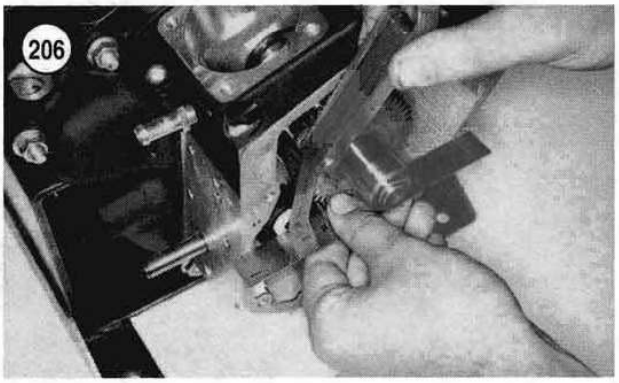
11. Install the gearcase cover and push it on until it is seated correctly. Do not try to correctly seat the cover with the mounting screws.
12. Install the cover screws and tighten to the following:
    a. 1984-1992 models: 62-88 in.-lb. (7-10 N•m).
    b. 1993-1998 models: 88-124 in.-lb. (10-14 N•m).
13. Pour about 1/4 pint of clean engine oil through the lifter guide hole to provide initial gear train lubrication.
14. Install the electronic sensor plate and rotor as described in Chapter Nine.
15. Install the valve lifters, guides and pushrods as described in this chapter.
16. Install the lifter oil screen (**Figure 189**), cap and O-ring (**Figure 188**). Tighten the cap to 90-120 in.-lb. (10-14 N•m).

### Breather Gear End Play Check and Adjustment

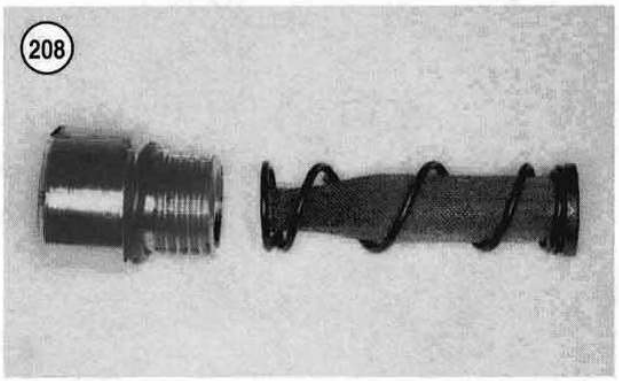
Prior to final assembly of the gearcase components, check the breather gear end play as follows:
1. Install the breather gear (**Figure 195**) and the spacer (**Figure 194**).
2. Install a *new* gearcase cover gasket onto the crankcase. Hold it in place with several small dabs of cold grease.
3. Place a straightedge across the gearcase and gasket adjacent to the breather gear spacer. Measure the clearance with a flat feeler gauge (**Figure 206**). Note the dimension.
4. Subtract 0.006 in. (0.15 mm) from the clearance dimension in Step 3. This is the existing end play clearance. **Table 2** lists the specified breather gear clearance.
5. Replace the spacer if necessary. Spacers with several different thicknesses are available from Harley-Davidson dealerships.
6. Remove the gasket and put it aside for installation.

### Camshaft Gear End Play Check and Adjustment

Prior to final assembly of the gearcase components, check the camshaft gear end play as follows:
1. Install the camshaft gear thrust washer, cam gear spacer washer (1984-1987 models) and the camshaft gear (**Figure 196**).
2. Install a *new* gasket and the gearcase cover. Install a minimum of four gearcase cover screws and tighten securely.
3. Insert a feeler gauge through the gearcase valve lifter hole (**Figure 207**) and measure the camshaft gear end play between the gear shaft and the thrust washer.
4. **Table 2** lists the specified camshaft gear end play.
5A. On 1984-1987 models, replace the washer if necessary. Washers with several different thicknesses are available from Harley-Davidson dealerships.



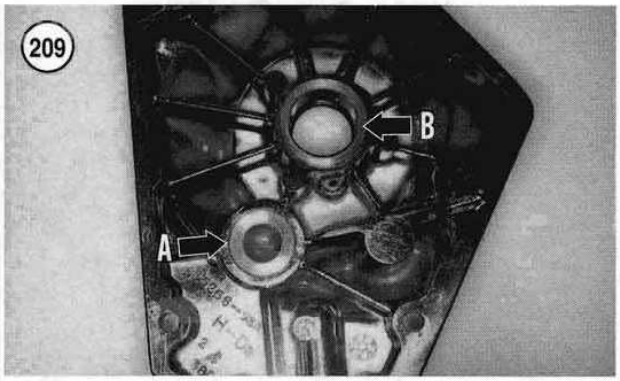


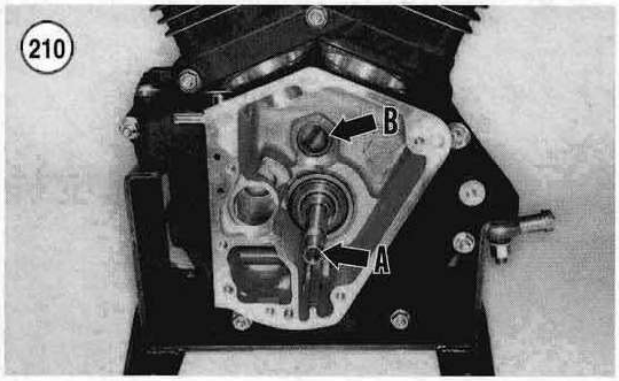


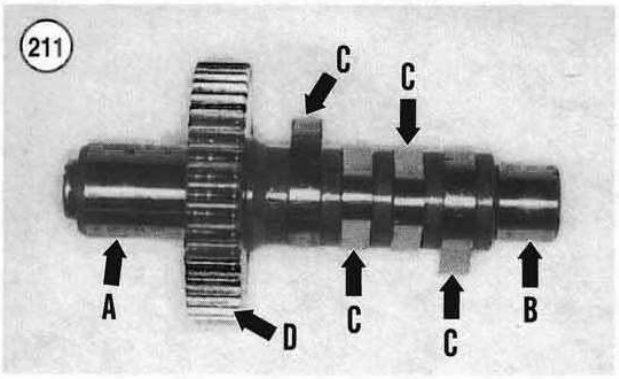

5B. On 1998 models, washers with different thicknesses are not available. If the clearance exceeds the specifications, check for worn or damaged parts and replace as necessary.

### Inspection

1. Thoroughly clean gearcase compartment, cover and components with solvent. Blow out all oil passages with low pressure compressed air. Remove all traces of gasket compound from the gasket mating surfaces.




2. Check the oil screen (**Figure 208**) for damage and/or contamination. Hold the screen upside down and fill it with engine oil. Watch the screen to see that the oil flows evenly through the screen. If not, replace the screen.

3. Check the pinion gear shaft and camshaft gear bushings in the gearcase cover for grooving, pitting or other wear. If the bushings appear visibly worn, refer replacement to a Harley-Davidson dealership. If the bushings are good, continue to Step 4.

4. Determine the pinion shaft bushing (A, **Figure 209**) clearance as follows:

a. Measure the pinion shaft bushing inside diameter. Record the measurement.

b. Measure the pinion shaft (A, **Figure 210**) outside diameter where it rides in the bushing. Record the measurement.

c. Subtract substep b from substep a to determine pin shaft bushing clearance. Replace the bushing if worn to the service limit in **Table 2**.

5. Determine camshaft gear bushing (B, **Figure 209**) clearance as follows:

a. Measure the camshaft gear bushing inside diameter. Record the measurement.

b. Measure the camshaft gear (A, **Figure 211**) outside diameter where it rides in the bushing. Record the measurement.

c. Subtract substep b from substep a to determine pin shaft bushing clearance. Replace the bushing if worn to the service limit in **Table 2**. Refer this service to a Harley-Davidson dealership.

6. Inspect the camshaft gear needle bearing (B, **Figure 210**) for wear or damage. If the bearing is good, perform Step 7. If worn or damaged, replace it as described in this chapter.

7. Measure the camshaft gear as follows:

a. Measure the end (B, **Figure 211**) where it rides in the crankcase needle bearing.

b. Repeat substep a measuring closer to the camshaft lobe where it does *not* ride in the needle bearing.

c. If the difference between substep a and b exceeds 0.003 in. (0.08 mm), replace the camshaft gear and the needle bearing.

8. Measure the camshaft lobes (C, **Figure 211**) with a micrometer and compare to the lobes on a *new* Evolution cam. If the camshaft lobes are worn more than 0.006 in. (0.15 mm), replace the camshaft gear.

*NOTE*

*Camshafts used in pre-1984 V-twin models are **not interchangeable** with 1984-1998 Evolution engines and vice versa. Do not use a non-Evolution camshaft when comparing lobe wear in Step 8.*

9. Inspect the camshaft gear for chipped or missing teeth (D, **Figure 211**).

10. Inspect the pinion gear and the oil pump pinion shaft for wear or damage.

*NOTE*

*Color codes identify the camshaft and pinion gear pitch diameters. The diameters of both replacement gears must be matched, or*

*abnormal gear noise will result. Refer this service to a Harley-Davidson dealership.*

11. Mount a dial indicator to the pinion shaft as shown in (**Figure 212**). Slowly rotate the sprocket shaft on the other side and measure the pinion shaft runout. If the runout is worn to the service limit, either the crankshaft must be trued, or the pinion shaft bearing in the crankcase is worn. Refer this procedure to a Harley-Davidson dealership.
12. Check the camshaft gear oil seal (**Figure 213**) in the gearcase cover. If worn, carefully pry it out of the case. Install a new seal. Refer to the typical procedure described in Chapter One.
13. Inspect the breather gear (**Figure 214**) for chipped or missing teeth. Also check the oil screen for debris or damage and clean with solvent if necessary. Replace the breather gear if necessary.

## CRANKCASE AND CRANKSHAFT

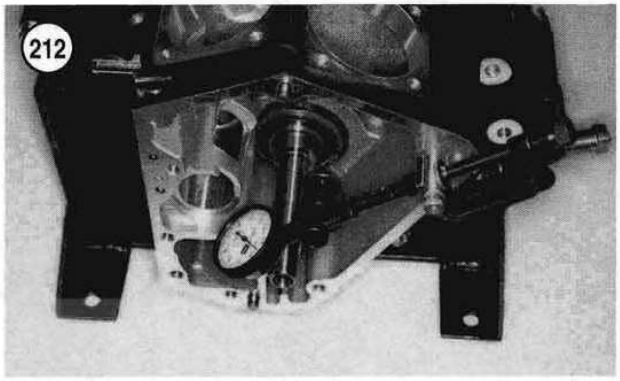
### Crankshaft End Play Check

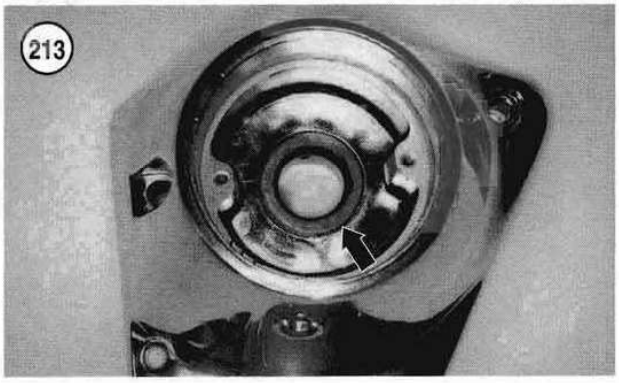
Measure the crankshaft end play prior to disassembling the crankcase. Crankshaft end play is a measure of sprocket shaft bearing wear.
1. Remove the engine from the frame as described in this chapter.
2. Remove the gearcase cover as described in this chapter.
3. Mount the crankcase in an engine stand (JIMS part No. 1006T) (**Figure 215**).
4. Install the bearing installation tool (JIMS part No. 97225-55) onto the sprocket shaft to preload the bearing races (**Figure 216**).
5. Attach a dial indicator so that the probe touches against the end of the crankshaft (**Figure 216**).
6. Turn and pull on the sprocket shaft while noting the end play registering on the dial indicator. If end play exceeds the limit in **Table 2**, the inner bearing spacer (4, **Figure 217**) or (4, **Figure 218**) must be replaced. Adjust end play by installing a different spacer selected from the chart in **Table 5**.

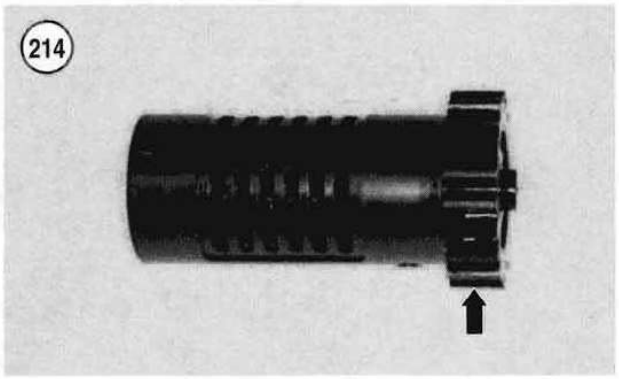
### Disassembly

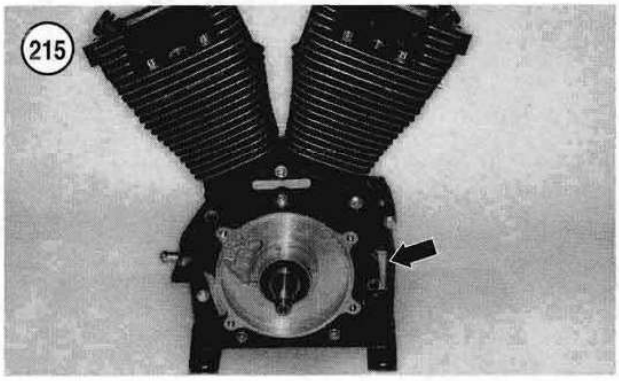
Refer to **Figure 217** and **Figure 218**.
1. Remove the engine from the frame as described in this chapter.

*CAUTION*
*After removing the cylinders, slip a 1/2-in. diameter vinyl or rubber hose over each cyl-*



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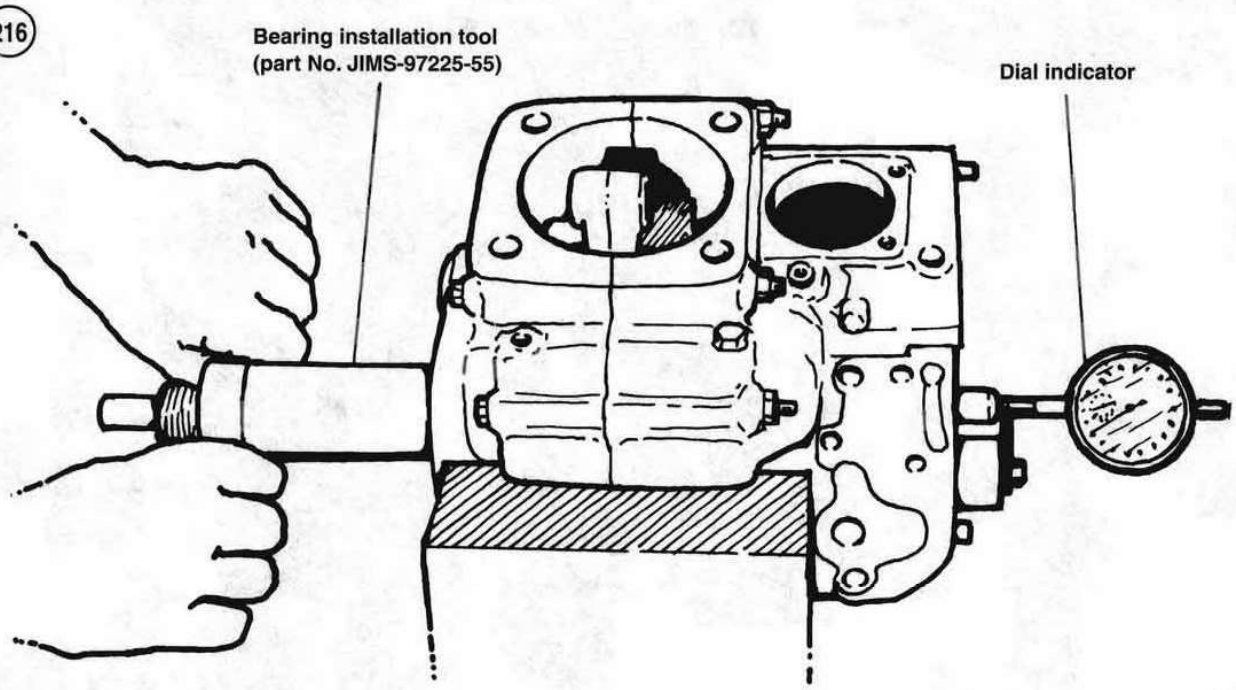
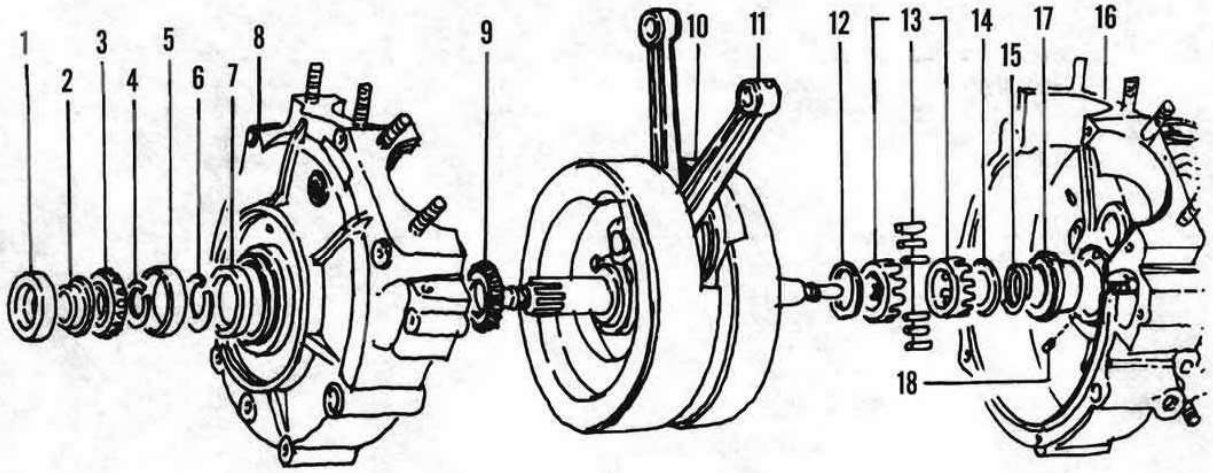


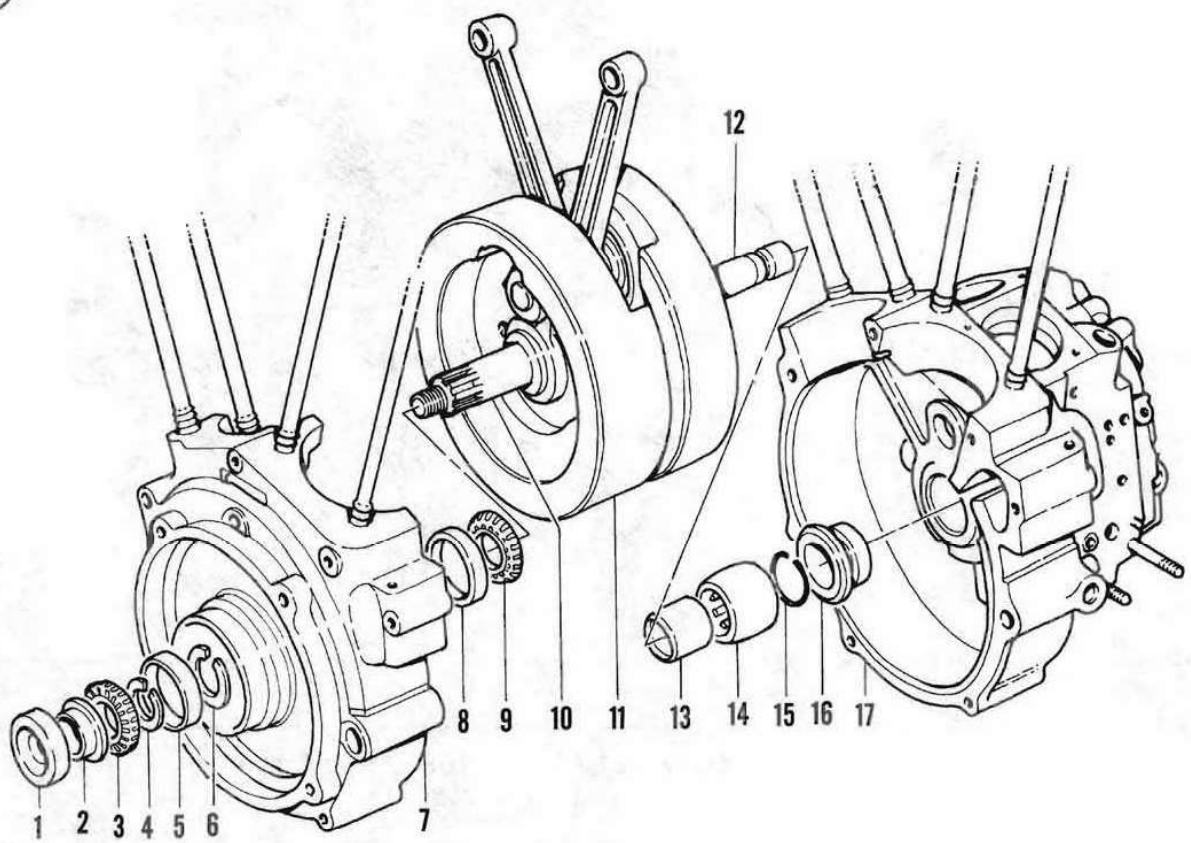

217

## CRANKCASE ASSEMBLY (1984-1986 MODELS)




1. Sprocket shaft bearing seal
2. Sprocket shaft spacer
3. Sprocket bearing half
4. Inner bearing spacer
5. Bearing outer race
6. Lockring
7. Bearing outer race
8. Left crankcase half
9. Sprocket bearing half
10. Crankshaft assembly
11. Connecting rod
12. Bearing washer
13. Bearings and retainer
14. Bearing washer
15. Snap ring
16. Right crankcase half
17. Pinion shaft bearing race
18. Lock screw

(218) **CRANKCASE ASSEMBLY (1987-1998 MODELS)**




1. Sprocket shaft bearing seal
2. Sprocket shaft spacer
3. Outer sprocket shaft bearing
4. Inner bearing spacer
5. Bearing race
6. Lockring
7. Left crankcase half
8. Bearing race
9. Inner sprocket shaft bearing
10. Sprocket shaft
11. Crankshaft assembly
12. Pinion shaft
13. Bearing inner race (1991-1998 models only)
14. Needle bearing
15. Snap ring
16. Pinion shaft bearing race
17. Right crankcase half

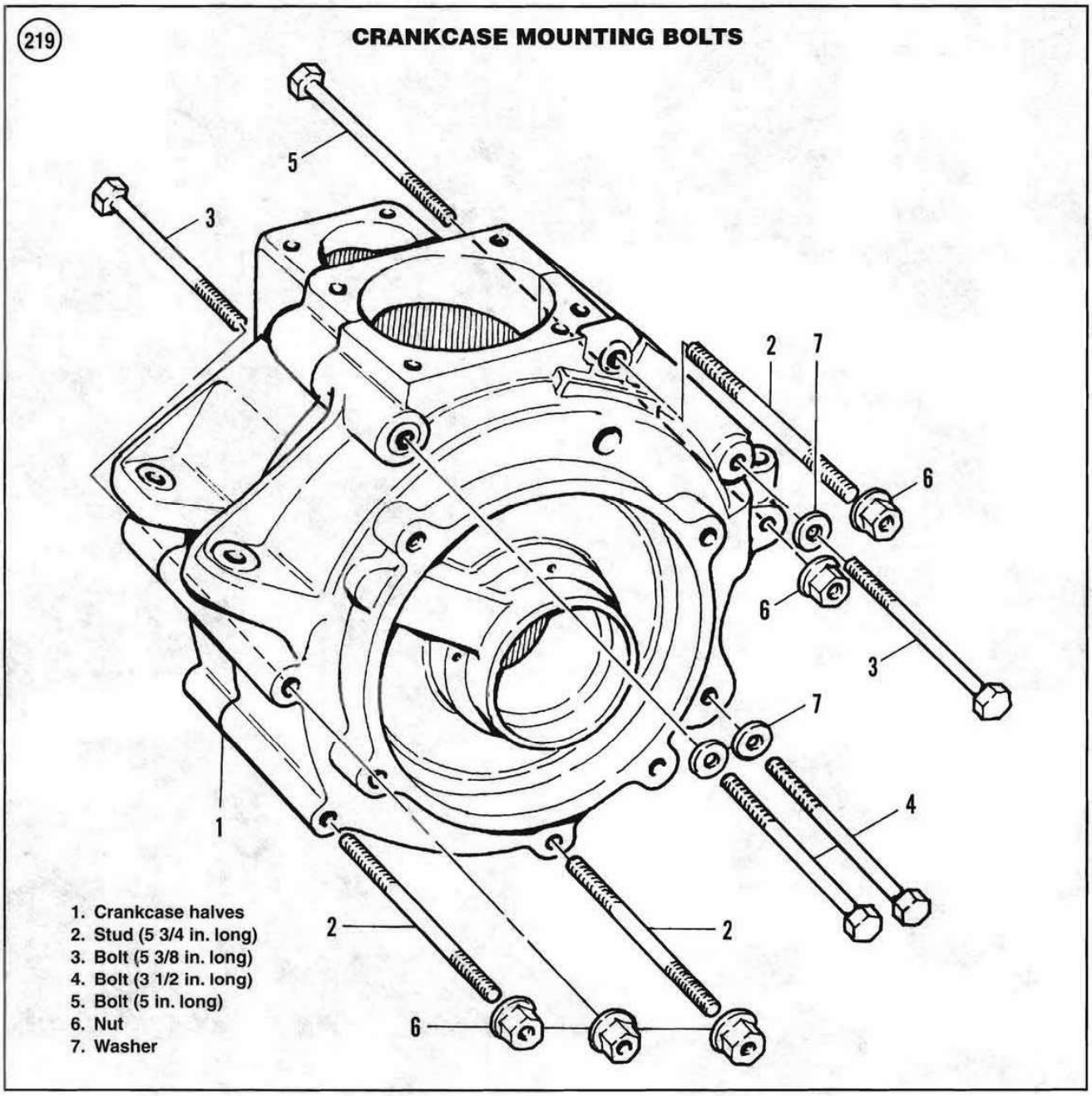
*inder stud. The hose will protect the studs during the following service procedures. In addition, do not lift the crankcase assembly by grabbing the cylinder studs. Bent or damaged cylinder studs may cause the engine to leak oil.*

2. Remove the following components as described in this chapter:
   a. Cylinder heads and cylinders.
   b. Pistons.
   c. Pushrods, valve lifters and lifter guides.
3. Disassemble and remove the gearcase assembly as described in this chapter.
4. Check the crankshaft end play as described in this chapter.

*NOTE*

*When removing the crankcase bolts and studs in Step 4, note that the top center stud and the right bottom studs are matched and fitted to the crankcase holes for correct crankcase alignment. Mark these bolts so they can be reinstalled in their original positions.*

5. Using a crisscross pattern, loosen and remove the crankcase bolts, threaded studs and nuts (**Figure 219**).
6. Lay the crankcase assembly on wooden blocks so the right side faces up.




7. Tap the crankcase with a plastic mallet and remove the right crankcase half (**Figure 220**).

8. Remove the pinion shaft snap ring (**Figure 221**).

9A. On 1984-1986 models, grasp the two bearing washers and remove the washers, bearings and retainers as an assembly from the pinion shaft. Store the complete assembly in a plastic bag.

9B. On 1997-1998 models, remove the needle bearing (**Figure 222**) from the pinion shaft.

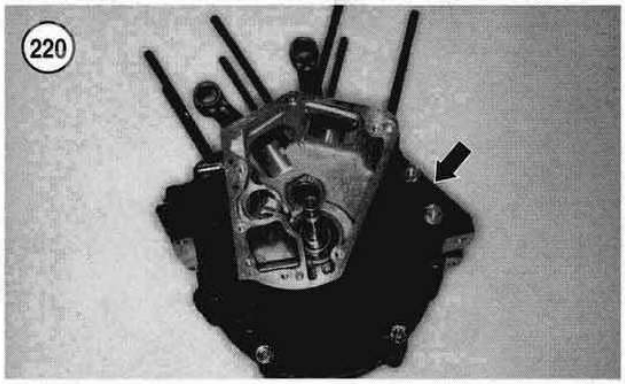
*WARNING*

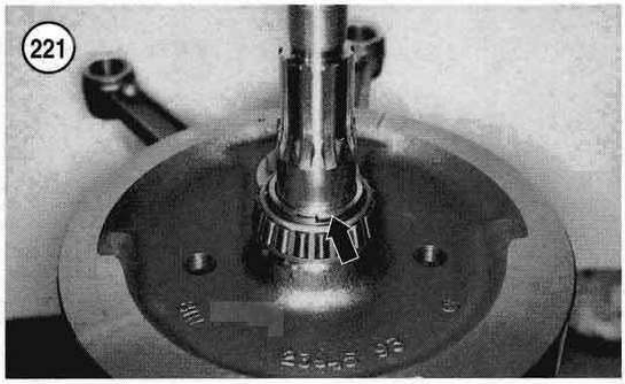
*Wear safety glasses to press out the crankshaft in Step 9.*

*CAUTION*

*Do not drive the crankshaft out of the crankcase with a hammer.*

10A. If a hydraulic press is available, press the crankshaft out of the left crankcase half as follows:




a. Support the left crankcase half on the press bed on wooden blocks (**Figure 223**).
b. Center the press ram on the sprocket shaft and apply slight pressure.
c. Have an assistant secure the crankshaft as it is being pressed out.
d. Press the crankshaft out of the left crankcase half and place it on workbench for further service.

10B. If a hydraulic press is not available, use the JIMS Crank Disassembly Removing Tool (part No. 1047-TP) and press the crankshaft out of the left crankcase half as follows:

a. Following the manufacturer's instructions, install a flywheel press onto the left side of the crankcase.
b. Apply clean engine oil or press lube to the end of the center screw and install it into the tool.

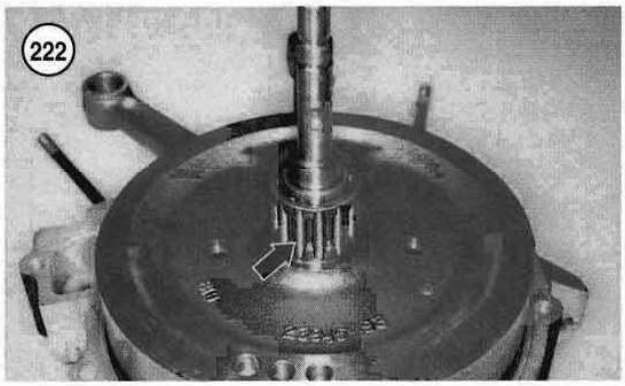
*CAUTION*

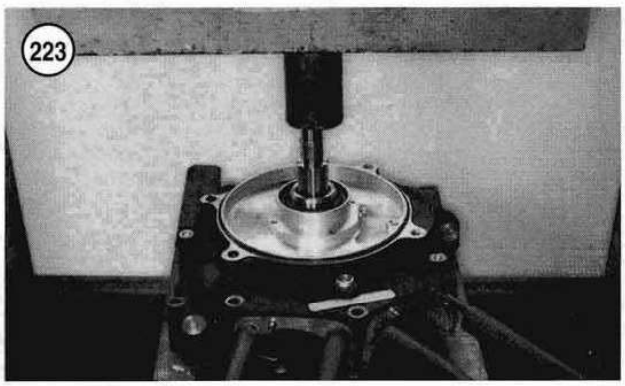
*Do not use a hand impact driver or air impact wrench on the center screw. They will damage the crankcase as well as the tool.*

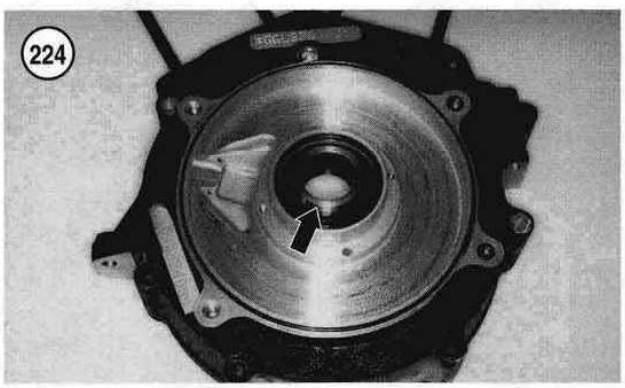
c. Secure the right side of the crankshaft with a wrench to prevent it from rotating in the following step.
d. Slowly turn the center screw with a wrench a half turn at a time. After each turn, tap on the end of the center screw with a brass mallet to relieve the stress on the center screw and the tool.
e. Repeat substep d until the center screw pushes the crankshaft out of the left crankcase half.
f. Remove the special tool from the left crankcase half.

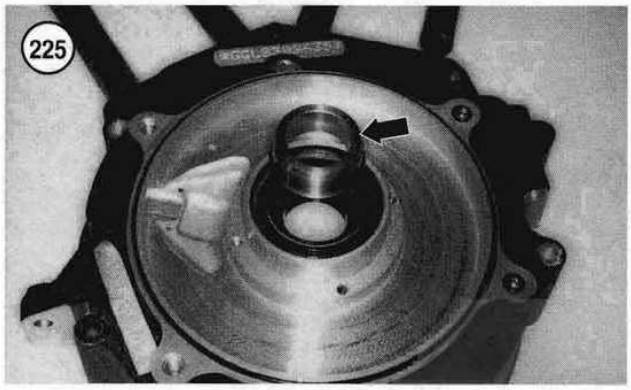
11. To remove the outer sprocket shaft bearing assembly, perform the following:

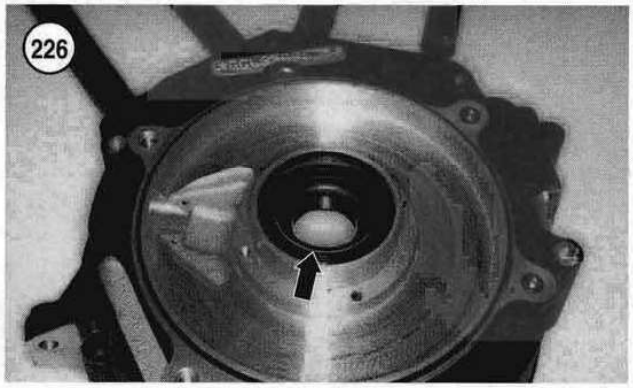
a. Carefully pry the sprocket shaft spacer (**Figure 224**) out of the oil seal (**Figure 225**).
b. Carefully pry the oil seal (**Figure 226**) out of the left crankcase with a wide blade screwdriver. Place a

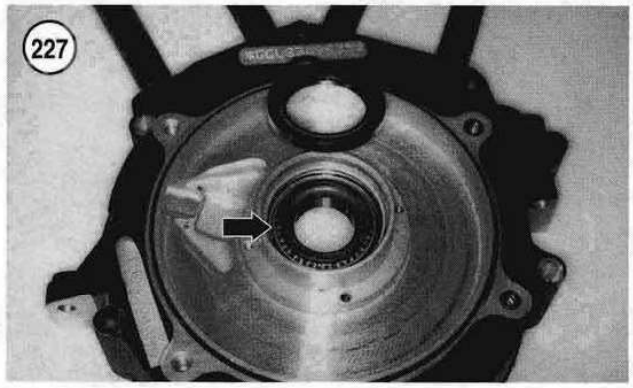


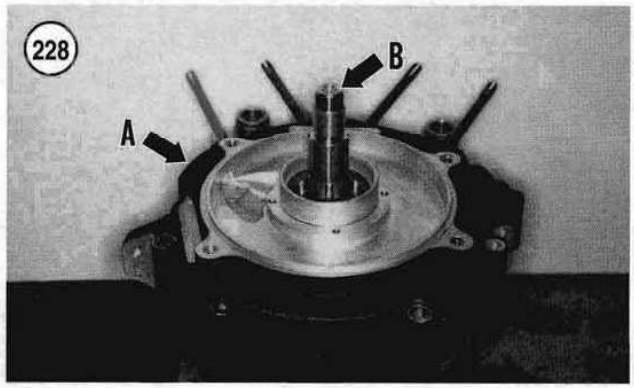



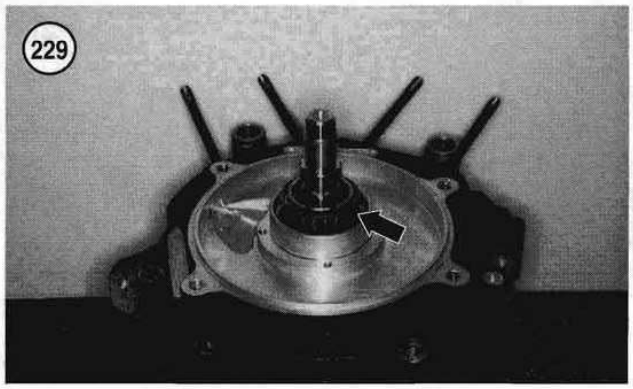






rag under the screwdriver to prevent damage to the crankcase (**Figure 227**).

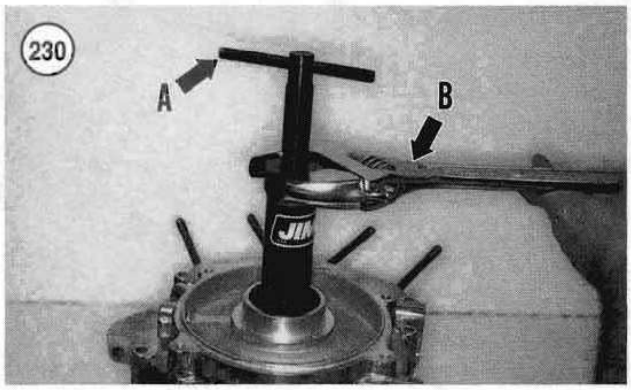
c. Lift out the outer sprocket shaft bearing half (B, **Figure 227**).

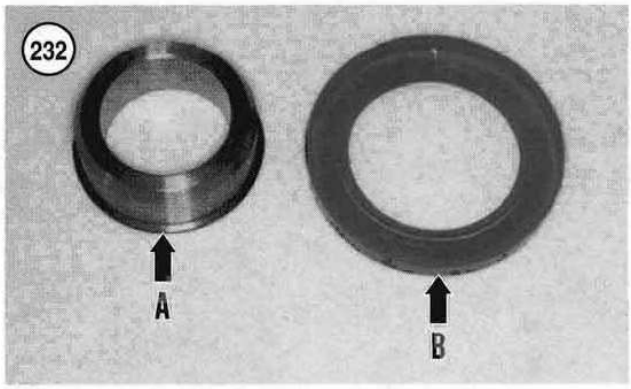
### Assembly

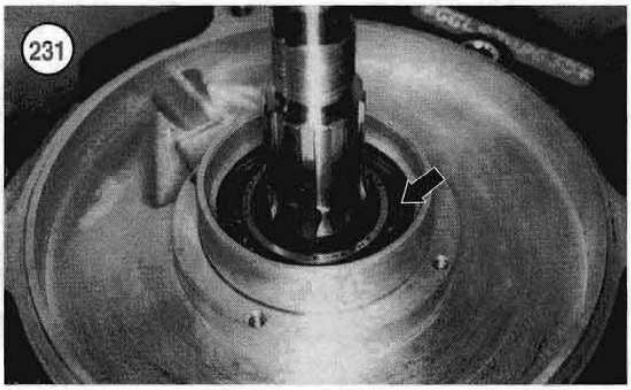
Refer to **Figure 217** and **Figure 218**.

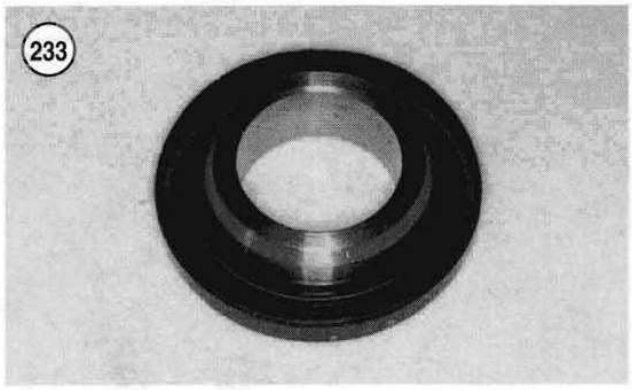
The JIMS Big Twin Sprocket Shaft Bearing Installation Tool (part No. 97225-55) is required to assemble the crankcase halves.

1. If removed, install the spacer onto the crankshaft next to the inner bearing.
2. Position the crankshaft with the left side facing up.
3. Apply clean engine oil or assembly lube to the inner bearing and to the left-side crankcase inner bearing race.
4. Place the left crankcase half (A, **Figure 228**) over the sprocket shaft (B).
5. Make sure the connecting rods are correctly positioned within the crankcase openings.
6. Make sure the crankcase is located correctly on the crankshaft inner bearing.
7. Install the outer sprocket shaft bearing over the sprocket shaft (**Figure 229**) and push it into the outer bearing race.
8. Install the sprocket shaft bearing installation tool onto the crankshaft following the manufacturer's instructions.
9. Hold onto the handle (A, **Figure 230**) and tighten the large nut with a wrench (B). Tighten the large nut until the outer bearing is seated correctly and makes firm contact with the spacer installed in Step 1.
10. Remove the special tools and make sure the outer bearing is seated correctly (**Figure 231**).
11. Check crankshaft end play as follows:
    a. Securely attach a dial indicator to the left crankcase half.
    b. Position the dial indicator contact pointer on the end of the crankshaft.



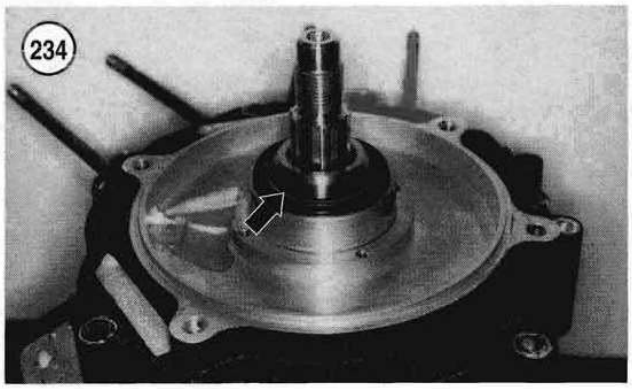



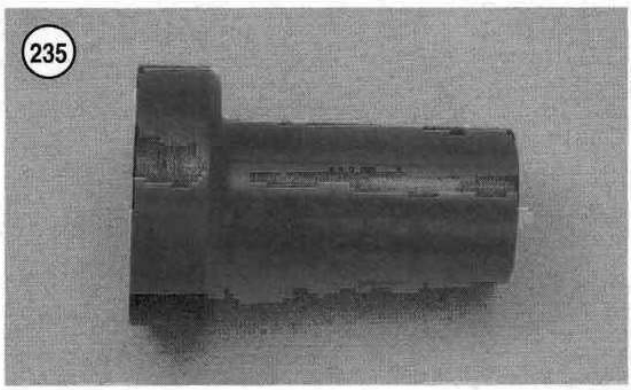



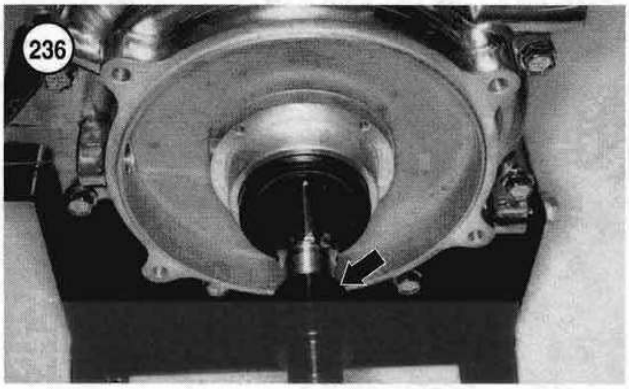



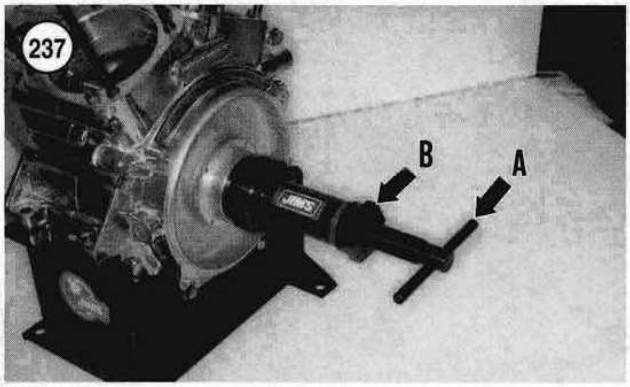

c. Push down hard on the crankcase while turning it back and forth.
d. Hold the crankcase down and zero the dial gauge.
e. Pull up on the crankcase as far as it will go while turning it back and forth. Note the dial indicator reading.
f. Repeat this step several times and note the readings. They should all be the same.
g. The end play must be within 0.001-0.005 in. (0.025-0.127 mm). If the end play is incorrect, the spacer must be replaced using a shim of a different thickness. **Table 4** lists the spacers with various thicknesses and the part numbers.
h. Remove the dial indicator.

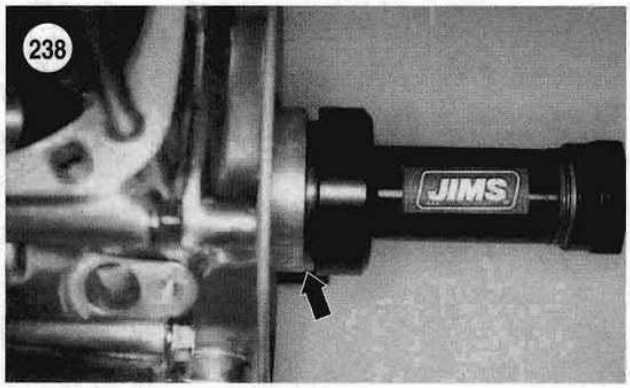
12. Turn the crankcase assembly over and place it on wooden blocks thick enough so the left side of the crankshaft clears the workbench surface.
13. Install the sprocket spacer (A, **Figure 232**) onto the *new* oil seal (B) so the spacer shoulder seats against the closed side of the oil seal (**Figure 233**).
14. Install the spacer and oil seal assembly into the crankcase half so the oil seal lip faces out (**Figure 234**).
15. Press the oil seal into the crankcase with the shaft seal install tool (JIMS part No.39361-69) (**Figure 235**) as follows:

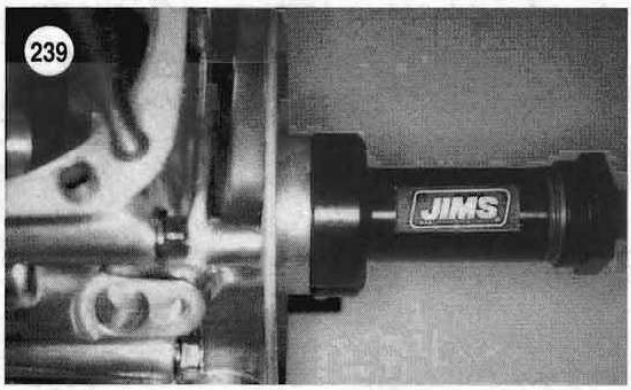


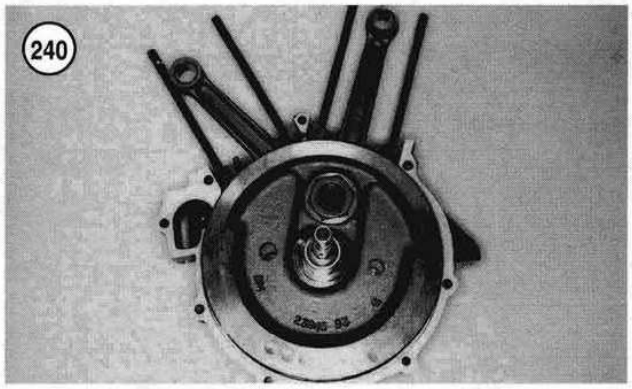



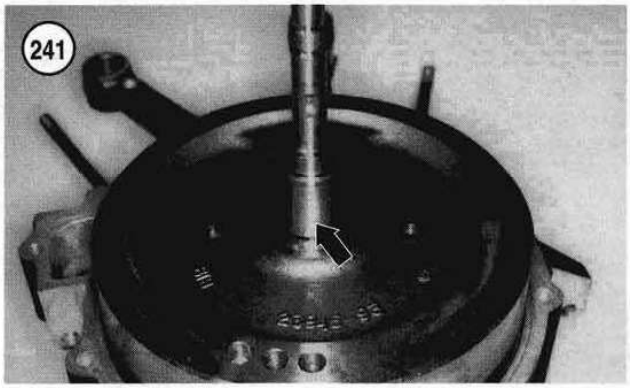



a. Apply clean engine oil or press lube to the special tool threads, both washers and the radial bearing.
b. Install the shaft seal installer tool following the manufacturer's instructions.
c. Install the main body onto the crankshaft and screw it on until it stops (**Figure 236**).
d. Hold onto the handle (A, **Figure 237**) of the main body and tighten the large nut (B) with a wrench. Tighten the large nut slowly and check that the oil seal (**Figure 238**) is entering straight into the bearing bore.
e. Tighten the large nut slowly until the shaft seal installer tool makes contact with the crankcase surface (**Figure 239**).
f. Remove the special tools.

16. Support the left crankcase half assembly on wooden blocks as shown in **Figure 240**.

17. Clean the bearing inner race (**Figure 241**), then apply clean engine oil to it.

18A. On 1984-1986 models, install the retainers, bearings and washers as an assembly onto the pinion shaft.

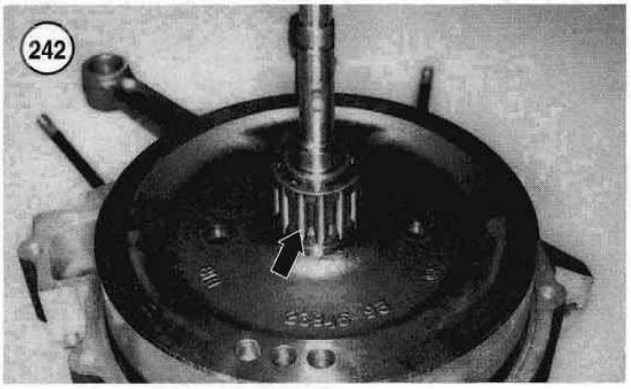
18B. On 1997-1998 models, apply clean engine oil to the needle bearing. Then slide it over the inner race (**Figure 242**).

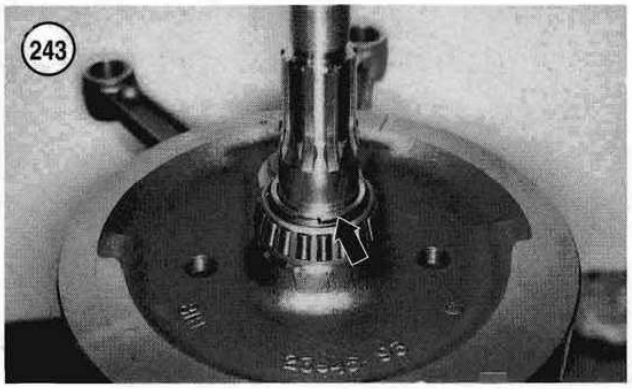
19. Install a *new* snap ring (**Figure 243**) and make sure it is seated correctly in the shaft groove.
20. Thoroughly clean and dry both crankcase gasket surfaces before applying gasket sealer in Step 21.
21. Apply a thin coat of a nonhardening gasket sealer to the crankcase mating surfaces. Use one of the following gasket sealers:
    a. Harley-Davidson crankcase sealant (part No. HD-99650-81).
    b. 3M #800 sealant.
    c. ThreeBond Liquid Gasket 1104.
22. Align the crankcase halves and carefully lower the right crankcase half onto the crankshaft and left crankcase half (**Figure 244**). Press it down until it is seated correctly on the locating dowels. If necessary, carefully tap the perimeter of the right crankcase half until it is seated around the entire perimeter.

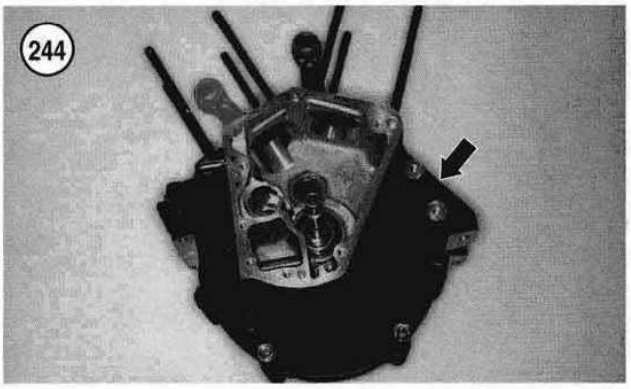
*CAUTION*

*When properly aligned, the crankcase halves will fit snugly against each other around the entire perimeter. If they do not meet correctly, do not attempt to pull the case halves together with the mounting bolts. Separate the crankcase assembly and investigate the cause of the interference.*

23. Carefully tap the three crankcase studs (marked during disassembly) into the crankcase halves (**Figure 245**). Center the studs. Then install the nuts onto each end of the studs and tighten hand-tight.
24. Install the remaining bolts and nuts.
25. Place the crankcase assembly in an engine stand (**Figure 246**). Secure the engine stand to the workbench so it cannot move.
26. Tighten the crankcase fasteners as follows:
    a. Tighten the fasteners to 10 ft.-lb. (14 N•m) in the sequence shown in **Figure 247**.
    b. Install the pistons, cylinders and cylinder heads as described in this chapter.
    c. Tighten the fasteners to 15-17 ft.-lb. (20-23 N•m) in the sequence shown in **Figure 247**.
27. Recheck the flywheel end play as described in this chapter.
28. Install and assemble the gearcase assembly as described in this chapter.
29. Install the following components as described in this chapter:
    a. Alternator rotor and stator assembly (Chapter Nine).
    b. Oil pump.
    c. Camshaft assembly.



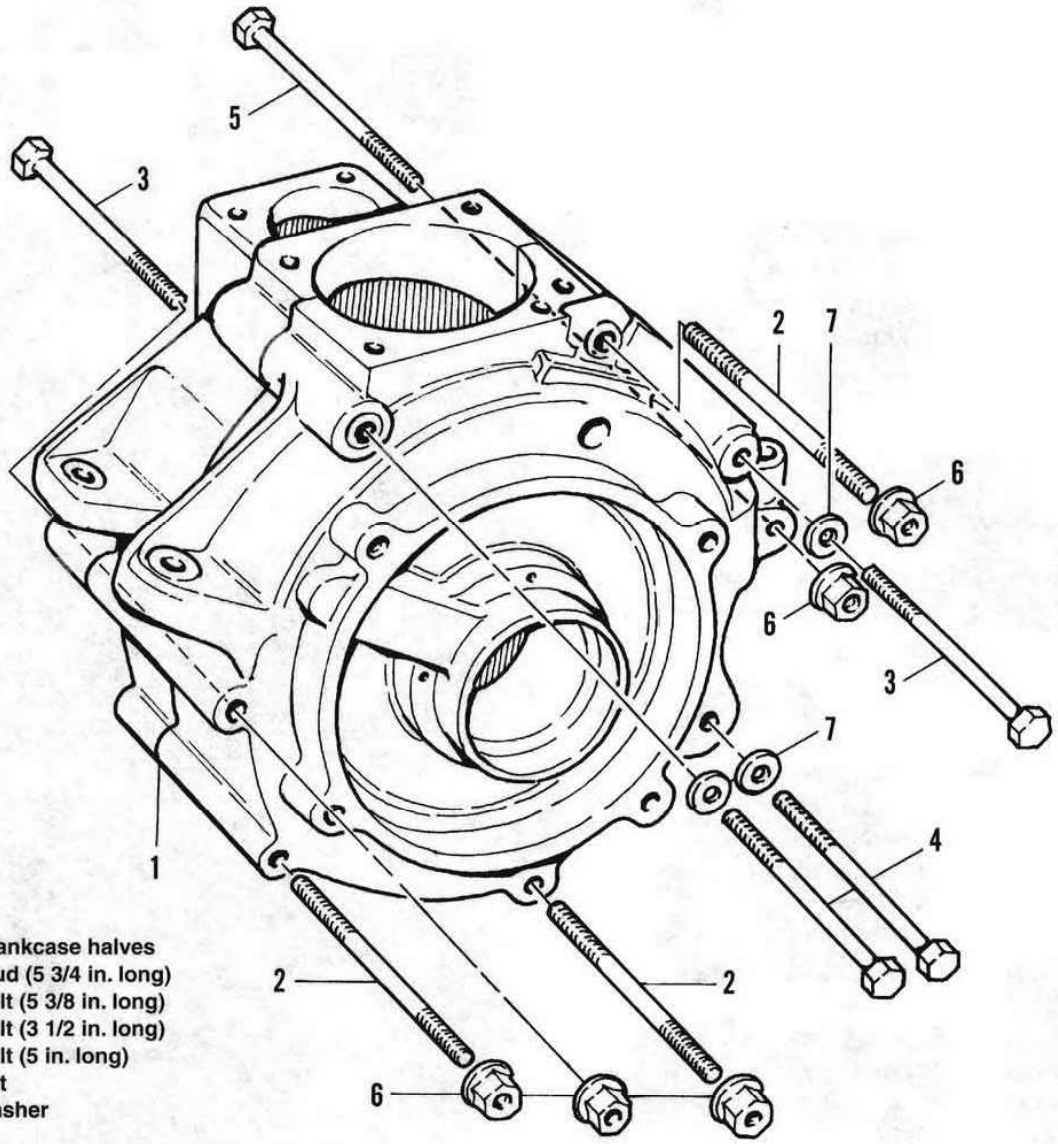

30. Install the engine into the frame as described in this chapter.

### Crankcase Cleaning and Inspection

1. Clean both case halves in solvent and dry with compressed air.
2. Apply a light coat of oil to the races to prevent rust.
3. Inspect the right (**Figure 248**) and left (A, **Figure 249**) case halves for cracks or other damage.

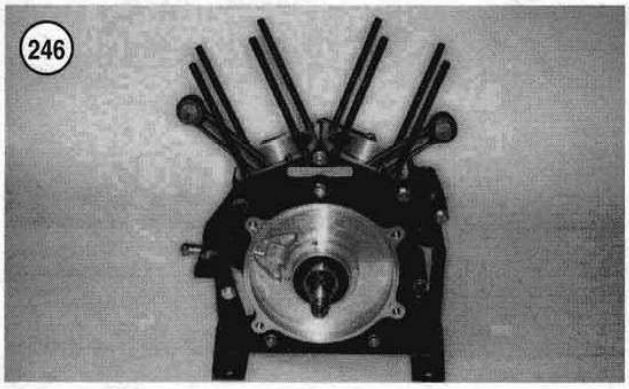
245

**CRANKCASE MOUNTING BOLTS**




1. Crankcase halves
2. Stud (5 3/4 in. long)
3. Bolt (5 3/8 in. long)
4. Bolt (3 1/2 in. long)
5. Bolt (5 in. long)
6. Nut
7. Washer

246



4. Inspect the case studs for bending, cracks or other damage. If necessary, replace studs as described under *Cylinder Stud Replacement* in this section.

5. Inspect the left main bearing races (B, **Figure 249**) for wear or damage. Replace the bearing assembly as described under *Left Main Bearing Replacement* in this section.

*NOTE*

*Harley-Davidson has determined that there is a possible problem with the inner race and has established a program to replace*

*the inner race on 1993-1998 models. Refer any questions regarding a possible problem to a Harley-Davidson dealership.*

6. Inspect the pinion shaft bearing race (A, **Figure 250**) for wear or damage. If damaged, inspect the needle bearing (**Figure 242**) and its inner race (**Figure 251**) for damage. Note the following:
   a. Replace the pinion shaft bearing and races at the same time as a complete set.
   b. Refer pinion shaft inner bearing race replacement to a Harley-Davidson dealership.
7. Inspect the camshaft gear needle bearing (B, **Figure 250**) in the right crankcase for damage. To replace this bearing, refer to *Camshaft Gear Needle Bearing Replacement* in this section.

### Crankshaft and Connecting Rods

#### Cleaning and Inspection

If any portion of the crankshaft and/or connecting rods are worn or damaged, they must be replaced as one assembly. If necessary, have the crankshaft overhauled by a Harley-Davidson dealership.

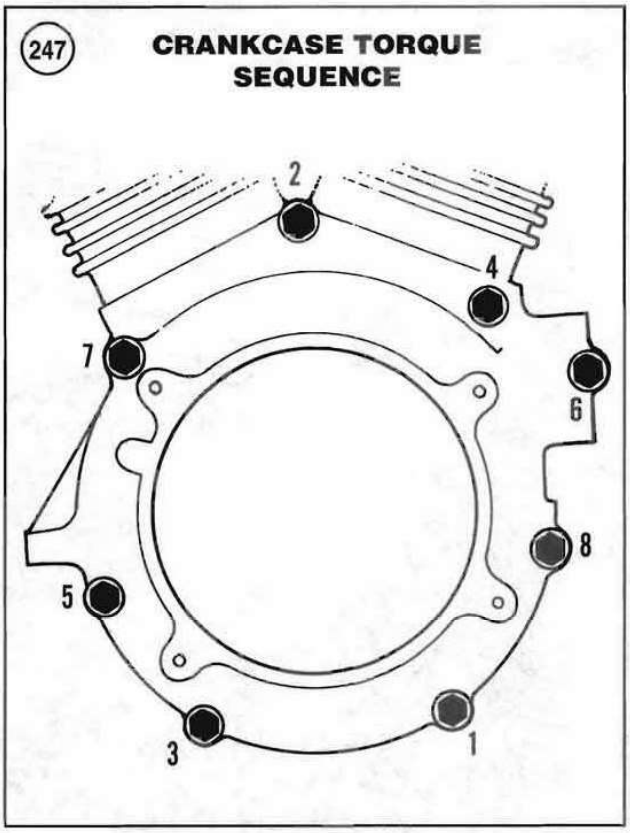
1. Clean the crankshaft assembly in solvent and dry thoroughly with compressed air.
2. Hold the shank portion of each connecting rod where it attaches to the crankshaft. Pull up and down on each connecting rod. Any slight amount of up and down movement indicates excessive lower bearing wear. If there is movement, the crankshaft must be overhauled.
3. Measure connecting rod side play with a feeler gauge (**Figure 252**) and check against the service limit in **Table 2**.
4. Inspect the pinion shaft (right side) (A, **Figure 253**) and the sprocket shaft (left side) (B) for excessive wear or damage.
5. Support the crankshaft on a truing stand or in a lathe and check runout at the flywheel outer rim (C, **Figure 253**) and at the shaft adjacent to the flywheel (D) with a dial indicator. Check against the service limit in **Table 2**.

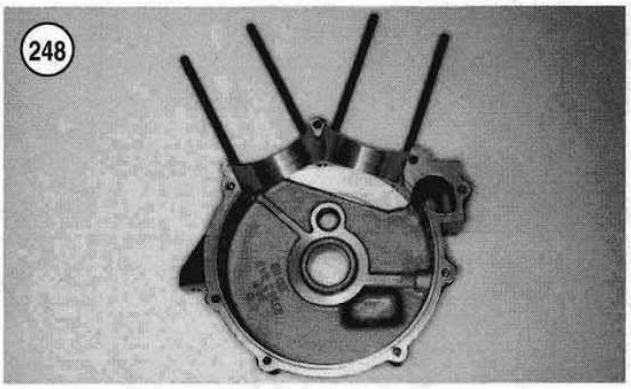
#### Camshaft Gear Needle Bearing Replacement

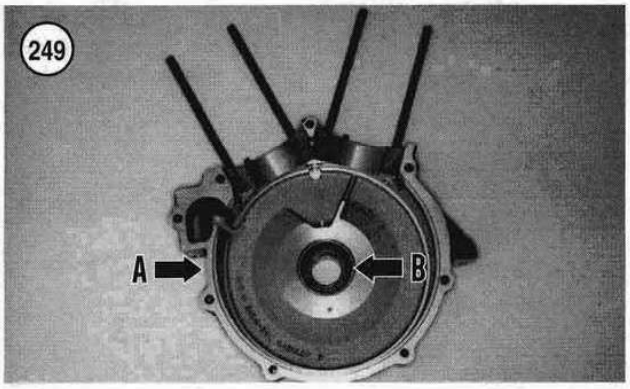
The camshaft needle bearing (B, **Figure 250**) can be removed from the crankcase with the engine mounted in the frame and the camshaft gearcase assembly removed.

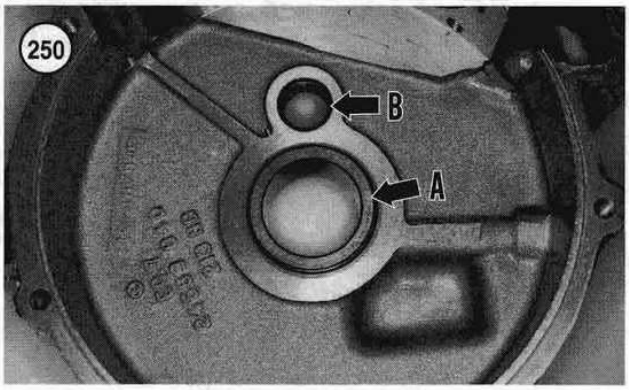
##### *Tools*

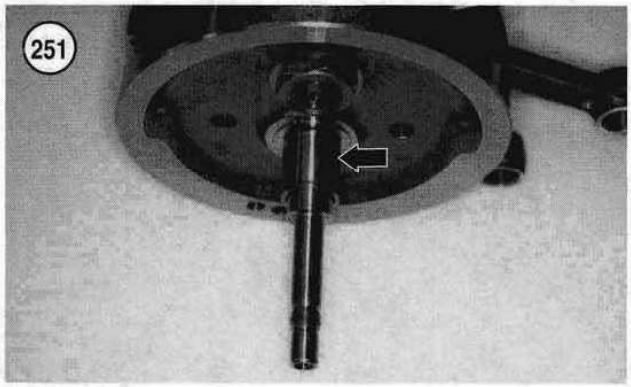
The following tools or the equivalents are required to replace the camshaft gear needle bearing:

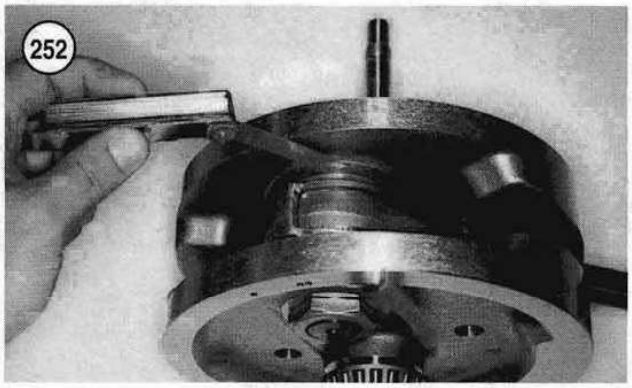


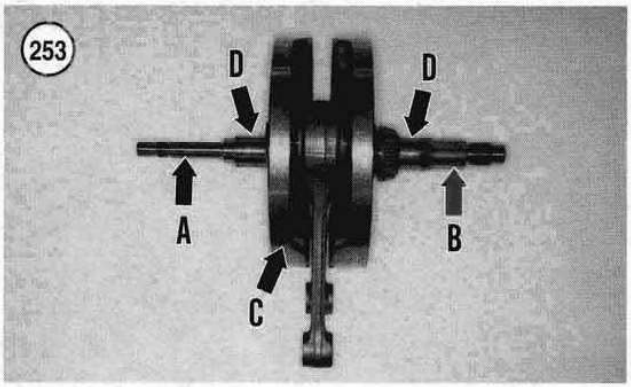



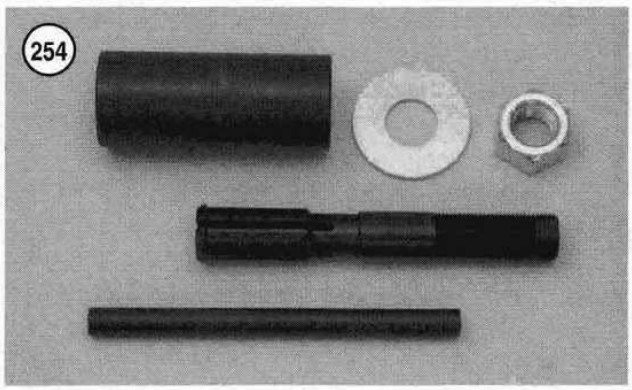






1. Engine stand (JIMS part No. 1006T) (if engine is removed from frame).
2. Needle bearing puller (JIMS part No. 95760-TB) (**Figure 254**).
3. Needle bearing installer (JIMS part No. 2188).

***Procedure***

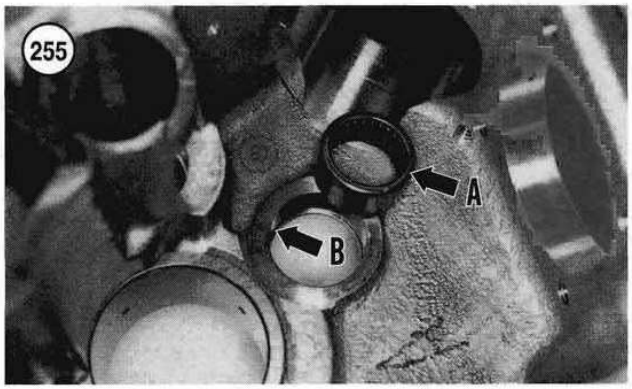
1. Remove the camshaft gearcase assembly from the engine as described in this chapter.
2. Rotate the crankshaft and verify that the crankpin is *not* visible through the camshaft needle bearing bore. Rotate the engine if necessary to obtain clearance.
3. Install the puller portion of the tool set partway into the needle bearing. Install a small hose clamp onto the end, closer to the needle bearing, and tighten. This will close the end of the tool so it can pass through the needle bearing. Push the puller all the way through the needle bearing. Then remove the hose clamp to grab the back side of the needle bearing.
4. Following the manufacturer's instructions, assemble the remainder of the tool components onto the puller portion.
5. Place a 5/8-in. wrench on the flats of the puller.
6. Place a 1 1/8-in. wrench or an adjustable wrench on the large nut.

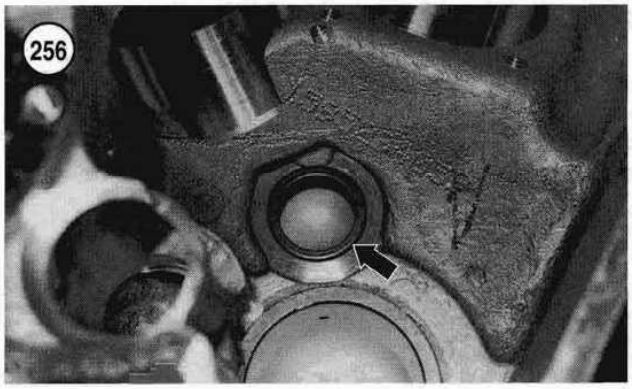
*CAUTION*

*Do not turn the 5/8-in. wrench because this will damage the special tool and the crankcase receptacle.*

7. Hold onto the 5/8-in. wrench to keep the puller from rotating. Turn the 1 1/8-in. wrench *clockwise* on the large nut. Tighten the large nut and pull the needle bearing out of the crankcase receptacle.
8. Disassemble the special tool and remove the needle bearing from it.

9. Apply a light coat of clean engine oil or press lube to the outer surface of the ball bearings, the crankcase needle bearing (A, **Figure 255**) and bearing receptacle (B).
10. Apply a light coat of clean engine oil to the threads of the screw portion and to the installer plate.
11. Insert the center screw portion of the special tool part way into the installer plate.
12. Following the manufacturer's instructions, install the installer onto the screw and push it on until it locks into place.
13. Position the new bearing with the manufacturer's marks facing out on the installer.
14. Install the installer plate onto the crankcase and align the tool to the bearing receptacle.
15. Install the thumb screws through the installer plate and onto the crankcase threaded holes. Tighten the screws securely.
16. Slowly tighten the center screw until the bearing starts to enter the crankcase receptacle. Continue to tighten until the installer contacts the crankcase surface. This will correctly locate the needle bearing within the crankcase.
17. Remove the special tools and make sure the needle bearing (**Figure 256**) is seated correctly.



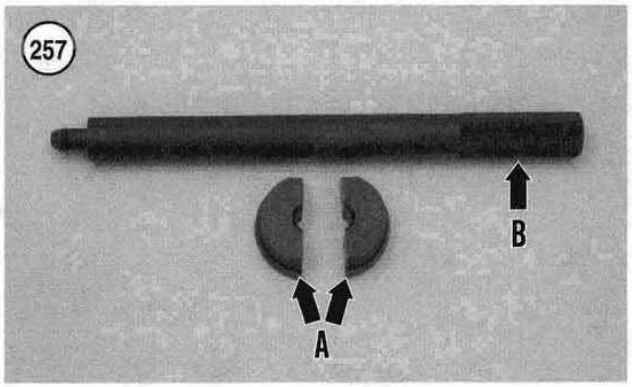



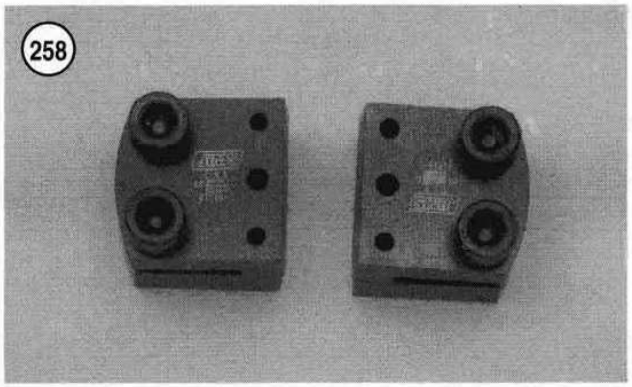

### Left Side Main Bearing Assembly Replacement

The left main bearing assembly must be replaced as a complete set even if one bearing or race is damaged.

#### *Tools*

The following tools or the equivalents are required to remove and install the left side main bearing:
1. Hydraulic press.
2. Sprocket shaft bearing race tool (JIMS part No. 94547-80A) (A, **Figure 257**).
3. Race and bearing installation tool handle (JIMS part No. 33416-80) (B, **Figure 257**).
4. Snap ring removal and installation tool (JIMS part No. 1710) (**Figure 258**).
5. Sprocket bearing race installation tool (JIMS part No. 2246) (**Figure 259**).

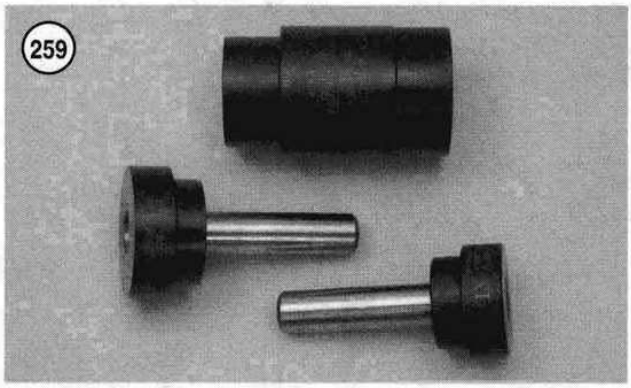


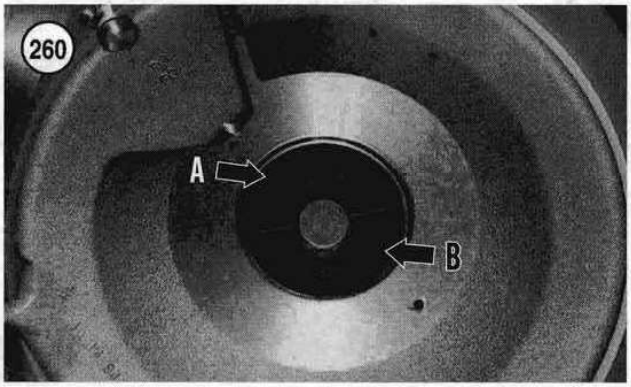



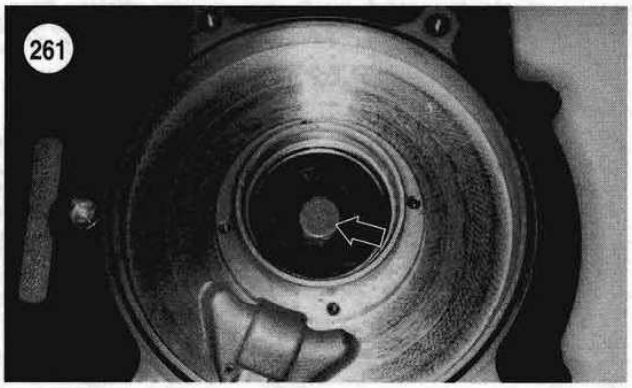

#### *Inner and outer bearing race replacement*

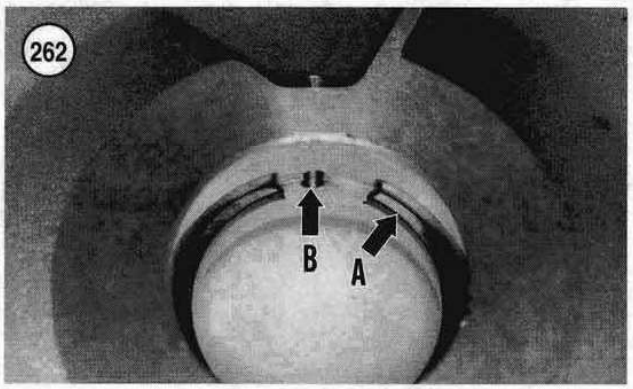
*CAUTION*

*When replacing the bearing races in the following steps, do not remove the lockring installed between the inner and outer bearing races unless it is loose or damaged. This*



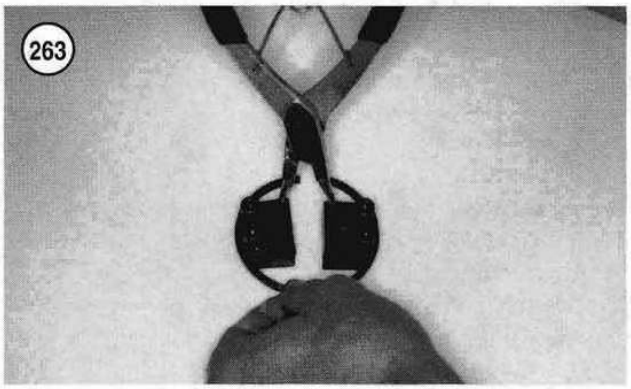



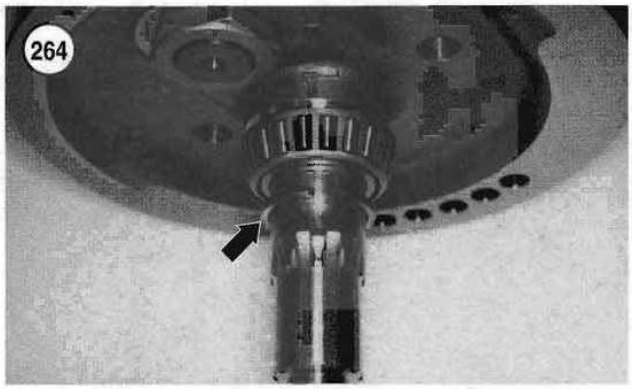

*ring is under heavy tension and will damage the bearing bore as it passes through it.*

1. Disassemble the crankcase as described in this section.
2. Place the crankcase on the workbench with the inboard surface facing up.
3. Install one half of the bearing race remover tool into the crankcase and push it against the inner bearing race (A, **Figure 260**).
4. Install the other half of the bearing race remover tool into the crankcase and push it against the inner bearing race (B, **Figure 260**).
5. Hold the bearing race remover tools in place and turn the crankcase over.
6. Insert the tool handle into the center (**Figure 261**) of both race remover tools. Press it into place until the ring is locked into both bearing race remover tools.
7. Support the left crankcase half on wooden blocks on the press bed with the tool handle facing up.
8. Center the press ram directly over the tool handle and slowly press the inner bearing race out of the crankcase.
9. Remove the crankcase and special tools from the press bed.
10. Place the crankcase on the workbench with the outboard surface facing up.
11. Repeat Steps 3-9 for the bearing on the other side.
12. Clean the crankcase half in solvent and dry with compressed air.
13. Check the lockring (A, **Figure 262**) for looseness or damage. If the lockring is loose or damaged, perform the following:
    a. Place the crankcase on a workbench with the outboard side facing up.
    b. With the gap of the lockring at the 12 o'clock position, install the special tool clamps onto each side of the lockring at the 10 o'clock and 2 o'clock positions.
    c. Securely tighten the 9/16-in. Allen screws securing the clamps to the lockring.
    d. Use snap ring pliers with straight tips and install them in one of the holes in each clamp.
    e. Squeeze the pliers, compress the lockring and withdraw it from the crankcase groove.
    f. Remove the clamps from the old lockring and install them onto the new lockring.
    g. Squeeze the pliers (**Figure 263**) and insert the lockring into the crankcase groove.
    h. Check that the lockring gap is centered with the crankcase oil hole as shown in B, **Figure 262**. Do not block the oil hole with the ring.

*NOTE*

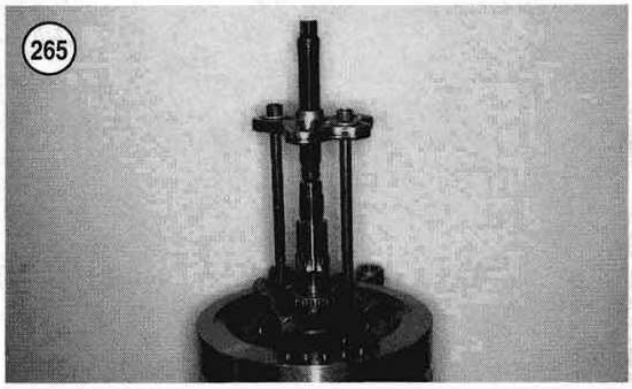
*Install both races with the larger diameter sides facing out. Install the bearing races*

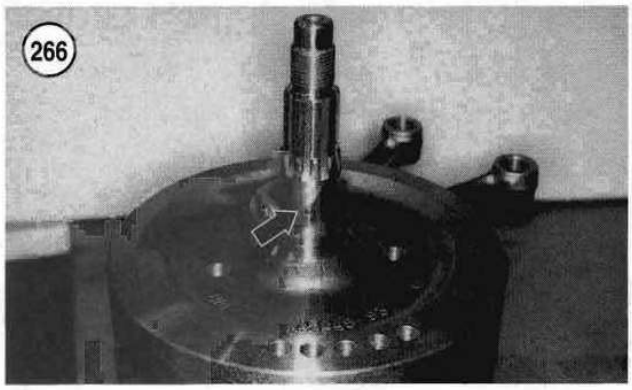



*with the same tool used to remove the old ones.*

14. Apply clean engine oil or press lube to the bearing receptacles in the crankcase and to the outer surface of the inner bearing races.
15. Position the installer base with the large end facing up and place it on the press bed.
16. Position the crankcase with the outboard surface facing up.
17. Install the crankcase onto the installer base until the crankcase retaining ring rests on top of the installer base.
18. Install the outboard outer race into position on the crankcase receptacle.
19. Apply clean engine oil or press lube to the shaft of the pressing plug and install the pressing plug into the installer base. Push it down onto the bearing outer race.
20. Center the press ram directly over the pressing plug and slowly press the outer bearing race into the outboard surface of the crankcase until it touches the retaining ring.
21. Remove the crankcase and special tools from the press.
22. Turn the crankcase over and repeat Steps 14-21 for the inboard outer bearing race.

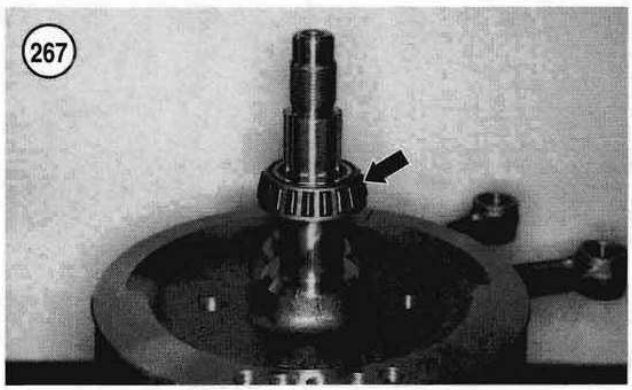


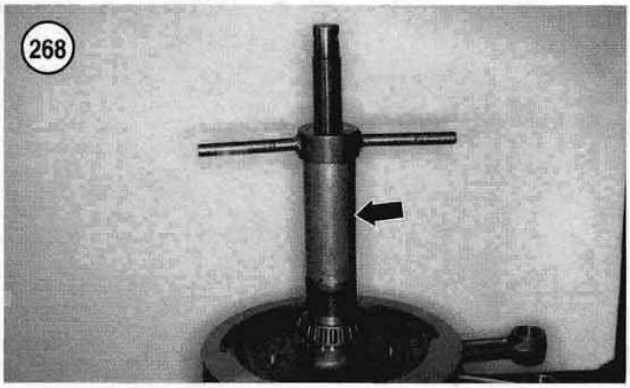



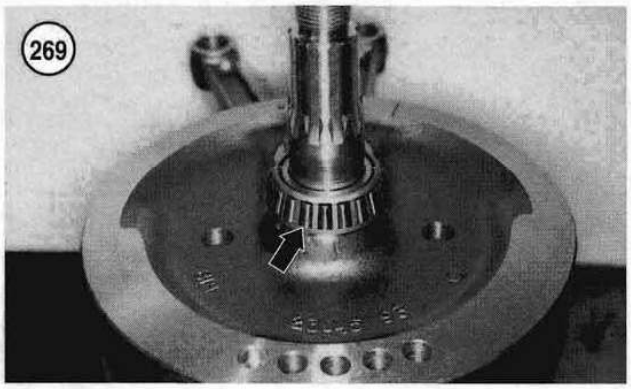

### *Crankshaft inner sprocket shaft bearing replacement*

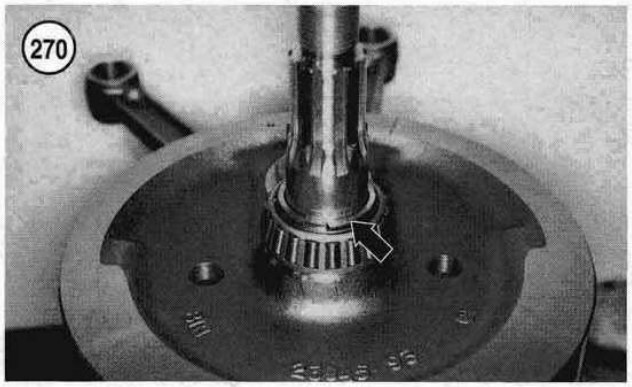
A sprocket shaft bearing cone installer (JIMS part No. 97225-55) is required to install the sprocket shaft bearing.

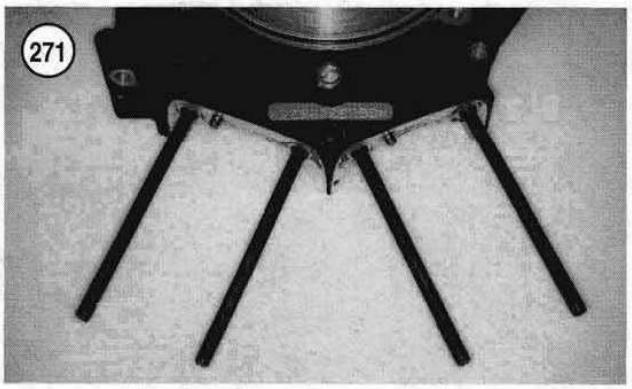
1. Support the crankshaft with the sprocket shaft bearing side facing up.
2. Remove the bearing spacer (**Figure 264**) from the sprocket shaft.
3. Install the bearing splitter under the bearing and tighten securely.
4. Attach a bearing puller to the splitter (**Figure 265**).
5. Slowly tighten the center screw and withdraw the bearing from the crankshaft shoulder.






6. Remove the bearing remover, splitter and bearing from the crankshaft.

7. Clean the sprocket shaft with contact cleaner. Check the sprocket shaft (**Figure 266**) for cracks or other damage. If damaged, refer service to a Harley-Davidson dealership.

8. Slide the new bearing (**Figure 267**) over the sprocket shaft.

9. Install the new bearing with the bearing installation tool (**Figure 268**). Remove the special tool.

10. Make sure the bearing is correctly seated (**Figure 269**) against the crankshaft.

11. Install the inner bearing spacer and seat it against the bearing (**Figure 270**).

### Cylinder Stud Replacement

Replace bent or otherwise damaged cylinder studs (**Figure 271**) to prevent cylinder block and cylinder head leaks.

1. If the engine lower end is assembled, block off the lower crankcase opening with clean shop cloths.

2A. If the stud has broken off with the top surface of the crankcase, remove it with a stud remover. Refer to Chapter One for typical procedures.

2B. If the stud is still in place, perform the following:

a. Thread a 3/8 in.–16 nut onto the top of the stud.

b. Thread an additional screw onto the stud and tighten it against the first nut so that they are locked.

c. Turn the bottom nut counterclockwise and unscrew the stud.

3. Clean the stud threads in the crankcase with a spiral brush. Then clean with an aerosol parts cleaner. If necessary, clean the threads with an appropriately sized tap.

*NOTE*

*On late 1987-1998 models, the cylinder studs have a shoulder on the upper end (**Figure 272**).*

4. On 1984-early 1987 models, measuring from the top of the stud and paint a mark that is 5.75 in. (146.05 mm) down from the top of the stud (**Figure 273**).

*NOTE*

*New studs may have a threadlocking compound patch already applied to the lower stud threads. If so, do not apply any additional locking compound to these studs.*

5. If the new stud does not have the threadlocking compound patch, apply ThreeBond TB1360 or an equivalent to the lower stud threads.

*NOTE*

*The cylinder studs have a shoulder on one end, and this end must be installed next to the crankcase surface.*

6. Place a 0.313 in. diameter steel ball (H-D part No. 8860) into a cylinder head bolt. Then thread the bolt onto the end of the new stud without the collar.

7. Position the stud with the shoulder end going in first and hand-thread the new stud into the crankcase.

*CAUTION*

*Do not use a breaker bar, ratchet or similar tool to install the studs. These tools can bend the stud and cause the engine to leak oil.*

8A. On 1984-early 1987 models, perform the following:

a. Hold the air impact wrench directly in line with the stud. *Slowly* tighten the new stud with an air impact wrench until the paint mark on the stud aligns with the gasket surface of the crankcase.

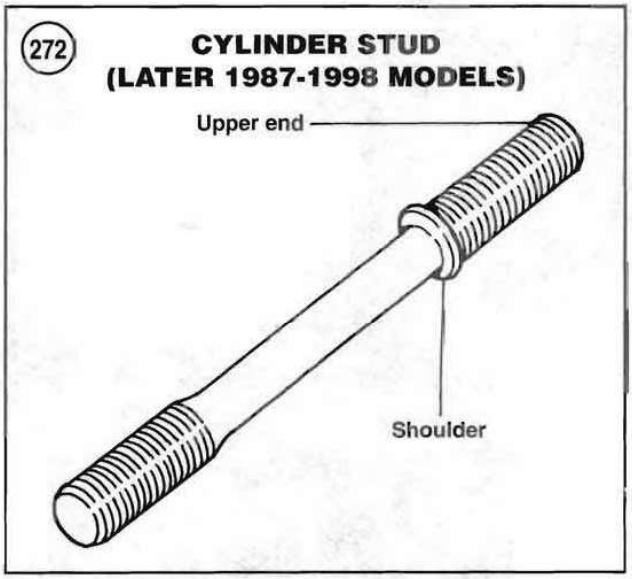
b. Measure the installed height of the stud with a vernier caliper. The installed height must be 5.670-5.770 in. (144.02-146.56 mm).

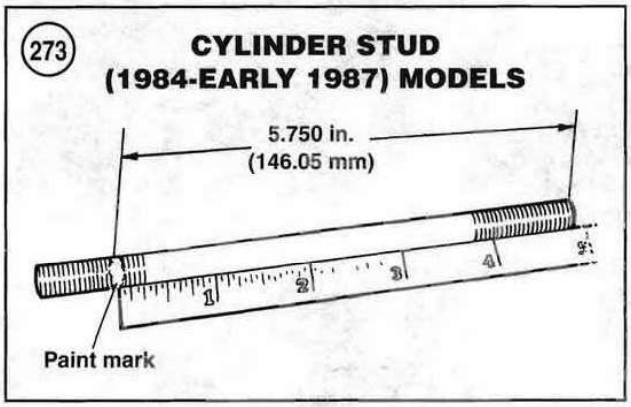
8B. On late 1987-1998 models, hold the air impact wrench directly in line with the stud. *Slowly* tighten the new stud with an air impact wrench until the stud shoulder contacts the top surface of the crankcase.

9. Use a torque wrench and hand-tighten the stud to 120 in.-lb. (14 N•m).

10. Remove the cylinder head bolt and steel ball from the cylinder stud.

11. Repeat for any additional studs.




## ENGINE BREAK-IN

Following cylinder service (boring, honing, new rings) and major lower end work, the engine must be broken in just as though it were new. The service and performance life of the engine depends on a careful and sensible break-in.

1. For the first 50 mi. (80 km), maintain engine speed below 2500 rpm in any gear. However, do not lug the engine. Do not exceed 50 mph during this period.

2. From 50-500 mi. (80-804 km), vary the engine speed. Avoid prolonged steady running at one engine speed. During this period, increase engine speed to 3000 rpm. Do not exceed 55 mph during this period.

3. After the first 500 mi. (804 km), the engine break-in is complete.

**Table 1 ENGINE GENERAL SPECIFICATIONS**

| Item | Specification |
|---|---|
| Engine type | Four-stroke, 45° OHV V twin |
| Bore x stroke | 3.498 x 4.250 in. (88.85 x 107.95 mm) |
| Displacement | 81.6 cubic inch (1340 cc) |
| Compression ratio | 8.5 to 1 |
| Cooling system | Air-cooled |

**Table 2 ENGINE SERVICE SPECIFICATIONS**

| Item | New in. (mm) | Service limit in. (mm) |
|---|---|---|
| Cylinder head | | |
| Warp | – | 0.006 (0.15) |
| Valve seat fit in head | 0.0020-0.0045 (0.051-0.1143) | 0.0020 (0.051) |
| Valve guide fit in head | 0.0020-0.0033 (0.051-0.084) | 0.0020 (0.051) |
| Rocker arm | | |
| Bushing fit in rocker arm | 0.002-0.004 (0.05-0.102) | 0.0035 (0.089) |
| Shaft-to-rocker arm bushing clearance | 0.0005-0.002 (0.013-0.050) | 0.0035 (0.089) |
| End clearance | 0.003-0.013 (0.08-0.33) | 0.025 (0.63) |
| Rocker arm shaft | | |
| Shaft-to-rocker arm cover | 0.0007-0.0022 (0.018-0.056) | 0.0035 (0.089) |
| Valves | | |
| Valve stem-to-guide clearance | | |
| Intake | 0.0008-0.0026 (0.020-0.066) | 0.0035 (0.89) |
| Exhaust | 0.0015-0.0033 (0.038-0.084) | 0.0040 (0.102) |
| Seat width | | |
| 1984 | 0.040-0.062 (0.102-0.157) | 0.062 (0.157) |
| 1985-1998 | 0.040-0.062 (0.102-0.157) | 0.090 (2.29) |
| Valve stem protrusion | 1.990-2.024 (50.55-51.41) | 2.034 (51.66) |
| Valve springs free length | | |
| Outer spring | 2.105-2.177 (53.47-55.3) | – |
| Inner spring | 1.926-1.996 (48.92-50.70) | – |
| Piston-to-cylinder clearance | | |
| 1984, early 1995 | 0.0008-0.0023 (0.020-0.058) | 0.0053 (0.135) |
| Late 1995-1998* | 0.00075-0.00175 (0.019-0.044) | 0.0053 (0.135) |
| Piston pin-to-piston clearance | 0.0002-0.0006 (0.005-0.015) | 0.001 (0.02) |
| Piston rings | | |
| Compression ring end gap | 0.007-0.020 (0.18-0.51) | 0.030 (0.76) |
| Oil control ring end gap | 0.009-0.052 (0.23-1.32) | 0.065 (1.65) |
| Compression ring side clearance | | |
| Top ring | 0.002-0.0045 (0.05-0.11) | 0.006 (0.15) |
| Second ring | 0.0016-0.0041 (0.041-0.104) | 0.006 (0.15) |
| Oil control ring side clearance | 0.0016-0.0076 (0.041-0.193) | 0.008 (0.20) |
| Cylinder | | |
| Taper | – | 0.002 (0.05) |
| Out-of-round | – | 0.002 (0.05) |
| Warp | | |
| At top (cylinder head) | – | 0.006 (0.15) |
| At base (crankcase) | – | 0.008 (0.20) |
| Cylinder bore | | |
| Standard | – | 3.501 (88.925) |
| Oversize 0.005 in. (0.13 mm) | – | 3.506 (89.052) |
| Oversize 0.010 in. (0.25 mm) | – | 3.511 (89.179) |
| Oversize 0.020 in. (0.51 mm) | – | 3.521 (89.433) |
| Oversize 0.030 in. (0.76 mm) | – | 3.531 (89.687) |

(continued)

**Table 2 ENGINE SERVICE SPECIFICATIONS (continued)**

| Item | New in. (mm) | Service limit in. (mm) |
|---|---|---|
| Connecting rods | | |
| Connecting rod-to-crankpin clearance | 0.0004-0.0017 (0.010-0.043) | 0.002 (0.05) |
| Piston pin clearance in connecting rod | 0.0003-0.0007 (0.008-0.018) | 0.001 (0.03) |
| Side play at crankshaft | 0.005-0.025 (0.13-0.63) | 0.030 (0.76) |
| Valve lifters | | |
| Lifter-to-guide clearance | 0.0008-0.002 (0.020-0.051) | 0.003 (0.08) |
| Roller end clearance | – | 0.015 (0.38) |
| Guide-to-crankcase fit | 0.000-0.004 (0.00-0.10) | – |
| Gearcase | | |
| Breather gear end play | 0.001-0.011 (0.025-0.28) | 0.016 (0.41) |
| Cam gear shaft-to-bushing clearance | 0.00075-0.00175 (0.0190-0.0444) | 0.003 (0.08) |
| Cam gear shaft-to-bearing clearance | 0.0005-0.0025 (0.013-0.063) | 0.005 (0.13) |
| Cam gear end play | 0.001-0.050 (0.025-1.27) | 0.050 (1.27) |
| Oil pump drive shaft-to-crankcase bushing | 0.0004-0.0025 (0.010-0.063) | 0.0035 (0.089) |
| Crankshaft | | |
| Runout at rim | 0.000-0.010 (0.00-0.25) | 0.015 (0.38) |
| Runout at pivot shaft end | 0.000-0.002 (0.00-0.05) | 0.003 (0.08) |
| End play | 0.001-0.005 (0.02-0.13) | 0.006 (0.15) |
| Sprocket shaft bearing | | |
| Cup fit in crankcase | 0.0032-0.0012 (0.081-0.030) | – |
| Cone fit on crankshaft | 0.0005-0.0015 (0.013-0.038) | – |
| Pinion shaft bearing and bushing | | |
| Roller bearing fit | 0.0002-0.0009 (0.005-0.023) | – |
| Cover bushing fit | 0.001-0.0025 (0.025-0.063) | 0.0035 (0.089) |
| Oil pump gears end clearance | – | 0.003-0.004 (0.08-0.10) |

*Specifies clearance for KSG pistons.

**Table 3 PUSHROD AND LIFTER LOCATION**

| Cylinder | Lifter bore | Cylinder head/ rocker housing bore |
|---|---|---|
| Front | | |
| Intake (yellow) | Inside | Rear |
| Exhaust (green) | Outside | Front |
| Rear | | |
| Intake (blue) | Inside | Front |
| Exhaust (purple) | Outside | Rear |

**Table 4 CRANKSHAFT INNER BEARING SPACER SHIM SIZE**

| Shim part number | in. | mm |
|---|---|---|
| 9120 | 0.0915-0.0925 | 2.324-2.350 |
| 9121 | 0.0935-0.0945 | 2.375-2.400 |
| 9122 | 0.0955-0.0965 | 2.426-2.451 |
| 9123 | 0.0975-0.0985 | 2.476-2.502 |
| 9124 | 0.0995-0.1005 | 2.527-2.553 |
| 9125 | 0.1015-0.1025 | 2.578-2.602 |
| 9126 | 0.1035-0.1045 | 2.629-2.654 |
| 9127 | 0.1055-0.1065 | 2.680-2.705 |
| 9128 | 0.1075-0.1085 | 2.731-2.756 |
| 9129 | 0.1095-0.1101 | 2.781-2.800 |

(continued)

**Table 4 CRANKSHAFT INNER BEARING SPACER SHIM SIZE (continued)**

| Shim part number | in. | mm |
|---|---|---|
| 9130 | 0.1115-0.1125 | 2.832-2.858 |
| 9131 | 0.1135-0.1145 | 2.883-2.908 |
| 9132 | 0.1155-0.1165 | 2.934-2.959 |
| 9133 | 0.1175-0.1185 | 2.985-3.010 |
| 9134 | 0.1195-0.1205 | 3.035-3.061 |

**Table 5 ENGINE TORQUE SPECIFICATIONS**

| Item | ft.-lb. | in.-lb. | N•m |
|---|---|---|---|
| Crankcase fasteners | | | |
| Initial | – | 124 | 14 |
| Final | 15-17 | – | 20-23 |
| Crankcase studs | – | 124 | 14 |
| Cylinder head bolts | See text | | |
| Cylinder studs | – | 124 | 14 |
| Engine mounting bolts | | | |
| Front lower | 33-38 | – | 45-52 |
| Rear at transmission | 33-38 | – | 45-52 |
| Upper mount bracket bolts | 28-35 | – | 38-47 |
| Gearcase cover screw | | | |
| 1984-1992 | – | 60-65 | 6.8-7.3 |
| 1993-1998 | – | 88-124 | 10-14 |
| Lifter oil screen cap | – | 88-124 | 10-14 |
| Oil filter mount screws | | | |
| 1992-1998 | 13-17 | – | 18-23 |
| Oil pump | | | |
| Housing bolts | – | 62-88 | 7-10 |
| Compression nut fitting | | | |
| 1992-1998 | – | 97-142 | 11-16 |
| Cover bolts (1984-1991) | – | 62-88 | 7-10 |
| Cover (1992-1998) | | | |
| Bolts | – | 88-124 | 10-14 |
| Manifold screw | – | 71-80 | 8-9 |
| Relief valve plug | – | 80-106 | 9-12 |
| Pinion gear shaft nut | 35-45 | – | 47-61 |
| Rocker cover bolts | | | |
| Upper and lower cover 1/4 in. bolts | – | 124-159 | 14-18 |
| Lower cover 5/16 in. bolts | 15-18 | – | 20-25 |
| Spark plug | 18-22 | – | 25-30 |
| Timing screws | – | 15-30 | 1.7-3.4 |
| Valve lifter oil screen plug | – | 88-124 | 10-14 |

# CHAPTER FIVE

# CLUTCH AND PRIMARY DRIVE

This chapter describes service procedures for the clutch and primary drive assembly.

Specifications are in **Tables 1-6** at the end of this chapter.

## PRIMARY CHAINCASE OUTER COVER

### Removal

Refer to **Figure 1**.

1. Disconnect the negative battery cable from the battery.

*WARNING*

*Disconnect the negative battery cable before working on the clutch or any primary drive component to avoid accidentally activating the starter.*

2. Thoroughly clean the primary chaincase cover of all dirt, oil and road debris before removing it.
3. On early models, remove the gearshift pedal (A, **Figure 2**).
4. On models so equipped, remove the left footboard (B, **Figure 2**) as described in Chapter Fifteen.
5. Drain the primary chain oil as described in Chapter Three.

*NOTE*

*Note the location of the outer cover screws. There are two screws with different lengths, and they must be reinstalled in the correct locations.*

6. Remove the bolts and captive washers securing the chaincase outer cover (**Figure 3**) and remove the chaincase outer cover.
7. Remove the chaincase outer cover gasket.
8. Remove the dowel pins, if necessary.

### Installation

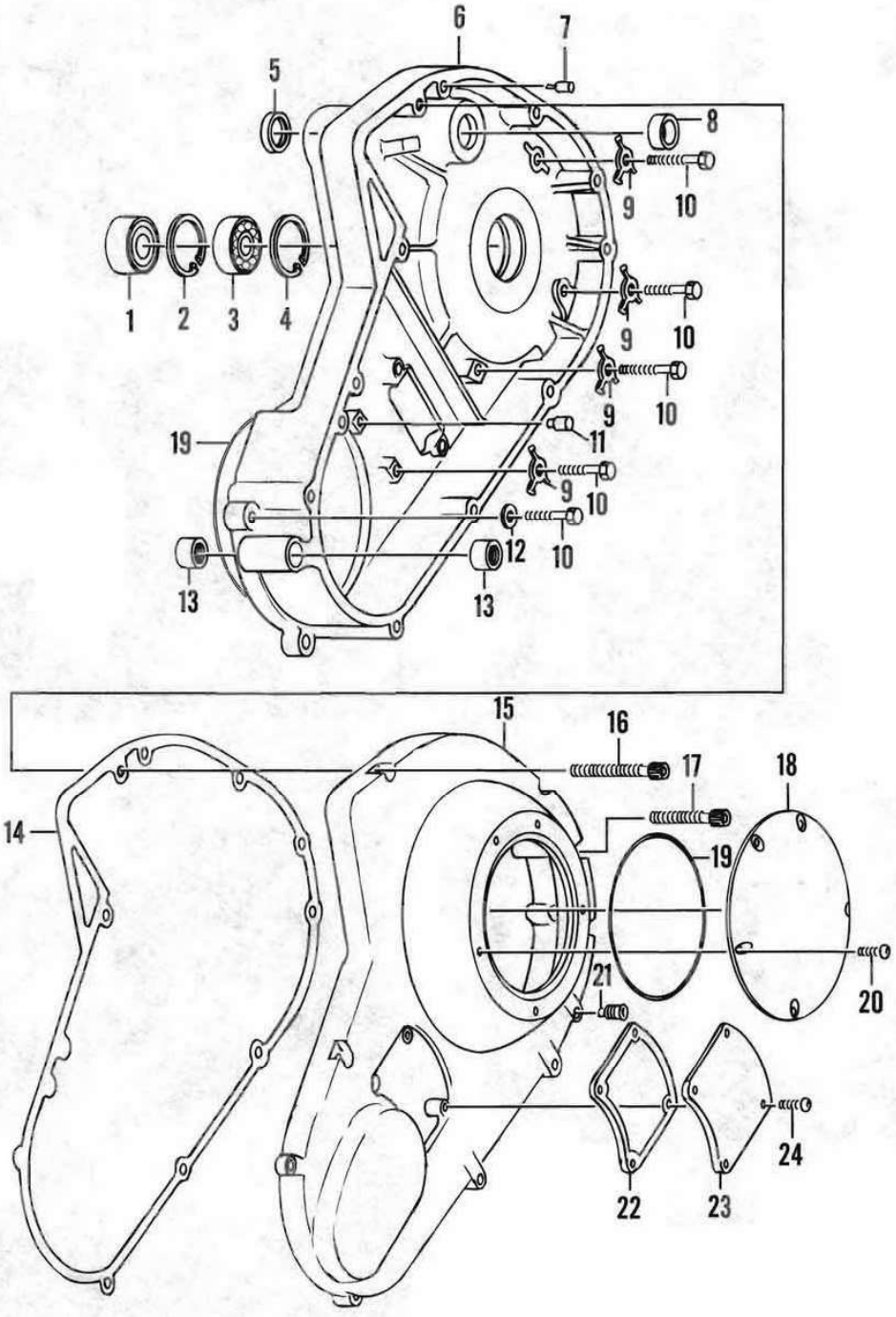
1. If removed, install the dowel pins (**Figure 4** and **Figure 5**) onto the chaincase inner housing.

*CAUTION*

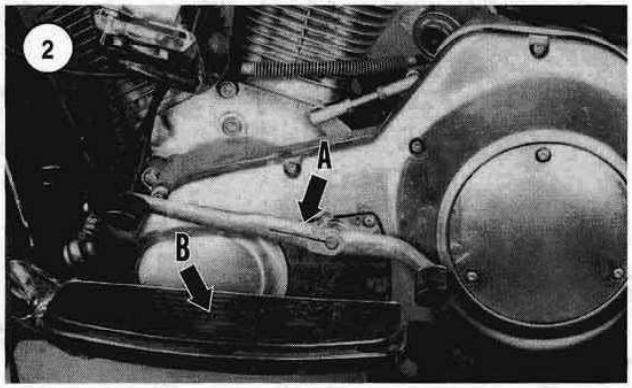
*Harley-Davidson specifies that a **new** Print-O-Seal gasket must be installed every time the chaincase outer cover is removed.*

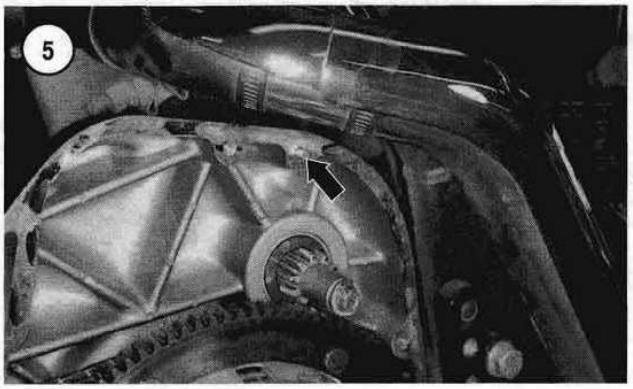
(1)

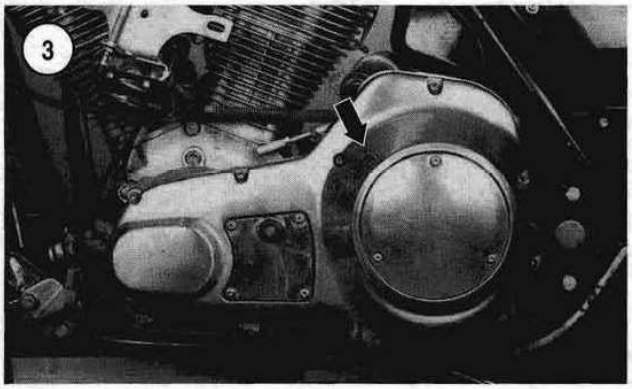
## PRIMARY CHAINCASE

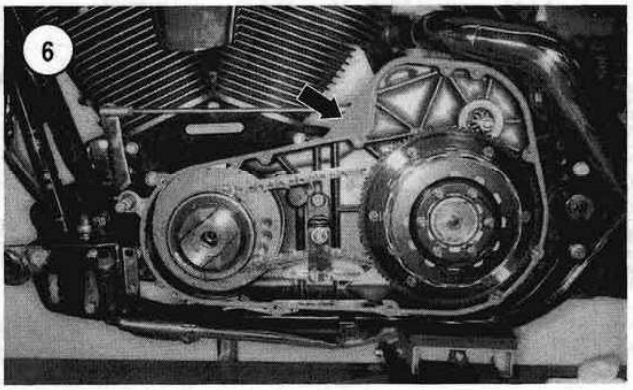


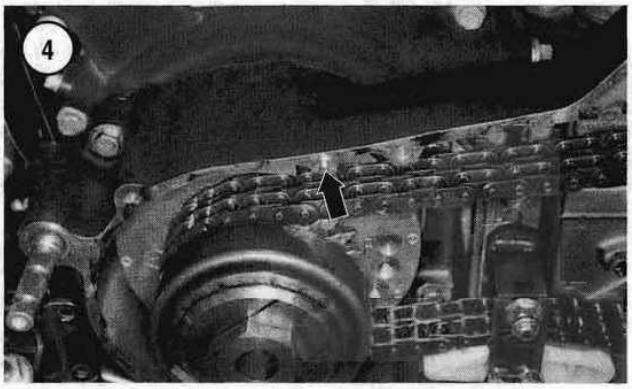

1. Bearing
2. Outer snap ring
3. Bearing
4. Inner snap ring
5. Oil seal
6. Housing
7. Dowel pin
8. Oil seal
9. Captive washer
10. Bolt
11. Dowel pin
12. Washer
13. Bushing
14. Gasket
15. Outer cover
16. Bolt
17. Bolt
18. Clutch cover
19. O-ring
20. Screw
21. Drain screw
22. Gasket
23. Inspection cover
24. Screw

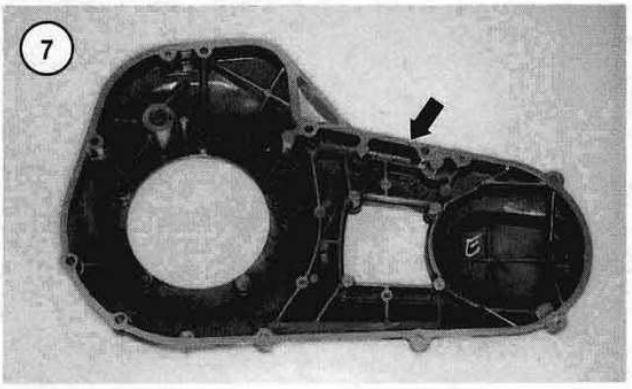


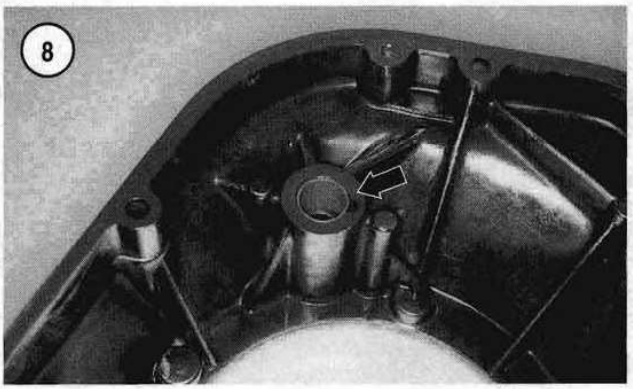



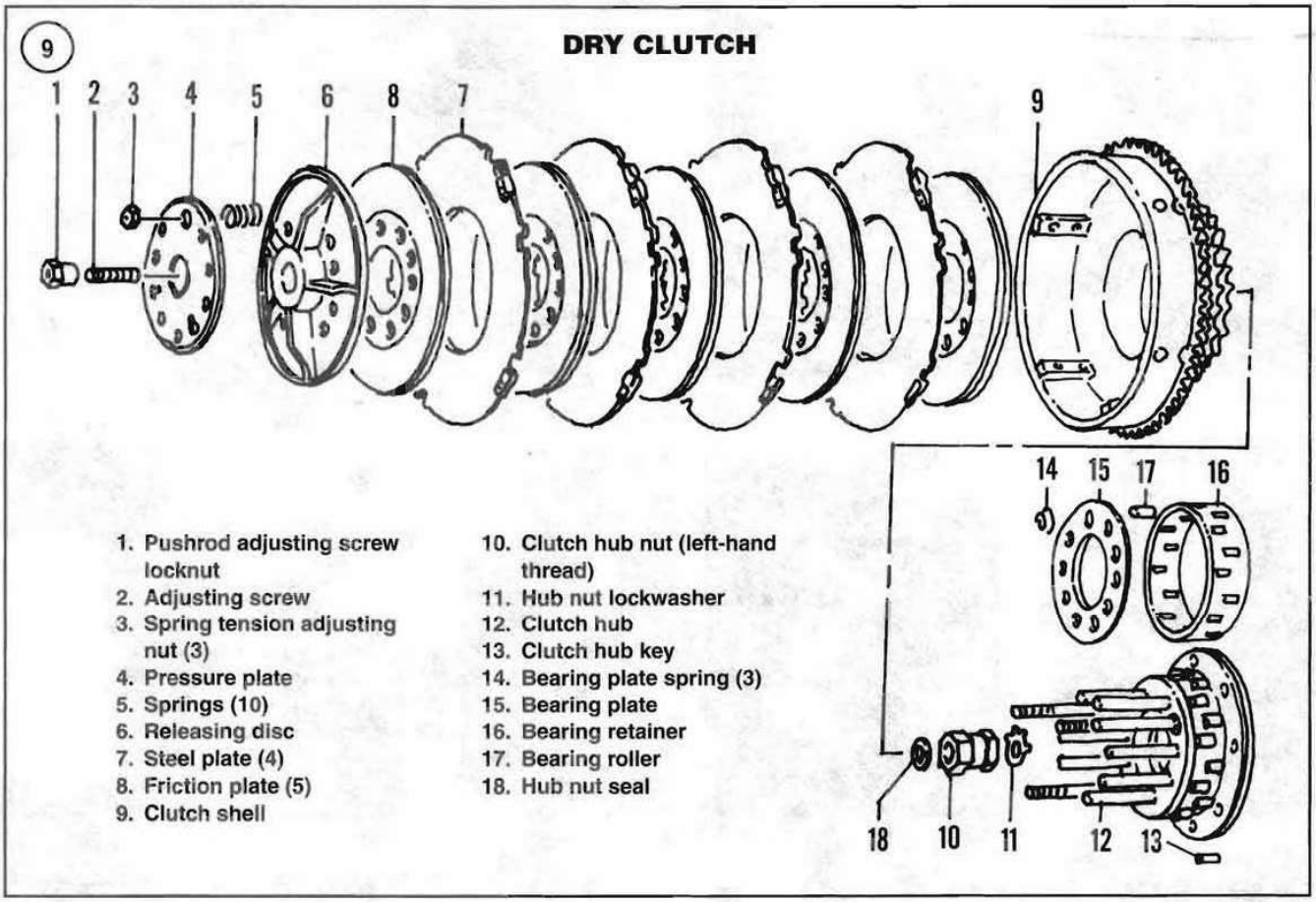

2. Install a *new* gasket (**Figure 6**) over the locating pins and seat it against the gasket surface of the chaincase inner housing.

3. Slide the primary cover over the locating dowels and seat it flush against the gasket.

*NOTE*

*The gasket sealing surface is very thin, and the overall size of the gasket is very large. The gasket might shift prior to installing the cover bolts, so make sure the gasket is posi-*






*tioned correctly while installing the cover bolts in Step 4.*

4. Install the primary chaincase outer cover bolts and captive washers into the correct locations noted during removal. Tighten the cover bolts to the torque in **Table 5** and **Table 6**. Check that the gasket seats flush around the cover.
5. On early models, install the gearshift pedal (A, **Figure 2**).
6. On models so equipped, install the left footboard (B, **Figure 2**) as described in Chapter Fifteen.
7. Refill the primary chaincase with the type and quantity of oil specified under *Primary Chain Lubrication* in Chapter Three.
8. Connect the negative battery cable.

### Inspection

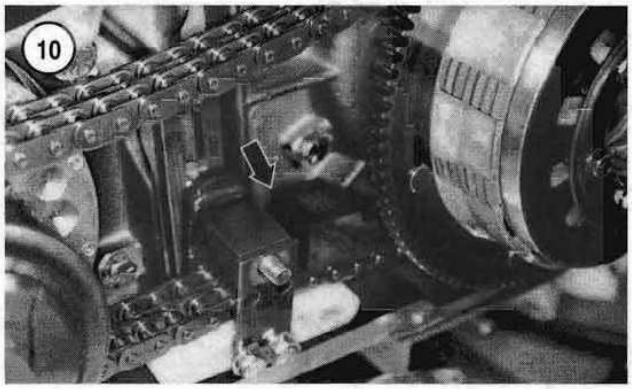
1. Remove all gasket residue from the chaincase outer cover (**Figure 7**) and chaincase inner housing gasket surfaces.
2. Clean the primary cover in solvent and dry with compressed air.
3. Inspect the primary chaincase outer cover for cracks or damage.
4. Inspect the starter jackshaft bushing (**Figure 8**) for excessive wear or damage. To replace the bushing, perform the following:
   a. Remove the bushing with a blind bearing removal tool.
   b. Clean the bushing bore in the housing.
   c. Press in the new bushing until its outer surface is flush with the edge of the bushing bore.

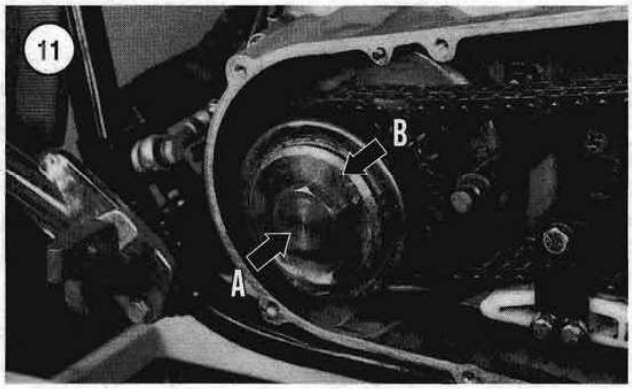
## DRY CLUTCH

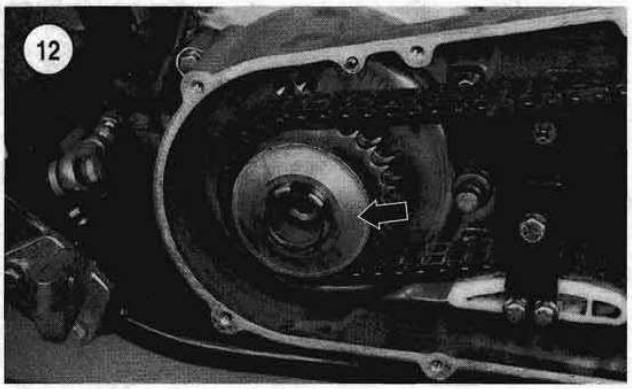
Refer to **Figure 9**.

### Removal

1. Disconnect the negative battery cable from the battery.
2. Remove the primary chaincase outer cover as described in this chapter.





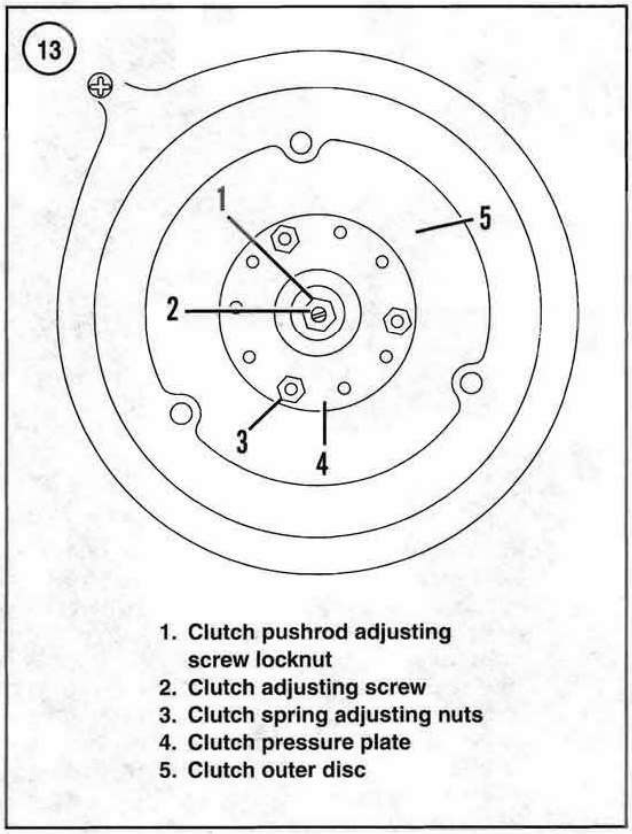
3A. If a special tool is available, place the primary drive locking tool (JIMS part No. 2234) onto the primary chain next to the clutch housing (**Figure 10**).

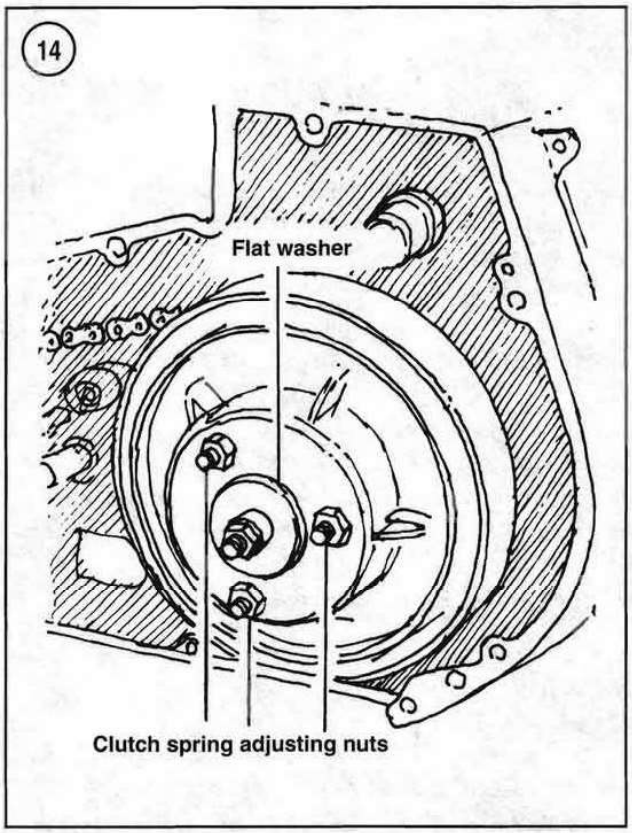
3B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.

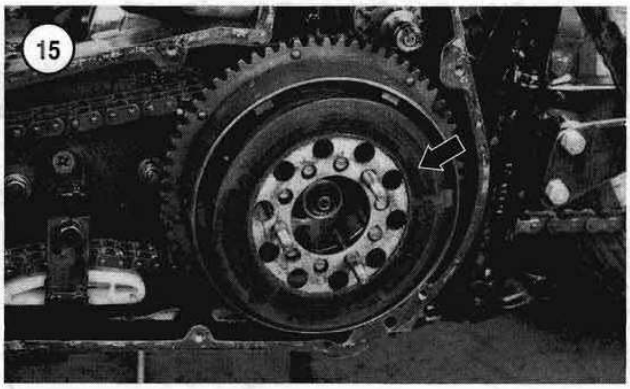
4. Loosen the compensating sprocket nut (A, **Figure 11**) with an impact wrench. Then remove the nut.

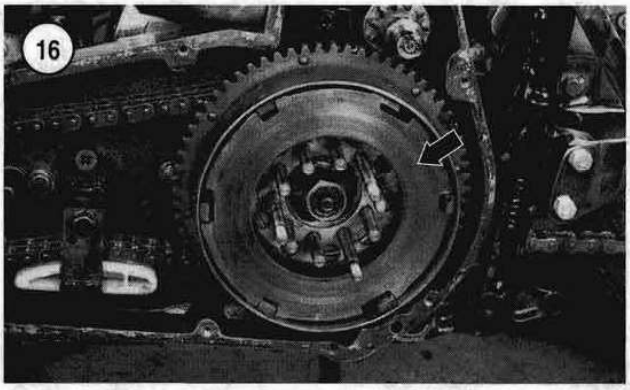
5. Remove the cover (B, **Figure 11**) and the sliding cam (**Figure 12**).

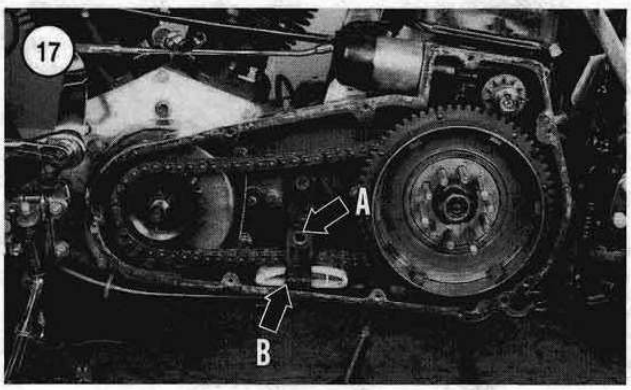
6. Remove the pushrod adjuster screw locknut (**Figure 13**).

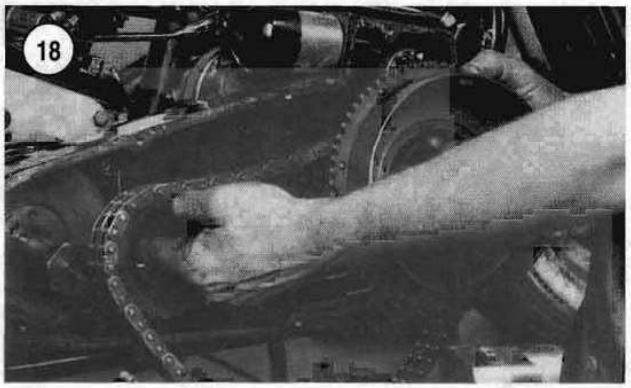


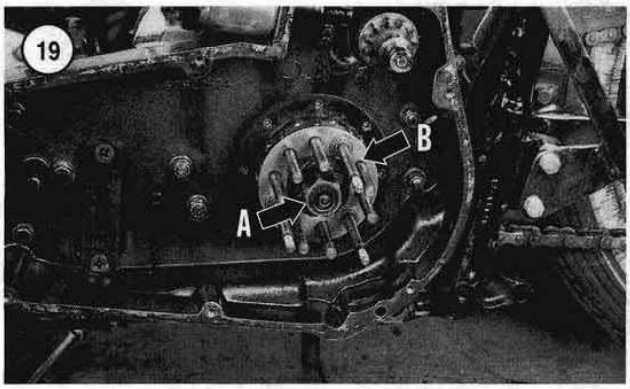






7. Place a flat washer (1/8 in. thick, 1 3/4-in. outer diameter and 3/8-in. inner diameter) over the pushrod adjusting screw (**Figure 14**). Reinstall the adjuster screw locknut removed in Step 6.

8. Tighten the pushrod adjusting screw locknut until the clutch spring adjusting nuts are loose.

9. Remove the clutch spring adjusting nuts (**Figure 14**).

*NOTE*

*Do not disassemble the parts in Step 10 unless replacement is required. Disassembly is described under **Clutch, Inspection** in this chapter.*

10. Remove the pressure plate, clutch springs and the releasing disc as an assembly.

11. Remove the friction (**Figure 15**) and steel (**Figure 16**) clutch plates in order.

12. Remove the primary chain adjuster bolt (A, **Figure 17**) and remove the chain adjuster assembly (B).

13. Remove the oil hose from the primary chain adjuster fitting.

14. Remove the clutch shell, compensating sprocket and primary chain as an assembly (**Figure 18**).

*NOTE*

*The clutch nut has **left-hand threads**. Turn the clutch nut **clockwise** to loosen it.*

15. Pry back the clutch hub lockwasher tab. Then loosen the clutch nut (A, **Figure 19**) by turning it clockwise. Remove the nut and the lockwasher.

16. Attach the clutch hub puller (JIMS part No. 95960-52C) to the clutch hub (**Figure 20**). Turn the center bolt on the puller *clockwise* and remove the clutch hub (B, **Figure 19**).

17. Remove the clutch hub Woodruff key (**Figure 21**) from the groove in the transmission mainshaft.

**Installation**

1. If the pressure plate unit was disassembled, assemble as follows:
   a. Place the clutch hub on the workbench with the bolts face up.
   b. Install the retaining disc on the hub.
   c. Install the clutch springs on the hub pins and studs.
   d. Place the pressure plate over the clutch springs. Because of stud hole arrangement, the plate collar in the pressure plate will fit only one way.
   e. Screw the pushrod adjuster locknut onto the adjuster screw until the screw is flush with the top of the nut. Install a 1 3/4-in. washer under the nut and thread the adjust screw into the releasing disc.
   f. Tighten the nut to compress the clutch springs.
   g. Install the three clutch spring adjusting nuts.
   h. Remove the adjust screw locknut and remove the 1 3/4-in. washer. Then reinstall the locknut.
   i. Tighten the three adjusting nuts in a crisscross pattern until the distance from the releasing disc to the pressure plate is exactly 1 1/32 in. (26.19 mm). Tighten the adjust locknut to maintain this distance.
2. If removed, install the Woodruff key (**Figure 21**) into the mainshaft keyway.
3. If removed, install the pushrod.
4. Install the clutch hub assembly (B, **Figure 19**) onto the mainshaft.

*NOTE*

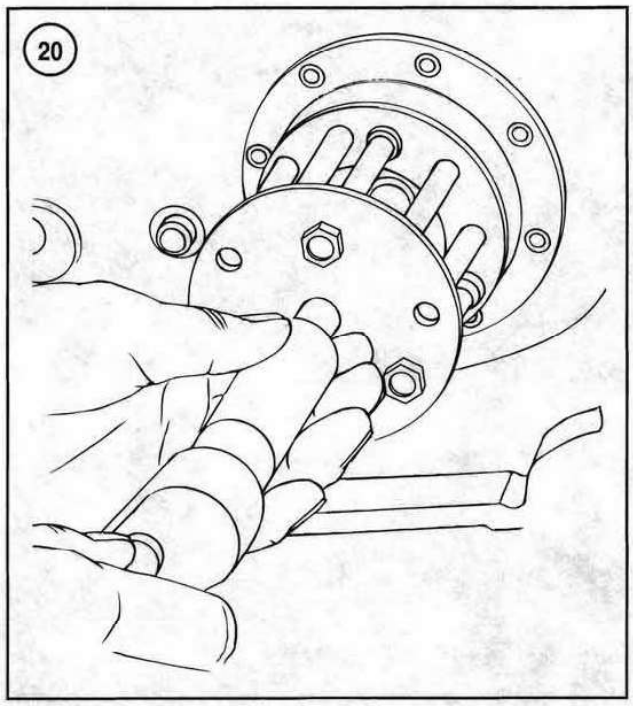
*The clutch nut has **left-hand threads**. Turn the clutch nut **counterclockwise** to tighten it.*

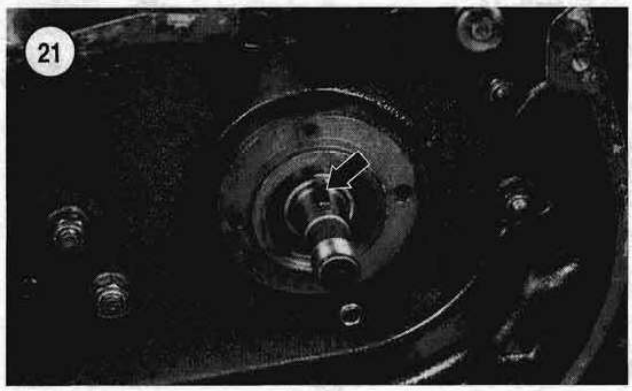
5. Install a *new* lockwasher and then the clutch nut onto the mainshaft.
6. Use the same tool setup to prevent the mainshaft from turning as used during disassembly.
7. Turn the nut *counterclockwise* and tighten to 50-60 ft.-lb. (67-81 N•m). Bend the lockwasher tab against the nut to lock it.

*NOTE*

*Grease the clutch shell bearing prior to installing the clutch shell in Step 7.*

8. Assemble the clutch shell, primary chain and the compensating sprocket as an assembly on the workbench.
9. Install the clutch shell, primary chain and the compensating sprocket as an assembly onto the crankshaft and transmission shaft as shown in **Figure 18**.
10. Install the washer (if removed), shaft extension (if removed), sliding cam (**Figure 12**) and cover.

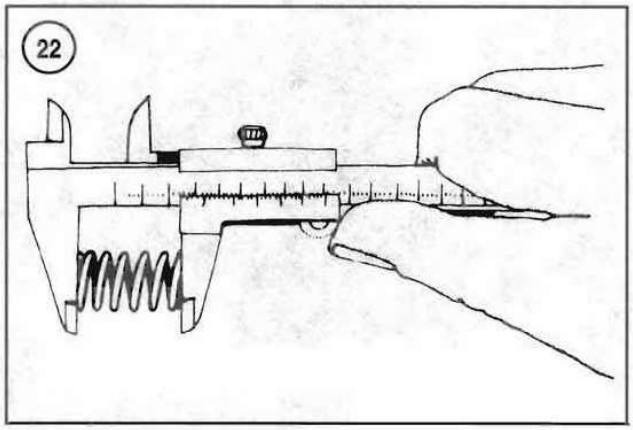


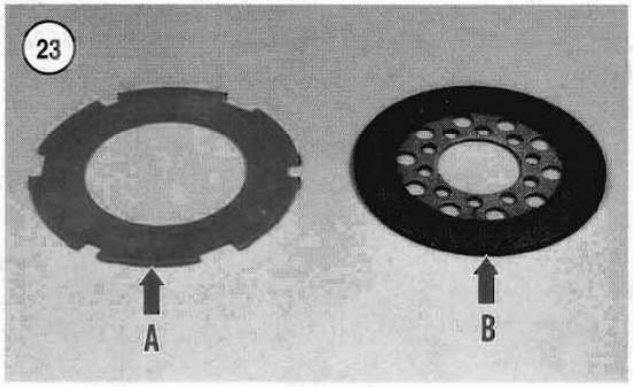



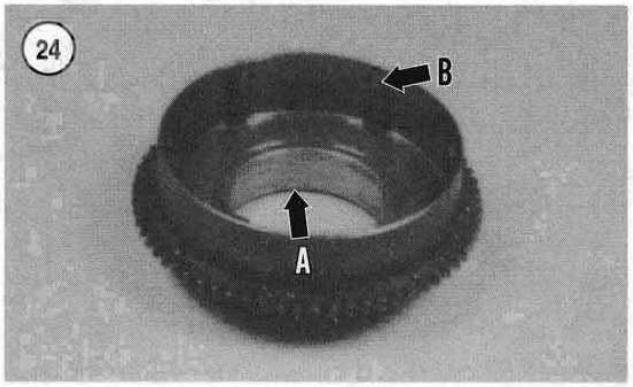

*CAUTION*

*The compensating sprocket nut is tightened to a high torque specification. Make sure to hold the sprocket securely when tightening the nut in Step 10.*

11. Apply a few drops of medium-strength threadlocking compound on the sprocket nut threads prior to installation.
12. Install the compensating sprocket nut (**Figure 11**) and tighten it to 90-100 ft.-lb. (122-136 N•m). Use the same tools and procedures to prevent the crankshaft from turning as used during disassembly. Remove the special tool at this time.
13. Position the steel clutch plates with the side stamped OUT facing outward.




14. Install a friction plate (**Figure 15**) and then a steel plate (**Figure 16**). Continue to alternately install the friction plates and steel plates. The last part installed is a friction plate.

15. Install the primary chain adjuster assembly (B, **Figure 17**) and the adjuster bolt (A).

16. Adjust the primary drive chain as described in Chapter Three.

17. Check primary chain alignment as described in this chapter.

18. Install the primary chaincase outer cover as described in this section.

19. Connect the negative battery cable to the battery.

20. Perform the *Primary Housing Vacuum Check (Early 1984 Models With Dry Clutch)* as described in this chapter.

21. Ride the motorcycle a short distance and check the cover for oil leaks.

### Inspection

When measuring the clutch components, compare the actual measurement to the specifications in **Table 1**. Replace parts that are out of specification or show damage as described in this section.

1. Clean all clutch parts in non-oil-based solvent and thoroughly dry with compressed air.
2. To disassemble the pressure plate assembly:
   a. Install three bolts through the original pressure plate-to-clutch hub bolt holes. The bolts must be long enough to allow removal of the parts while under compression.
   b. Secure each nut with a flat washer and nut. Tighten all nuts in a crisscross pattern until the clutch springs compress slightly.
   c. Remove the adjuster locknut and remove the adjuster screw.
   d. Loosen the nuts one-half to one turn at a time in a crisscross pattern and release the spring tension evenly.
   e. After loosening the nuts, remove the washers and three bolts.
   f. Separate the pressure plate and remove the clutch springs.
3. Measure the free length of each clutch spring (**Figure 22**).
4. Inspect steel clutch plates (A, **Figure 23**) for warping or wear grooves.
5. Inspect friction plates (B, **Figure 23**) for a shiny appearance or signs of oil soaking. Also check the plates for worn or grooved lining surfaces. Measure each plate.
6. Check for loose clutch plate rivets; replace if necessary.
7. Check the clutch shell inner bearing race (A, **Figure 24**) for grooves, wear or damage. Also check the clutch shell plate tabs (B, **Figure 24**) for looseness or damage. If found, replace the clutch shell.
8. Check both sets of gear teeth on the clutch shell (**Figure 25**). If the teeth are visibly worn or undercut, replace the clutch shell.
9. Spin the clutch hub roller bearing assembly by hand. If bearing assembly appears rough, remove the three bear-

ing plate springs. Then slide the bearing plate off the hub pins and remove the bearing retainer. Check all parts for wear or damage; replace parts as required.

10. Pry the pushrod seal out of the hub nut. Carefully tap a *new* seal into place.

## WET CLUTCH (LATE 1984-1989)

Refer to **Figure 26**.

### Removal

1. Disconnect the negative battery cable from the battery.
2. Remove the primary chaincase cover as described in this chapter.

3A. If a special tool is available, such as the primary drive locking tool (JIMS part No. 2234), place it onto the primary chain next to the clutch housing (**Figure 10**).

3B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.

4. Loosen and remove the adjuster plate bolts (A, **Figure 27**) in a crisscross pattern.
5. Remove the adjuster plate (B, **Figure 27**) and the diaphragm spring (C).
6. Remove the snap ring and the release plate (A, **Figure 28**) from the pressure plate.
7. Remove the pressure plate (B, **Figure 28**).
8. Remove the steel clutch plate (**Figure 29**) and friction clutch plate (A, **Figure 30**) plates.
9. Remove the pushrod (B, **Figure 30**).

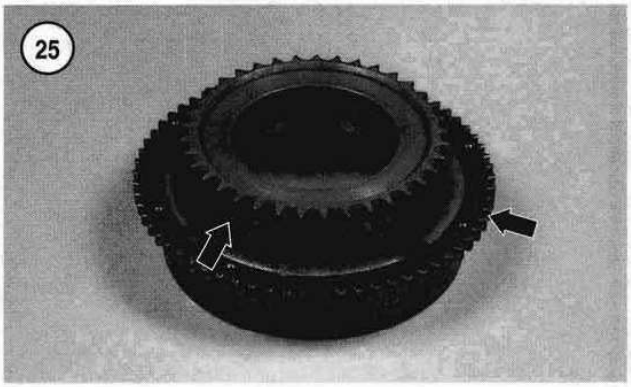
10A. If a special tool is available, place the primary drive locking tool (JIMS part No. 2234) onto the primary chain next to the clutch housing (**Figure 10**).

10B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.

*NOTE*

*The clutch nut has left-hand threads. Turn the nut **clockwise** to loosen it.*

11. Turn the clutch nut (**Figure 31**) clockwise and remove it. Do not remove the special tool at this time.
12. Remove the primary chain adjuster bolt (A, **Figure 32**) and remove the chain adjuster assembly (B).
13. The engine is still locked from Step 10.
14. Loosen the compensating sprocket nut (A, **Figure 33**) with an impact wrench. Then remove the nut.
15. Remove the cover (B, **Figure 33**) and the sliding cam (**Figure 34**).
16. Following the manufacturer's instructions, attach the puller (JIMS part No. 95960-52C) to the clutch hub (**Figure 35**).




17. Turn the clutch hub puller pressure screw to pull the clutch hub and remove the clutch shell (with clutch hub attached) (C, **Figure 32**), primary chain (with adjuster) (D) and compensating sprocket (E) at the same time.
18. Remove the shaft extension and washer, if necessary.
19. Disassembly of the clutch shell and hub assembly is not required unless parts are damaged and require replacement.
20. Remove the Woodruff key (**Figure 36**) from the transmission mainshaft.

### Installation

Refer to **Figure 26**.

1. If removed, install the Woodruff key (**Figure 36**) into the transmission mainshaft.

*NOTE*

*Make sure that the Woodruff key is parallel with the mainshaft taper and is completely seated.*

2. Refer to **Figure 37** and install the washer and shaft extension (if removed).
3. Install the clutch shell, hub (C, **Figure 32**), primary chain (D), compensating sprocket and cam (E) as an assembly. Make sure the Woodruff key was not knocked out of alignment during installation.

*CAUTION*

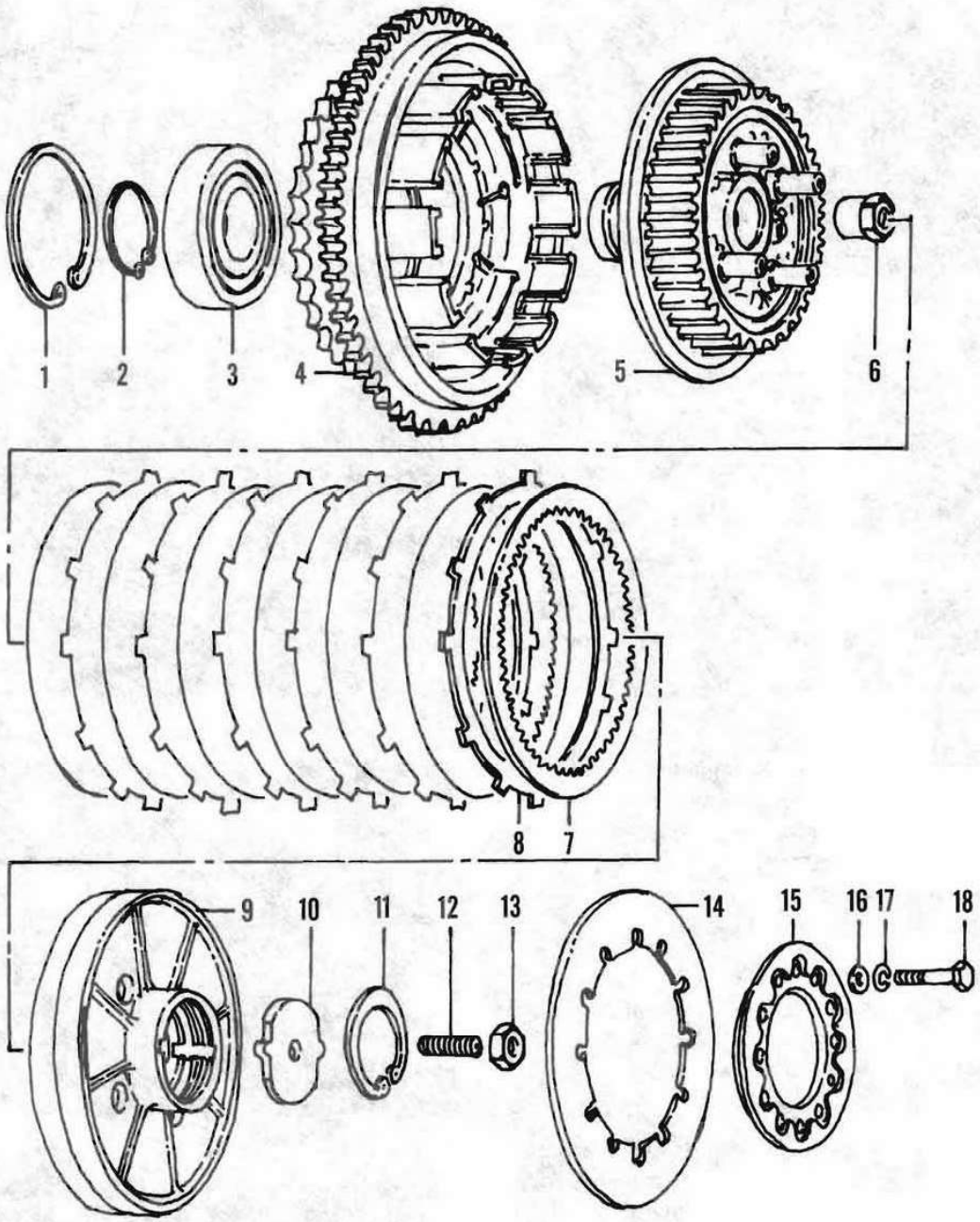
*Do not overtighten the clutch nut because overtightening can damage the clutch hub and pilot bearing.*

*NOTE*

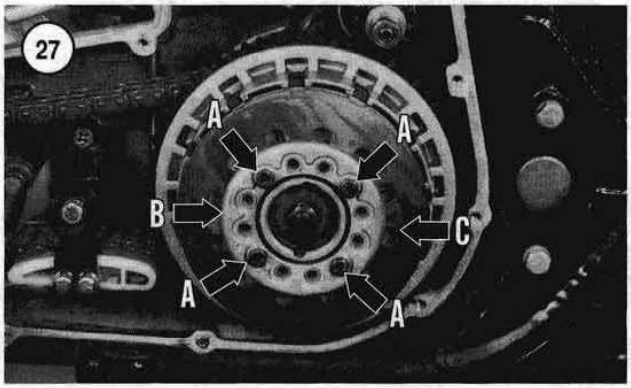
*The clutch nut has left-hand threads. Turn the nut **counterclockwise** to tighten.*

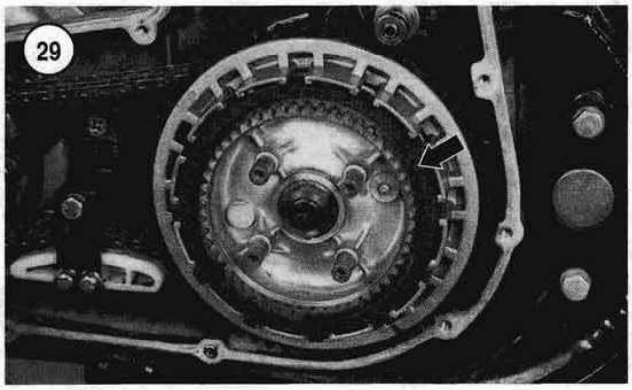
26

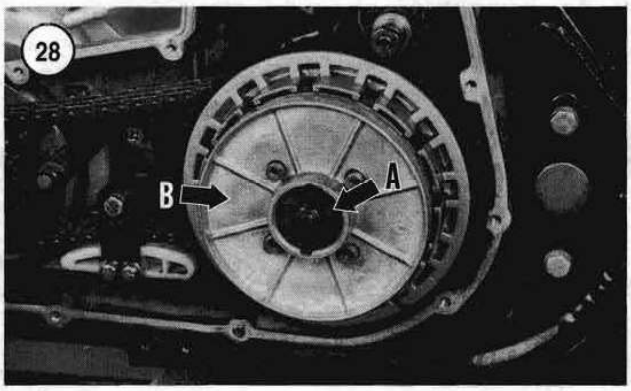
## WET CLUTCH (LATE 1984-1989)

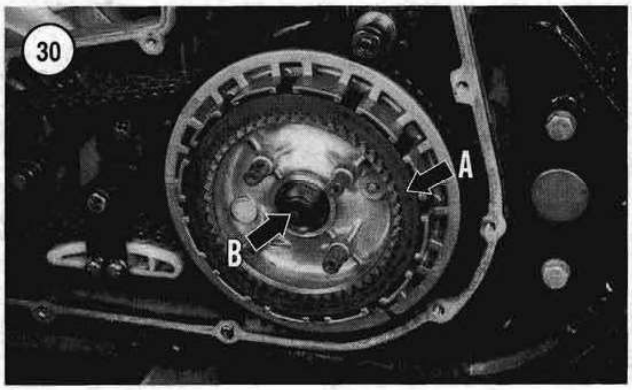



1. Snap ring
2. Snap ring
3. Pilot bearing
4. Clutch shell
5. Inner clutch hub
6. Nut
7. Steel clutch plate
8. Friction clutch plate
9. Pressure plate
10. Release plate
11. Snap ring
12. Adjuster screw
13. Nut
14. Diaphragm spring
15. Adjuster plate
16. Washer
17. Lockwasher (late 1984-early 1985 only)
18. Bolt



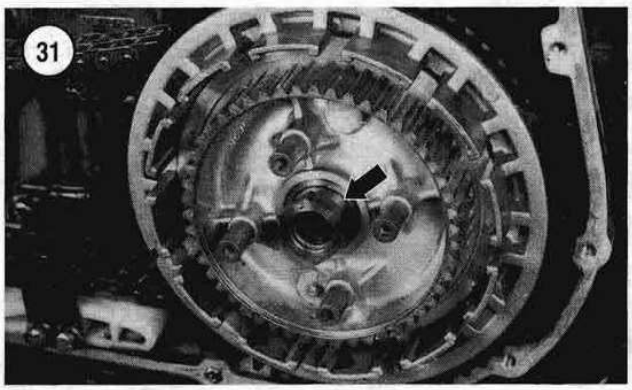



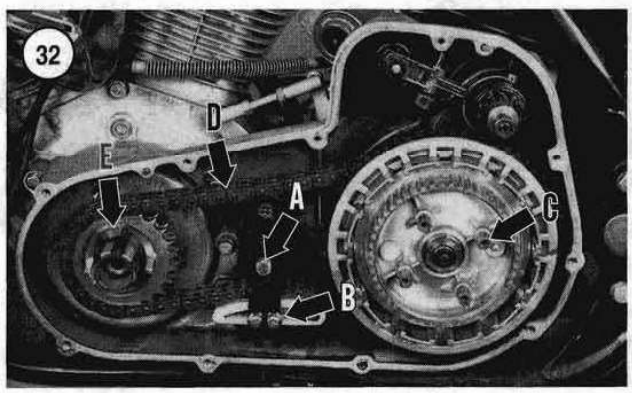

4. Apply a few drops of medium-strength threadlocking compound to the clutch nut threads prior to installation.
5. Use the same tools and procedures to prevent the mainshaft from turning as used during disassembly.
6. Install the nut onto the mainshaft and turn it *counterclockwise*. Tighten the nut to 50-60 ft.-lb. (67-81 N•m).

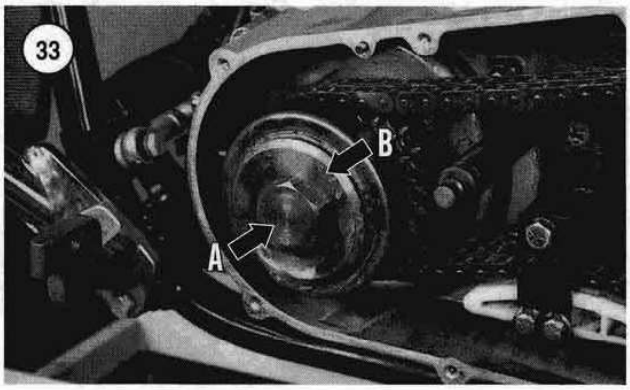
*CAUTION*

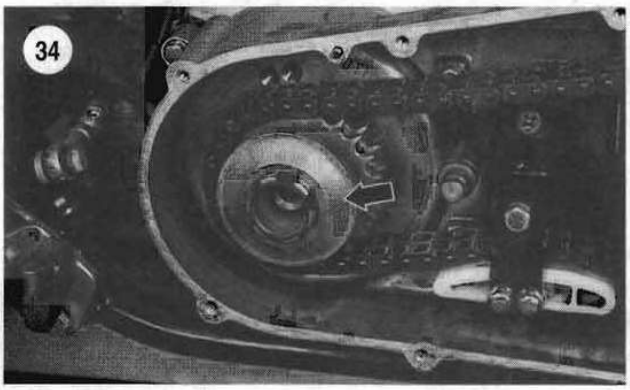
*The compensating sprocket nut is tightened to a high torque specification. Make sure you hold the sprocket securely when tightening the nut in Step 5.*

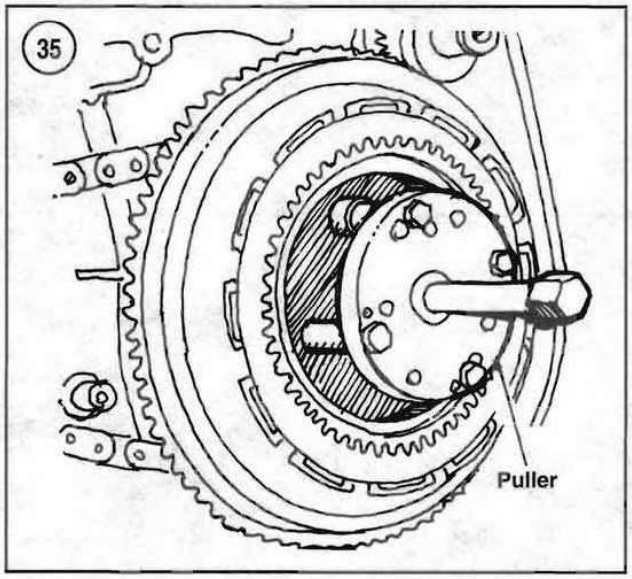
7. Apply a few drops of medium-strength threadlocking compound to the sprocket nut threads prior to installation.
8. Install the sprocket nut (A, **Figure 33**) and tighten to 90-100 ft.-lb. (122-136 N•m). Use the same tools and procedures as used during disassembly to prevent the crankshaft from turning. Remove the special tool at this time.
9. Soak all friction plates in clean engine oil before assembly.
10. Install a steel clutch plate (**Figure 29**) and then a friction clutch plate (A, **Figure 30**). Continue to alternately install the friction plates and steel plates. The last part installed is a steel clutch plate (**Figure 29**).
11. If removed, install the pushrod into the release plate.



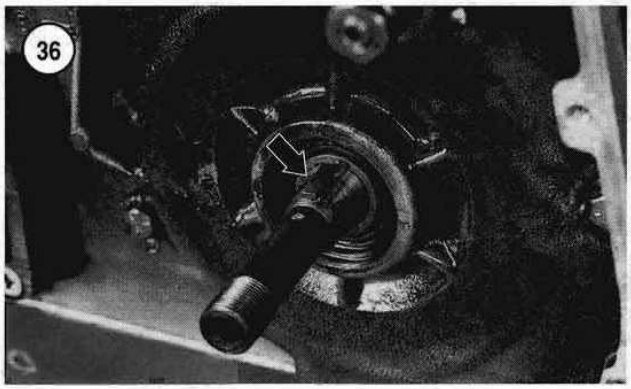






12. If the release plate was removed from the pressure plate, perform the following:
    a. Install the release plate (A, **Figure 38**) into the pressure plate (B).
    b. Position the snap ring with the beveled edge faces inward.




    c. Install the beveled snap ring and make sure it seats correctly in the pressure plate groove.
13. Install the pressure plate (B, **Figure 28**).
14. Position the diaphragm spring (C, **Figure 27**) with its convex side facing outward and install it onto the pressure plate.
15. Install the adjuster plate (B, **Figure 27**).

*NOTE*

*Late 1984-early 1985 models use a flat washer and a lockwasher on each of the clutch hub bolts. Late 1985 and later models use only the washer, not the lockwasher.*

16. Install the washer(s) onto each of the clutch hub bolts.

*NOTE*

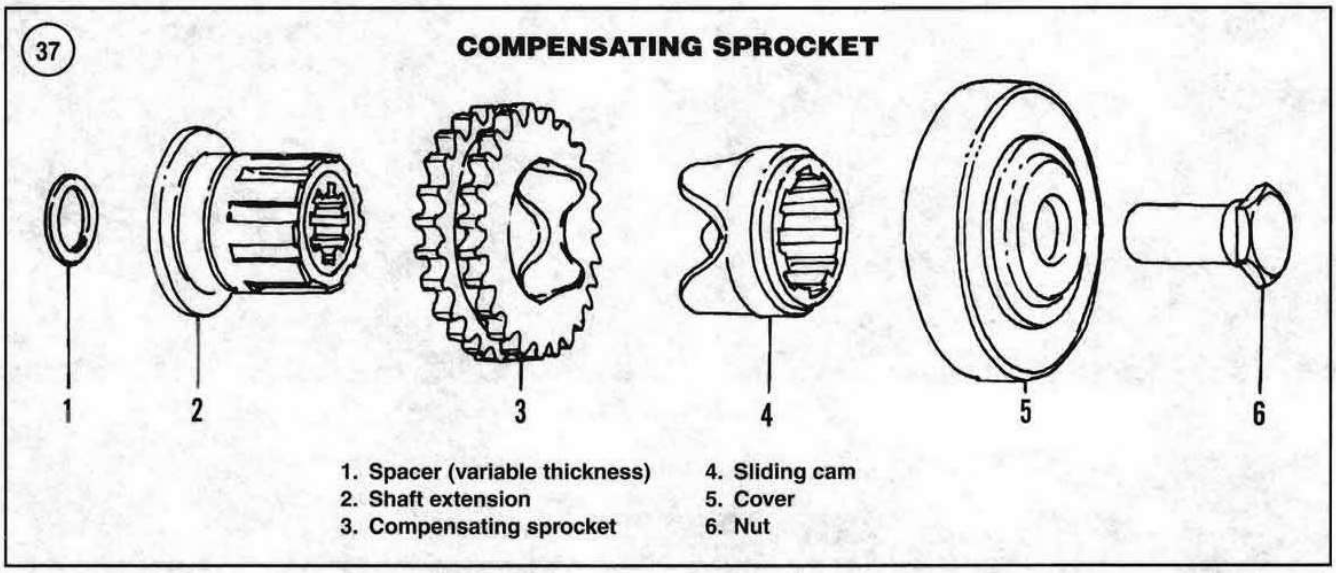
*Use only Loctite 222 (purple) threadlocking compound in Step 17.*

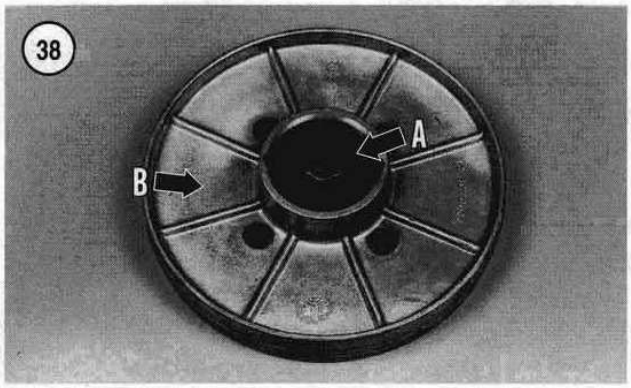
17. Thoroughly clean the bolt threads with Loctite primer. Apply a few drops of Loctite 222 (purple) to threads on each of the clutch hub bolts.
18. Install the bolts (A, **Figure 27**) through the adjuster plate (B) and pressure plate. Then screw the bolts into the clutch hub. Tighten the bolts in a crisscross pattern to 80-97 in.-lb. (9-11 N•m).
19. Adjust the clutch as described in Chapter Three.

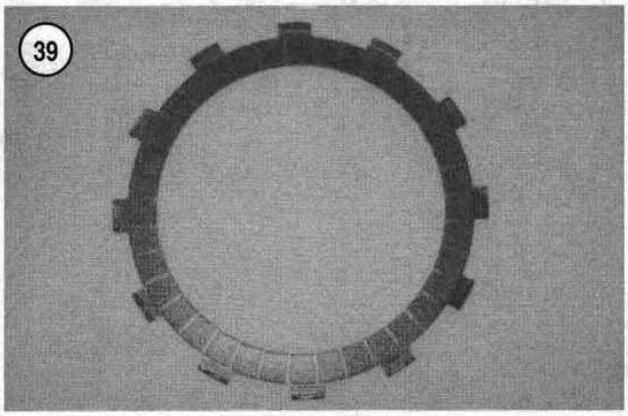
*NOTE*

*If new clutch components were installed, readjust the clutch at the first 500-mile (800 km) interval.*

20. Assemble and secure the primary chain adjust shoe assembly as described in this chapter.
21. Adjust the primary chain as described in Chapter Three.
22. Check primary chain alignment as described in this chapter.



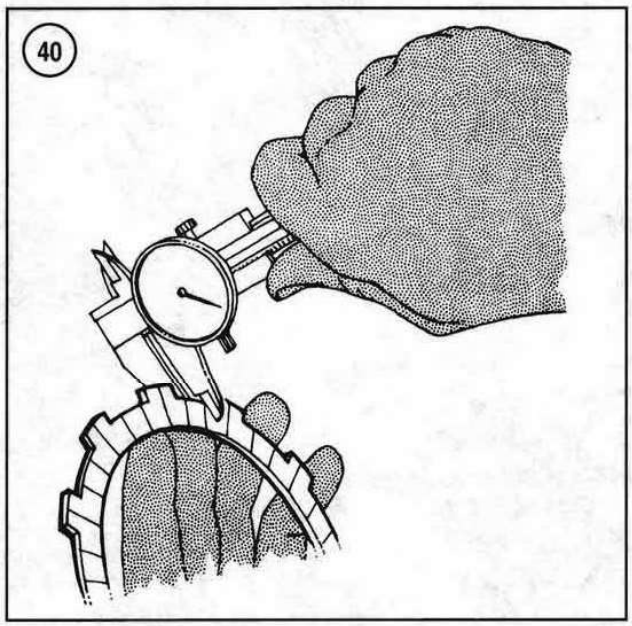




23. Install the primary chaincase outer cover as described in this chapter.

24. Refill the primary chain housing with the correct type and quantity of oil as described in Chapter Three.

25. Connect the negative battery cable to the battery.

26. Ride the motorcycle a short distance and check the cover for oil leaks.

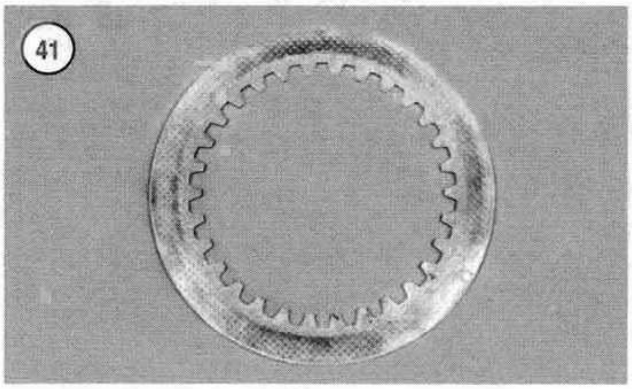


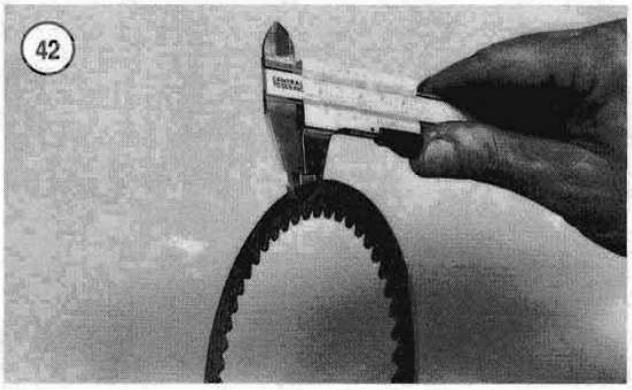

### Inspection

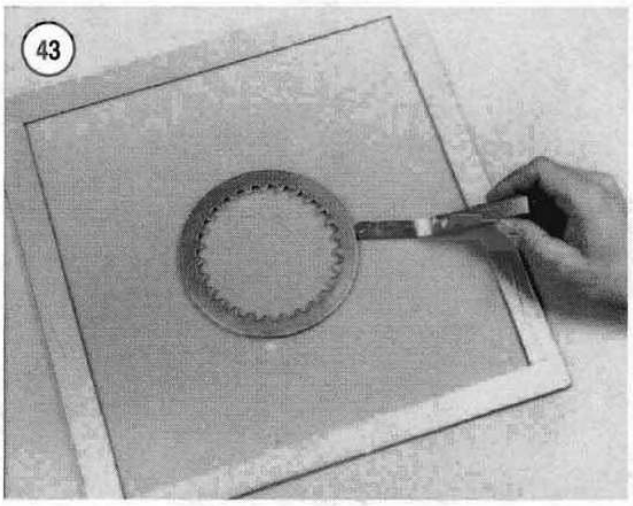
When measuring the clutch components, compare the actual measurement to the specifications in **Table 2**. Replace parts that are out of specification or show damage as described in this section.

1. Clean all clutch parts in a non-oil-based solvent and thoroughly dry with compressed air.

2. Inspect the friction plates (**Figure 39**) for worn or grooved lining surfaces. Measure each plate (**Figure 40**).



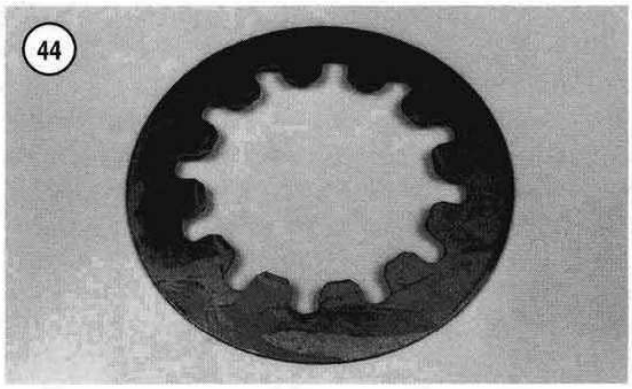



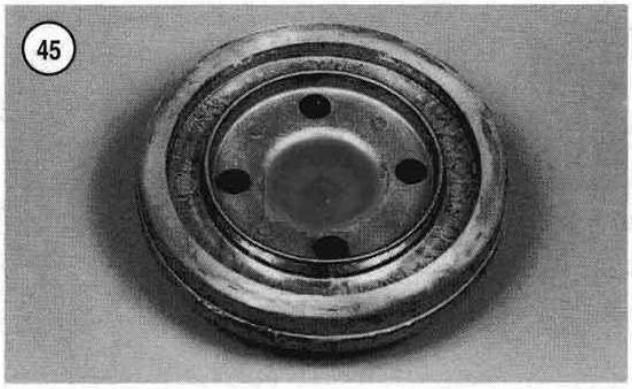




Replace the friction plates as a set if one plate is found too thin.

3. Check each steel plate (**Figure 41**) for thickness with a vernier caliper (**Figure 42**). Also check each steel plate for flatness with a feeler gauge and straightedge in several places (**Figure 43**).

4. Check the diaphragm spring (**Figure 44**) for wear or damage. Replace if necessary.




5. Check the pressure plate surfaces (B, **Figure 38** and **Figure 45**) for wear or cracking. Replace if necessary.

*CAUTION*

*The clutch shell assembly consists of the inner clutch hub, clutch shell and pilot bearing. Because of the possibility of damaging the pilot bearing when removing it, do not disassemble these parts unless it is necessary to replace worn or damaged parts or to access the parts for closer inspection. A press is required for disassembly and assembly.*

6. Check the pilot bearing (A, **Figure 46**) for wear by holding the clutch hub and turning the clutch shell by hand. If the bearing appears worn, replace it as described in this section.

7. Check both sets of gear teeth on the clutch shell (B, **Figure 46**). If the teeth are visibly worn or undercut (**Figure 47**), replace the clutch shell.

8. Check the inner clutch hub splines (**Figure 48**) for wear or damage. If worn or damaged parts are detected, disassemble the clutch shell assembly as described under *Clutch Shell, Clutch Hub and Sprocket (All Wet Clutch Models)* in this chapter.

## WET CLUTCH ASSEMBLY (1990-1997 MODELS)

This section describes removal, inspection and installation of the clutch plates. If the clutch requires additional service, refer to the clutch shell procedures in this chapter.

In order to remove the clutch plates from the clutch hub, a special tool is necessary to safely compress the diaphragm spring and remove the snap ring. Use the clutch spring compressor (JIMS part No. 38515-90) (**Figure 49**) or an equivalent tool.

If the correct tool is not available, remove the clutch unit intact from the motorcycle and take it to a Harley-Davidson dealership or independent repair shop for disassembly, service and assembly. Do not attempt to disassemble the clutch without the correct tool.

### Removal

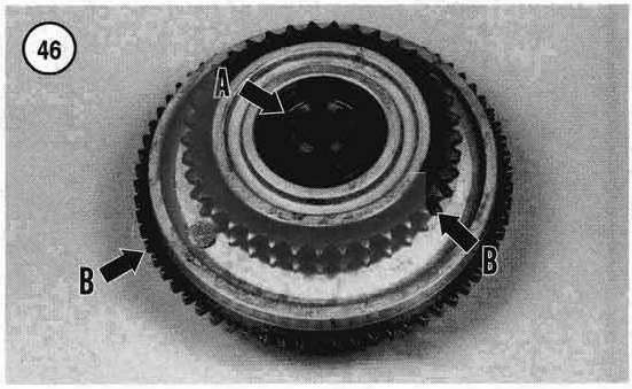
Refer to **Figure 50**.

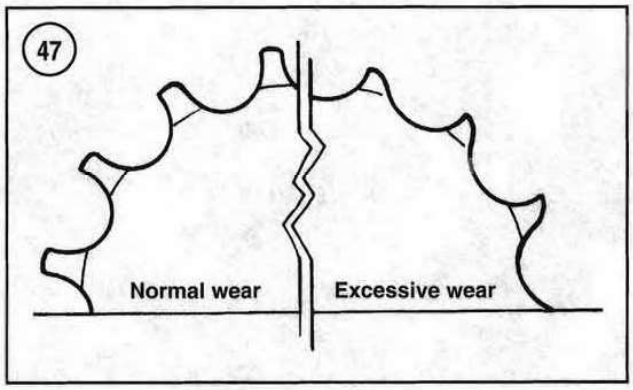
1. Disconnect the negative battery cable from the battery.
2. Remove the primary chaincase cover as described in this chapter.
3. Loosen the clutch adjust screw locknut with a socket (**Figure 51**). Then remove the adjusting screw and locknut.

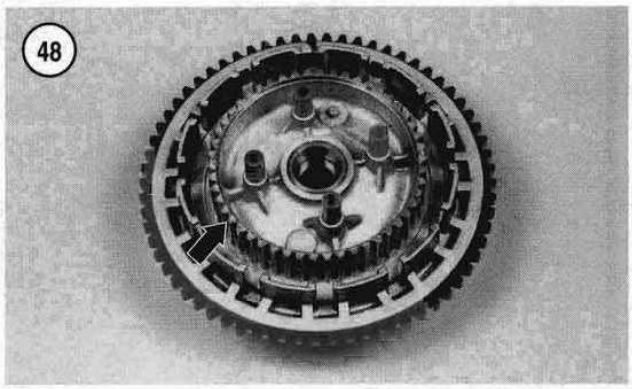
*WARNING*

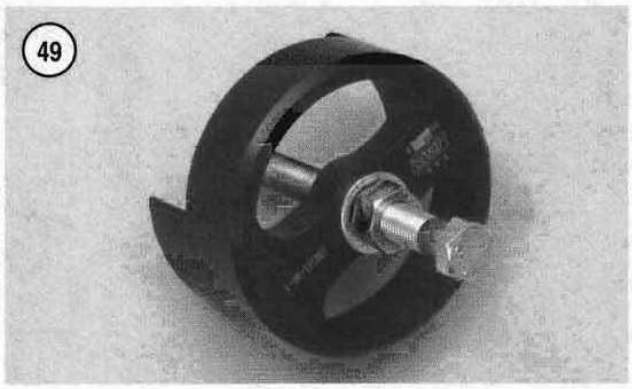
*The previously described tool **must be used** in the following step. The clutch diaphragm spring is under considerable pressure and, when released, will come off rapidly and possibly cause injury.*

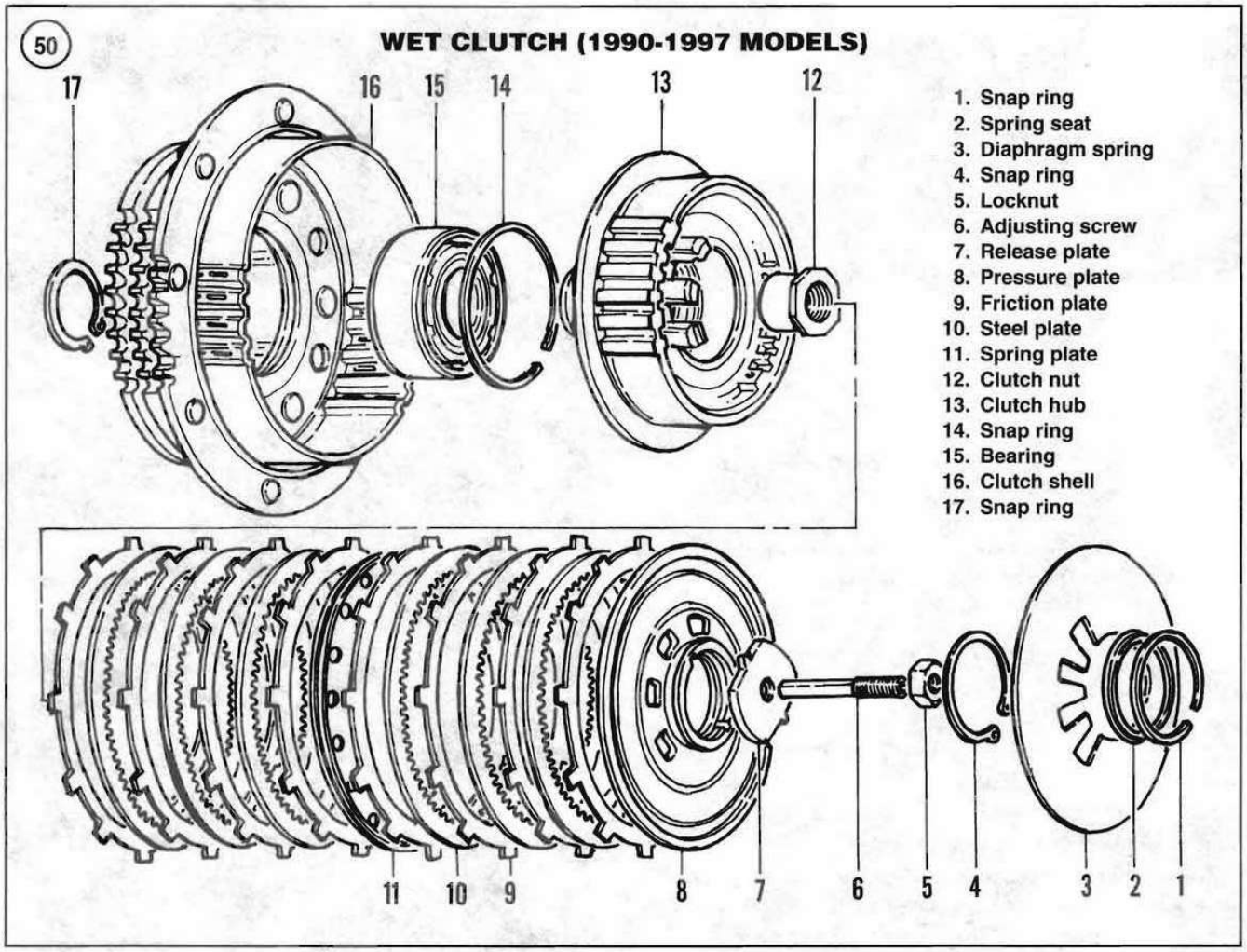
4. Install the spring compressor tool as follows:
   a. Align the tool with the clutch assembly and thread the forcing screw on the tool into the release plate until the hex head on the forcing screw bottoms out against the release plate (**Figure 52**).
   b. Turn the tool handle clockwise to compress the diaphragm tool while at the same time moving the clutch spring seat inward and away from the large snap ring.
   c. When the clutch spring seat has been moved away from the snap ring, remove the snap ring with snap ring pliers or carefully pry it out with a small screwdriver (**Figure 53**).
5. After removing the snap ring in Step 4, remove the tool from the clutch with the diaphragm spring and pressure plate still attached (**Figure 54**).

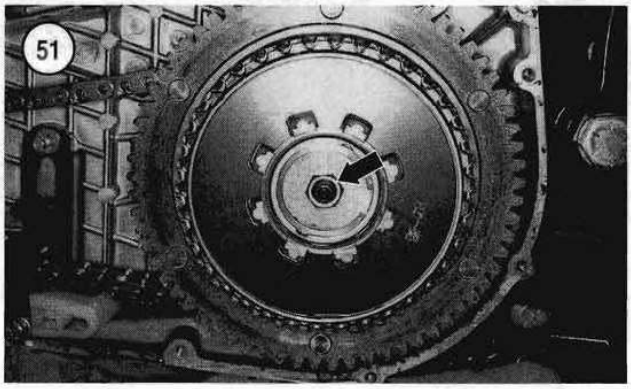


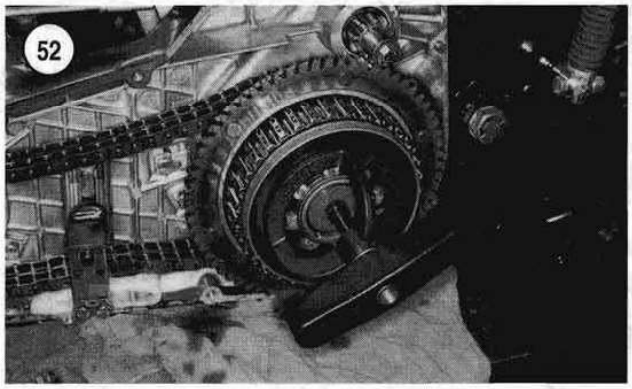






*NOTE*

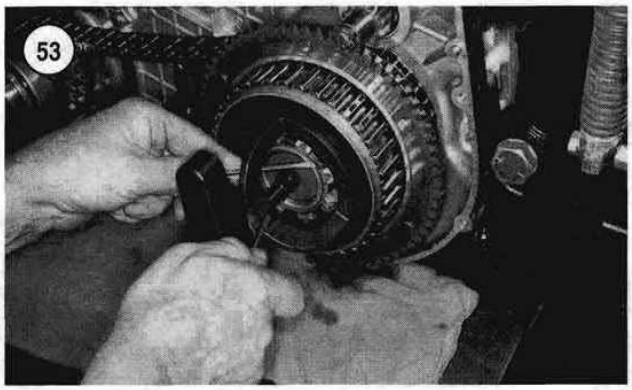
*Do not loosen the spring compressor tool to remove the diaphragm spring or pressure plate unless these parts require inspection or replacement. Loosening and removing the tool will require repositioning of the diaphragm spring during assembly. This step will not be required as long as the tool is not removed from these parts.*

6. Remove the friction and steel clutch plates (and the spring plate) from the clutch assembly (**Figure 55**) and

keep them in order. Note the spring plate installed between the fourth and fifth friction plate (**Figure 56**).

*NOTE*

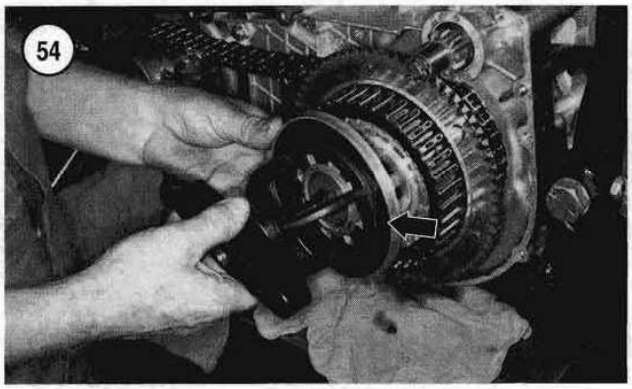
*Further removal steps are not required unless it is necessary to remove the clutch hub and shell assembly. If necessary, remove these parts as described under* ***Clutch Shell, Compensating Sprocket and Primary Drive Chain*** *in this chapter. See* ***Figure 57****.*



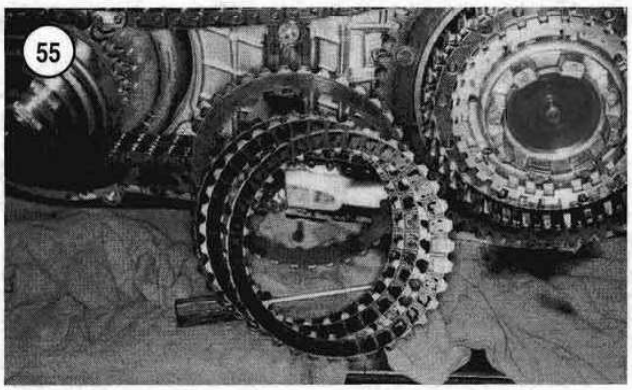

**Installation**

*NOTE*

*The original equipment clutch has eight friction plates, six steel plates and one spring plate. Make sure each part is installed in the correct order. When installing an aftermarket clutch plate assembly, follow the manufacturer's instructions.*




1. Soak the friction plates and steel plates in clean primary chaincase oil for approximately five minutes before installing them.
2. Install a friction plate, then a steel plate, a friction plate, a steel plate, a friction plate, a steel plate and a friction plate and stop. At this point, four friction plates and three steel plates have been installed.
3. Install the spring plate, then a friction plate and a steel plate. Continue to alternately install the friction plates and steel plates. The last part installed is a friction plate. Make sure it is locked into place in the clutch shell.



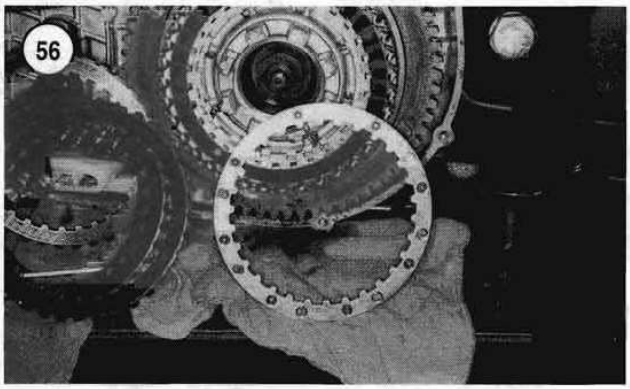

*NOTE*

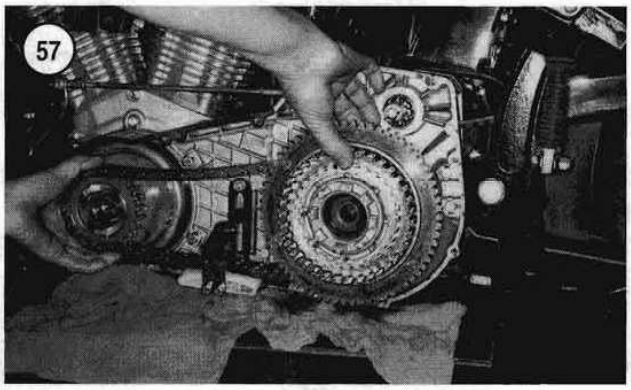
*If the diaphragm spring and pressure plate were removed from the compression tool, proceed to Step 4. If they were not removed from the tool, proceed to Step 5.*

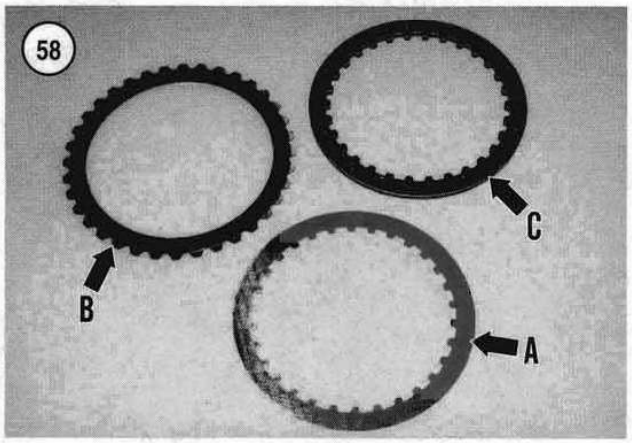
4. Assemble the pressure plate and diaphragm spring as follows:
   a. Align the release plate tabs with the slots in the pressure plate and install it into the pressure plate.
   b. Install the snap ring and secure the release plate in the pressure plate. Make sure the snap ring seats in the groove completely. Do not thread the adjusting screw and locknut into the release plate at this time.
   c. Align the teeth on the pressure plate with the clutch hub. Then insert the pressure plate into the clutch hub.
   d. Position the diaphragm spring with the convex side facing out from the pressure plate and install it onto the pressure plate. The diaphragm spring has room to move around within the pressure plate. This is normal. Center the diaphragm spring by hand and hold it in position.
   e. Position the clutch spring seat with the lip side facing out and install it onto the diaphragm spring.

*WARNING*

*The previously described tool* ***must be used*** *in the following step. The clutch diaphragm spring is under considerable pressure and must be held in place during snap ring in-*




*stallation. Personal injury could occur if the correct tool is not used.*

f. Align the spring compressor tool with the clutch hub and thread the center screw on the tool into the release plate until the hex head on the forcing screw bottoms out against the release plate (**Figure 52**). Then check that the diaphragm spring is still centered within the clutch hub spring pocket as described in substep d. If necessary, reposition the diaphragm spring.

g. Turn the tool handle *clockwise*. Compress the diaphragm spring moving the clutch spring seat inward to access the clutch hub snap ring groove.

h. Install the diaphragm spring snap ring into the clutch hub groove. Make sure the ends of the snap ring do not hang over the bosses or posts on the end of the clutch hub.

i. After making sure the snap ring is seated completely in the clutch hub groove and that it is positioned as described in substep h, *slowly* turn the tool handle *counterclockwise* while making sure that the clutch spring seat lip seats inside the snap ring. After all tension has been removed from the tool, remove it from the release plate.

j. Install the adjust screw and locknut into the release plate (**Figure 51**).

5. If the tool was not removed from the diaphragm spring, install the diaphragm spring as follows:

a. Align the teeth on the pressure plate (**Figure 52**) with the clutch hub. Then insert the pressure plate into the clutch hub.

b. Thread the forcing screw on the tool into the release plate until the hex head on the forcing screw bottoms out against the release plate.

c. Turn the tool handle *clockwise* to compress the diaphragm spring and move the clutch spring seat inward to access the clutch hub snap ring groove.

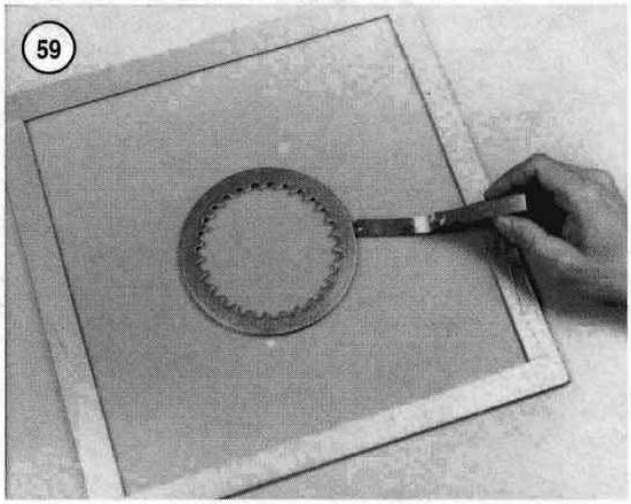
d. Install the diaphragm spring snap ring into the clutch hub groove while making sure the ends of the snap ring do not overhang the bosses or posts on the end of the clutch hub.

e. After making sure the snap ring is seated completely in the clutch hub groove and positioned as described in substep d, slowly turn the tool handle *counterclockwise* while checking that the clutch spring seat lip seats inside the snap ring. After all tension has been removed from the tool, remove it from the release plate.

### Inspection

When measuring the clutch components, compare the actual measurement to the specifications in **Table 3**. Replace parts that are out of specification or show damage as described in this section.

1. Clean all clutch parts in a non-oil-based solvent and thoroughly dry with compressed air.
2. Check each steel plate (A, **Figure 58**) for visual damage such as cracks or wear grooves.



3. Also check each steel plate for flatness with a feeler gauge and straightedge in several places (**Figure 59**).

4. Inspect the friction plates (**Figure 60**) for worn or grooved lining surfaces. Replace the friction plates as a set if any one plate is damaged.

5. Clean each friction plate thoroughly with a lint-free cloth to remove as much oil from the plates as possible. Then stack each of the eight friction plates on top of each other and measure the thickness of the plate assembly with a vernier caliper or micrometer. Replace the friction plates as an assembly if the combined minimum thickness of the eight plates is less than the specification in **Table 3**.

6. Inspect the friction plates (B, **Figure 58**) for worn or grooved lining surfaces.

7. Check the spring plate (C, **Figure 58**) for cracks or damage. Check each of the rivets (**Figure 61**) for looseness or damage. Replace the spring plate if necessary.

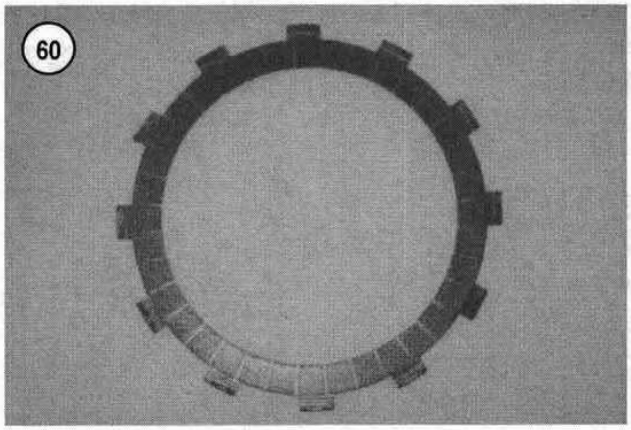
8. Check the diaphragm spring for cracks or damage. Check also for bent or damaged tabs. Replace the diaphragm spring if necessary.

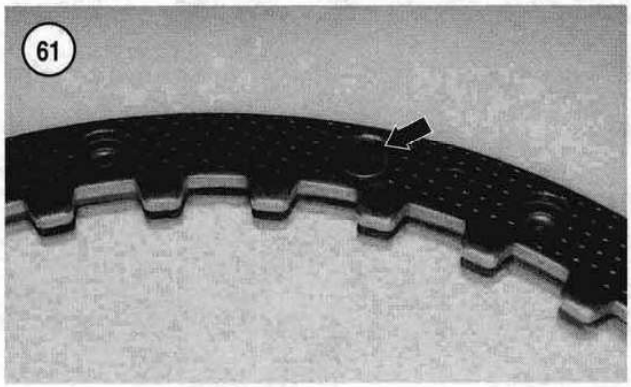
## CLUTCH SHELL, COMPENSATING SPROCKET AND PRIMARY DRIVE CHAIN (WET CLUTCH ASSEMBLY [1990-1997 MODELS])

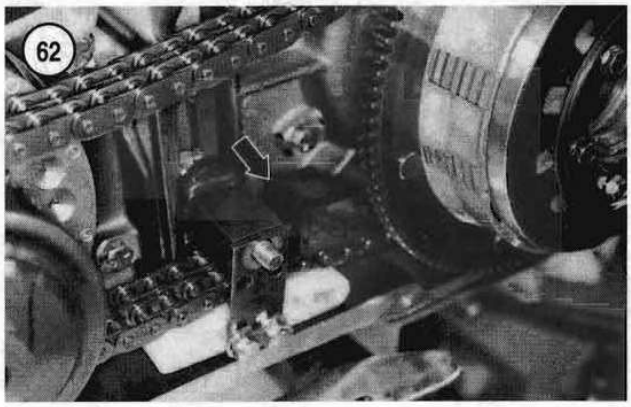
### Removal

This procedure describes clutch shell, primary chain and compensating sprocket removal. These components must be removed from the engine and transmission as an assembly.

1. Disconnect the negative battery cable from the battery.





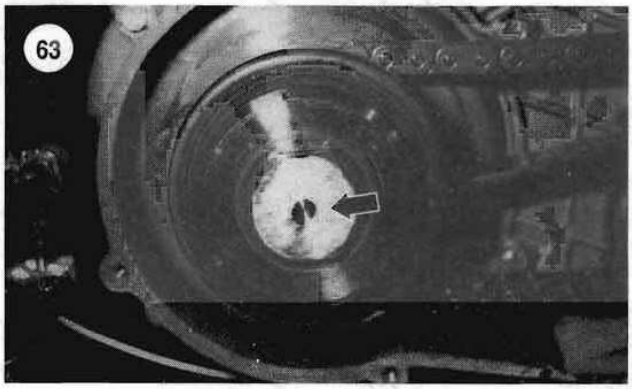


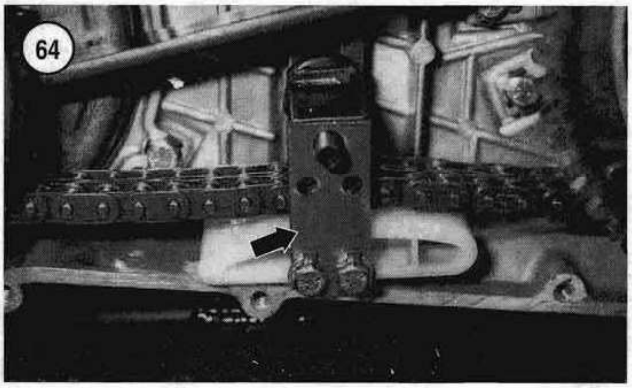
2. Remove the primary chaincase cover as described in this chapter.

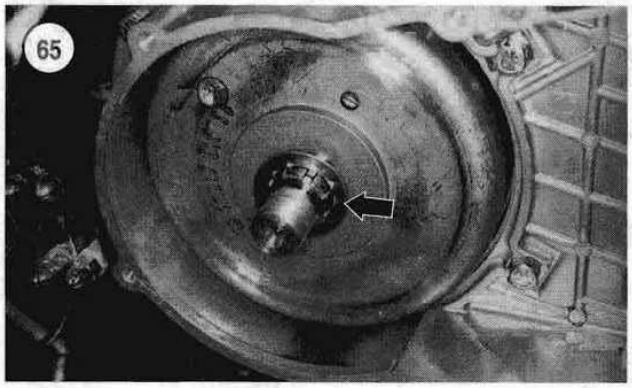
3. Remove the clutch components from the clutch shell and hub as previously described.

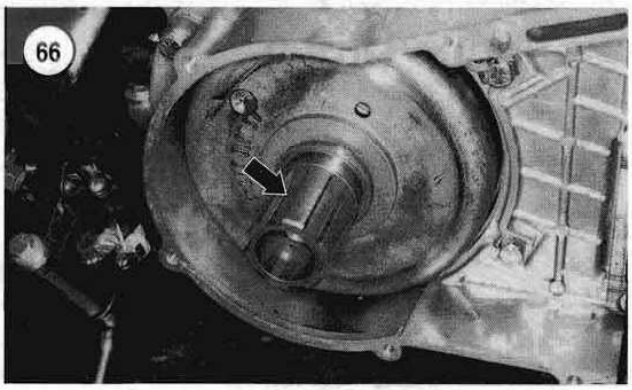
4A. If a special tool is available, such as the primary drive locking tool (JIMS part No. 2234), place it onto the primary chain next to the clutch housing (**Figure 62**).

4B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.




5. Loosen the compensating sprocket nut (**Figure 63**) with an impact wrench. Then remove the nut.

*CAUTION*

*The clutch hub nut has **left-hand threads**. Turn the clutch nut **clockwise** to loosen it.*

6. Loosen the clutch nut with an impact wrench. Remove the clutch nut.
7. Remove the nut and washer from the center bolt on the primary chain adjusting shoe assembly (**Figure 64**).
8. Remove the special tool installed in Step 4A.
9. Remove the clutch assembly, compensating sprocket, primary chain and chain adjuster bracket as an assembly (**Figure 57**).
10. Inspect the clutch shell as described in this chapter.

**Installation**

1. Remove all threadlocking compound residue from the crankshaft and mainshaft threads, compensating sprocket nut and clutch nut.
2. Remove all gasket residue from the inner primary housing gasket surface.
3. If removed, install the sprocket shaft spacer (**Figure 65**) and the compensating sprocket shaft extension (**Figure 66**).
4. Assemble the clutch, compensating sprocket, primary chain and chain adjuster bracket.
5. Install the clutch assembly, compensating sprocket, primary chain and chain adjuster bracket as an assembly (**Figure 57**). Make sure the chain tension assembly is still attached to the chain.

6A. Use the same tool setup used during removal to prevent the compensating sprocket and clutch shell from rotating during the following steps.

6B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.

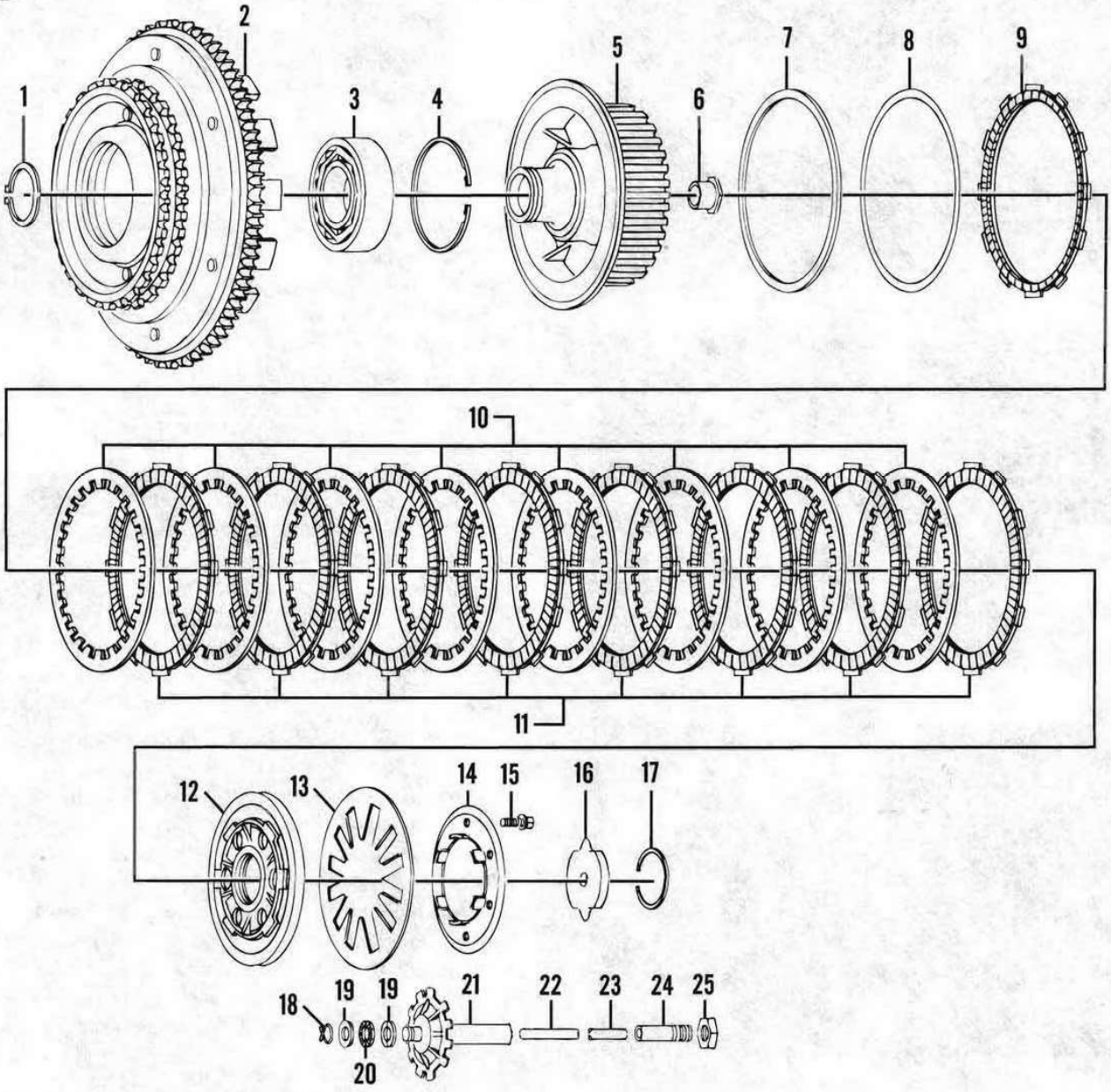
*CAUTION*

*The clutch hub nut has **left-hand threads**. Turn the clutch nut **counterclockwise** to tighten it.*

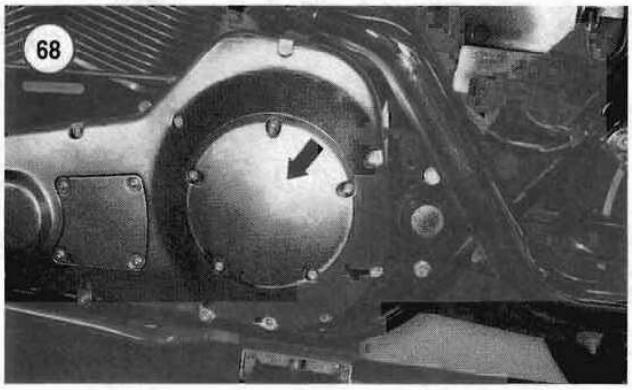
7. Apply two drops of medium-strength threadlocking compound to the clutch hub nut threads. Install the nut and tighten it to 70-80 ft.-lb. (95-108 N•m).
8. Apply two drops of medium-strength threadlocking compound to the compensating sprocket nut threads and thread the nut onto the crankshaft.
9. Use the same tools and procedures to prevent the compensating sprocket from turning. Tighten the nut to 150-165 ft.-lb. (203-224 N•m).

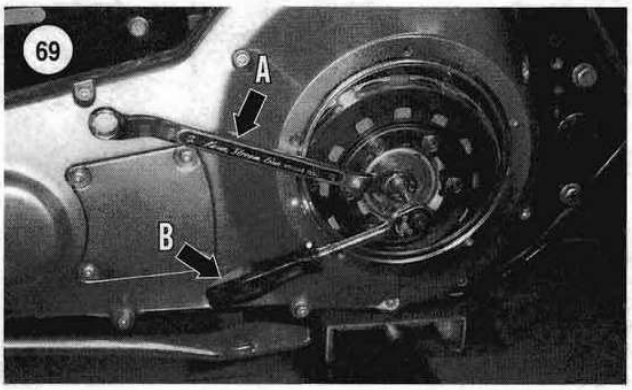
(67)

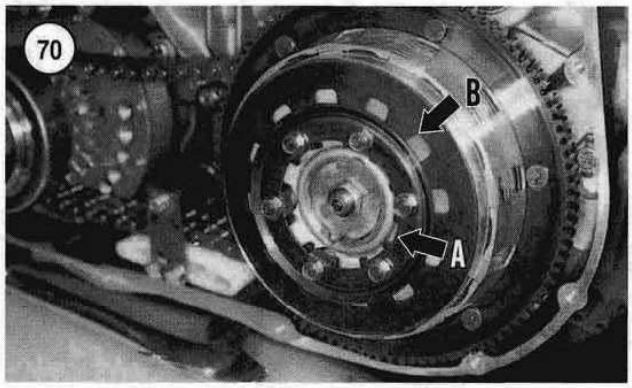
## WET CLUTCH (1998-1999 MODELS)

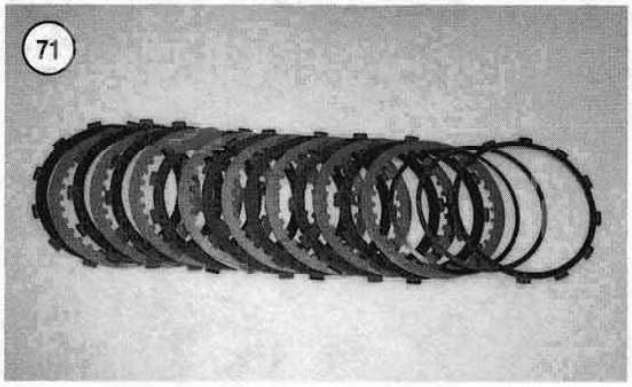



1. Snap ring
2. Clutch shell and sprocket
3. Bearing
4. Snap ring
5. Clutch hub
6. Clutch nut
7. Diaphragm spring seat
8. Diaphragm spring
9. Friction disc B
10. Clutch plates
11. Friction disc A
12. Pressure plate
13. Diaphragm spring
14. Diaphragm spring retainer
15. Bolt
16. Release plate
17. Snap ring
18. Snap ring
19. Thrust washer
20. Radial bearing
21. Oil slinger
22. Pushrod (right side)
23. Pushrod (right side)
24. Pushrod (left side)
25. Locknut




10. Adjust the clutch as described in Chapter Three.

*NOTE*

*If new clutch components were installed, readjust the clutch at the first 500-mile (800 km) interval.*

11. Assemble and secure the primary chain adjust shoe assembly as described in this chapter.

12. Adjust the primary chain as described in Chapter Three.

13. Check the primary chain alignment as described under *Primary Chain and Guide Alignment* in this chapter.

14. Install the primary chaincase cover as described in this chapter.

15. Ride the motorcycle a short distance and check the cover for oil leaks.

## WET CLUTCH (1998-1999 MODELS)

This section describes removal, inspection and installation of the clutch plates. If the clutch requires additional service, refer to *Clutch Shell, Clutch Hub and Sprocket* in this chapter.

Refer to **Figure 67**.

### Removal

1. Disconnect the negative battery cable from the battery.

2. Remove the clutch mechanism inspection cover and O-ring (**Figure 68**).

3. At the clutch mechanism, loosen the clutch adjusting screw locknut (A, **Figure 69**) and turn the adjusting screw (B) *counterclockwise* to allow slack against the diaphragm spring.

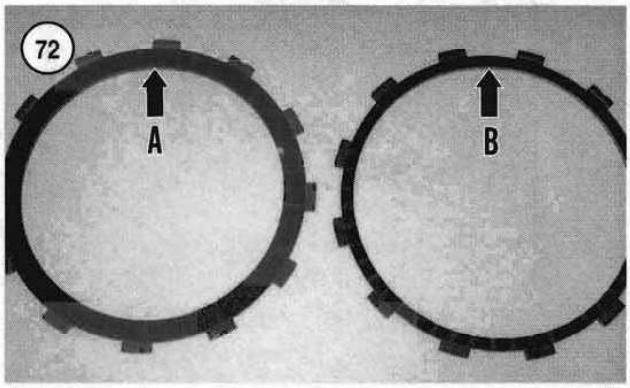
4. Remove the primary chaincase outer cover as described in this chapter.

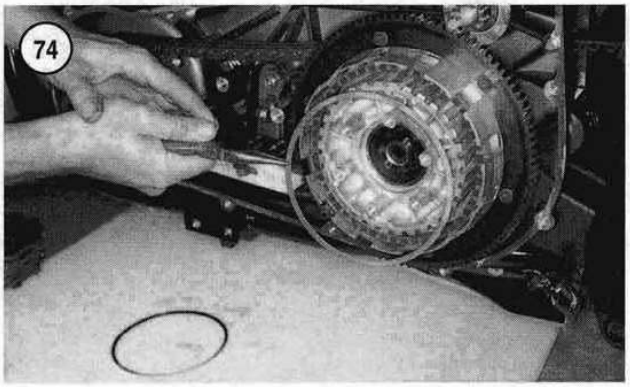
5. Loosen the bolts securing the diaphragm spring retainer (A, **Figure 70**) in a crisscross pattern. Remove the bolts and the retainer and diaphragm spring (B, **Figure 70**).

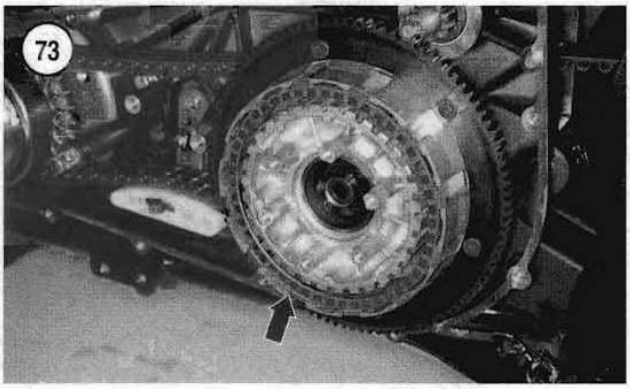
6. Remove the pressure plate.

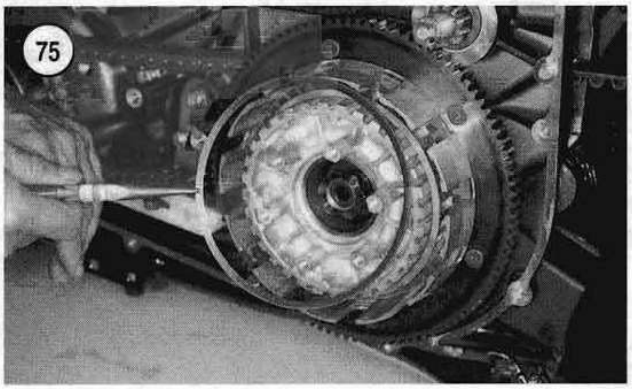
7. Remove the clutch plates and friction discs from the clutch shell.

8. Remove the damper spring and damper spring seat from the clutch shell. Keep all parts in order as shown in **Figure 71**.




**Installation**

*NOTE*

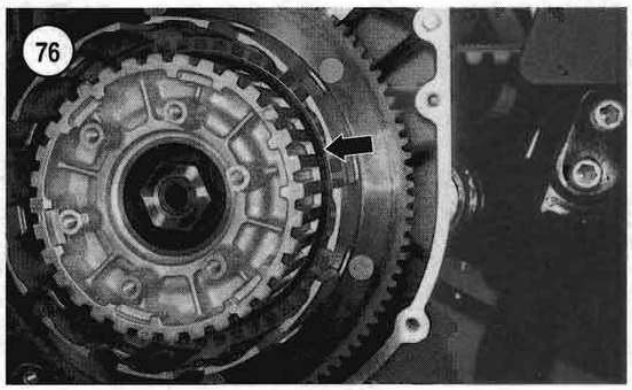
*The original equipment clutch (**Figure 71**) has nine friction plates, eight steel plates, one damper spring and one damper spring seat. Make sure each part is installed. If installing an aftermarket clutch plate assembly, follow the manufacturer's instructions for plate quantity, alignment and installation sequence.*

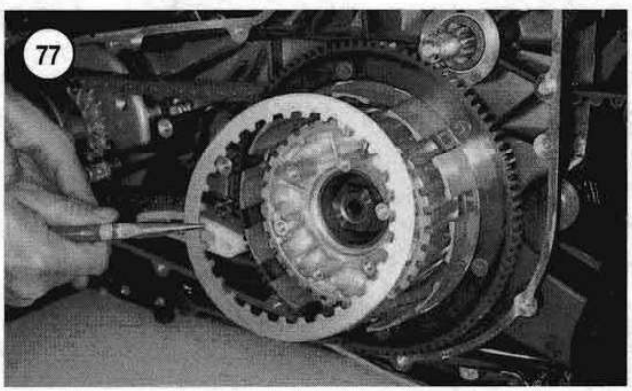
1. Soak the clutch friction disc and clutch plates in new primary drive oil for approximately five minutes before installing them.

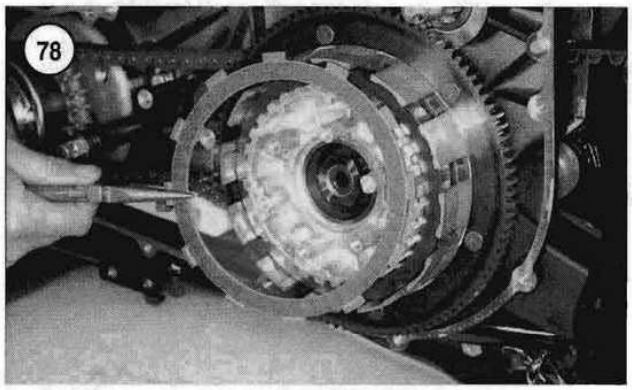
*NOTE*

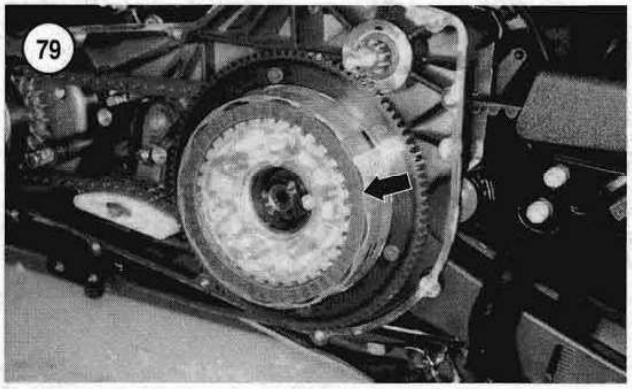
*There are two different types of clutch friction discs (**Figure 72**). The wider friction disc A is the normal width disc. The narrow width disc B is installed first because it works in conjunction with the damper spring and damper spring seat.*

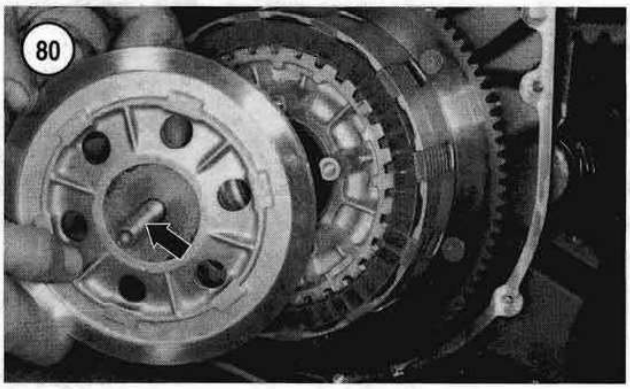
2. Install the clutch friction disc B (**Figure 73**) onto the clutch shell and clutch hub. Push it on all the way until it bottoms within the clutch hub.

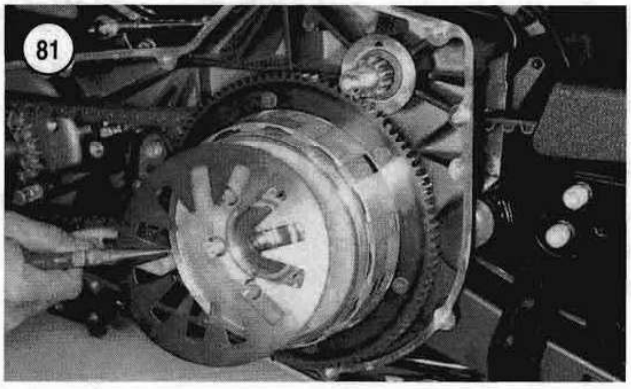


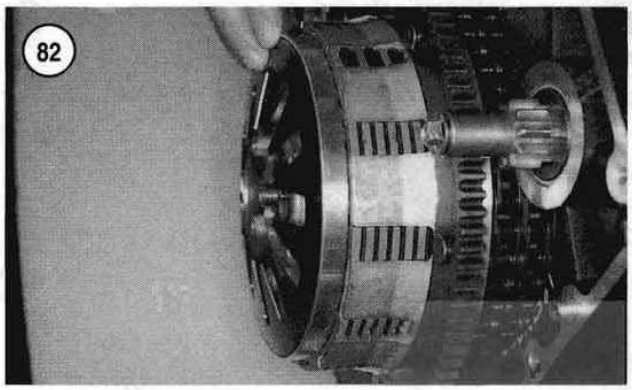



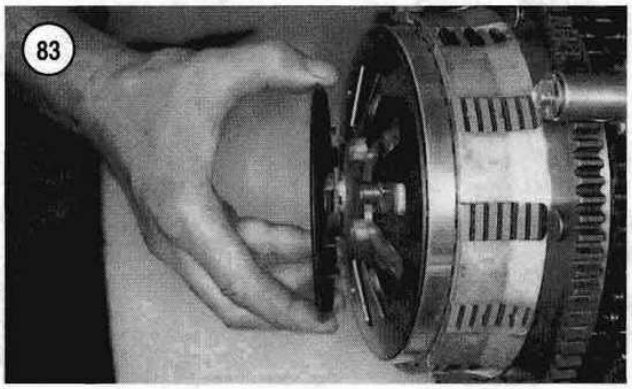



3. Install the damper spring seat (**Figure 74**) onto the clutch hub and push it in until it seats within the clutch friction disc B.

4. Position the damper spring with the concave side facing out (**Figure 75**) and install it onto the clutch hub against the damper spring seat (**Figure 76**).

5. Install a clutch plate (**Figure 77**) and then friction disc A (**Figure 78**). Continue to alternately install the clutch plates and friction discs. The last part installed is friction disc A (**Figure 79**).

6. Make sure the left pushrod assembly (**Figure 80**) is in place in the pressure plate. Install the pressure plate onto the clutch hub.

7. Position the diaphragm spring with the convex side facing out (**Figure 81**) and install it onto the pressure plate (**Figure 82**). Hold the pressure plate in place.

8. Position the diaphragm spring retainer with the finger side (**Figure 83**) facing in toward the diaphragm spring (B, **Figure 70**). Install the diaphragm spring retainer (A) and bolts.

9. Tighten the bolts in a crisscross pattern to 90-110 in.-lb. (10-12 N•m).

10. Install the primary chaincase outer cover as described in this chapter.

11. Install the clutch mechanism inspection cover and O-ring.
12. Connect the negative battery cable.

### Inspection

When measuring the clutch components, compare the actual measurements to the specifications in **Table 4**. Replace parts that are out of specification or show damage as described in this section.

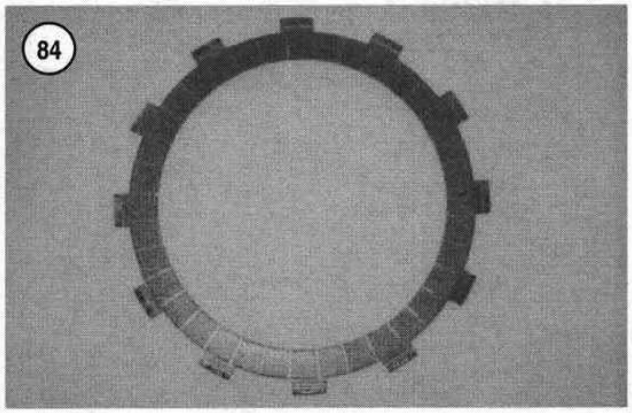
1. Clean all parts in solvent and thoroughly dry with compressed air.
2. Inspect the friction discs as follows:

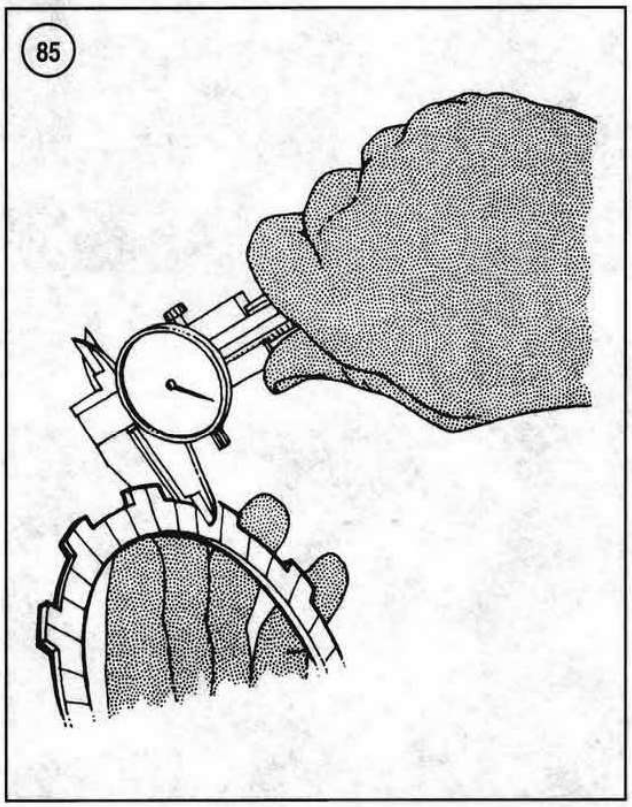
*NOTE*
*If any friction disc is damaged or out of specification as described in the following steps, replace **all** of the friction discs as a set. Never replace only one or two discs.*

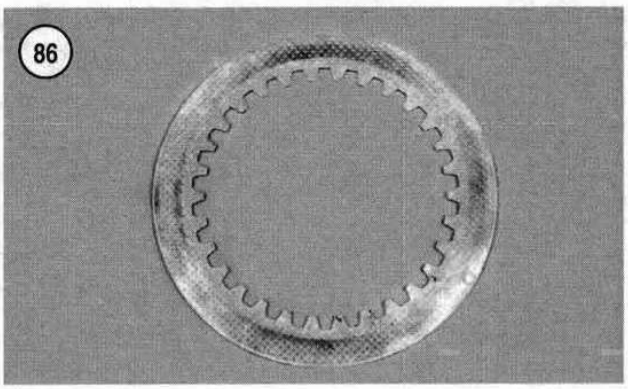
   a. The friction material used on the friction discs (**Figure 84**) is bonded to an aluminum plate for warp resistance and durability. Inspect the friction material for excessive or uneven wear, cracks and other damage. Check the disc tangs for surface damage. The sides of the disc tangs must be smooth where they contact the clutch shell finger; otherwise, the discs cannot engage and disengage correctly.

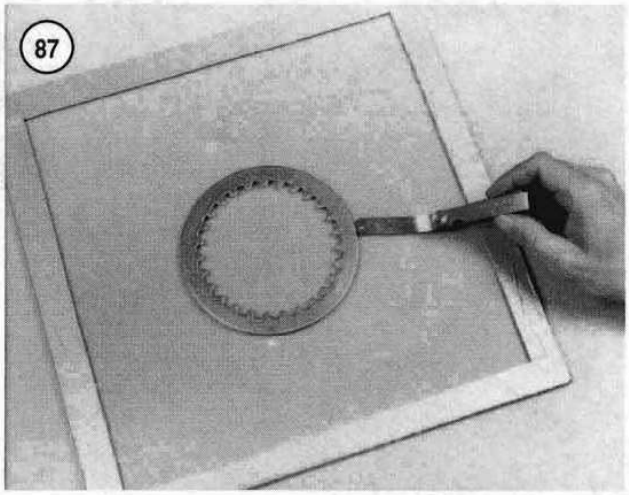
*NOTE*
*If the disc tangs are damaged, carefully inspect the clutch shell fingers as described later in this section.*

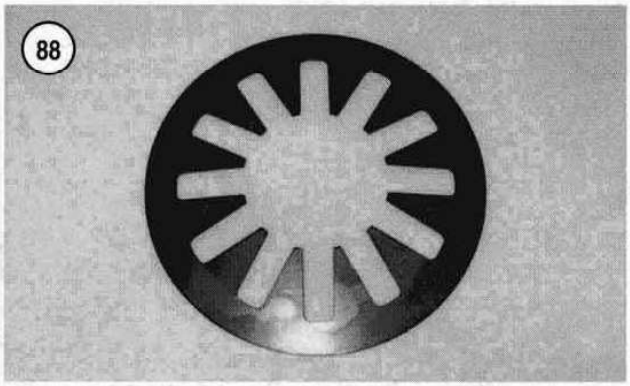
   b. Measure the thickness of each friction disc with a vernier caliper (**Figure 85**). Measure at several places around the disc.
3. Inspect the clutch plates (**Figure 86**) as follows:
   a. Inspect the clutch plates for cracks, damage or color change. Overheated clutch plates will have a blue discoloration.
   b. Check the clutch plates for oil glaze buildup. Remove by lightly sanding both sides of each plate with 400-grit sandpaper placed on a surface plate or piece of glass.
   c. Place each clutch plate on a flat surface and check for warp with a feeler gauge (**Figure 87**).
   d. The clutch plate inner teeth mesh with the clutch hub splines. Check the clutch plate teeth for any roughness or damage. The teeth contact surfaces must be smooth; otherwise, the plates cannot engage and disengage correctly.

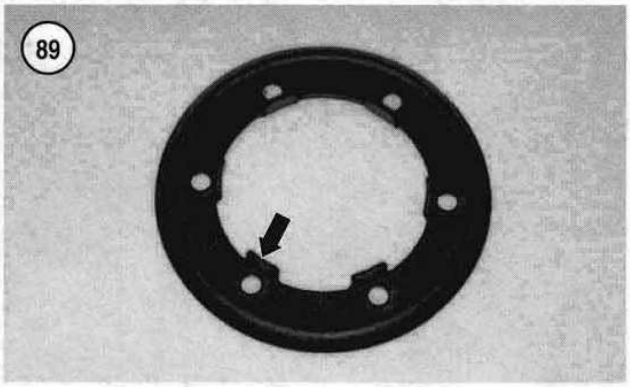


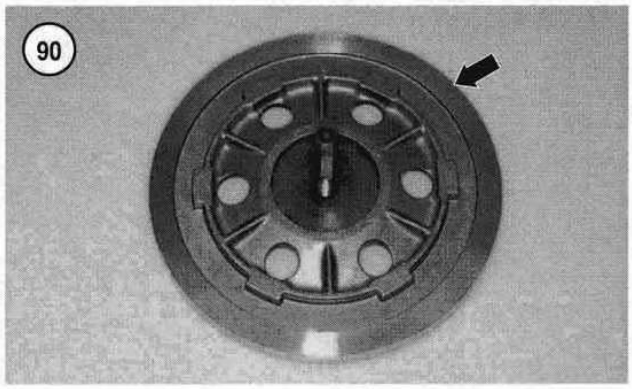


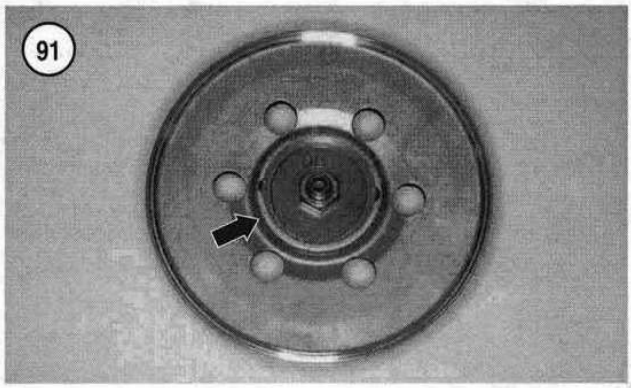




*NOTE*
*If the clutch plate teeth are damaged, carefully inspect the clutch hub splines as described later in this section.*

4. Inspect the diaphragm spring (**Figure 88**) for cracks or damage.
5. Inspect the diaphragm spring retainer for cracks or damage. Check also for bent or damaged tabs (**Figure 89**).




6. Inspect the pressure plate contact surface (**Figure 90**) for cracks or other damage.
7. If necessary, disassemble the pressure plate as follows:
   a. Remove the snap ring and remove the release plate, left pushrod and locknut (**Figure 91**) from the pressure plate.
   b. Inspect the release plate, left pushrod and locknut for wear or damage.
   c. Inspect the snap ring groove for damage.
   d. Position the release plate with the OUT mark facing out (**Figure 92**) and install the assembly into the pressure plate.
   e. Install the snap ring and make sure it is correctly seated in the pressure plate groove.

## CLUTCH SHELL, COMPENSATING SPROCKET AND PRIMARY DRIVE CHAIN (WET CLUTCH ASSEMBLY [1998-1999 MODELS])

### Removal

This procedure describes clutch shell **Figure 93**, primary chain and compensating sprocket removal (**Figure 94**). These components must be removed as an assembly.

1. Disconnect the negative battery cable from the battery.
2. Remove the primary chaincase outer cover as described in this chapter.
3. If necessary, remove the diaphragm spring, pressure plate, clutch plates and friction discs as described in this chapter.
4A. If the special tool is available, such as the primary drive locking tool (JIMS part No. 2234), place it onto the primary chain next to the clutch housing (**Figure 95**).
4B. If the special tool is not available, shift the transmission into fifth gear. Have an assistant apply the rear brake.

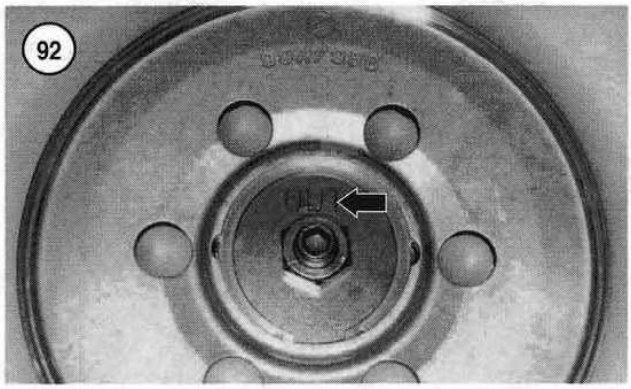
*CAUTION*

*The clutch nut has **left-hand threads**. Turn the clutch nut **clockwise** to loosen it.*

5. Loosen the clutch nut with an impact wrench. Remove the clutch nut (**Figure 96**).
6. Loosen the compensating sprocket nut (**Figure 97**) with an impact wrench.
7. Remove the compensating sprocket nut (**Figure 97**), washer, cover (**Figure 98**) and sliding cam (**Figure 99**).
8. Remove the primary chain shoe adjuster locknut (**Figure 100**).
9. Remove the compensating sprocket, primary chain, chain adjuster and clutch assembly at the same time (**Figure 101**).
10. Remove the shaft extension (**Figure 102**) and the spacer.
11. Inspect the various components as described in this chapter.

### Installation

1. Remove all residue from the crankshaft and mainshaft threads and from the compensating sprocket nut and the clutch nut.
2. Remove all gasket residue from the inner primary housing gasket surfaces.
3. Install the spacer and the shaft extension (**Figure 102**) onto the crankshaft.
4. Assemble the compensating sprocket, primary chain, chain adjuster and clutch as shown in **Figure 101**.
5. Install the compensating sprocket, primary chain, chain adjuster and clutch. Insert the chain adjuster bolt through the chain adjuster hole as shown in **Figure 103**.
6. Install the primary chain shoe adjuster locknut (**Figure 100**) and tighten finger-tight at this time.
7. Install the compensating sprocket (**Figure 99**) and the cover (**Figure 98**).
8. Install the washer.




9. Install the same tool setup (**Figure 95**) used during removal or shift the transmission into fifth gear to prevent the compensating sprocket and clutch shell from rotating during the following steps.
10. Apply two drops of medium-strength threadlocking compound to the compensating sprocket nut threads. Install the nut (**Figure 97**) and tighten to 150-165 ft.-lb. (203-224 N•m).

*NOTE*

*The clutch nut has **left-hand threads**. Turn the nut **counterclockwise** to tighten it.*

11. Apply two drops of medium-strength threadlocking compound to the clutch nut threads. Install the nut (**Figure 96**) and tighten (**Figure 104**) to 70-80 ft.-lb. (95-108 N•m).
12. If used, remove the special tool from the clutch shell.
13. Adjust the primary chain as described in Chapter Three.
14. Install the clutch plates, friction discs, pressure plate and diaphragm spring as described in this chapter.
15. Install the primary chaincase outer cover as described in this chapter.
16. Adjust the clutch as described in Chapter Three.
17. Connect the negative battery cable to the battery.

## CLUTCH SHELL, CLUTCH HUB AND SPROCKET (ALL WET CLUTCH MODELS)

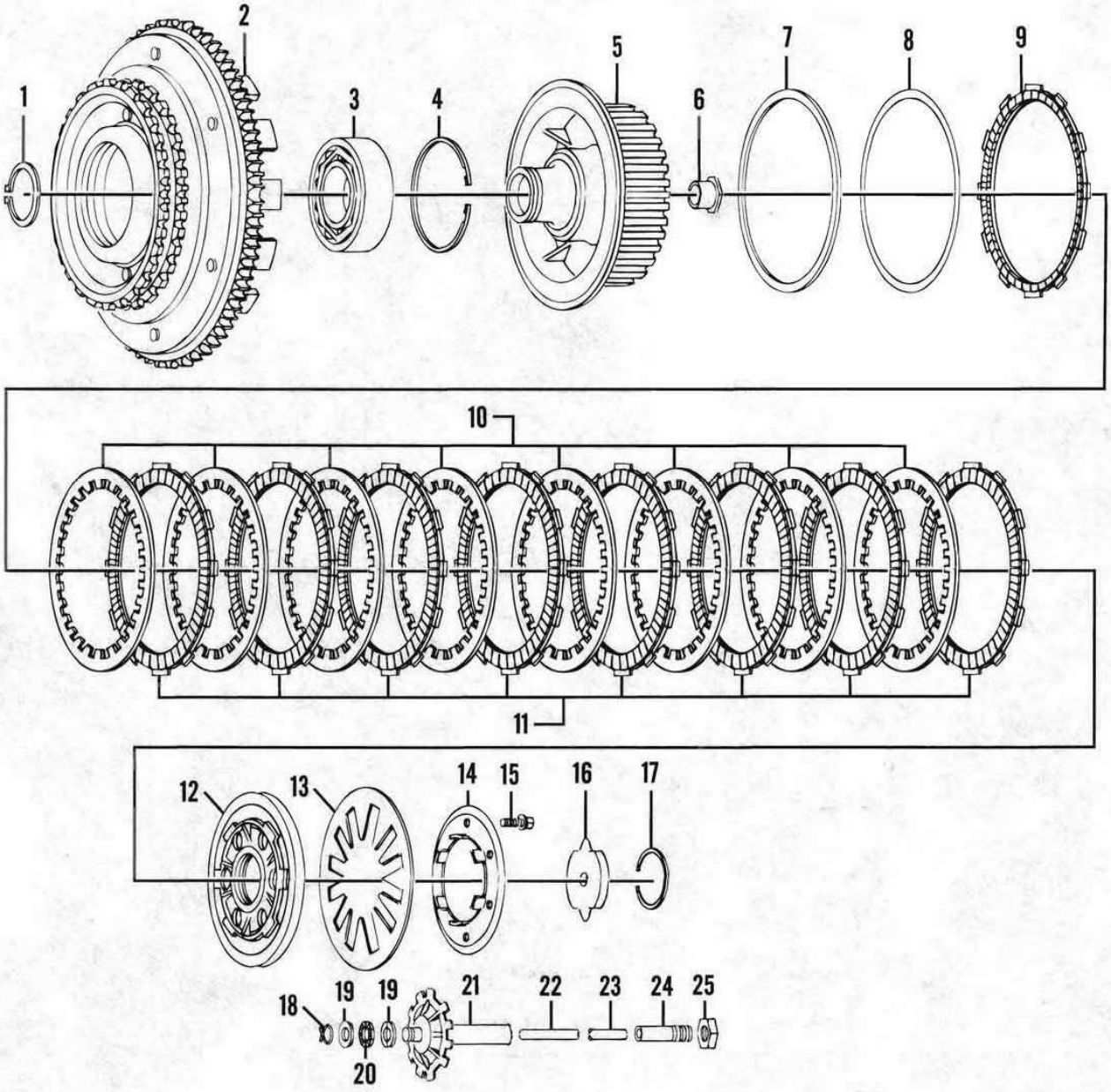
### Disassembly/Assembly

Do not separate the clutch hub and shell unless the bearing or either part is going to be replaced. If the two parts are separated, the bearing will be damaged. Removal and installation of the bearing requires the use of a hydraulic press.

Refer to **Figure 93**.

93

## WET CLUTCH (1998-1999 MODELS)




1. Snap ring
2. Clutch shell and sprocket
3. Bearing
4. Snap ring
5. Clutch hub
6. Clutch nut
7. Diaphragm spring seat
8. Diaphragm spring
9. Friction disc B
10. Clutch plates
11. Friction disc A
12. Pressure plate
13. Diaphragm spring
14. Diaphragm spring retainer
15. Bolt
16. Release plate
17. Snap ring
18. Snap ring
19. Thrust washer
20. Radial bearing
21. Oil slinger
22. Pushrod (right side)
23. Pushrod (right side)
24. Pushrod (left side)
25. Locknut