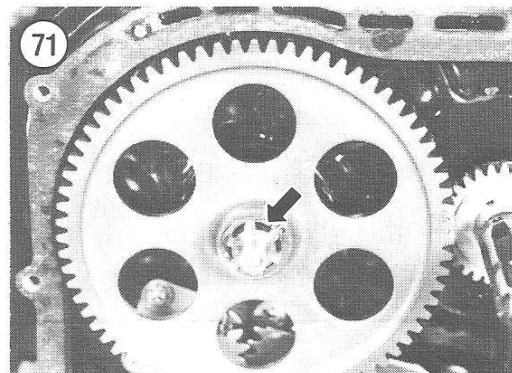
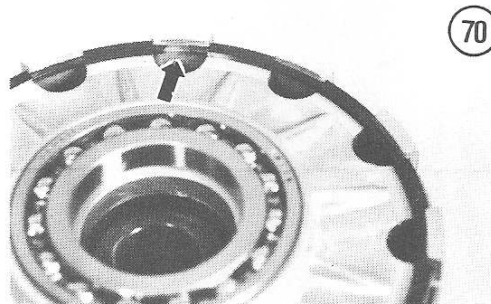
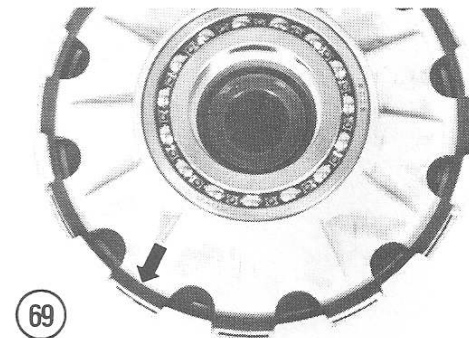
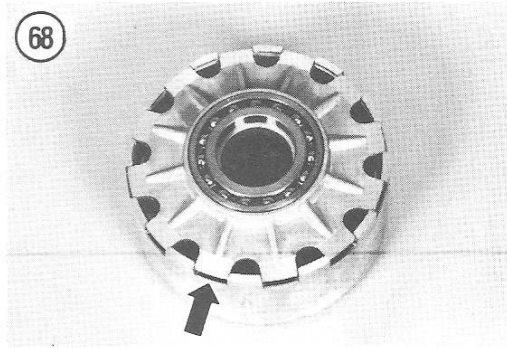
11. When the clutch is fully installed on the crankshaft and all the parts are aligned, carefully hold the inner and outer clutch parts together and remove the unit. Place the clutch on your work surface, taking care not to move any of the internal components while completing the assembly.

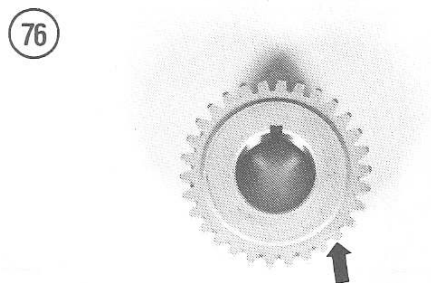
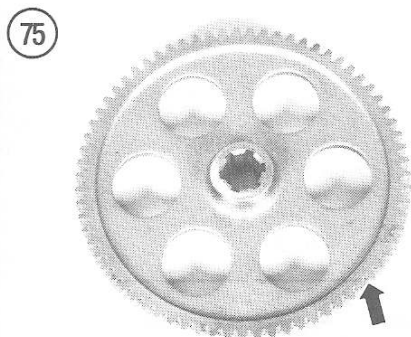
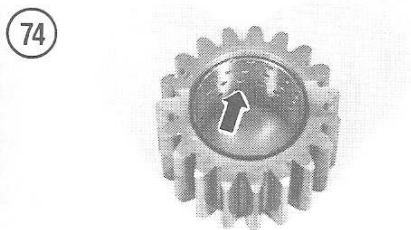
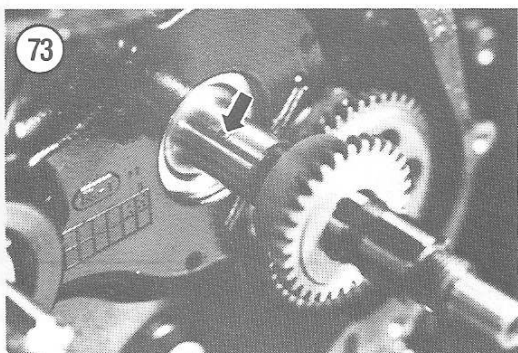
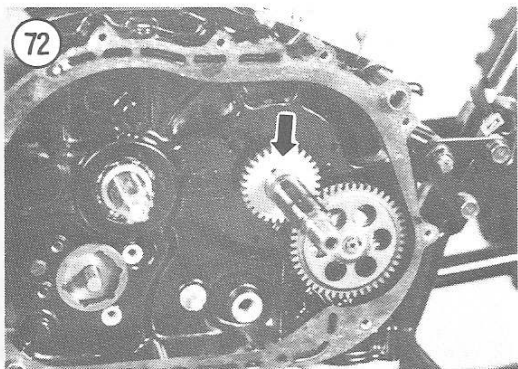
12. Lay the clutch spring on top of the centrifugal clutch unit with the spring fingers pointing out (Figure 67).

13. Install the pressure plate over the clutch housing. Make sure the ends of the pressure plate are aligned with the notches of the clutch housing (Figure 68).

14. Lay the pressure plate retaining clip on the pressure plate. Carefully hold the clutch parts together and install the clutch unit into the vise or install the threaded compression tool as described during clutch disassembly.

15. Carefully compress the clutch spring and install the retaining clip. Make sure the clip fits securely under all lugs of the clutch housing (Figure 69). Move the retaining clip until both ends of the clip are installed under one lug as shown in Figure 70.





PRIMARY GEARS

Removal/Installation

1. Remove the clutch as previously outlined. The primary drive gear is installed into the back of the clutch housing and is removed with the clutch.
2. Remove the snap ring securing the primary driven gear (Figure 71) and slide the gear off the transmission shaft.
3. Slide the oil pump drive gear off the crankshaft (Figure 72). Note how the drive pin in the crankshaft engages the groove in the gear (Figure 73).
4. Perform *Inspection*.
5. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Make sure that the snap ring securing the primary driven gear fully locks into the groove in the transmission shaft.
 - b. Install the clutch as outlined in this chapter.

Inspection

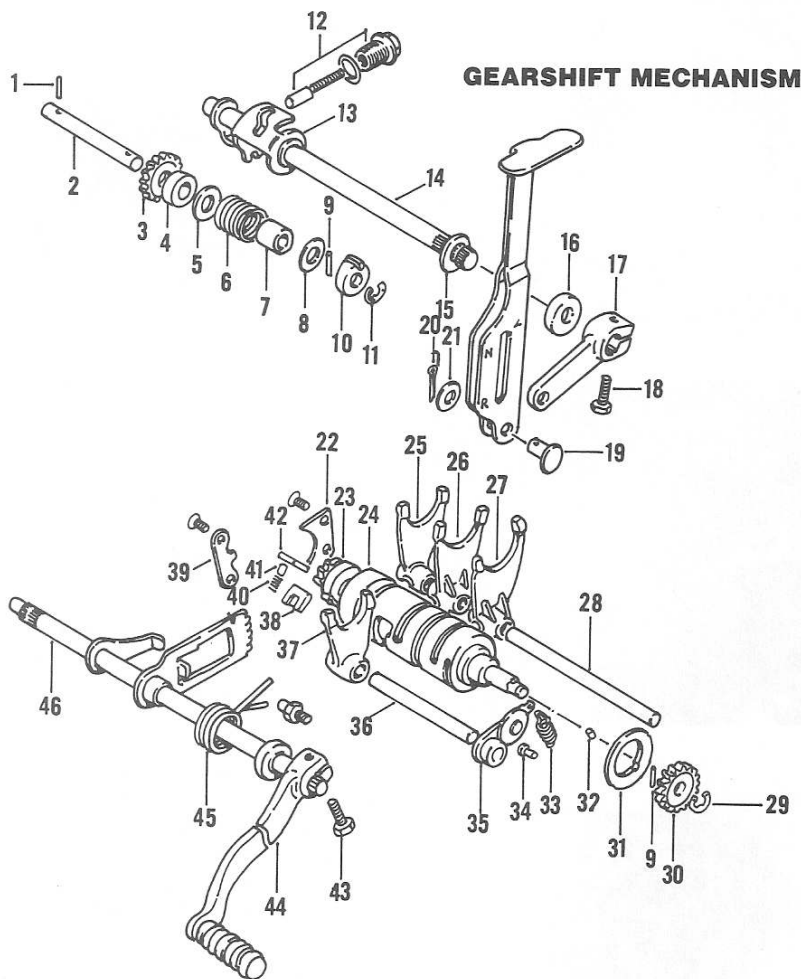
1. Carefully inspect the bushing in the primary drive gear (Figure 74). Replace the gear if the bushing is worn or damaged.
2. Examine the teeth on the primary driven gear (Figure 75) and the oil pump drive gear (Figure 76). Replace the gears if any teeth are missing or if any of the teeth show signs of chipping or wear.

EXTERNAL GEARSHIFT LINKAGE

Removal/Installation

- Refer to Figure 77 for this procedure.
1. Remove the bolt securing the reverse shifting arm to the reverse gearshift shaft (Figure 78). The bolt must be removed completely, not just loosened.
 2. Remove the circlip securing the gear position indicator (Figure 79).

77



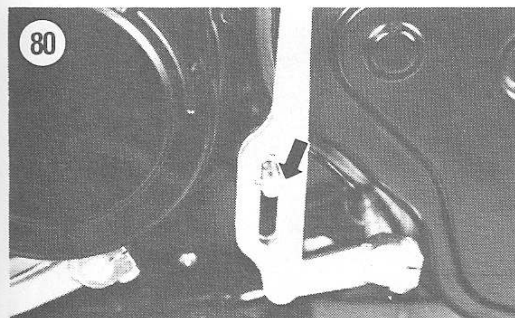
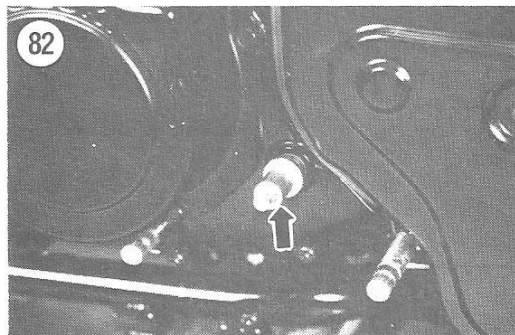
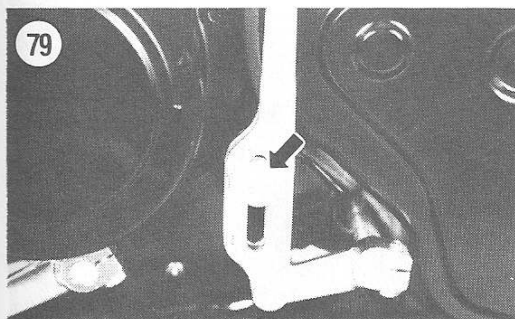
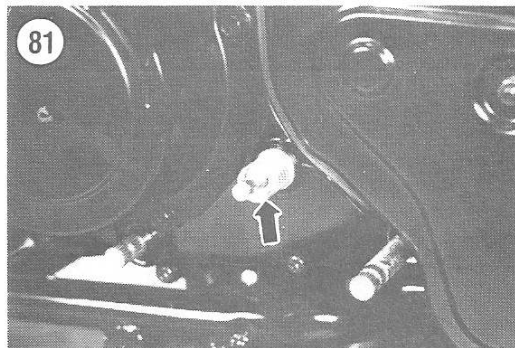
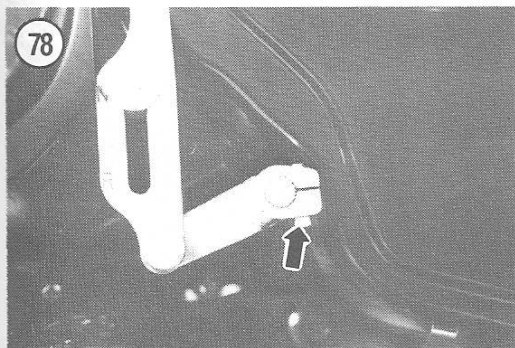
GEARSHIFT MECHANISM

- | | | |
|--|----------------------------------|------------------------------|
| 1. Pin | 15. Washer | 31. Cam stopper plate |
| 2. Gear position indicator shaft | 16. Oil seal | 32. Pin |
| 3. Gear position indicator gear | 17. Reverse shifting arm | 33. Spring |
| 4. Oil seal | 18. Bolt | 34. Pin |
| 5. Washer | 19. Pin | 35. Cam stopper |
| 6. Spring | 20. Cotter pin | 36. No. 2 shift fork shaft |
| 7. Spacer | 21. Washer | 37. No. 3 gear shifting fork |
| 8. Washer | 22. Pawl lifter | 38. No. 2 pawl |
| 9. Pin | 23. Pawl holder assembly | 39. Cam guide |
| 10. Gearshift indicator | 24. No. 1 gear shifting cam | 40. Spring |
| 11. Circlip | 25. No. 4 shift fork | 41. Pin |
| 12. Neutral cam stopper assembly | 26. No. 2 shift fork | 42. No. 1 pawl |
| 13. Reverse shifting cam
(gear shifting cam No. 2) | 27. No. 1 shift fork | 43. Bolt |
| 14. Reverse gearshift shaft
(No. 2 gear shifting shaft) | 28. No. 1 shift fork shaft | 44. Gearshift lever |
| | 29. Circlip | 45. Spring |
| | 30. Gear position indicator gear | 46. Gearshift shaft |

CLUTCH TRAY



3. Remove the gear to lose the indicator the drive pin from 4. Slide the reverse gearshift shaft and Note the position and in reassembly. 5. Remove the inner washer from 6. Installation is the following point a. Make sure the inner washer b. Install the gearshift shaft



5

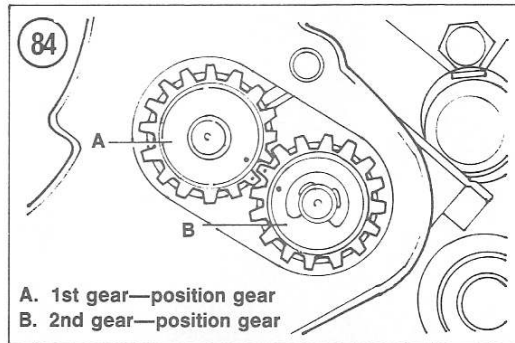
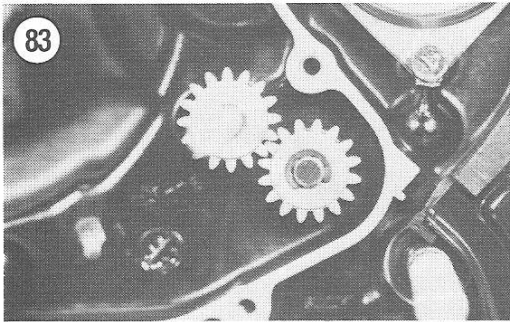
3. Remove the gearshift indicator. Take care not to lose the indicator drive pin (Figure 80). Remove the drive pin from the shaft.
4. Slide the reverse shifting arm off the reverse gearshift shaft and remove the external linkage. Note the position of the shifting arm to the shaft to aid in reassembly.
5. Remove the outer washer, spring, spacer and inner washer from the indicator shaft (Figure 81).
6. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Make sure the spacer is installed next to the inner washer (Figure 82).
 - b. Install the reverse shifting arm on the reverse gearshift shaft as noted during removal. Install

and tighten the bolt securing the reverse shifting arm. Shift the transmission into REVERSE and measure the clearance between the end of the gear position shaft and the bottom of the slot in the external shifting linkage.

NOTE

It may be necessary to rock the machine back and forth to cause the reverse gear to engage without the engine running.

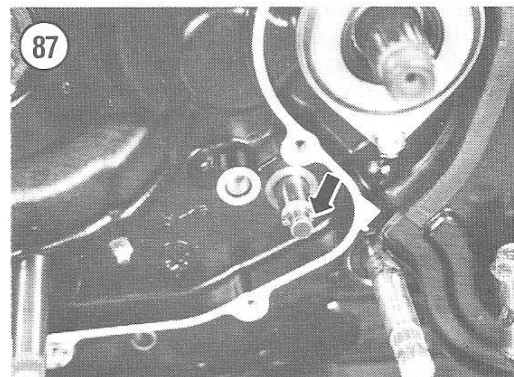
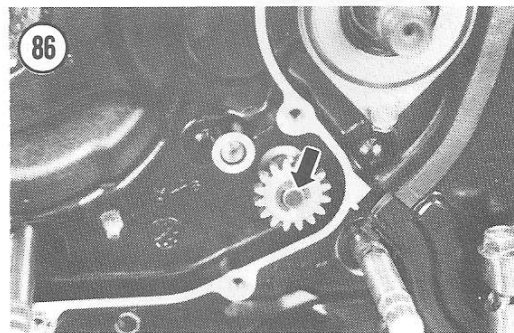
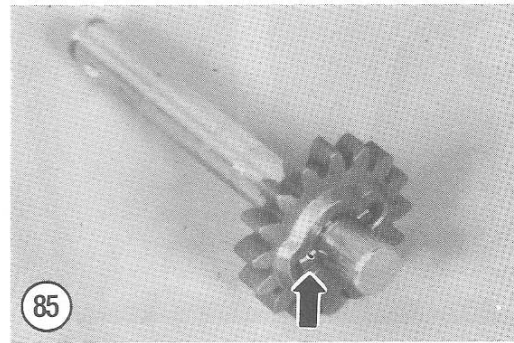
- c. The clearance should be approximately 2-9 mm (1/16-3/8 in.). If the clearance is more than 9 mm (3/8 in.) or if the slot in the linkage contacts the end of the gear position shaft, the shifting arm must be moved until the clearance is correct. Remove the bolt securing the shifting arm and move the arm one spline at a time on the gearshifting shaft until the clearance is within the range specified.
- d. Complete the assembly of the external linkage.
- e. Start the engine and shift the linkage through all gear positions. Ensure that the linkage works smoothly without any binding or tight spots.



GEAR POSITION INDICATOR GEARS

Removal/Installation

1. Remove the external gearshift linkage as outlined in this chapter.
2. Remove the magneto housing as outlined in Chapter Four.
3. Remove the 1st gear position indicator gear and shaft (Figure 83). Note how the punch marks on each gear are aligned (Figure 84). The gears must be realigned the same way during assembly. Take care not to lose the small drive pin behind the indicator gear (Figure 85).
4. Remove the circlip securing the 2nd gear position indicator gear to the end of the gear shifting cam (Figure 86). Remove the drive pin (Figure 87).
5. Installation is the reverse of these steps. Keep the following points in mind:
 - a. Install the drive pin in the gear shifting cam (Figure 87) before installing the 2nd gear (Figure 86). Secure the gear with the circlip.
 - b. Position the 1st gear on the indicator shaft with the drive pin as shown in Figure 85.
 - c. Install the 1st gear and indicator shaft so that the punch marks on each gear are positioned as shown in Figure 84.
 - d. Install the magneto housing as outlined in Chapter Four.
 - e. Install the external gearshift linkage as outlined in this chapter.



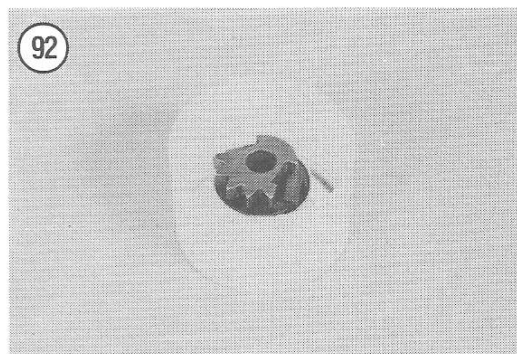
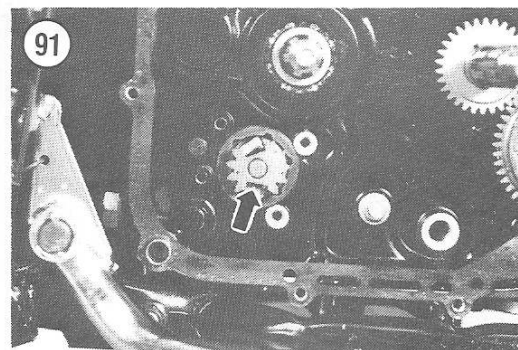
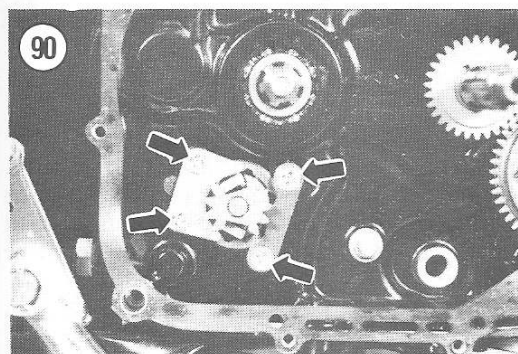
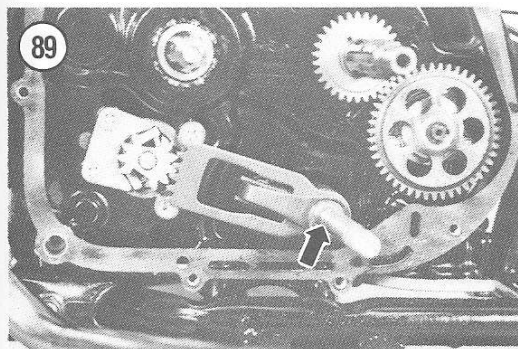
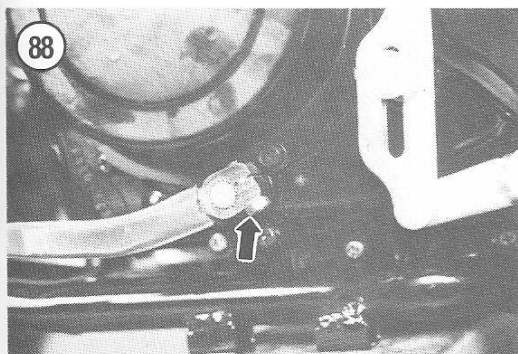
EXTERNAL GEARSHIFT MECHANISM

The external gearshift mechanism consists of all the gearshift components that can be removed and repaired with the engine still installed in the frame.

Disassembly/Assembly

Refer to Figure 77 for this procedure.

1. Remove the clutch, primary gear and external gearshift linkage as outlined in this chapter. If the



internal gearshift mechanism must also be disassembled, remove the gear position indicator gears as outlined in this chapter.

2. Remove the pinch bolt securing the gearshift lever (Figure 88) and remove the lever. The bolt must be removed completely, not just loosened.

3. Slide out the gearshift shaft (Figure 89). It should slide out of the engine with just a small amount of resistance. If the shaft is difficult to remove, check the portion of the shaft exposed on the left side of the engine. If the machine has ever been in a hard spill or collision, the end of the gearshift shaft may be bent. A bent shaft is impossible to remove or straighten without putting abnormal stress on the crankcases. If the shaft is bent enough to prevent its normal removal, there is little choice but to cut the shaft off with a hacksaw very close to the crankcase. It is much cheaper in the long run to replace the shaft than risk damaging a very expensive matched set of engine crankcases.

4. Use a hammer driven impact tool to remove the screws then remove the pawl lifter and cam guide (Figure 90).

5. Compress the spring-loaded shifting pawls with your fingers and lift out the pawl holder assembly (Figure 91).

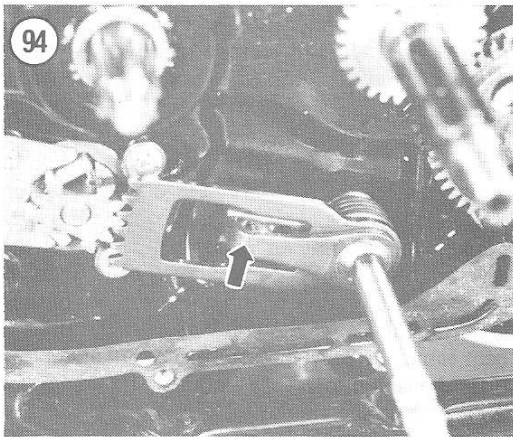
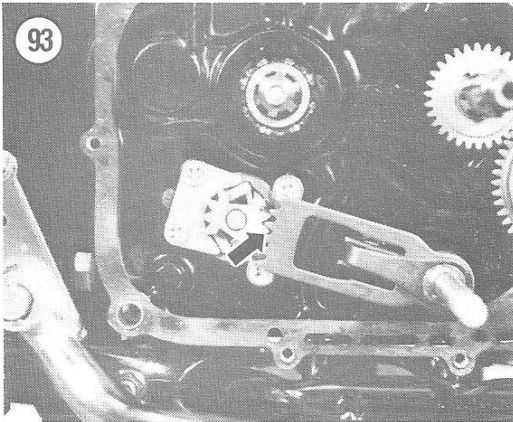
6. Store the pawl holder assembly in a spray paint can top to keep all the components together (Figure 92).

7. If further gearshift mechanism is required, the engine crankcases must be separated. Refer to Chapter Four for engine disassembly, then perform *Internal Gearshift Mechanism Removal* as outlined in this chapter.

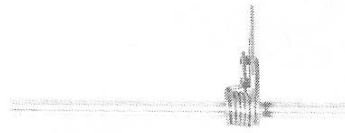
8. Perform *Inspection*.

9. Assembly is the reverse of these steps. Keep the following points in mind:

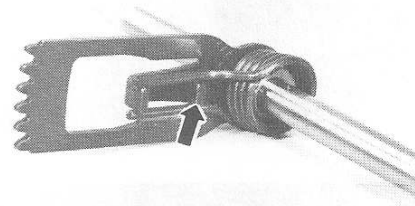
- a. Install the pawl holder assembly with the 5 teeth pointing toward the rear of the engine as shown in Figure 91.



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96



- b. Use blue Loctite (Lock N' Seal No. 2114) on the cam guide and pawl lifter screws and install the cam guide and pawl lifter as shown in **Figure 90**.
- c. Slide the gearshift shaft into the engine and center the teeth on the pawl holder assembly as shown in **Figure 93**.
- d. Ensure that the spring on the shift shaft is positioned over the pin in the crankcase as shown in **Figure 94**.
- e. Install the primary gears, clutch and external gearshift linkage as outlined in this chapter.
- f. Install the gear position indicator gears, if removed.
- g. Install the gearshift lever (**Figure 88**).

Inspection

1. Examine the gearshift shaft for signs of damage or excessive wear (**Figure 95**). Make sure the shaft

is not bent and that the splines on each end of the shaft are in good condition. If the gearshift shaft shows any signs of damage or wear it must be replaced.

2. Ensure that the shaft spring is correctly centered on the shaft as shown in **Figure 96**.
3. Carefully inspect the pawl lifter and cam guide (**Figure 97**) for signs of wear; replace them if necessary.
4. Disassemble the pawl holder and inspect the pins, springs and pawls for wear or damage (**Figure 98**).
5. Assemble one half of the pawl holder assembly. Make sure the rounded ends of the pawl pins fit in the grooves as shown in **Figure 99**. The grooves in the pawls are offset. When the pawls are installed correctly, the rear edge of the pawls must be flush with the rear edge of the pawl holder as shown in **Figure 100**.

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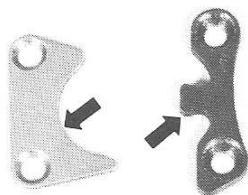
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6. Use a piece of
in place and as
holder assembly.

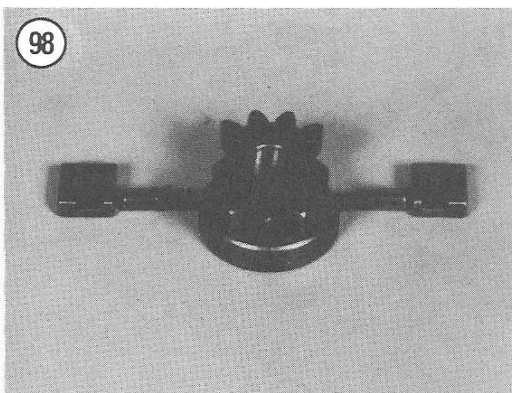
INTERNAL

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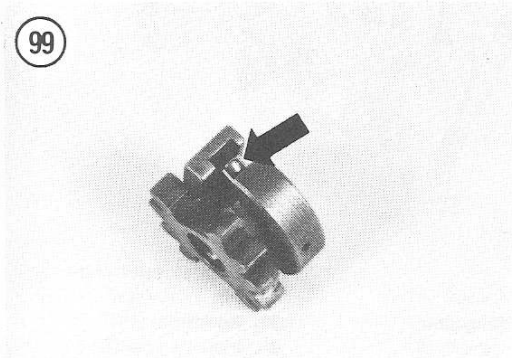
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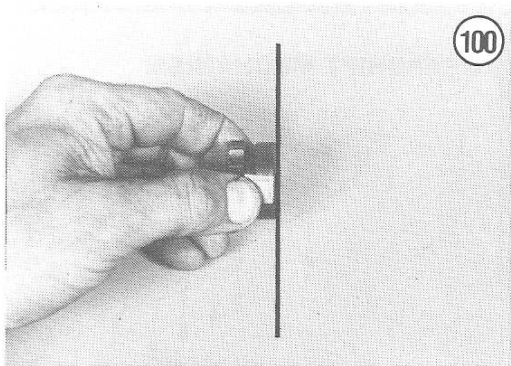


6. Use a piece of tape to hold the first pawl and pin in place and assemble the other half of the pawl holder assembly.

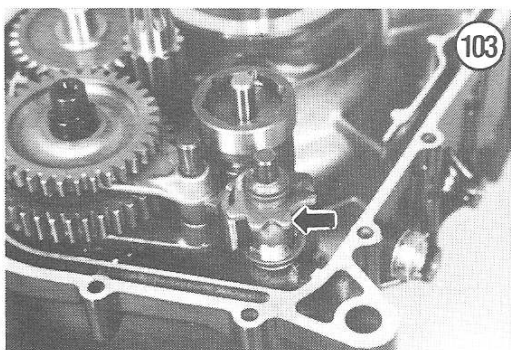
TRANSMISSION AND INTERNAL GEARSHIFT MECHANISM

The internal gearshift mechanism consists of the gearshift components, including the reverse gear assemblies, that can only be removed after the engine is removed and disassembled.

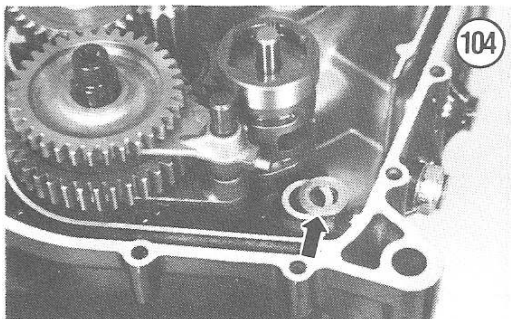
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104



The transmission, other than reverse gear assemblies, consists of 2 complete gearsets. The internal gearshift components must be removed before the gearsets can be removed.

Removal/Installation

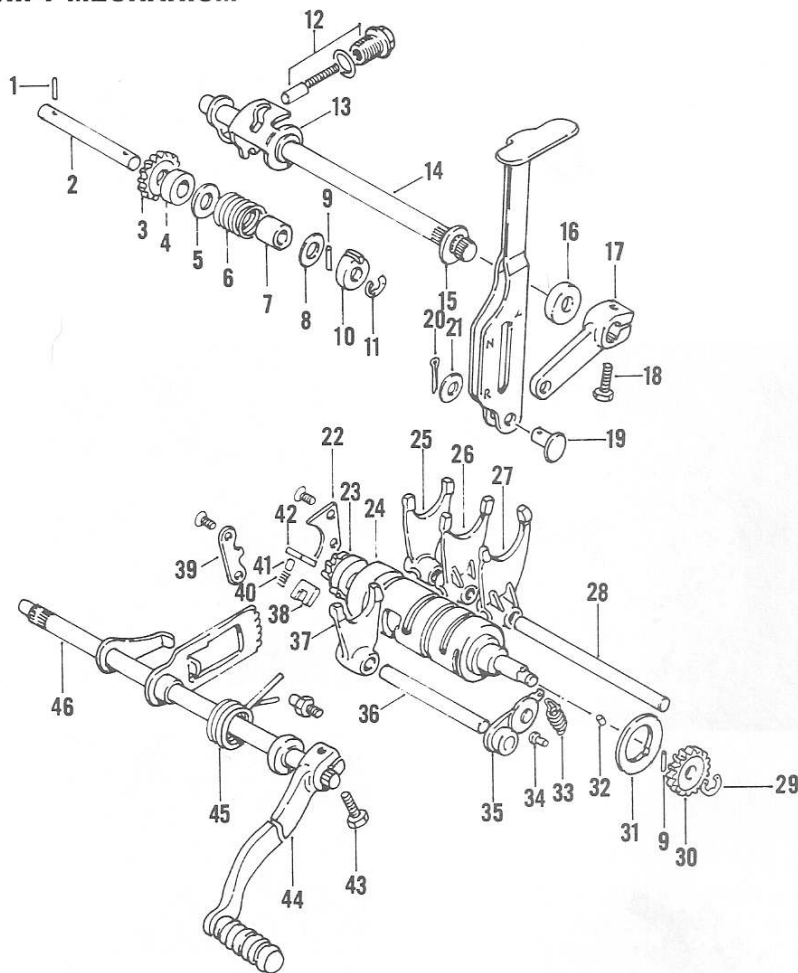
Refer to Figure 101 and Figure 102 for this procedure.

1. Disassemble the crankcase as described in Chapter Four.
2. Slide out the reverse gearshift shaft with the reverse shifting cam (Figure 103). Take care not to lose the thrust washer (Figure 104). The washer

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GEARSHIFT MECHANISM



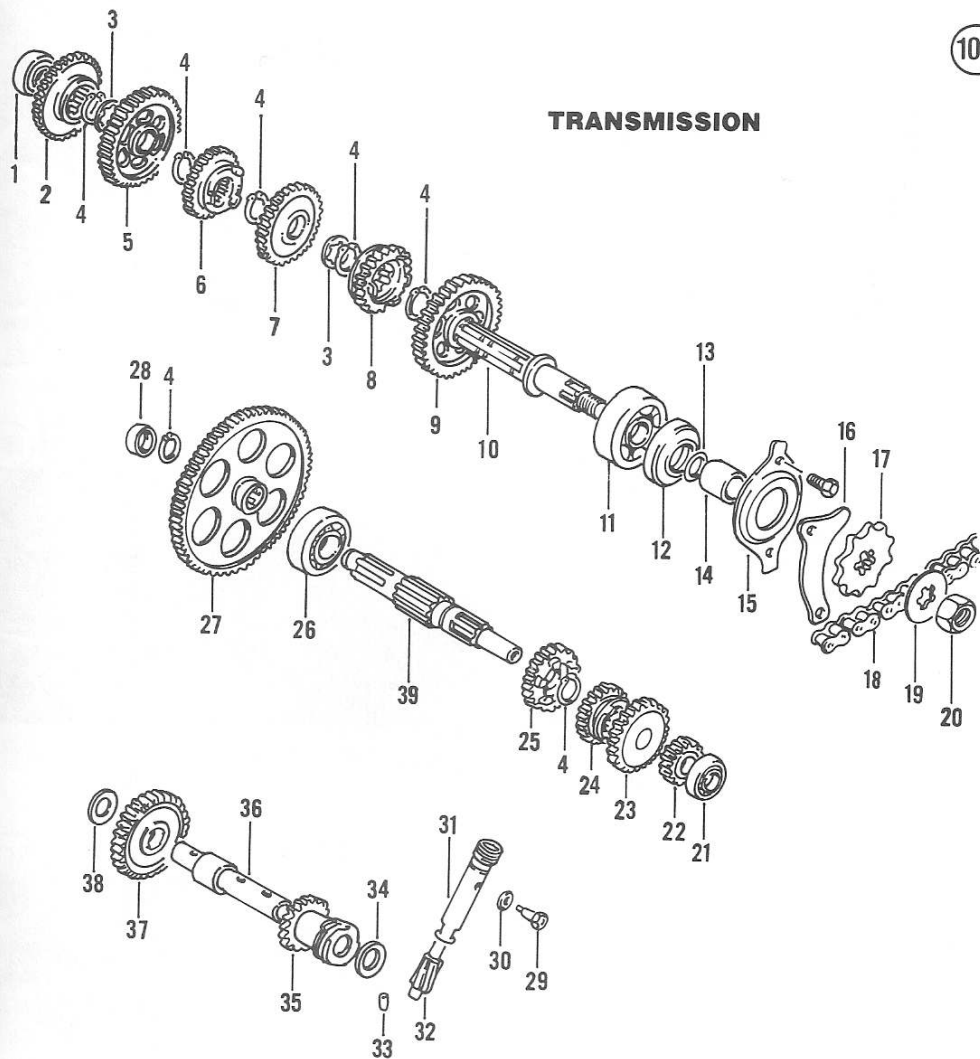
- | | | |
|--|----------------------------------|------------------------------|
| 1. Pin | 15. Washer | 31. Cam stopper plate |
| 2. Gear position indicator shaft | 16. Oil seal | 32. Pin |
| 3. Gear position indicator gear | 17. Reverse shifting arm | 33. Spring |
| 4. Oil seal | 18. Bolt | 34. Pin |
| 5. Washer | 19. Pin | 35. Cam stopper |
| 6. Spring | 20. Cotter pin | 36. No. 2 shift fork shaft |
| 7. Spacer | 21. Washer | 37. No. 3 gear shifting fork |
| 8. Washer | 22. Pawl lifter | 38. No. 2 pawl |
| 9. Pin | 23. Pawl holder assembly | 39. Cam guide |
| 10. Gearshift indicator | 24. No. 1 gear shifting cam | 40. Spring |
| 11. Circlip | 25. No. 4 shift fork | 41. Pin |
| 12. Neutral cam stopper assembly | 26. No. 2 shift fork | 42. No. 1 pawl |
| 13. Reverse shifting cam
(gear shifting cam No. 2) | 27. No. 1 shift fork | 43. Bolt |
| 14. Reverse gearshift shaft
(No. 2 gear shifting shaft) | 28. No. 1 shift fork shaft | 44. Gearshift lever |
| | 29. Circlip | 45. Spring |
| | 30. Gear position indicator gear | 46. Gearshift shaft |

1. Bearing
2. Reverse
3. Thrust
4. Circlip
5. 1st driv
6. 4th driv
7. 3rd driv
8. 5th driv
9. 2nd driv
10. Drive s
11. Bearing
12. Oil seal
13. O-ring

101

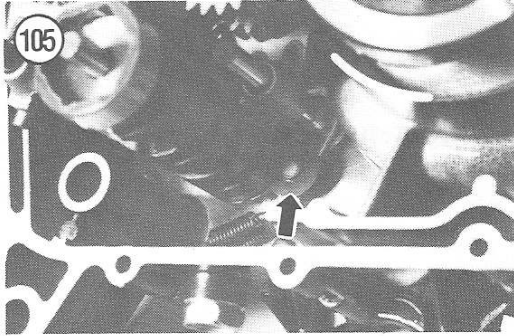
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TRANSMISSION



- | | | |
|------------------------|-------------------------|--------------------------|
| 1. Bearing | 14. Sprocket spacer | 27. Primary driven gear |
| 2. Reverse driven gear | 15. Seal retainer | 28. Oil seal |
| 3. Thrust washer | 16. Plate | 29. Bolt |
| 4. Circlip | 17. Engine sprocket | 30. Washer |
| 5. 1st driven gear | 18. Drive chain | 31. Sleeve |
| 6. 4th driven gear | 19. Folding lockwasher | 32. Odometer driven gear |
| 7. 3rd driven gear | 20. Engine sprocket nut | 33. Pin |
| 8. 5th driven gear | 21. Bearing | 34. Thrust washer |
| 9. 2nd driven gear | 22. 2nd drive gear | 35. Odometer drive gear |
| 10. Drive shaft | 23. 5th drive gear | 36. Reverse gear shaft |
| 11. Bearing | 24. 3rd drive gear | 37. Reverse idler gear |
| 12. Oil seal | 25. 4th drive gear | 38. Thrust washer |
| 13. O-ring | 26. Bearing | 39. Counter shaft |

5



may be stuck to the gearshift shaft. The reverse gearshift shaft should slide out of the engine with just a small amount of resistance. If the shaft is difficult to remove, check the portion of the shaft end exposed on the left side of the engine. If the machine has ever been in a hard spill or collision, the end of the gearshift shaft may be bent. A bent shaft is impossible to remove or straighten without putting abnormal stress on the crankcases. If the shaft is bent enough to prevent its normal removal, there is little choice but to cut the shaft off with a hacksaw very close to the crankcase. It is much cheaper in the long run to replace the shaft than risk damaging a very expensive matched set of engine crankcases.

3. Partially lift up the No. 2 shift fork shaft and remove the cam stopper from under the fork shaft (Figure 105). Disengage the cam stopper spring from the pin in the crankcase and remove the cam stopper.

4. Swing the No. 2 shift fork shaft away from the gearshifting cam and remove the fork shaft (Figure 106).

5. Lift the No. 1 shift fork shaft out of the hole in the crankcase (Figure 107). Swing the fork shaft with the 3 shift forks toward the rear of the engine so that the pins on the shift forks are disengaged from the gearshifting cam.

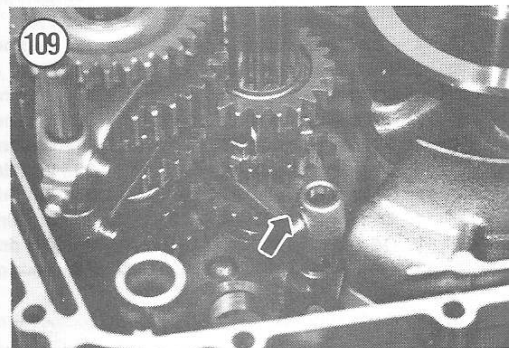
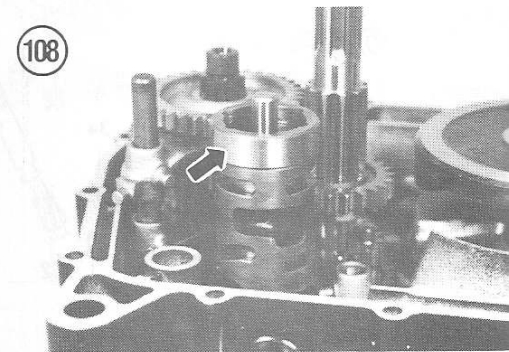
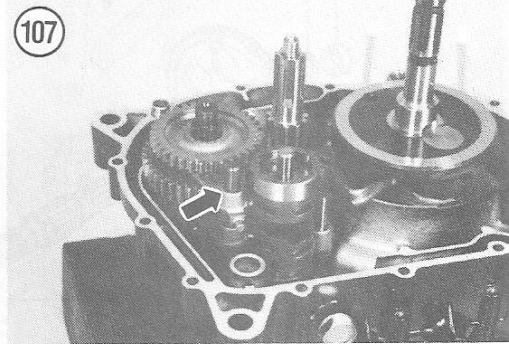
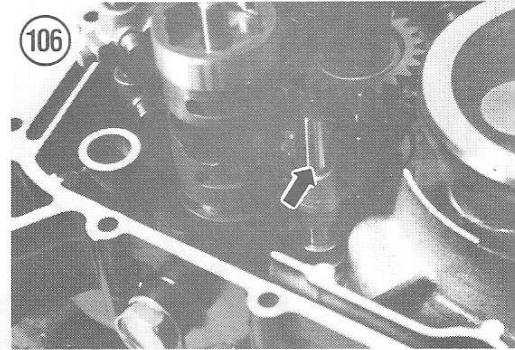
6. Lift out and remove the gearshifting cam (Figure 108).

7. Remove the No. 3 shifting fork (Figure 109).

8. Remove the reverse idler gear (Figure 110). Note the thrust washer next to the gear.

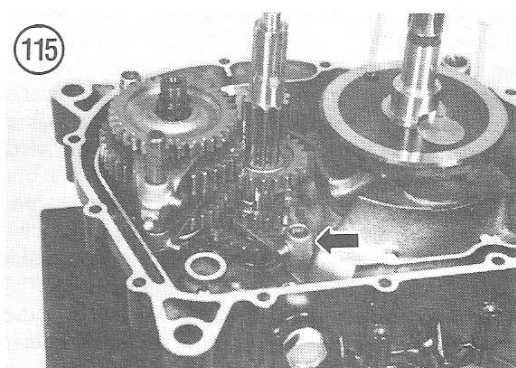
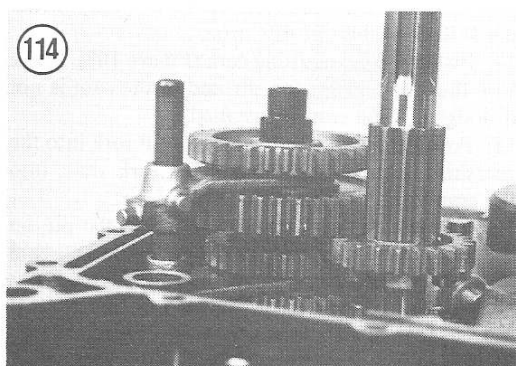
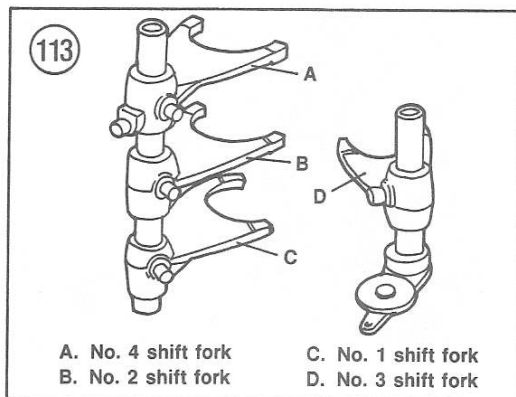
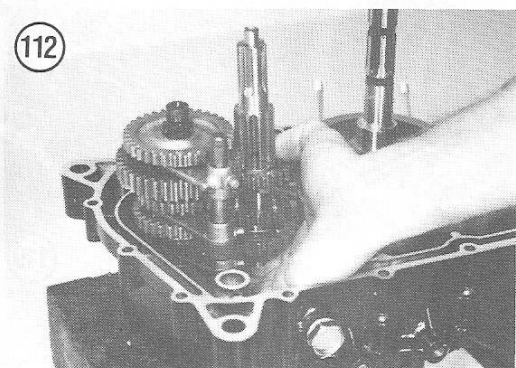
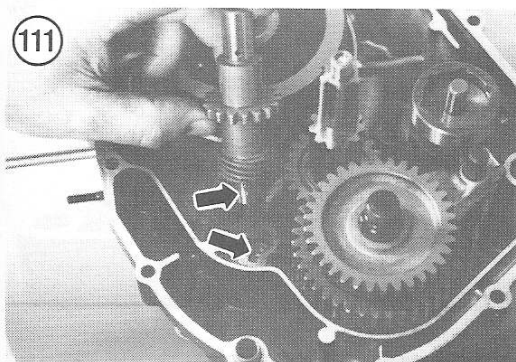
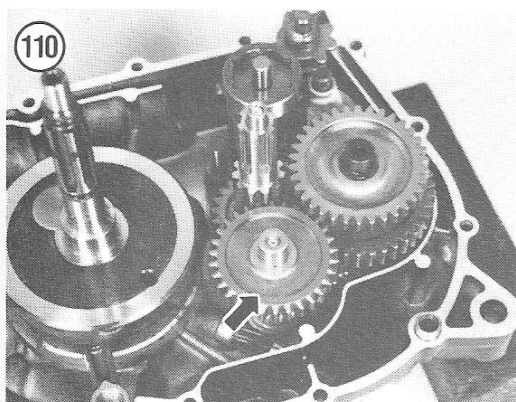
9. Lift out and remove the reverse gear shaft with the odometer drive gear (Figure 111). Note how the pin on the end of the shaft engages the slot in the crankcase.

10. Carefully lift out both gearsets with the shift fork shaft and shift forks as shown in Figure 112. Carefully separate the gearsets and the shift forks with the shift shaft. Place all the parts in order on clean rags.



Carefully
position and
The forks
must be ins

11. Installation is
the following poi
12. Assemble the
No. 1 shift fork s

**NOTE**

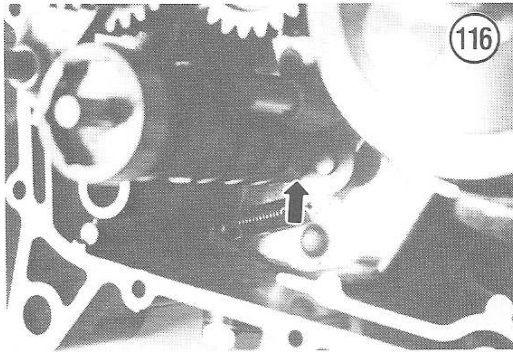
Carefully note and write down the position and location of each shift fork. The forks are not interchangeable and must be installed exactly as removed.

11. Installation is the reverse of these steps. Keep the following points in mind.
12. Assemble the No. 1, 2 and 4 shift forks on the No. 1 shift fork shaft as shown in **Figure 113**.

NOTE

The No. 4 shift fork is also the reverse shift fork.

13. Carefully position the shift forks into the gears. Mesh both gearsets together and install the gearsets into the crankcase as shown in **Figure 112**.
14. Position the shift forks and gears as shown in **Figure 114**.
15. Slide the No. 3 shift fork into the countershaft gearset as shown in **Figure 115**.



16. Position the cam stopper between the No. 3 shift fork and the crankcase but do not fully install the shift fork shaft at this time.

17. Install the gearshifting cam (Figure 108). Make sure the stopper plate on the end of the cam is not dislodged as the cam is installed.

18. Position the pin on the No. 3 shift fork into the gearshifting cam. Fully install the fork shaft into the crankcase (Figure 106).

19. Connect the cam stopper spring to the pin on the crankcase and position the wheel of the cam stopper against the gearshifting cam (Figure 116).

20. Position the reverse gearshifting cam on the reverse gearshift shaft as shown in Figure 117.

21. Install the reverse gearshift shaft. Make sure the thrust washer is located between the reverse cam and the crankcase (Figure 104).

22. Swing the No. 1 shift fork shaft inward and engage the pins of the shift forks with the grooves in the gearshifting cam. Make sure the pin on the reverse fork also engages the reverse cam (Figure 118). Ensure that the fork shaft is fully installed into the hole in the crankcase.

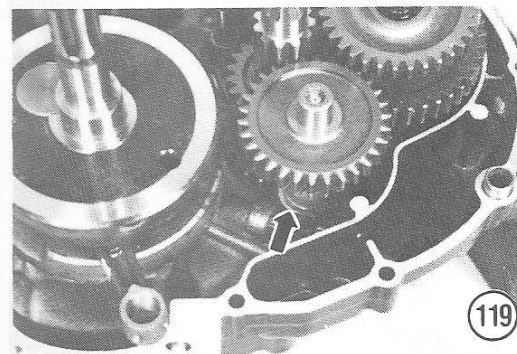
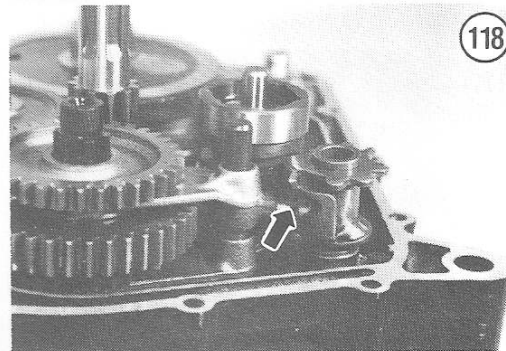
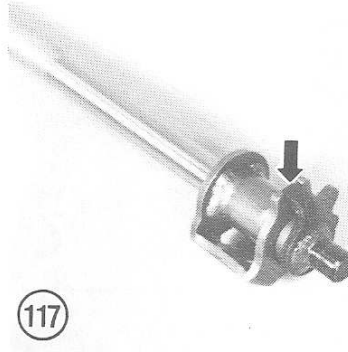
23. Install the odometer drive gear with the pin located into the crankcase groove (Figure 111).

24. Install the reverse idler gear on the shaft. Make sure the odometer drive gear meshes with the odometer driven gear (Figure 119). Turn the transmission gears as necessary to get the odometer gears to mesh correctly.

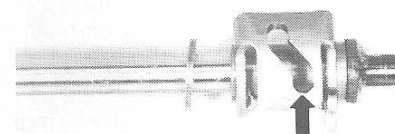
25. Refer to Chapter Four and assemble the engine crankcases. Install the neutral cam stopper housing after the crankcases have been assembled to hold the transmission in neutral.

Gearshift Mechanism Inspection

1. Inspect the engagement groove in the reverse gear shifting cam (Figure 120).
2. Slide the reverse shifting cam off the reverse gear shifting shaft and check the shaft for bending or other damage (Figure 121).



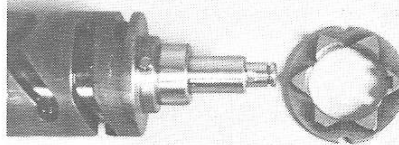
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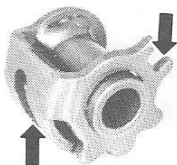


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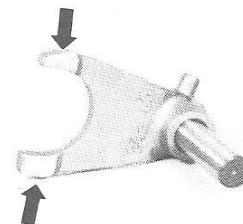


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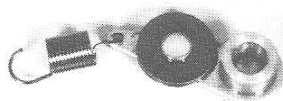
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126



123



3. Inspect the inside and other contact areas of the reverse gear shifting cam for signs of wear or damage (Figure 122). Replace the cam if worn or damaged.

4. Check the cam stopper: replace it if signs of wear or damage are visible (Figure 123).

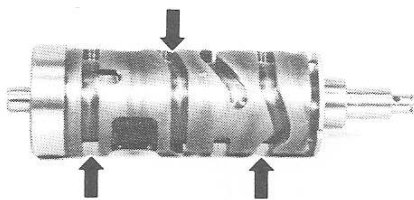
5. Carefully examine the grooves in the shifting cam for wear or roughness (Figure 124). Replace the shifting cam if any grooves are chipped or worn.

6. Remove the stopper plate from the end of the shifting cam (Figure 125). Inspect the stopper plate and the end of the shifting cam. Replace either component if wear is visible. Install the stopper plate with the notch aligned with the pin in the shifting cam.

7. Inspect the ends of each shift fork for damage or excessive wear (Figure 126). Measure the thickness of the shift forks with a micrometer or calipers as shown in Figure 127. Refer to Table 2 for standard dimensions and service limits.

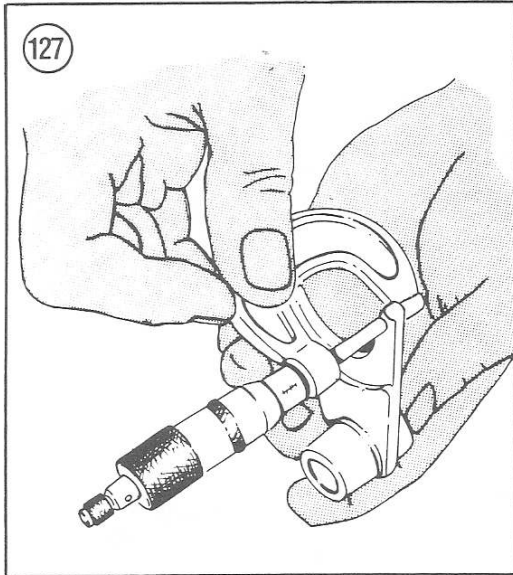
8. Install each shift fork in its respective gear. Use a feeler gauge to measure the clearance between the fork and the gear as shown in Figure 128. Refer to Table 2 for fork clearance specifications.

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CAUTION

It is recommended that marginal shift forks be replaced. Worn forks can cause the transmission to slip out of gear, leading to more serious and expensive damage.



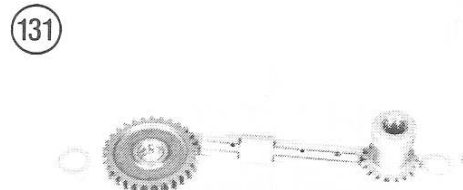
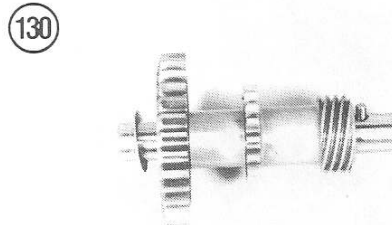
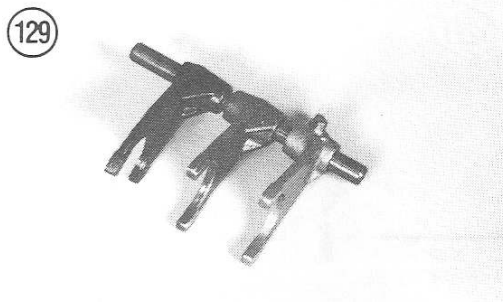
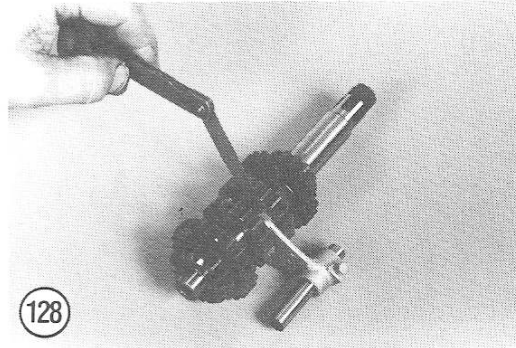
9. If the width of a shift fork is within tolerance but the clearance between the fork and the gear is excessive, use calipers and measure the gear groove width. If the groove width exceeds the dimensions specified in **Table 2** the gear must be replaced.
10. Slide each shift fork on the fork shafts and make sure the forks slide freely, but without excessive play (**Figure 129**).

TRANSMISSION GEARSET DISASSEMBLY/ASSEMBLY

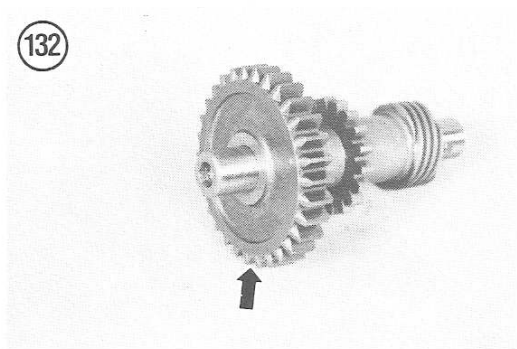
The following procedures refer to the countershaft and drive shaft. The countershaft (also known as the input shaft) is connected to the clutch. All the gears on the countershaft are identified as "drive" gears. The drive shaft (also known as the output shaft) is connected to the drive chain. All the gears on the drive shaft are identified as "driven" gears.

Some early 1983 models experienced difficulties staying in REVERSE when the machine was operated. If this problem occurs, refer to *External Gearshift Mechanism, Installation* in this chapter to make sure the linkage is installed correctly. If the linkage is correct and the problem continues, install the Suzuki reverse gear and cam kit (part No. 24500-18830). The kit consists of modified reverse driven gear and idler gears, shifting forks and gearshifting cams. All the parts must be installed as a kit, individual parts are not interchangeable with earlier stock components.

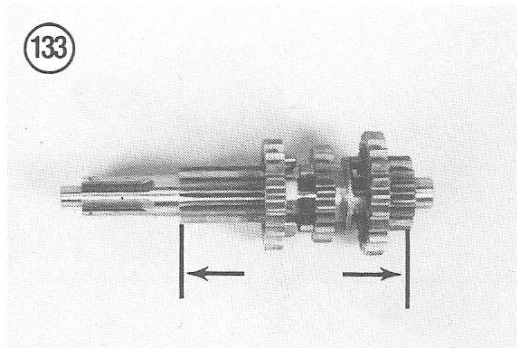
During repair procedures, pay particular attention to the location and position of gears and



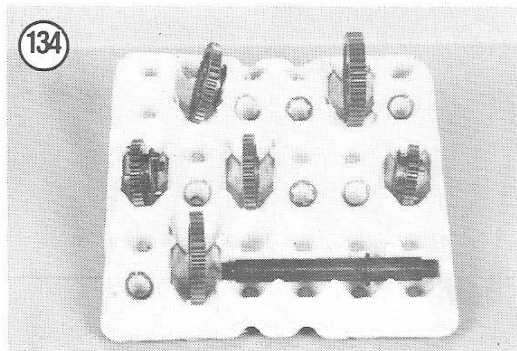
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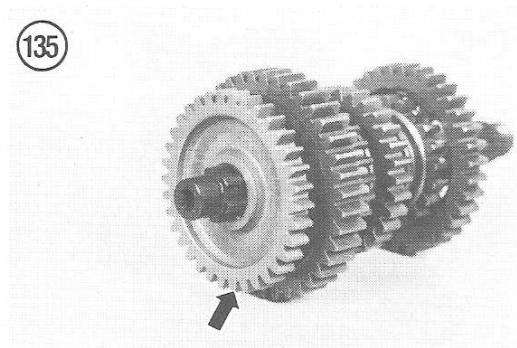
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134



135



thrust washers. Write down the order in which all parts are removed to simplify the assembly and to make sure components are installed in the correct order. Refer to Figure 102 for the following procedures.

Reverse Gearset Disassembly/Assembly

Refer to Figure 130 for this procedure.

The reverse gearset consists of an idler gear, a gear shaft and the odometer drive gear.

1. Disassemble the reverse gearset as shown in Figure 131.
2. Assemble the gearset as shown in Figure 130. Keep the following points in mind:
 - a. Make sure the chamfer on the idler gear teeth faces out as shown in Figure 132.
 - b. Install the thrust washer on the outside of the idler gear as shown in Figure 130.

Countershaft Gear Set Disassembly/Assembly

The 2nd drive gear (the outer gear opposite the splined end) is pressed on the shaft. Replacing gears on the countershaft requires a hydraulic press and special skills; therefore, this task should be referred to a competent machine shop or authorized dealer. If a gear has been replaced on the shaft, make sure that the distance between the 2 outer gears is 111.4-111.6 mm (4.386-4.394 in.) as shown in Figure 133.

Drive Shaft Gear Set Disassembly/Assembly

CAUTION

Suzuki recommends using new circlips to secure the gears whenever gearsets are disassembled. Never expand a circlip more than necessary to slide it over a shaft. All of the circlips are 1.2 mm (0.05 in.) thick and all of the thrust washers are 0.5 mm (0.02 in.) thick.

NOTE

When disassembling the drive shaft gear set, place all the parts in an egg carton as shown in Figure 134. The egg carton helps keep all the gears, washers and circlips in the correct order and proper position.

1. Remove the reverse driven gear (Figure 135).
2. Remove the circlip and thrust washer securing the 1st driven gear (Figure 136) and remove the gear.