HANDLEBAR ASSEMBLY
(ALL MODELS EXCEPT 883C AND 1200C MODELS)

1. Allen bolt (short)
2. Allen bolt (long)
5. Upper handlebar clamp
7. Handlebar
8. Lower right handlebar clamp
9. Locknut
10. Lower left handlebar clamp
11. Cup washer
12. Rubber bushing
13. Stud
14. Spacer
15. Ground wire
16. Locknut
17. Bolt

HANDLEBAR (883C AND 1200C MODELS)

1. Bolt
2. Washer
3. Handlebar
4. Lower clamp
5. Riser cover
6. Rubber bushing
7. Upper triple clamp
8. Spacer
9. Cup washer
10. Ground wire
11. Upper clamp
4. Loosen the throttle housing (B, Figure 3) screws so that the housing can slide off of the handlebar later in this procedure. It is not necessary to separate the housing halves.

5. Remove the left switch housing (A, Figure 4) screws and separate the housing halves (Figure 5).

6. Remove the clutch lever clamp mounting screws (B, Figure 4) and separate the clamp halves.

7. Disconnect or remove any clamps securing electrical cables to the handlebar.

8. On 883C and 1200C models, remove the riser covers.

9. If lower handlebar holder removal is required, loosen the holder bolts or nuts, but do not remove the bolts or nuts.

10. Loosen the handlebar clamp bolts (Figure 6). Remove the handlebar clamp bolts, then remove the instrument cluster and clamp. Do not lose the washers or spacers, if so equipped.

11. Remove the handlebar.

**Inspection**

1. Clean the knurled section of the handlebar with a wire brush and remove any debris in the knurling.

2. Check the handlebar for cracks, bends or other damage. Replace the handlebar if necessary. Do not attempt to repair it.

3. Clean the clamps and holders thoroughly before installing the handlebar.

**Installation**

1. Install the handlebar in the lower holder(s).

2A. On all models except 883C and 1200C, install the clamp and instrument housing using the following procedure:
   a. Install the handlebar clamp and two rear clamp bolts.
   b. Install the instrument housing and two front clamp bolts.
   c. Tighten the rear clamp bolts first, then tighten the front clamp bolts. Tighten the clamp bolts to 144-180 in.-lb. (16-20 N•m).

2B. On 883C and 1200C models, install the clamp and instrument housing as follows:
   a. Install the handlebar clamp and two front clamp bolts.
   b. Install the instrument housing and two rear clamp bolts.
   c. Tighten the front clamp bolts first, then tighten the rear clamp bolts. Tighten the clamp bolts to 144-180 in.-lb. (16-20 N•m).
   d. Install the riser covers.

3. After installing the handlebar, sit on the motorcycle and check the handlebar position. Adjust the handlebar as needed.
4. Install the right switch housing (Chapter Twelve).
5. Install the left switch housing (Chapter Twelve).
6. Install the clutch lever (Chapter Three).
7. Refer to Chapter Sixteen and install the front master cylinder onto the handlebar.
8. Reinstall the wiring and cable retaining clamps.
9. Install the mirrors.

FRONT FORK
(ALL MODELS EXCEPT 1200S)

The front suspension consists of a spring-controlled, hydraulically dampened telescopic fork.

Before suspecting major trouble, drain the front fork oil and refill with the proper type and quantity (Chapter Three). If the trouble persists, such as poor damping, a tendency to bottom or top out or leaks around the rubber seals, follow the service procedures in this section.

To simplify fork service and to prevent the mixing of parts, remove, service and install the legs individually.

Removal

1. Support the motorcycle so the front wheel clears the ground. Make sure the motorcycle is stable before removing the front wheel and fork.
2. Remove the front wheel as described in Chapter Thirteen.
3. Remove the front fender as described in Chapter Seventeen.
4. On models equipped with a lower fork stem cover, loosen the cover screws and raise the cover for access to the lower fork pinch bolts.

NOTE
Label the left and right fork tubes so they can be reinstalled in their original positions,

5. Loosen the upper fork bracket pinch bolt (A, Figure 7).
6. If fork tube disassembly is required, loosen but do not remove the fork cap (B, Figure 7).
7. On 1986-1987 models, remove the cap bolt (B, Figure 7).
8. Loosen the lower fork bracket pinch bolt (Figure 8) and slide the fork tube out of the fork brackets. If necessary, rotate the fork tube while removing it.
9. If fork service is required, refer to Disassembly in this section.

Installation

NOTE
The fork assemblies must be reinstalled on the correct side of the motorcycle so the brake caliper and front fender can be properly installed. If the fork assemblies are installed on the wrong side, the bolt holes on these components will not align properly.

1. Clean off any corrosion or dirt on the upper and lower fork bracket receptacles.
2. On 1988-2003 models, install each fork tube so the tube extends 0.42-0.50 in. (10.7-12.7 mm) above the upper fork bracket as shown in Figure 9.
3. Tighten the lower bracket pinch bolt (Figure 8) to 30 ft.-lb. (14 N•m).
4. If loose, tighten the fork cap (B, Figure 7) securely.
1. Cap bolt
2. Washer (1986-1987 models)
3. O-ring
4. Spring
5. Piston rings
6. Damper rod
7. Rebound spring
8. Fork tube
9. Lower bushing
10. Oil lock piece
11. Dust cover
12. Retaining ring
13. Oil seal
14. Seal spacer
15. Upper bushing
16. Slider
17A. Drain screw (1986-1987 models)
17B. Drain screw (1988-2003 models)
18A. Washer (1986-1987 models)
18B. Washer (1988-2003 models)
19A. Washer (1986-1987 models)
19B. Washer (1988-2003 models)
20A. Allen bolt (1986-1987 models)
20B. Allen bolt (1988-2003 models)
5. Tighten the upper bracket pinch bolt (A, Figure 7) to the torque specification in Table 1.
6. Install the front fender as described in Chapter Seventeen.
7. Install the front wheel as described in Chapter Thirteen.
8. Apply the front brake and operate the front fork several times to seat the fork and front wheel.

Disassembly

Refer to Figure 10.

**NOTE**

Fork holding tools are available (Figure 11, typical), and such a tool may be shown in the following illustrations. However, the text refers to the use of a vise as a holding tool.

1. Using the front axle boss at the bottom of the fork tube, clamp the slider in a vise with soft jaws. Do not clamp the slider at any point above the fork axle boss.

**NOTE**

Loosen the bottom Allen bolt before removing the fork cap and spring. Leaving the cap on provides spring tension against the damper rod. This prevents the damper rod from spinning when attempting to loosen the Allen bolt.

2. Loosen, but do not remove, the Allen bolt (Figure 12) at the bottom of the slider.

**WARNING**

Keep body parts away from the fork cap when removing it. The fork cap is under spring pressure and may fly off when loosening it. In addition, make sure the fork tube is fully extended from the slider. If the fork is damaged and stuck in a compressed state, the fork should be disassembled by a dealership.

3. Remove the fork cap (Figure 13) from the top of the fork tube. Then pull the spring out of the fork tube.
4. Remove the fork tube from the vise and pour the oil into a drain pan. Pump the fork several times by hand to get most of the oil out. Check the oil for contamination, indicating worn or damaged parts. Discard the oil after examining it.

5A. On 1986-1987 models, insert a small flat-tipped screwdriver under the dust cover (11, Figure 10) and pry the cover off of the slider and remove it. Be careful not to damage the slider surface.

5B. On 1988-2003 models, insert a small punch in the notch under the dust cover (Figure 14) and drive the cover off the slider and remove it. Do not damage the slider surface.
6. Insert a small flat-tipped screwdriver under the dust seal (Figure 15) and pry the seal out of the slider and remove it. Do not damage the slider surface.
7. Pry the retaining ring (Figure 16) out of the groove in the slider and remove it. See Figure 17.
8. Remove the Allen screw and washer (Figure 18) at the bottom of the slider.

**NOTE**
The slider bushing is installed with an interference fit. When separating the fork tube and slider, the slider bushing, spacer seal and oil seal will be removed at the same time.

9. Hold the fork tube in one hand then pull the slider away repeatedly, knocking the slider bushing against the fork tube bushing (Figure 19). As the slider bushing is knocked out of the slider, it will push the oil seal and seal spacer out of the slider. Continue until these components are pushed out of the slider.
10. Remove the oil lock piece (Figure 20) from the damper rod.
11. Remove the damper rod and small spring (Figure 21) from the fork tube.

**Inspection**

**NOTE**
Handle the guide bushings (Figure 22) carefully when cleaning them to avoid scratching or removing any of their coating material. If there is any metal powder clinging to the guide bushings, clean them with new fork oil and a nylon brush.

1. Initially clean all of the fork components in solvent, first making sure the solvent will not damage the rubber parts. Then clean with soap and water and rinse with clear water. Dry thoroughly.
2. Check the fork tube (A, Figure 23) for bends, nicks, rust or other damage. Check the fork tube for straightness with a set of V-blocks and a dial indicator. If these tools are not available, roll the fork tube on flat surface like a place of glass. The manufacturer does not provide service limit
specifications for runout. If a fork tube is slightly bent, check with a dealership to see if it can be straightened. If a fork tube is creased or wrinkled, replace the fork tube.

3. Check the slider (B, Figure 23) for dents or other exterior damage. Check the retaining ring groove (Figure 24) in the top of the slider for cracks or other damage. Replace the slider if the groove is cracked or damaged.

4. Check the slider and fork tube bushings (Figure 25) for severe wear, cracks or damage. The slider bushing was removed with the oil seal. The fork tube bushing should not be removed unless replacement is required. To replace the fork tube bushing, perform the following:
   a. Expand the bushing slit using a screwdriver and slide it off the fork tube.
   b. Coat the new bushing with new fork oil.
   c. Install the new bushing by expanding the slit using a screwdriver. Expand the bushing only enough to fit it over the fork tube.
   d. Seat the new bushing (Figure 25) into the groove in the fork tube.

5. Replace the drain screw, Allen bolt or washers if damaged.

6. Check the damper rod piston rings (Figure 26) for severe wear, cracks or other damage. If necessary, replace both rings as a set.

7. Check the damper rod for straightness using a set of V-blocks and a dial indicator (Figure 27) or by rolling it on
a flat surface, like a plate glass. The manufacturer does not provide service limit specifications for runout.

8. Make sure the oil passage holes in the damper rod (Figure 28) are open. If clogged, flush with solvent and dry with compressed air.

9. Check the threads in the bottom of the damper rod for stripping, cross-threading or sealer residue. If necessary, use a tap to renew the threads or to remove any deposits.

10. Check the damper rod rebound spring and the fork spring for wear or damage. The manufacturer does not provide service limit specifications for spring free length.

11. The manufacturer specifies that the oil seals (A, Figure 29) should be replaced whenever they are removed. If installing the original oil seals, inspect them closely for wear, hardness or other damage. Always replace both oil seals as a set.

12. Inspect the outer dust seal(s) (B, Figure 29) for cracks, weather deterioration or other damage. Replace if damaged.

13. Replace the fork cap O-ring if leaking or damaged.

14. Any parts that are worn or damaged should be replaced. When replacing fork springs, replace both springs as a set; do not replace only one spring. Simply cleaning and reinserting unserviceable components will not improve performance of the front suspension.

Assembly

Refer to Figure 10.

1. Prior to assembly, perform the inspection procedure in this section. Clean all parts before assembly.

2. Coat all parts with the specified fork oil (Chapter Three) before assembly.

3. Install the rebound spring onto the damper rod (Figure 30) and slide the rod into the fork tube until it protrudes from the end of the tube.

4. Install the oil lock piece (Figure 31) onto the end of the damper rod.

5. Insert the fork spring (Figure 32) into the fork tube so that the tapered end of the spring faces toward damper rod. Install the fork cap to tension the spring and hold the damper rod in place.
6. Install the slider over the damper rod (Figure 33) and onto the fork tube until it bottoms. Make sure the oil lock piece is still mounted onto the end of the damper rod.

7. Install the washer onto the damper rod Allen bolt.

8. Apply a non-permanent thread locking compound to the damper rod Allen bolt threads prior to installation. Insert the bolt (Figure 34) through the lower end of the slider and thread it into the damper rod. Tighten the bolt securely.

9. Remove the fork cap and fork spring (Figure 32).

   **NOTE**
   
   The slider bushing, seal spacer and oil seal are installed into the slider at the same time with a suitable driver placed over the fork tube and against the oil seal. A fork seal driver (part No. HD-36583 or equivalent) can be used. A piece of pipe can also be used to drive the parts into the slider. When using a piece of pipe or similar tool, do not damage to the slider, oil seal or fork tube. Wrap both ends of the pipe or tool with duct tape to prevent it from scratching the fork tube and tearing the oil seal.

10. Install the slider bushing, seal spacer and oil seal (Figure 35) at the same time. Perform the following:

   a. Coat the slider bushing (A, Figure 35) with fork oil and slide the bushing down the fork tube and rest it against the slider bore.

   b. Install the seal spacer (B, Figure 35) over the fork tube with the concave side facing down. Rest the seal spacer on the slider bushing.

   c. Slide a new oil seal (C, Figure 35) over the fork tube with the closed side facing up. Rest the oil seal on the seal spacer.

   d. Slide the fork seal driver down the fork tube (Figure 36).

   e. Drive the bushing, seal spacer and oil seal into the slider until the retaining ring groove in the slider can be seen above the top surface of the oil seal.

   f. Remove the fork seal driver.
11. Install the retaining ring (Figure 37) into the slider groove. Make sure the retaining ring is fully seated in the groove.
12. Slide the dust seal (Figure 38) down the fork tube and seat it into the top of the slider.
13. Install the dust cover (Figure 39) as follows:
   a. Slide the dust cover down the fork tube and rest it against the top of the slider.
   b. Slide one of the discarded oil seals down the fork tube and rest it against the dust cover.
   c. Use the same fork seal driver used in Step 10 and carefully drive the dust cover onto the top of the slider as shown in Figure 39.
   d. Remove the installation tool and old oil seal.
14. Fill the fork tube with the correct quantity of Type E Fork Oil or equivalent listed in Table 1.
15. The fork spring is tapered at one end. Install the spring (Figure 32) so that the tapered end faces toward the bottom of the fork.
16. Lubricate the fork cap O-ring and threads with new fork oil.
17. On 1988-2003 models, align the fork cap with the spring (Figure 32) and push down on the cap to compress the spring. Start the cap slowly, don’t cross thread it. Place the slider in a vise with soft jaws and tighten the fork cap securely.
18. Install the fork tube as described in this chapter.

**FRONT FORK**
**(1200S MODELS)**

The front suspension consists of a spring-controlled, hydraulically dampened telescopic fork.

Before suspecting major trouble, drain the front fork oil and refill with the proper type and quantity (Chapter Three). If the trouble persists, such as poor damping, a tendency to bottom or top out, or leaks around the seals, follow the service procedures in this section.

To simplify fork service and to prevent the mixing of parts, remove, service and install the legs individually.

**Front Fork Adjustment**

**Suspension preload adjustment**

Adjust the front and rear spring preload before making any other suspension adjustments. An assistant is required to determine proper preload adjustment for a particular load on the motorcycle.

1. Remove the motorcycle from the sidestand, then bounce the suspension several times to make sure nothing is binding.
2. With the motorcycle unloaded, measure the rear suspension length and the front suspension length.
a. The rear suspension length is the distance from the center of the upper shock nut to the center of the lower shock nut (A, Figure 40).

b. The front suspension length is the distance from the center of the front axle to the bottom of the lower triple clamp (B, Figure 40).

3. Load the full gear onto the motorcycle.

4. Measure the rear-suspension length and front-suspension length of the loaded motorcycle.

**WARNING**
*Preload must be equal on both sides of the motorcycle. Set both rear shock-absorber preload cams to the same setting. Also set both fork adjusting nuts to the same setting. Handling will be adversely affected if preload is not the same on both sides of the motorcycle.*

5. Subtract the loaded suspension length from the unloaded suspension length. The difference must be 0.5-1.0 inches (12.7-25.4 mm). Adjust the preload if the difference is not within the specification.

a. To adjust the front preload, turn the preload adjuster (A, Figure 41) with a 7/8-in. wrench. Turning the nut clockwise increases front preload; counterclockwise decreases the preload.

b. To adjust the rear preload, refer to Shock Absorber in Chapter Fifteen.

**Front fork damping adjustment**

The 1200S fork is adjustable for compression and rebound damping.

1. Adjust the preload as described in the Suspension Preload Adjustment in this section.

**WARNING**
*Compression and rebound damping settings must be equal on both sides of the motorcycle. Handling will be adversely affected if damping is not the same on both fork legs.*

2. The front fork on the 1200S has 14 compression damping settings. Setting 1 (fully clockwise) is the hardest; setting 14 (fully counterclockwise) is the softest. The recommended setting is 13 clicks from the hardest setting.

**NOTE**
*To ensure the desired results, do not adjust the damping more than two clicks without testing the setting.*

a. Turn the compression damping adjuster (B, Figure 41) one or two clicks. Turning the adjuster clockwise increases compression damping, counterclockwise decreases compression damping.

b. Turn the compression damping adjuster on the other fork leg to the same setting.

c. Test ride the motorcycle.

d. Repeat the above steps until the desired compression damping is obtained.

3. The 1200S front fork has 15 rebound damping settings. Setting 1 (fully clockwise) is the hardest; setting 15 (fully counterclockwise) is the softest. The recommended setting is 8 clicks from the hardest setting.

a. Turn the rebound damping adjuster (C, Figure 41) one or two clicks. Turning the rebound adjuster clockwise increases rebound damping; counterclockwise decreases rebound damping.

b. Turn the rebound damping adjuster on the other fork leg to the same setting.
c. Test ride the motorcycle.
d. Repeat the above steps until the desired rebound damping is obtained.

Removal

Refer to Figure 42.
1. Support the motorcycle so the front wheel clears the ground. Make sure the motorcycle is stable before removing the front wheel and fork legs.
2. Remove the front wheel (Chapter Thirteen).
3. Remove the front fender (Chapter Seventeen).

**NOTE**
Label the left and right fork legs so they can be reinstalled in their original positions.

4. Loosen the upper fork bracket pinch bolt.
5. If the fork legs are going to be disassembled, loosen but do not remove the fork cap.
6. Loosen the lower fork-bracket pinch bolt, and slide the fork leg out of the fork brackets. If necessary, rotate the fork leg while removing it.
7. If fork service is required, refer to Disassembly in this section.

Installation

1. Clean any corrosion or dirt from the upper and lower fork-bracket receptacles.

**NOTE**
The fork assemblies must be reinstalled on the correct side of the motorcycle so the brake caliper and front fender can be properly installed.

2. Install each fork leg so that the tube extends 1.735-1.745 in. (44.1-44.3 mm) above the upper fork bracket as shown in Figure 43.
3. Tighten the lower bracket pinch bolt to 30 ft.-lb. (41 N·m).
4. Tighten the upper bracket pinch bolt to 30 ft.-lb. (47 N·m).
5. Install the front fender (Chapter Seventeen).
6. Install the front wheel (Chapter Thirteen).
7. Apply the front brake and pump the front fork several times to seat the fork and front wheel.

Disassembly

To simplify fork service and to prevent the mixing of parts, the legs should be disassembled and assembled individually.

Refer to Figure 42.

**NOTE**
Fork holding tools are available (Figure 11, typical), and such a tool may be shown in the following illustrations. However, the text refers to the use of a vise as a holding tool.

1. Clamp the fork axle boss at the bottom of the slider in a vise with soft jaws. Do not clamp the slider at any point above the fork axle boss.
Loosen the bottom Allen bolt before removing the fork cap and spring. Leaving the cap on provides spring tension against the damper rod. This prevents the damper rod from spinning while attempting to loosen the Allen bolt.

2. Loosen, but do not remove, the Allen bolt at the bottom of the slider (Figure 44).

3. Remove the stopper ring (1, Figure 45), and remove the spring preload adjuster (3, Figure 45).

WARNING
Stay clear of the fork cap when removing it. The fork cap is under spring pressure, and it may fly off when loosened. In addition, make sure the fork tube is fully extended from the slider. If the fork tube is damaged and stuck in a compressed state, have a dealership disassemble the fork.

4. Unscrew the fork cap from the fork tube. The fork leg will fall away from the cap.

5. Install the fork spring compressor (A, Figure 46; part No. HD-41549A) onto the spring collar. Tighten the screws on the compressor so they engage the holes in the spring collar.

6. Use the tool to compress the spring and have an assistant insert the fork spring plate tool (B, Figure 46; part No. HD-41551) between the upper spacer and the spring collar.

7. Hold the rebound adjuster (A, Figure 47) and remove the fork cap (B) from the adjuster.

8. Remove the spring plate tool and fork spring compressor.

9. Remove the spacers, spring collar and fork spring from the fork tube.

10. Remove the slider from the vise. Pour out the oil by pumping the damper rod until the rod moves freely. Check the oil for contamination, which indicates worn or damaged parts. Discard the oil after examining it.

11. Remove the Allen screw and washer (Figure 48) at the bottom of the slider.

12. Insert a small flat-tipped screwdriver under the dust cover (9, Figure 42), and pry the cover out of the slider. Do
not damage the slider surface. Remove the cover from the slider.

13. Insert a small flat-tipped screwdriver under the dust seal (Figure 49). Pry the seal out of the slider and remove it. Do not damage the slider surface.

14. Pry the retaining ring out of the groove in the slider and remove it. See Figure 50.

**NOTE**
The slider bushing is installed with an interference fit. When separating the fork tube and slider, the slider bushing, spacer seal and oil seal will be removed at the same time.

15. Hold the fork tube and pull the slider downward repeatedly so the slider bushing knocks against the fork tube bushing (Figure 51). As the slider bushing is knocked out of the slider, it pushes the oil seal and seal spacer out of the slider. Continue until these components are removed from the slider.

**Inspection**

**CAUTION**
Clean and handle the guide bushings (Figure 52) carefully to avoid damaging their coating material. If there is any metal powder clinging to the guide bushings, clean them with new fork oil and a nylon brush.

1. Initially clean all of the fork components in solvent. Make sure any cleaning solvents used will not damage the rubber parts. Then, clean all components with soap and water, and rinse them with clear water. Dry thoroughly.

2. Check the fork tube (A, Figure 53) for bending, nicks, rust or other damage. Check the fork tube runout with a set of V-blocks and a dial indicator. Replace the fork tube if runout exceeds 0.008 in. (0.2 mm).

3. Check the slider (B, Figure 53) for dents or other exterior damage. Check the retaining ring groove (Figure 54) in the top of the slider for cracks or other damage. Replace the slider if the groove is cracked or damaged.

4. Check the slider and fork tube bushings (Figure 52) for severe wear, cracks or damage. The slider bushing was removed with the oil seal. The fork tube bushing should not be removed unless it is going to be replaced. To replace the fork tube bushing, perform the following:
   a. Expand the bushing slit (Figure 55) using a screwdriver and slide the bushing off the fork tube.
   b. Coat the new bushing with new fork oil.
   c. Install the new bushing by expanding the slit using a screwdriver. Expand the bushing only enough to fit it over the fork tube.
   d. Seat the new bushing into the groove in the fork tube.

5. Replace the Allen bolt and washer if damaged.

6. Make sure the oil passage holes in the damper are open. If clogged, flush with solvent and dry with compressed air.
7. Check the threads in the bottom of the damper for stripping, cross-threading or sealer residue. If necessary, use a tap to renew the threads or to remove any deposits.

8. Check the fork spring free length. Replace the fork spring if the free length is less than 16.02 in. (407 mm).

9. Inspect the outer dust seal(s) (B, Figure 56) for cracks, weather deterioration or other damage. Damaged dust seals allow dirt to pass through and damage the oil seal.

10. Replace the fork cap O-ring if leaking or if severe wear or damage is apparent.

11. Replace any worn or damaged parts.

12. When replacing fork springs, replace the springs as a set.

Assembly

Refer to Figure 42.

1. Prior to assembly, perform the inspection procedure in this section to confirm all worn or defective parts have been repaired or replaced. Clean all parts before assembly.

2. Coat all parts with the specified fork oil (Chapter Three) before assembly.

3. Insert the fork tube into the slider.

   **NOTE**
   The slider bushing, seal spacer and oil seal are installed into the slider at the same time. Use a fork seal driver (part No. HD-36583 or an equivalent). A piece of pipe can also be used to drive the parts into the slider. When using a piece of pipe or similar tool do not damage the slider, oil seal or fork tube. Wrap both ends of the pipe or tool with duct tape to prevent it from scratching the fork tube and tearing the oil seal.

4. Install the slider bushing, seal spacer and oil seal at the same time. Perform the following:

   a. Coat the slider bushing (A, Figure 57) with fork oil. Slide the bushing down the forktube and rest it against the slider bore. Make sure the opening in the bushing faces the side, not the front or rear of the slider.
b. Install the seal spacer (B, Figure 57) over the fork tube with the concave side facing down. Rest the seal spacer on the slider bushing.

c. Slide a new oil seal (C, Figure 57) over the fork tube with the closed side facing up. Rest the oil seal on the seal spacer.

d. Slide the fork seal driver down the fork tube (Figure 58).

e. Drive the bushing, seal spacer and oil seal into the slider until the retaining ring groove in the slider can be seen above the top surface of the oil seal.

f. Remove the fork seal driver.

5. Install the retaining ring (Figure 50) into the slider groove. Make sure the retaining ring is fully seated in the groove.

6. Slide the dust seal (Figure 49) down the fork tube and seat it into the top of the slider.

7. If the rebound adjuster was removed from the damper rod, perform the following:

a. Turn the locknut onto the damper rod until the nut bottoms.

b. Press the detent spring and ball with your thumb, and turn the rebound adjuster counterclockwise until it
backs out to the last click (Figure 59). Turn the rebound adjuster clockwise 13 clicks.
c. Thread the rebound adjuster onto the damper rod. Turn the rod as far as it will go without forcing it. Do not overtighten the adjuster.
d. Thread the locknut (A, Figure 60) up into the rebound adjuster until the locknut is seated against the rebound adjuster (B).

8. Clamp the fork axle boss at the bottom of the slider in a vise with soft jaws. Do not clamp the slider at any point above the fork axle boss.
9. Install the damper into the fork tube.
10. Install the Allen bolt by performing the following:
   a. Insert the fork spring into the fork tube so the tightly coiled end goes down into the slider. Install the fork cap to tension the spring and hold the damper in place.
   b. Install the washer onto the damper rod Allen bolt.
   c. Insert the Allen bolt (Figure 48) through the lower end of the slider and thread it into the damper. Tighten the bolt to 22-29 ft.-lb. (30-39 N·m).
   d. Remove the fork cap and fork spring.
11. Refer to Table 1 for the fork oil capacity. Pour half of the quantity into the fork tube. Pump the damper rod slowly to purge air from the slider and fork tube (Figure 61). Pump the rod at least ten times.
12. Push the damper rod into the fork tube until it bottoms.
13. Pour the remaining quantity of fork oil into the fork tube.

NOTE
An oil level-measuring device can be made, as shown in Figure 62. Position the lower edge of the hose clamp at the specified oil level distance up from the small diameter hole. Fill the fork with a few ounces more than the required amount of oil. Position the hose clamp on the top edge of the fork tube and draw out the excess oil. Oil is drawn out until the level reaches the small diameter hole. A precise oil level can be achieved with this simple device.

14. Use an oil gauge (part No. HD-59000A or equivalent) to adjust the oil to the level specified in Table 1. See Figure 63.
15. Install the fork spring so the end with closer-wound coils faces the slider.
16. Install one spacer, the spring collar, and the other spacer into the fork tube. One side of the spacer has sharper edges than the other one. Make sure the side with the sharp edge faces the spring collar.
17. Install the fork spring compressor (A, Figure 46) onto the spring collar. Tighten the screws on the compressor so they engage the holes on the spring collar.

18. Use the tool to compress the spring and have an assistant install the spring plate (B, Figure 46) between the upper spacer and the spring collar.

19. Install the fork cap (B, Figure 47) onto the rebound adjuster (A). Tighten the fork cap to 22-29 ft.-lb. (30-39 N•m).

20. Remove the spring plate and fork spring compressor. Turn the fork cap into the fork tube. Tighten the fork cap to 11-22 ft.-lb. (15-30 N•m).

21. Install the preload adjuster plate (4, Figure 45).

22. Install a new O-ring onto the preload adjuster (3, Figure 45). Lubricate the O-ring with fork oil, and install the preload adjuster.

23. Install the stopper ring.

24. Install the dust cover (Figure 64) as follows:
   a. Slide the dust cover down the fork tube and rest it against the top of the slider.
   b. Slide one of the discarded oil seals down the fork tube and rest it against the dust cover.
   c. Use the same fork seal driver used in Step 4 and carefully drive the old dust cover onto the top of the slider as shown in Figure 64.
   d. Remove the driver and old oil seal.

25. Adjust the spring, compression damping and rebound damping (Chapter Three).

**STEERING HEAD AND STEM**

The fork stem extends from the lower triple clamp into the frame steering head. The lower portion of the steering head rests on a tapered roller bearing located at the bottom of the fork stem. The upper end of the fork stem rides in a tapered roller bearing that seats in the upper portion of the steering head. Both bearings seat against races pressed into the steering head. Dust shields are used at both bearing areas to protect bearings from dust and other contaminants.

**Removal**

Refer to Figure 65 or Figure 66.
2. Steering stem bolt
3. Washer
4. Upper fork bracket
5. Pinch bolt
6. Dust shield
7. Upper bearing
8. Upper bearing racer
9. Frame neck
10. Lower bearing race
11. Lower bearing
12. Dust shield
13. Steering stem/lower fork bracket
14. Upper fork tube pinch bolt
15. Lower fork tube pinch bolt
16. Lower fork bracket
NOTE
Although not necessary, it is advisable to remove the fuel tank as described in Chapter Ten or Chapter Eleven. Otherwise, cover it with suitable material.

1. Remove the headlight (Chapter Twelve).
2. Remove the front fork as described in this chapter.
3. On models so equipped, disconnect the speedometer and tachometer cables from the instruments.
4A. On 1998-2003 models, remove the brake hose bracket at the bottom of the fork stem bracket (Figure 67). Do not disconnect the brake hose connection.
4B. On 1986-1987 models, detach the brake hose bracket on the upper fork bracket. Do not disconnect the brake hose connection.

NOTE
If it is not necessary to remove the handlebar, the handlebar can be removed along with the upper fork bracket. If necessary, remove the handlebar as described in this chapter.

5. On 1991-2003 models, unscrew the bolt cap (Figure 68) and remove it. See Figure 69.
6A. On 1986-1987 models, remove the fork stem end nut (Figure 70).
6B. Remove the steering stem bolt (A, Figure 71) and washer.

NOTE
Make sure the steering stem lower fork bracket to keep it from falling out once the pinch bolt is loosened.

7. Loosen the pinch bolt (B, Figure 71) and lift the upper fork bracket (C) off the steering stem. Set the bracket aside with the cables attached.
8. Lower the fork stem assembly out of the steering head and remove it.
9. Remove the upper dust cover (Figure 72) and bearing (Figure 73).
10. Inspect the fork stem and bearing assembly as described in this chapter.

Inspection

The bearing races (Figure 74) are pressed into the steering head. Do not remove the bearing races unless they require replacement.

Use wheel bearing grease to pack bearings and races when performing the following steps.
1. Wipe the bearing races with a solvent soaked rag and then dry with compressed air or a lint-free cloth. Check the races in the steering head for pitting, scratches, galling or severe wear. If any of these conditions exist, replace the races as described in this chapter. If the races are in good condition, wipe each race with grease.
2. Clean the bearings in solvent to remove all of the old grease. Blow the bearing dry with compressed air, making sure not to allow the air jet to spin the bearing. Do not remove the lower bearing from the fork stem unless replacement is required; clean the bearing together with the steering stem.

3. After the bearings are dry, hold the inner race with one hand and turn the outer race with your other hand. Turn the bearing slowly, checking for roughness, looseness, trapped dirt or grit. Check the bearing (Figure 75) for pitting, scratches or visible damage. If the bearings are worn, check the dust covers for wear or damage or for improper bearing lubrication. Replace the bearing if necessary. Pack it with grease and wrap it with wax paper until it can be reinstalled. Do not store the bearings for any length of time without lubricating them or they will rust.

4. Check the steering stem for cracks or damage. Check the threads at the top of the stem for strippage or damage. Check the steering stem bolt or nut by threading it into the steering stem; make sure the bolt or nut threads easily with no roughness. If necessary, clean the threads carefully with a brush and solvent or use a tap or die of the correct thread type and size.

5. Worn or damaged parts should be replaced. When discarding a bearing, both bearings and their races should be replaced at the same time. Replace bearing races as described in this chapter.

6. Replace the lower steering stem bearing and dust cover as described in this chapter.

7. Check for broken welds on the frame around the steering head. If any are found, have them repaired by a frame shop.

**Installation**

1. Make sure the steering head bearing races are properly seated as described in *Steering Head Bearing* in this chapter.

2. Wipe the bearing races with a clean lint-free cloth. Then lubricate each race with bearing grease.

3. Pack the upper and lower bearings with bearing grease. The lower bearing and lower dust shield should be installed on the steering stem prior to installing the steering stem in the steering head. If necessary, install the lower bearing as described in this chapter.
4. Insert the steering stem into the frame steering head and hold it firmly in place.
5. Install the upper bearing around the fork stem and seat it into the upper race. Install the upper dust shield.
6. Install the upper fork bracket (C, Figure 71) over the steering stem.
7. Install the washer and the steering stem bolt (A, Figure 71). Tighten the bolt hand-tight only.
8. Install the front fork as described in this chapter.
9. Tighten the steering stem bolt (A, Figure 71) until the steering stem can be turned from side to side with no noticeable axial or lateral bearing play. When the play feels correct, tighten the fork stem pinch bolt (B, Figure 71) securely on 1986-1987 models or to 30 ft.-lb. (41 N•m) on 1988-2003 models.

**CAUTION**

Do not overtighten the steering stem bolt or the bearings and races may be damaged. Final adjustment of the fork stem will take place after the front wheel has been installed on the motorcycle.

10. Install the brake hose bracket onto the lower fork bracket and tighten the mounting bolt (Figure 67) securely.
11. Install the front wheel (Chapter Thirteen).
12. Adjust the steering play as described in *Steering Play Adjustment* in this chapter.

**STEERING HEAD BEARING**

Whenever the steering stem and bearings are removed from the steering head, cover the steering head with a cloth to protect the bearing races from accidental damage. If a race is damaged, the bearing and race must be replaced as a set. Because the bearing races are pressed into place, do not remove them unless they require replacement.

**Upper and Lower Bearing Race Replacement**

The upper and lower bearing races (Figure 74) are pressed into the frame steering head. Both races are identical and can be purchased separately from the bearing. If bearing replacement is required, purchase the bearing and race as a set.
1. To remove a race, insert an aluminum or brass rod into the steering head and carefully tap the race out from the inside (Figure 76). Tap around the race so that neither the race nor the steering head are bent.
2. Clean the steering head with solvent and dry thoroughly.
3A. The bearing races can be installed using a head bearing race installation tool (part No. HD-39302 or equivalent). Follow the manufacturer’s instructions for using the tool.
3B. If a head bearing race installation tool is not available, install the bearing races as follows:
   a. Clean the race thoroughly before installing it.
   b. Align the upper race with the frame steering head and tap it slowly and squarely in place with a block of wood, a suitable socket or bearing driver, making sure not to contact the bearing race tapered surface. See Figure 77. If an old race is available, grind its outside rim so that it is a slip fit in the steering head, then use it to drive the new race into place. Drive the race into the steering head until it bottoms on the bore shoulder.
   c. Repeat to install the lower race into the steering head.
Fork Stem Lower Bearing Replacement

Do not remove the fork stem lower bearing (Figure 78, typical) unless it is going to be replaced with a new bearing. Do not reinstall a lower bearing that has been removed, as it is no longer true to alignment. When replacing the lower bearing, install a new lower dust shield.

**WARNING**

Safety glasses and insulated gloves must be worn when removing the inner race.

1. Using a chisel, break the bearing cage and rollers from the inner race. When the bearing cage and rollers are free, the inner race on the fork stem is exposed. To remove the inner race, heat the race with a torch until it expands enough to slide or drop off the fork stem. Remove and discard the dust cover after removing the bearing.
2. Clean the fork stem with solvent and dry thoroughly.
3. Pack the new bearing with grease before installing it.
4. Slide a new dust shield onto the fork stem so it bottoms on the lower bracket.
5. Align the new bearing with the fork stem and press or drive it onto the fork stem until it bottoms. When installing the bearing onto the fork stem, a bearing driver must be used against the inner bearing race (Figure 79). Do not install the bearing by driving against the outer bearing race.

**STEERING PLAY ADJUSTMENT**

The steering play should be checked periodically and anytime the steering stem assembly has been removed and installed.

1. Support the motorcycle so that the front wheel clears the ground.
2. Remove the windshield, if used, and all other accessory weight from the handlebar and front forks. If any control cable affects handlebar movement, disconnect it.
3. Apply a strip of masking tape across the front end of the front fender. Draw a vertical line across the tape at the center of the fender. Then draw two lines on each side of the centerline, 1 inch apart from each other. See Figure 80.
4. Turn the handlebar so that the front wheel points straight ahead.
5. Place a pointer on a stand and then center the pointer so that its tip points to the center of the fender (tape mark) when the wheel points straight ahead.
6. Lightly push the fender towards the right side until the front end starts to turn by itself. Mark this point on the tape.
7. Repeat Step 6 for the left side.
8. Measure the distance between the two marks on the tape. For proper bearing adjustment, the distance should be 1-2 in. (25.4-50.8 mm). If the distance is incorrect, perform Step 9.
9. Adjust steering play as follows:
   a. Loosen the lower fork tube pinch bolts (Figure 81).
   b. On 1991-2003 models, unscrew and remove the bolt cap (Figure 69).
   c. Loosen the fork stem pinch bolt (A, Figure 82).
   d. If the distance between the two marks is less than 1 in. (25.4 mm), tighten the steering stem nut (Figure 70) or bolt (B, Figure 82).
e. If the distance between the two marks is more than 2 in. (50.8 mm), loosen the steering stem nut (Figure 70) or bolt (B, Figure 82).
f. Repeat Steps 6 and 7 to measure steering play, continue until the distance between the two marks is within 1-2 in. (25.4-50.8 mm).

10. When steering play adjustment is correct, perform the following:

a. Tighten the fork stem pinch bolt (A, Figure 82) securely on 1986-1987 models or to 30 ft.-lb. (41 N•m) on 1988-2003 models.
b. Tighten the lower bracket pinch bolt (Figure 81) to 30 ft.-lb. (41 N•m).
c. On 1991-2003 models, install and tighten the bolt cap (Figure 69) securely.

11. Reinstall all parts previously removed.

---

### Table 1 FRONT FORK OIL* CAPACITY

<table>
<thead>
<tr>
<th></th>
<th>Wet</th>
<th>Dry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>oz.</td>
<td>ml</td>
</tr>
<tr>
<td>1986-1987 models</td>
<td>5.4</td>
<td>160</td>
</tr>
<tr>
<td>1988-1991 models</td>
<td>9.0</td>
<td>266</td>
</tr>
<tr>
<td>1992-1998 models</td>
<td>10.7</td>
<td>316</td>
</tr>
<tr>
<td>883H models</td>
<td>9.0</td>
<td>266</td>
</tr>
<tr>
<td>All other models</td>
<td>9.0</td>
<td>266</td>
</tr>
<tr>
<td>1999-2003 models</td>
<td>9.0</td>
<td>266</td>
</tr>
</tbody>
</table>

*Harley-Davidson Type E or equivalent.

### Table 2 FRONT FORK SPECIFICATIONS (XL1200S MODELS)

<table>
<thead>
<tr>
<th></th>
<th>in.</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork tube runout</td>
<td>0.008</td>
<td>0.2</td>
</tr>
<tr>
<td>Fork spring free length</td>
<td>16.02</td>
<td>407</td>
</tr>
<tr>
<td>Fork oil level (below top of fork tube)</td>
<td>5.6</td>
<td>142</td>
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</table>

### Table 3 FRONT SUSPENSION TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake hose clamp screws</td>
<td>–</td>
<td>30-40</td>
<td>3-5</td>
</tr>
<tr>
<td>Fork cap to rebound adjuster (1200S models)</td>
<td>22-29</td>
<td>–</td>
<td>30-39</td>
</tr>
<tr>
<td>Fork cap to fork tube (1200S models)*</td>
<td>11-22</td>
<td>–</td>
<td>15-30</td>
</tr>
<tr>
<td>Fork lower bracket pinch bolt</td>
<td>30</td>
<td>–</td>
<td>41</td>
</tr>
<tr>
<td>Fork slider Allen bolt (1200S models)</td>
<td>22-29</td>
<td>–</td>
<td>30-39</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th></th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork stem pinch bolt</td>
<td>30</td>
<td>–</td>
<td>41</td>
</tr>
<tr>
<td>(1988-2003 models)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fork upper bracket pinch bolt</td>
<td>21-27</td>
<td>–</td>
<td>29-37</td>
</tr>
<tr>
<td>1986-1987 models</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1988-2003 models</td>
<td>30</td>
<td>–</td>
<td>41</td>
</tr>
<tr>
<td>Handlebar clamp bolts</td>
<td>–</td>
<td>144-180</td>
<td>16-20</td>
</tr>
</tbody>
</table>

*Other models no specification available.
CHAPTER FIFTEEN

REAR SUSPENSION

This chapter covers the rear suspension. Refer to Chapter Thirteen for rear wheel, hub, rear axle and tire service information.

Tables 1 are located at the end of this chapter.

WARNING
Replace all rear suspension fasteners with parts of the same type. Do not use a replacement part of lesser quality or substitute design, as this may affect the performance of the system or result in failure of the part, leading to loss of motorcycle control. Use the torque specifications listed during installation to ensure proper component retention.

SHOCK ABSORBERS

The rear shocks are spring controlled and hydraulically damped. Spring preload can be adjusted on all models.

Spring Preload Adjustment

NOTE
On 1200S models, both the front and rear suspension spring preload is adjustable. Refer to Front Fork (1200S Models) in Chapter Fourteen for the spring preload adjustment procedure.

On all models, the shock absorber springs can be adjusted to suit rider and load. Rotate the cam ring (Figure 1) at the base of the spring to compress the spring for heavier loads or extend the spring for lighter loads. Use a spanner wrench to rotate the cam ring.

Damping Adjustment

The 1200S model rear shock absorbers are adjustable for compression and rebound damping.

WARNING
Compression and rebound damping settings must be equal on both sides of the motorcycle. Handling will be adversely affected if damping is not the same on both shocks.

1. Adjust the suspension preload as described in Front Fork (1200S Models) in Chapter Fourteen.
2. The shock absorbers on the 1200S models have 14 compression damping settings. Setting 1 (fully clockwise) is the hardest; setting 14 (fully counterclockwise) the softest. The
The recommended setting is eight clicks from the hardest setting.

**NOTE**
To ensure the desired results, do not adjust the damping more than two clicks without testing the setting.

a. Turn the compression damping adjuster (A, Figure 2) one or two clicks. Turning the adjuster clockwise increases compression damping, counterclockwise decreases compression damping.
b. Set the compression damping adjuster on the other shock absorber to the same setting.
c. Test ride the motorcycle.
d. Repeat the above steps until compression damping is at the desired level.

3. The 1200S model shock absorbers have 15 rebound damping settings. Setting 1 (fully clockwise) is the hardest; setting 15 (fully counterclockwise) the softest. The recommended setting is six clicks from the hardest setting.
a. Turn the rebound damping adjuster (B, Figure 2) one or two clicks. Turning the rebound adjuster clockwise increases rebound damping; counterclockwise decreases rebound damping.
b. Set the rebound damping adjuster on the other shock absorber to the same setting.
c. Test ride the motorcycle.
d. Repeat the above steps until you obtain the desired rebound damping.

### Removal/Installation

Removal and installation of the rear shocks is easier if they are serviced separately. The remaining unit will support the rear of the motorcycle and maintain the correct relationship between the top and bottom mounts. If both shock absorbers must be removed at the same time, cut a piece of steel a few inches longer than the shock absorber and drill two holes in the steel the same distance apart as the bolt holes in a shock absorber. Install the steel support after one shock absorber is removed. This will allow the motorcycle to be easily moved around until the shock absorbers are reinstalled or replaced.

1. Support the motorcycle so that the rear wheel clears the ground.

**NOTE**
In Step 2A or 2B, 1200S models are not equipped with washers or a stud cover (Figure 3). Remove the appropriate fastener.

2A. On 1986-1999 models, remove the upper Acorn nut, washer, stud cover and washer (Figure 4).
2B. On 2000-2003 models except 1200S models, remove the upper bolt, washer, stud On cover and washer (Figure 5).
3. Remove the lower locknut, bolt and washer.
4. Remove the shock absorber (Figure 6).
5. Install by reversing the preceding removal steps while noting the following:
   a. Apply threadlock (Loctite 242 or equivalent) to the upper and lower shock fasteners threads.
   b. Tighten the upper and lower fasteners as noted in Table 1.

Disassembly/Reassembly

Refer to Figure 3, Figure 4 and Figure 5. The shock absorber body and spring are not available separately.
1. Remove the shock absorber as described in this section.
2. Adjust the cam ring to its softest setting.

WARNING
Do not attempt to remove the shock absorber spring without a spring compression (part No. HD-97010-52A or equivalent) or bodily injury may result.

3. Using a shock absorber spring compression tool, compress the shock absorber spring and remove the upper spring retainer. Figure 7 shows a typical spring compressor.
4. Release spring pressure, then remove the shock absorber assembly from the tool.
5. Disassemble the shock absorber.
6. Inspect the shock absorber as described in this section.
7. Assembly is the reverse of the removal steps. Lightly grease all cam parts before assembly.

Inspection

Inspect all parts for wear or damage.
1. Replace all rubber bushings that show signs of wear, damage or cracking.
2. Check the shock absorber for fluid leaks. Replace the shock body if leaking.

SWING ARM

Removal/Installation

Refer to Figure 8.
1. Remove the rear wheel as described in Chapter Thirteen.

CAUTION
Cover the frame, swing arm, rear wheel and adjacent parts to protect them from accidental brake fluid spills. Brake fluid can damage painted and plastic surfaces. Immediately wash the surfaces that come into contact with brake fluid with soapy water and rinse completely.

2. Disconnect all brake hose clamps from the swing arm.
3. Remove the rear brake caliper as described in Chapter Sixteen. It is not necessary to disconnect the brake lines. Make sure to support the brake caliper so it is not hanging from the brake line.
4. Remove the bolts or nuts securing the shock absorbers to the swing arm and pull the shock absorbers clear of the mounts.
5. Remove the fasteners securing the rear chain guard and remove the guard.
6. Remove the pivot shaft covers (Figure 9), if so equipped.
7. Prior to completing swing arm removal, check its condition by grasping the swing arm on both sides and trying to move it from side to side. If the free play is excessive, replace the swing arm bearings as described in Swing Arm Bearing Replacement in this section. The manufacturer does not list free play specifications.
8. Remove the socket screw from the left side (Figure 10).
9. Remove the swing arm pivot bolt (Figure 11).
CAUTION
Keep all bearing components together. If they fall out, reinstall them into their correct assembled positions. Wear patterns have developed on these parts and rapid wear may occur if the components are intermixed and not installed in their original positions.

10. Slide the swing arm out of the frame. Make sure the bearings do not drop to the ground.
11. Remove the pivot spacer (11, Figure 8) from the swing arm.
12. Remove the dust shields (2, Figure 8), inner bearing race (3, Figure 8), outer bearing race (4, Figure 8) and
bearing spacer (6. **Figure 8**). Make sure to keep all the bearing components together and with their correct assembled positioned.

13. Install by reversing the preceding removal steps while noting the following.
   a. Coat the swing arm pivot shaft thoroughly with bearing grease before installation.
   b. Lubricate the bearings with waterproof bearing grease.

   _CAUTION_
   _The bearing spacer must be installed between the bearings as described or the bearings will fail during operation._

   c. Install the bearing spacer between the right side bearings.
   d. Install new dust shields with their lip side positioned in toward the inner bearing races.

   _WARNING_
   _Install the pivot spacer (11, **Figure 8**) so the chamfered end faces out (left side). If the pivot spacer is installed incorrectly unstable handling may result from an insufficient clamp load._

   e. Install the pivot spacer (11, **Figure 8**) into the pivot bushing (8, **Figure 8** in the swing arm.
   f. If the engine is installed in the frame, insert the screw (9, **Figure 8**) into the pivot spacer (11, **Figure 8**).
   g. Slide the swing arm into position in the frame.
   h. Install the pivot bolt (**Figure 11**) from the right side. Apply threadlock (Loctite 242 or equivalent) to the threads of the screw and thread the screw (**Figure 10**) onto the end of the pivot shaft. Tighten the pivot shaft bolt to 50 ft.-lb. (68 N-m).
   i. Tighten the lower shock absorber fasteners to specifications in **Table 1**.
   j. Install the rear brake caliper (Chapter Sixteen).
   k. Adjust the drive chain or drive belt and rear brake (Chapter Three).

### Swing Arm Bearing Replacement

Refer to **Figure 8**.

1. Secure the swing arm in a vise with soft jaws.

   _CAUTION_
   _Tag each component when removed from the swing arm so it can be reinstalled in its original position. Bearing components must not be intermixed. Wear patterns develop on bearing assemblies and rapid wear may occur if the components are not installed in their original positions._

2. Remove the following parts from the right side in the following order:
   a. Dust shields (2, **Figure 8**).
   b. Bearings (3, **Figure 8**).

   _CAUTION_
   _Unless replacement is required, do not remove the outer bearing races or the pivot bushing. The complete bearing assembly must be replaced as a unit if any one bearing part is worn or damaged._

   _NOTE_
   _Steps 3-9 require the use of a hydraulic press. Refer service to a dealership if a press is not available. Do not attempt to drive the bearing races or pivot bushing out of the swing arm._

3. Press the outer bearing races (4, **Figure 8**) out of the swing arm.
4. Remove and discard the lock ring (5, **Figure 8**).
5. Remove the bearing spacer (6, **Figure 8**).
6. Press the right pivot bushing (8, **Figure 8**) out of the swing arm.
7. Clean the inside of the swing arm with solvent and dry with compressed air.
8. Install a new lock ring (5, **Figure 8**).
1. Pivot shaft
2. Dust shield
3. Bearing
4. Outer bearing race
5. Lockring
6. Bearing spacer
7. Swing arm
8. Pivot bushing
9. Screw
10. Frame
11. Pivot spacer
CAUTION
Never reinstall an outer bearing race that has been removed. During removal it may twist, which will affect swing arm alignment.

9. Press new bearing races (4, Figure 8) into position.
10. Press a new pivot bushing (8, Figure 8) into the swing arm on the left side.
11. Apply bearing grease to all parts.

WARNING
Install the pivot spacer (11, Figure 8) so the chamfered end faces outward (left side). If the pivot spacer is installed incorrectly, unstable handling may result from an insufficient clamp load.

12. Install the pivot spacer (11, Figure 8) into the pivot bushing.

WARNING
The bearing spacer must be installed between the bearing races during bearing installation or the bearings will fail during operation.

13. Install the bearings and bearing spacer (6, Figure 8) in the order shown in Figure 8.
14. Install dust shields over the bearing. The dust shield lip must face in.

### Table 1 REAR SUSPENSION TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swing arm pivot shaft bolt*</td>
<td>50</td>
<td>–</td>
<td>68</td>
</tr>
<tr>
<td>Rear shock absorber fasteners*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1993-2003 models</td>
<td>30-50</td>
<td>–</td>
<td>41-68</td>
</tr>
</tbody>
</table>

*Apply threadlock (Loctite 242 or equivalent).
This chapter covers the front and rear brakes. Table 1 and Table 2 are at the end of this chapter.

**BRAKE FLUID SELECTION**

**WARNING**

Do not use brake fluid labeled DOT 5.1. This is a glycol-based fluid that is not compatible with silicone-based DOT 5. DOT 5 brake fluid is purple while DOT 5.1 is amber/clear. Do not intermix these two different types of brake fluid as it can cause brake component damage and lead to brake system failure.

**WARNING**

Do not intermix DOT 3, DOT 4 or DOT 5.1 brake fluids as they are not silicone-based. Using non-silicone brake fluid in these models can cause brake failure.

**CAUTION**

Never reuse brake fluid (like fluid expelled during brake bleeding). Contaminated brake fluid can cause brake failure. Dispose of used brake fluid according to local or EPA toxic waste regulations.

When adding or replacing brake fluid, only use silicone-based DOT 5 brake fluid.

**BRAKE SERVICE**

**WARNING**

Do not ride the motorcycle unless the brakes work correctly. The proper operation of this system depends on a supply of clean brake fluid (DOT 5) and a clean work environment when any service is being performed. Any tiny particle of debris that enters the system can damage the components and cause poor brake performance.

**WARNING**

When working on the brake system, do not inhale brake dust. It may contain asbestos, which is a known carcinogen. Do not use compressed air to blow off brake dust. Use an aerosol brake cleaner. Wet down the brake components before working on the brake sys-
Dispose of all brake dust and cleaning materials properly. Wear a facemask that meets OSHA requirements. Wash thoroughly after completing the work.

The disc brake system transmits hydraulic pressure from the master cylinders to the brake calipers. This pressure is transmitted from the calipers to the brake pads, which grip both sides of the brake discs and slow the motorcycle. As the pads wear, the pistons move out of the caliper bores to automatically compensate for wear. As this occurs, the fluid level in the master cylinder reservoir goes down. This must be compensated for by occasionally adding fluid.

Use only fluid clearly marked DOT 5. If possible, use the same brand of fluid. Do not replace the fluid with a glycol-based fluid (DOT 3, 4 or 5.1). It is not possible to remove all of the old fluid. Other types are not compatible with DOT 5. Do not reuse drained fluid. Discard old fluid properly. Do not combine brake fluid with fluids for recycling.

Perform brake service procedures carefully. Do not use any sharp tools inside the master cylinders or calipers or on the pistons. Damage of these components could cause a loss of system hydraulic pressure.

Consider the following when servicing the brake system:
1. The hydraulic components rarely require disassembly. Make sure it is necessary.
2. Keep the reservoir covers in place to prevent the entry of moisture and debris.
3. Clean parts with an aerosol brake parts cleaner or denatured alcohol. Never use petroleum-based solvents on internal brake system components. They will cause seals to swell and distort.
4. Do not allow brake fluid to contact plastic, painted or plated parts. It will damage the surface.
5. Before performing any procedure where there is a possibility of brake fluid contacting the motorcycle, cover the work area with a heavy tarp or a large piece of plastic.
6. Before handling brake fluid or working on the brake system, fill a small container with soap and water and keep it close to the motorcycle while working. If brake fluid contacts the motorcycle, clean the area and rinse thoroughly.
7. To help control the flow of brake fluid when filling the reservoirs, punch a small hole into the seal of a new container next to the edge of the pour spout.
8. If the hydraulic system, not including the reservoir cover, has been opened, bleed the system to remove air from the system. Refer to *Bleeding the System* in this chapter.
9. Dispose of brake fluid properly.

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**FRONT BRAKE PADS**

*(1986-1999 MODELS)*

There is no recommended mileage interval for changing the front brake pads. Pad wear depends on riding habits and conditions. Frequently inspect brake pads for wear. Increase the inspection interval when the wear indicator reaches the edge of the brake disc. After removal, measure the thickness of each pad. Replace the pads if they are worn to 0.062 in. (1.6 mm).

Always replace the front brake pads as a set. If equipped with dual front calipers, never replace the brake pads in one caliper without also replacing them in the other caliper.

Do not disconnect the brake hose from the caliper for brake pad replacement. Only disconnect the brake hose if the caliper is going to be removed.

As the brake pads wear, the brake fluid level drops in the reservoir and automatically adjusts for wear. Check brake fluid level often.

**Inspection**

Refer to *Periodic Maintenance* in Chapter Three.

**Replacement**

Refer to Figure 1.

1. Review *Brake Service* in this chapter.
2. Place a spacer between the brake lever and the throttle grip, and secure it in place. If the brake lever is inadvertently applied, this prevents the pistons from being forced out of the cylinders. If the piston is pushed out of the cylinder the caliper must be reassembled as described in *Front Brake Caliper (1986-1999 Models)* in this chapter.
3. Loosen the upper mounting screw (A, Figure 2) and the lower mounting pin (B). Remove the upper screw and its washer and the mounting pin.
4. Lift the brake caliper off of the brake disc.

**NOTE**

*If the brake pads will be reused, mark each pad so that it can be reinstalled in its original mounting position in the caliper.*

5. Remove the outer pad, pad holder and spring clip as an assembly (Figure 3).
6. Remove the screw (A, Figure 4), pad retainer (B) and inner pad (Figure 5).
7. Push the outer pad (A, Figure 6) free of the spring clip (B) and remove it. See Figure 7.
8. Check the brake pads (Figure 7) for wear or damage. Replace the brake pads if they are worn to 0.062 in. (1.6 mm) or less (Figure 8). Replace both pads as a set.

9. Inspect the caliper upper mounting screw (A, Figure 9) and mounting pin (B). If either part has damaged threads or is worn or badly corroded, replace the damaged part. Replace the mounting pin if its shoulder is scored or otherwise damaged.

10. Replace the pad retainer (Figure 10) if cracked or deformed.

11. Check the piston dust boot (Figure 11). If the boot is swollen or cracked or if brake fluid is leaking from the caliper bore, remove the caliper and overhaul it as described in Front Brake Caliper in this chapter.

12. Remove all corrosion from the pad holder.

13. Replace the spring clip (B, Figure 6) if worn, cracked or badly corroded.

14. Check the brake disc for wear as described in this chapter. Service the brake disc if necessary.

15. Assemble the pad holder, spring clip and outer brake pad (Figure 12) as follows:
   a. Lay the pad holder on a workbench so the upper mounting screw hole is positioned at the upper right as shown in A, Figure 13.
   b. Install the spring clip (B, Figure 13) at the top of the pad holder so the spring loop faces in the direction shown in Figure 12.
   c. The outer brake pad (A, Figure 6) has an insulator pad mounted on its backside.
   d. Center the outer brake pad into the pad holder so the lower end of the pad rests inside the pad holder. Then push firmly on the upper end of the brake pad, past the spring clip and into the holder. The pad should be held firmly by the spring in the spring holder. Refer to Figure 13.

**CAUTION**

Do not allow the master cylinder to overflow. Brake fluid back flows to the reservoir as the pistons are pushed back into their bores. Because brake fluid damages most surfaces, immediately wash spilled brake fluid off
surfaces it contacts. Use soapy water and rinse completely.

16. Remove the master cylinder cover (Figure 14) and diaphragm. Use a shop syringe and remove about 50% of the brake fluid in the reservoir. This prevents the master cylinder from overflowing when the pistons are compressed for pad installation. Do not drain more than 50% of the brake fluid, or air may enter the system. Discard fluid properly.

17. Push the piston into the cylinder with your fingers. Reinstall the master cylinder cover and diaphragm, but do not tighten the screws.

**NOTE**
The piston should move freely. If not, and there is evidence of it sticking in the caliper bore, remove the caliper and service it as described in this chapter.

18. Install the inner brake pad (Figure 5) in the caliper recessed seat. The inner pad does not have an insulator backing.

19. Insert the pad retainer (B, Figure 4) in the caliper counterbore. Install the self-tapping screw (A, Figure 4) through the pad retainer and thread it into the brake pad. Tighten the screw to 40-50 in.-lb. (5-6 N•m).

20. Insert the outer brake pad/pad holder assembly into the caliper so that the brake pad insulator backing faces against the piston. See Figure 3.

**CAUTION**
On 1992-1999 models, the threaded bushing head must be installed between the rivet head and the pad holder. On 1992 models, one of the U-shaped notches on the outer bushing flange must engage the rivet as shown. On 1993-1999 models, the U-shaped notch on the outer bushing flange must engage the rivet. If the bushing is positioned incorrectly, the rivet will be damaged when the caliper mounting screw and pin are tightened. Refer to Figure 1.
21. Coat the lower mounting pin shoulder with high-temperature bearing/brake grease (Dow Corning Moly 44 or equivalent).

22. Install the caliper over the brake disc, making sure the friction surface on each pad faces against the disc.

23. Align the two mounting holes in the caliper with the slider mounting lugs.

24. Install a washer onto the upper mounting screw (A, Figure 2) and insert the screw through the slider lug and then thread into the caliper bushing. Install the screw finger-tight.

25. Insert the lower mounting pin (B, Figure 2) through the caliper and then thread into the slider lug. Tighten the mounting pin finger-tight.

26. Tighten the lower mounting pin to 25-30 ft.-lb. (34-41 N•m).

27. Tighten the upper mounting screw to 25-30 ft.-lb. (34-41 N•m).

28. Refill the master cylinder reservoir with DOT 5 silicone-based brake fluid, if necessary, to maintain the correct fluid level. Install the diaphragm and top cap (Figure 14).

29. While the motorcycle is stationary with the engine off, squeeze the front brake lever several times to seat the pads against the disc.

WARNING
Do not ride the motorcycle until the brakes are operating correctly. If necessary, bleed the brake as described in this chapter.

30. Bed the pads in gradually for the first 100 miles (160 km) of riding by using only light pressure as much as possible. Immediate hard application glazes the new friction pads and reduces their effectiveness.

FRONT BRAKE PADS (2000-2003 MODELS)

There is no recommended mileage interval for changing the front brake pads. Pad wear depends on riding habits and conditions. Frequently inspect brake pads for wear. Increase the inspection interval when the wear indicator reaches the edge of the brake disc. After removal, measure the thickness of each pad. Replace the pads if they are worn to 0.062 in. (1.6 mm).

Always replace the front brake pads as a set. If equipped with dual front calipers, replace both sets of pads.
Do not disconnect the brake hose from the caliper for brake pad replacement. Only disconnect the brake hose if the caliper is going to be removed.

As the brake pads wear, the brake fluid level drops in the reservoir and automatically adjusts for wear. Check brake fluid level often.

**Replacement**

Refer to Figure 15.

1. Review Brake Service in this chapter.
2. Place a spacer between the brake lever and the throttle grip, and secure it in place. If the brake lever is inadver-

ently applied, this will prevent the pistons from being forced out of the cylinders. If the piston is pushed out of the cylinder, the caliper must be reassembled as described in Front Brake Caliper (2000-2003 Models) in this chapter.
3. Clean the top of the master cylinder.
4. Remove the screws (A, Figure 16) securing the cover, the cover (B) and diaphragm.

**CAUTION**

Do not allow the master cylinder to overflow. Brake fluid back flows to the reservoir as the pistons are pushed back into their bores. Because brake fluid damages most surfaces, immediately wash spilled brake fluid off surfaces it contacts. Use soapy water and rinse completely.

5. Use a shop syringe and remove about 50% of the brake fluid from the reservoir. This prevents the master cylinder from overflowing when the pistons are compressed for reinstallation. Do not drain more than 50% of the brake fluid or air will enter the system. Discard the brake fluid properly.
6. Loosen the pad pins (Figure 17).

**CAUTION**

The brake disc is thin in order to dissipate heat and may bend easily. When pushing against the disc, support the disc adjacent to the caliper to prevent damage to the disc.

7. Hold the caliper body from the outside and push it toward the brake disc. This will push the outer pistons into the caliper bores to make room for the new brake pads. Constantly check the reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, before it overflows. Install the diaphragm and cover. Tighten the screws finger-tight.
8. Remove the caliper mounting bolts (Figure 18) and remove the caliper from the front fork.
9. Remove the pad pins (Figure 17).
10. Remove the inboard and outboard brake pads from the caliper.
11. Check the brake pads for uneven wear or damage.
12. Remove rust or corrosion from the brake disc.
13. Clean the pad pins of corrosion or dirt.
14. Check the friction surface of the new pads for debris or manufacturing residue. If necessary, clean them with an aerosol brake cleaner.

**NOTE**

When purchasing new pads, check with the parts supplier to make sure the friction compound of the new pad is compatible with the disc material. Remove roughness from the backs of the new pads with a fine-cut file, then thoroughly clean them.

**NOTE**

The pads are not symmetrical. The pad with one tab (A, Figure 19) must be installed on the inboard side of the left side caliper and on the
outboard side of the right side caliper. The pad with two tabs (B, Figure 19) must be installed on the outboard side of the left side caliper and on the inboard side of the right side caliper.

15. Install the outboard pad (Figure 20). Hold the pad in place against the anti-rattle spring and install both pad pins (Figure 21) through the caliper and the outboard brake pad.

16. Install the inboard pad (Figure 22) into the caliper. Hold the pad in place against the anti-rattle spring and push both pad pins through the inboard brake pad and into the caliper. Tighten the pad pins finger-tight.

17. Separate the brake pads (Figure 23) to allow room for the brake disc.

18. Install the caliper onto the brake disc and install the mounting bolts (Figure 18). Tighten the bolts to 28-38 ft.-lb. (38-52 N•m).

19. Tighten the pad pin bolts (Figure 17) to 180-204 in.-lb. (20-23 N•m).

20. Remove the spacer from the front brake lever.

21. Make sure there is sufficient brake fluid in the master cylinder reservoir. Top it off if necessary.

22. Pump the front brake lever several times to reposition the brake pads against the brake disc.

23. Refill the master cylinder reservoir, if necessary, to maintain the correct fluid level as indicated on the side of the reservoir. Install the diaphragm and the top cover. Tighten the screws to 6-8 in.-lb. (0.5-1 N•m).

**WARNING**

_Do not ride the motorcycle until the brakes are operating correctly. If necessary, bleed the brake as described in this chapter._

24. Bed the pads in gradually for the first 100 miles (160 km) of riding by using only light pressure as much as possible. Immediate hard application glazes the new friction pads and greatly reduces their effectiveness.

**FRONT BRAKE CALIPER**

(1986-1999 MODELS)

Review _Brake Service_ in this chapter.

**Removal**

1. Remove the upper mounting screw and washer (A, Figure 24) and the lower mounting pin (B).

2. Lift the brake caliper off the brake disc.

3A. If the caliper is going to be disassembled for service, perform the following:

**NOTE**

_If the brake pads will be reused, mark each pad so it can be reinstalled in its original position in the caliper._

a. Remove the brake pads as described in this chapter.
CAUTION
Do not allow the pistons to travel out far enough to contact the brake disc. If this happens, the pistons may damage the disc during caliper removal.

b. Slowly apply the front brake lever to push the piston part way out of the caliper for ease of removal during caliper service.

3B. If caliper service is not required, insert a spacer between the brake pads (Figure 25) in the caliper. The spacer prevents the piston from being forced out of the caliper if the brake lever is squeezed while the caliper is removed from the brake disc. If the pistons are forced out, disassemble the caliper and reseat the pistons as described in this chapter.

NOTE
If complete removal of the caliper is not necessary, suspend the caliper and disregard the remaining steps. Do not let the caliper hang from the brake line.

4. Drain the brake fluid from the front brake hose as described in Brake Hose and Line Replacement in this chapter.

5. Remove the banjo bolt from the caliper (C, Figure 24). Remove the bolt and the two washers. Place the open hose end into a plastic bag to prevent spills and to keep out dirt.

6. Remove the caliper. Place it in a plastic bag until installation or disassembly.

Installation

WARNING
The upper and lower caliper bushings must be installed in the fork slider prior to installing the brake caliper. Otherwise, the caliper and pad will be improperly located in relation to the brake disc. This condition will bind the caliper and brake pads, causing uneven braking and possible brake lockup.

1. Make sure the upper and lower caliper bushings, installed in the fork slider, are in place (Figure 26, typical).

2. If removed, install the brake pads as described in this chapter.

3. Coat the lower mounting pin with high-temperature bearing/brake grease (Dow Corning Moly 44 or equivalent).

4. Align the two mounting holes in the caliper with the fork slider mounting lugs.

5. Install a washer onto the upper mounting screw and insert the screw (A, Figure 24) through the slider lug and then thread into the caliper bushing. Install the screw finger-tight.

6. Insert the lower mounting pin (B, Figure 24) through the caliper and thread it into the slider lug. Tighten the mounting screw finger-tight.
7. Tighten the lower mounting pin (B, Figure 24) to 25-30 ft.-lb. (34-41 N•m).
8. Tighten the upper mounting screw (A, Figure 24) to 25-30 ft-lb. (34-41 N•m).
9. Tighten the bleed valve (D, Figure 24) to 80-100 in.-lb. (9-11 N•m).
10. If removed, assemble the brake line onto the caliper by placing a new washer (Figure 27) on both sides of the brake line fitting, then secure the fitting to the caliper with the banjo bolt (C, Figure 24). Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m). Orient the fitting against the caliper as shown in C, Figure 24.
11. If necessary, refill the system and bleed the brakes as described in this chapter.
12. While the motorcycle is stationary with the engine off, squeeze the front brake lever several times to seat the pads against the disc.

**WARNING**
*Do not ride the motorcycle until the brakes operate properly.*

**Disassembly**
Refer to Figure 28.
1. Partially remove the piston from the caliper as described during caliper removal in this section.

**WARNING**
*Compressed air will force the piston out of the caliper under considerable force. Do not block the piston by hand as injury will occur.*
2. Insert a small screwdriver into the notched groove machined in the bottom of the piston bore (Figure 29). Then pry the retaining ring (Figure 30) out of the caliper body.
3. If the piston did not come partially out of the caliper bore, perform the following:
   a. Place a rag and a wood block in the caliper (Figure 31). Keep fingers out of the way of the piston.
   b. Apply compressed air through the brake hose port and force the piston out of the caliper.
4. Remove the piston and dust boot assembly (Figure 32).
5. Remove the piston seal (Figure 33) from the groove in the caliper body.
6. Pull the threaded bushing (A, Figure 34) out of the caliper, then remove the pin boot (B).
7. Remove the O-rings from the caliper body (Figure 35).

**Inspection**
Service specifications for the front caliper components are not available from the manufacturer. Replace worn, damaged or questionable parts.
1. Clean the caliper body and piston in new DOT 5 brake fluid or isopropyl alcohol, and dry them with compressed air.

2. Make sure the fluid passageway in the base of the piston bore is clear. Apply compressed air to the opening to make sure it is clear. Clean it out, if necessary, with new brake fluid.
3. Inspect the piston seal groove in the caliper body for damage. If it is damaged or corroded, replace the caliper assembly.
4. Inspect the banjo bolt threaded hole in the caliper body. If it is worn or damaged, renew it using an appropriately sized thread tap or replace the caliper assembly.
5. Inspect the bleed valve threaded hole in the caliper body. If it is worn or damaged, renew it using an appropriately sized thread tap or replace the caliper assembly.
6. Inspect the bleed valve. Apply compressed air to the opening and make sure it is clear. Clean it out with new brake fluid. Install the bleed valve and tighten it to 80-100 in.-lb. (9-10 N•m).
7. Inspect the caliper body for damage.
8. Inspect the cylinder wall and piston (Figure 36) for scratches, scoring or other damage.

**Assembly**
1. An original equipment rebuild kit includes a piston seal (A, Figure 37), piston (B), dust boot (C) and retaining ring (D).

**WARNING**
*Never reuse an old dust boot or piston seal. Very minor damage or age deterioration can result in leaks and possible brake failure.*
2. Soak the new dust and piston seal in clean DOT 5 brake fluid.
3. Install the new piston seal into the groove. Make sure the seal is properly seated in its groove.
4. Install new O-rings into the caliper grooves.
5. Wipe the inside of the pin boot with high-temperature bearing/brake grease (Dow Corning Moly 44 or equivalent). Then insert the boot into the bushing bore with the flange end seating in the bore groove (Figure 38).
6. Insert the threaded bushing into the boot (Figure 39).
7. Install the piston dust boot on the piston before the piston is installed in the caliper bore. Perform the following:
FRONT BRAKE CALIPER
(1986-1999 MODELS)

1. Screw
2. Pad retainer
3. Inner brake pad
4. Outer brake pad
5. Retaining ring
6. Dust boot
7. Piston
8. Piston seal
9. O-rings
10. Spring clip
11. Caliper body
12. Bleed valve
13. Washer
14. Upper mounting screw
15. Lower mounting pin
16A. Threaded bushing (1986-1991 models)
16B. Threaded bushing (1992-1999 models)
17. Pin boot
18A. Pad holder (1986-1991 models)
18B. Pad holder (1992-1999 models)
a. Place the piston on the workbench with its open side facing up.
b. Align the piston dust boot with the piston so the shoulder on the dust boot faces up.
c. Slide the piston dust boot onto the piston until the inner lip on the dust boot seats in the piston groove (Figure 32).

8. Coat the piston and the caliper bore with DOT 5 brake fluid.
9. Align the piston with the caliper bore so its open end faces out (Figure 32). Push the piston into the bore until it bottoms.
10. Seat the piston dust boot (Figure 40) into the caliper bore.
11. Locate the retaining ring groove in the top end of the caliper bore. Align the retaining ring so its gap (Figure 41) is at the top of the caliper bore and install the ring into the ring groove. Make sure the retaining ring is correctly seated in the groove.
12. Apply a light coat of high-temperature bearing/brake grease (Dow Corning Moly 44 or equivalent) to the caliper mounting lug bores.
13. If the bleed valve was removed, install it and tighten it to 80-100 in.-lb. (9-11 N•m).
14. Install the caliper and brake pads as described in this section.
15. Bleed the brakes as described in *Bleeding the System* in this chapter.
FRONT BRAKE CALIPER
(2000-2003 MODELS)

Review Brake Service in this chapter.

Removal

1. If the caliper is going to be disassembled for service, perform the following:

   **NOTE**
   *If the brake pads will be reused, mark each pad so it can be reinstalled in its original position in the caliper.*

   a. Remove the brake pads as described in this chapter.

   **CAUTION**
   *Do not allow the pistons to travel out far enough to contact the brake disc. If this happens, the pistons may damage the disc during caliper removal.*

   b. Slowly apply the brake lever to push the pistons part way out of the caliper assembly for ease of removal during caliper service.

   c. Loosen the two body mounting bolts (A, Figure 42).

   d. Loosen the brake hose banjo bolt (B, Figure 42).

2. Remove the banjo bolt and sealing washers (B, Figure 42). Account for the sealing washer on each side of the hose fitting(s).
3. Place the loose end of the brake hose in a plastic bag to prevent the entry of debris and keep brake fluid from leaking out.
4. Remove the mounting bolts (Figure 43).
5. Remove the caliper. Place it in a plastic bag until installation or disassembly.

Installation

1. Install the caliper assembly onto the disc, take care not to damage the leading edge of the brake pads.
2. Install the mounting bolts (Figure 43). Install the long bolt into the upper hole. Install the upper bolt finger-tight, then install the lower bolt. Tighten the lower bolt to 28-38 ft.-lb. (38-52 N•m). Tighten the upper bolt to 28-38 ft.-lb. (38-52 N•m).
3. Apply new DOT 5 brake fluid to the rubber portions of the new banjo bolt sealing washers prior to installation.
4. Install a new sealing washer on each side of the brake hose fitting and install the banjo bolt (B, Figure 42). Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m).
5. Bleed the brake as described in this chapter.

Disassembly

Refer to Figure 44.

1. Remove the caliper as described in this section.
2. Remove the two caliper body bolts (Figure 45) loosened during the removal procedure.
3. Separate the caliper body halves. Remove the O-rings (Figure 46). New O-rings must be installed every time the caliper is disassembled.

**NOTE**
If the pistons were partially forced out of the caliper body during removal, steps 4-6 may not be necessary. If the pistons or caliper bores are corroded or very dirty, compressed air may be necessary to completely remove the pistons from the body bores.

4. Place a piece of soft wood and a shop cloth over the end of the pistons and the caliper body. Turn this assembly over with the pistons facing down on top of a workbench.

**WARNING**
Compressed air forces the pistons out of the caliper body under considerable force. Do not block the piston by hand, as injury will result.

5. Apply the air pressure in short spurts to the hydraulic fluid passageway and force out the pistons. Repeat for the other caliper body half.

**CAUTION**
Do not use a sharp tool to remove the dust and piston seals from the caliper cylinders. Do not damage the cylinder surface.

6. Use a piece of wood or a plastic scraper and push the dust seal and the piston seal (Figure 47) in toward the caliper cylinder and out of their grooves. Remove the dust and piston seals.
7. If necessary, unscrew and remove the bleed valve (A, Figure 48).
8. Inspect the caliper as described in this section.

Inspection

1. Clean both caliper body halves and pistons in new DOT 5 brake fluid or isopropyl alcohol and dry with compressed air.
2. Make sure the fluid passageways (Figure 49) in the piston bores are clear. Apply compressed air to the openings to make sure they are clear. Flush the passageways, if necessary, with new brake fluid.
3. Make sure the fluid passageways (A, Figure 50) in both caliper body halves are clear. Apply compressed air to the openings to make sure they are clear. Flush the passageways, if necessary, with new brake fluid.
4. Inspect the piston and dust seal grooves (Figure 51) in both caliper bodies for damage. If damaged or corroded, replace the caliper assembly.
5. Inspect the banjo bolt threaded hole (B, Figure 48) in the outboard caliper body. If worn or damaged, renew with an appropriately sized thread tap or replace the caliper assembly.
6. Inspect the bleed valve threaded hole in the caliper body. If worn or damaged, clean out with an appropriately sized thread tap or replace the caliper body.
7. Inspect the bleed valves (A, Figure 48). Apply compressed air to the opening and make sure it is clear. Clean out, if necessary, with clean brake fluid. Install the bleed valve and tighten to 80-100 in.-lb. (9.0-11.3 N•m).
8. Inspect both caliper body halves for damage. Check the inboard caliper mounting bolt hole threads (B, Figure 50) for wear or damage. Clean up the threads with an appropriately sized tap or replace the caliper assembly.
9. Inspect the cylinder walls and pistons for scratches, scoring or other damage.
1. Inboard caliper body
2. Crossover O-ring
3. Piston seal
4. Dust seal
5. Piston
6. Anti-rattle spring
7. Brake pad
8. Outboard caliper body
9. Bridge bolt
10. Bleed valve
11. Pad pin
10. Check the anti-rattle spring (Figure 52) for wear or damage.

Assembly

**CAUTION**

Never reuse old dust seals or piston seals. Very minor damage or age deterioration can result in leaks and possible brake failure.

1. Soak the new dust and piston seals in new DOT 5 brake fluid.
2. Coat the piston bores and pistons with new DOT 5 brake fluid.
3. Install the new piston seals into the lower grooves. Make sure the seals are properly seated in their respective grooves.
4. Install the new dust seals into the upper grooves. Make sure all seals are properly seated in their respective grooves (Figure 53).
5. Repeat Step 3 and Step 4 for the other caliper body half.
6. Position the pistons with the open end facing out and install the pistons into the caliper cylinders (A, Figure 54). Push the pistons into the bore until they bottom (B).
7. Repeat Step 6 for the other caliper body half. Make sure all pistons are installed correctly.
8. Coat the new O-ring seals in new DOT 5 brake fluid and install the O-rings (Figure 46) into the inboard caliper half.
9. Install the anti-rattle spring (Figure 55) onto the boss on the outboard caliper half.
10. Make sure the O-rings are still in place and assemble the caliper body halves.
11. Install one of the caliper mounting bolts through the upper hole (A, Figure 56) to correctly align the caliper halves.
12. Install the two caliper body bolts (B, Figure 56) and tighten securely. They will be tightened to the specified torque after the caliper is installed on the front fork.
13. If removed, install the bleed valve assembly and tighten to 80-100 in.-lb. (9.0-11.3 N•m).
14. Install the caliper as described in this section.

**FRONT MASTER CYLINDER**

(1986-1995 MODELS)

Review Brake Service in this chapter.
Refer to Figure 57.

Removal

1. Pull the rubber cover off of the front caliper bleed valve (Figure 58) and insert a hose onto the end of the valve. Insert the open end of the hose into a container. Open the front bleed valve and drain the brake fluid from the front brake assembly by operating the hand lever. Remove the hose and close the bleed valve after draining the assembly. Discard
the brake fluid. Refer to Brake Fluid Draining in this chapter.
2. Place a couple of shop cloths under the banjo bolt and remove the banjo bolt and washers securing the brake hose to the master cylinder (A, Figure 59).
3. Remove the screws (B, Figure 59) securing the master cylinder to the handlebar and remove the master cylinder.

Installation
1. Position the master cylinder onto the handlebar and install the clamp and screws (B, Figure 59). Tighten the screws to 70-80 in.-lb. (8-9 N•m).
2. Install the brake hose onto the master cylinder and brake caliper. Be sure to place a new banjo bolt washer on each side of the hose fitting (A, Figure 59) when installing the banjo bolt. Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m).
3. Fill the master cylinder with new DOT 5 brake fluid. Bleed the brake system as described in this chapter.
4. If necessary, loosen the clamp screws and reposition the master cylinder to suit the rider. Retighten the clamp screws to 70-80 in.-lb. (8-9 N•m).

Disassembly
1. Remove the master cylinder as described in this section.
2. If still in place, remove the screws securing the top cover and remove the cover and diaphragm.
3. Remove the brake lever assembly as follows:
   a. Remove the snap ring from the pivot pin.
   b. Push out the pivot pin and remove the brake lever assembly.
   c. Remove the reaction pin (A, Figure 60) from the brake lever (B).
   d. Remove the pushrod from the piston assembly.
4. Remove the piston assembly as follows:
   a. Remove the dust boot (A, Figure 61).
   b. Remove the piston and spring assembly (B, Figure 61).
5. If damaged, remove the grommet and sight glass from the master cylinder housing.

Assembly
1A. If installing the original equipment master cylinder rebuild kit, use the supplied lubricant to coat the master cylinder bore and piston components.
1B. If installing an aftermarket master cylinder rebuild kit, soak the piston O-ring and cup in new DOT 5 brake fluid prior to installation. Apply a thin coat of brake fluid to the cylinder bore prior to assembly.
2. Install the grommet and sight glass if removed.
3. Install the cup onto the small end of the spring.
4. Install the O-ring onto the piston.
FRONT MASTER CYLINDER (1986-1995 MODELS)

1. Screw
2. Cover
3. Diaphragm
4. Sight glass
5. Grommet
6. Reservoir/body
7. Sealing washers
8. Brake hose
9. Banjo bolt
10. Screw
11. Clamp
12. Pivot pin
13. Brake lever
14. Snap ring
15. Spring
16. Cup
17. Piston
18. O-ring
19. Dust boot
20. Pushrod and brake switch
21. Reaction pin
4. Position the spring with the wide end first and install the spring into the master cylinder.

5. Position the piston with the O-ring end going in last and install the piston into the master cylinder (Figure 62).

6. Slide the dust boot (A, Figure 63) onto the pushrod (B). Refer to Figure 64.

7. Assemble the brake lever as follows:

    NOTE
    Do not seat the dust boot into the master cylinder at this time.

a. Slide the long end of the pushrod (Figure 65) into the piston with the dust boot facing the piston. Turn the pushrod so the arm faces the master cylinder.

b. Apply a light coat of antiseize lubricant onto the reaction pin (A, Figure 66).

c. Install the reaction pin (A, Figure 66) into the brake lever (B). Make sure the square pinhole (Figure 67) faces out.

d. Slide the brake lever into the master cylinder and seat the end of the pushrod into the reaction pin hose (Figure 68). Hold the brake lever in this position. Install the pushrod arm into the cutout in the master cylinder.

e. Slide the pivot pin through the master cylinder and brake lever pivot holes.
f. Turn the master cylinder over and install the snap ring into the pivot pin groove. Make sure the snap ring is seated correctly in the groove.

g. Apply the brake lever once to seat the dust seal into the master cylinder bore (Figure 69).

8. Apply the brake lever several times. There must be no binding or excessive play. Make sure the pushrod is seated in the reaction pinhole (Figure 69). If the brake lever does not operate correctly, repeat this procedure and correct the problem.

**WARNING**

*If the assembled pushrod and reaction pin are not operating correctly, the front master may cause the front brake to lock up and/or result in the complete loss of front brake operation.*

**Inspection**

Replace worn or damaged parts as described in this section. A new piston kit should be installed every time the master cylinder is disassembled.

1. Clean all parts in new DOT 5 brake fluid or isopropyl alcohol. Inspect the body cylinder bore surface for signs of wear and damage. If it is less than perfect, replace the master cylinder assembly. The body cannot be replaced separately.

2. The piston assembly consists of the dust boot, O-ring, piston, cup and spring. Inspect the rubber parts for wear, cracks, swelling or other damage. Check the piston for wear or damage. If any one part of the piston assembly is damaged, replace the entire piston assembly as a kit.

3. Inspect the master cylinder bore for scratches or wear grooves.

4. Clean the vent hole in the cover if plugged.

5. Check the banjo bolt threads in the master cylinder. If the threads are slightly damaged, renew them using the properly sized thread tap. If the threads are severely worn or damaged, replace the master cylinder body.

6. Inspect the piston bore in the master cylinder for wear, corrosion or damage. Replace the master cylinder if necessary.

**NOTE**

*If a tap is used to clean the threads in the master cylinder, flush the master cylinder thoroughly and blow dry.*

7. Make sure the banjo bolt passage hole is clear.

**FRONT MASTER CYLINDER**

*(1996-2003 MODELS)*

Review *Brake Service* in this chapter.

Refer to Figure 70.
Identification

Two different master cylinders are used depending on the number of front disc brakes on the motorcycle. The master cylinder used with a single front brake disc has a smaller bore than the master cylinder used with dual brake discs.

A number cast into the master cylinder body (Figure 71) identifies the type of master cylinder. The number “9/16” identifies a master cylinder designed for single-disc operation. The number “11/16” identifies a master cylinder designed for dual-disc operation.

Removal

1. Pull the rubber cover off the front caliper bleed valve (Figure 72) and insert a hose onto the end of the valve. Insert the open end of the hose into a container. Open the front
bleed valve and drain the brake fluid from the front brake assembly by operating the hand lever. Remove the hose and close the bleed valve after draining the assembly. Discard the brake fluid. Refer to Brake Fluid Draining in this chapter.

2. Clean the top of the master cylinder.

**CAUTION**
Failure to install the spacer in Step 3 will result in damage to the rubber boot and plunger on the front brake switch.

3. Insert a 5/32 in. (4 mm) thick spacer (A, Figure 73) between the brake lever and lever bracket. Make sure the spacer stays in place during the following steps.

4. Remove the banjo bolt (A, Figure 74) and sealing washers securing the brake hose to the master cylinder.

5. Place the loose end of the brake hose in a plastic bag to prevent fluid leaks and the entry of moisture and debris.

6. Remove the screw securing the right side handlebar switch together and separate the switch.

7. Remove the bolts and washers securing the clamp and master cylinder to the handlebar.

8. Remove the master cylinder assembly from the handlebar.

9. If necessary, remove the screws (B, Figure 74) securing the cover, then remove the cover (C) and diaphragm. Drain any residual brake fluid from the master cylinder and dispose of it properly.

10. If the master cylinder assembly is not going to be serviced, reinstall the clamp and bolts to the master cylinder. Place the assembly in a plastic bag to protect it from moisture and debris.

**Installation**

**CAUTION**
Failure to install the spacer between the brake lever and the brake spacer results in damage to the rubber boot and plunger on the front brake switch.

1. Insert the 5/32 in. (4 mm) thick spacer between the brake lever and lever bracket if not in place. Make sure the spacer stays in place during the following steps.

2. Position the front master cylinder onto the handlebar. Align the master cylinder notch (B, Figure 73) with the locating tab on the lower portion of the right side switch.

**CAUTION**
Do not damage the front brake light switch and rubber boot (Figure 75, typical) when installing the master cylinder.

3. Push the master cylinder all the way onto the handlebar (A, Figure 76). Hold it in this position and install the upper portion of the right side switch (B, Figure 76). Install the switch clamp screw and tighten it securely.
4. Position the clamp and install the bolts and washers. Tighten the upper mounting screw, then the lower screw. Tighten the screws to 70-80 in.-lb (8-9 N•m).
5. Apply new DOT 5 brake fluid to the rubber portions of the new sealing washers prior to installation.
6. Install new sealing washers and the banjo bolt (Figure 77) securing the brake hose to the master cylinder (A, Figure 74). Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m).
7. Remove the spacer from the brake lever.
8. Refill the master cylinder reservoir and bleed the brake system as described in this chapter.

Disassembly

1. Remove the master cylinder as described in this section.
2. If still in place, remove the top cover and diaphragm.
3. Remove the snap ring (A, Figure 78) and pivot pin securing the hand lever to the master cylinder. Remove the hand lever (B, Figure 78).
4. Remove the retainer (A, Figure 79) and the rubber boot (B) from the area where the hand lever actuates the piston assembly.
5. Remove the piston assembly (Figure 80) and the spring.
6. Inspect all parts as described in this section.

Inspection

Replace worn or damage parts as described in this section. Install a new piston kit assembly every time the master cylinder is disassembled.
1. Clean all parts in new DOT 5 brake fluid or isopropyl alcohol. Inspect the body cylinder bore surface for signs of wear and damage. Replace the master cylinder assembly, if damaged. The body cannot be replaced separately.
2. Inspect the piston cup (A, Figure 81) and O-ring (B) for signs of wear and damage.
3. Make sure the fluid passage (Figure 82) in the bottom of the master cylinder reservoir is clear. Clean it out if necessary.
4. Inspect the piston contact surface for signs of wear and damage.
5. Check the end of the piston (C, Figure 81) for wear caused by the hand lever.
6. Check the hand lever pivot lugs in the master cylinder body for cracks or elongation.
7. Inspect the hand lever pivot hole and bushing (A, Figure 83), and the pivot pin (B) for wear, cracks or elongation.
8. Inspect the piston cap and retainer (Figure 84) for wear or damage.
9. Inspect the threads in the bore for the banjo bolt. If they are worn or damaged, clean them out with a thread tap or replace the master cylinder assembly.
10. Check the top cover and diaphragm for damage or deterioration.
11. If necessary, separate the cover from the diaphragm as follows:
   a. Pull straight up on the sight glass (Figure 85) and remove it from the cover and diaphragm.
   b. Separate the diaphragm from the cover.
   c. The trim plate may separate from the cover.

Assembly

CAUTION
The cover and diaphragm must be assembled as described. If the sight glass is not installed correctly through the cover and diaphragm neck, brake fluid will leak past these components.

Refer to Figure 71.

1A. If installing the original equipment master cylinder rebuild kit, use the supplied lubricant to coat the master cylinder bore and piston components.

1B. If installing an aftermarket master cylinder rebuild kit, soak the piston O-ring in new DOT 5 brake fluid prior to installation. Apply a thin coat of brake fluid to the cylinder bore assembly.

2. If the cover and the diaphragm were disassembled, assemble them as follows:
   a. Install the trim plate (Figure 86) onto the cover if it was removed.
   b. Insert the neck of the diaphragm into the cover. Press it in until it seats correctly and the outer edges align with the cover.
   c. Push the sight glass (Figure 85) straight down through the cover and the neck of the diaphragm (Figure 87) until it snaps into place. The sight glass must lock these two parts together to avoid leaks.

3. Soak the new cup, O-ring and piston assembly in new DOT 5 brake fluid for 15 minutes to make them pliable. Coat the inside of the cylinder bore with new brake fluid prior to the assembly of parts.
CAUTION
When installing the piston assembly, do not allow the cup to turn inside out as it will be damaged and allow brake fluid leaks within the cylinder bore.

4. Install the spring and piston assembly into the cylinder (Figure 88). Push them in until they bottom in the cylinder (Figure 80).

5. Position the retainer with the flat side going on first, and install the piston cap and retainer onto the piston end.

6. Push down on the piston cap (Figure 89). Hold it in place and press the retainer down until it correctly seats in the cylinder groove (A, Figure 79).

7. Make sure the bushing is in place in the hand lever pivot area.

8. Install the hand lever (B, Figure 78) into the master cylinder. Install the pivot pin and secure it with the snap ring. Make sure the snap ring is correctly seated in the pivot pin groove (A, Figure 78).

9. Apply the lever to make sure it pivots freely.

10. Install the master cylinder as described in this section.

REAR BRAKE PADS
(1986-EARLY 1987 MODELS)

There is no recommended mileage interval for changing the brake pads. Pad wear depends on personal riding habits and the condition of the brake system. Inspect the rear brake pads for uneven wear, scoring, oil contamination or other damage. Replace the brake pads if the pad thickness is less than 0.062 in. (1.6 mm.).

Always replace the rear brake pads as a set.

Do not disconnect the brake hose from the caliper for brake pad replacement. Only disconnect the brake hose if removing the caliper.

Review Brake Service in this chapter.
Replacement

Refer to Figure 90.

1. Tie the end of the brake pedal to the frame so it cannot be depressed. This prevents inadvertent application which may cause the pistons to be pushed out the caliper.
2. Remove the two caliper body mounting screws (Figure 91).
3. Pull the caliper body (5, Figure 90) away from the mounting frame (3).
4. Remove the pad spring (Figure 92) from inside the caliper.
5. Secure the caliper body to the motorcycle. Do not allow the caliper body to hang from the brake hose. Do not disconnect the brake line unless removing the caliper.

NOTE

If reusing the brake pads, mark each pad so it can be reinstalled in its original position in the caliper.

6. Slide the brake pads (Figure 93) off the frame.
7. Remove the upper and lower caliper pins. See Figure 94.
8. Check the abutment shims (Figure 95) in the caliper frame. If they are worn or damaged, replace as follows:
   a. Pry the abutment shims away from the caliper. See Figure 96.
   b. Remove all adhesive from the caliper surface where the abutment shims are located.
   c. Clean the abutment shim surfaces with rubbing alcohol.
d. Apply silicone sealant to the abutment shim surfaces on the caliper and install the abutment shims. Hold the shims in position by installing the brake pads (Figure 93) in the frame.

e. Allow the silicone sealant to dry thoroughly before completing brake pad installation.

f. Make sure the brake pads slide freely in the frame.

9. Check the brake pads (Figure 97) for wear or damage. Measure the brake pad thickness (Figure 98) and replace them if they are worn to 0.062 in. (1.6 in.).
10. Check the brake caliper for brake fluid leaks. If brake fluid has leaked from the caliper, rebuild it as described in this section.

11. Inspect the brake disc as described in this chapter.

12. Inspect the pins (A, *Figure 99*) for wear or damage. Check the boots (B, *Figure 99*) for tearing or deterioration. Replace worn or damaged parts if necessary.

13. Inspect the pin bushings (*Figure 100*) in the frame for wear or damage. Replace the frame assembly if the bushings are worn or damaged.

14. Install the boots onto the pin bushings. Then install the pin bushings in the frame. Insert the pin with the nylon sleeve into the top frame bushing (*Figure 94*). Fit the boots so they seat on the boss around the bushing holes.

**CAUTION**

*If the boots are not seated properly, dirt can enter and cause rapid pin and bushing wear.*

15. Turn the pins so the flats on the sides of the pins face as shown in *Figure 101*.

**CAUTION**

*Do not allow the master cylinder to overflow. Brake fluid back flows to the reservoir as the pistons are pushed back into their bores. Because brake fluid damages most surfaces, immediately wash spilled brake fluid off surfaces it contacts. Use soapy water and rinse completely.*

16. Remove the master cylinder cover (*Figure 102*) and diaphragm. Remove about 50% of the brake fluid in the reservoir. This prevents the master cylinder from overflowing when the pistons are compressed for pad installation. Do not drain more than 50% of the brake fluid, or air will enter the system. Discard fluid properly.

17. Push the piston (A, *Figure 103*) into the cylinder. Reinstall the master cylinder cover and diaphragm, but do not tighten the screws. The piston should move freely. If the piston is tight and there is evidence of sticking in the cylinder, remove and service the caliper as described in this section.

18. Install the pad spring (B, *Figure 103*) into the top of the caliper so the long tab on the spring extends above the piston. Hook the short tab on the spring above the ridge on the caliper casting opposite the piston. See *Figure 104*.

19. Install the brake pads (*Figure 93*) on the frame. Then install the caliper body over the brake pads and onto the bracket. Make sure the upper and lower pins (*Figure 101*) do not move when installing the caliper body.

20. Install the caliper screws (*Figure 91*) and tighten to 132-168 in.-lb. (15-19 N·m). Align the upper and lower pins as shown in *Figure 101*.

21. If tied to the frame, untie the rear brake pedal so it can be operated.
22. While the motorcycle is stationary with the engine off, apply the rear brake lever several times to seat the pads against the disc.

**WARNING**

Do not ride the motorcycle until the brakes are operating correctly. If necessary, bleed the brake as described in this chapter.

23. Bed the pads in gradually for the first 100 miles (160 km) by using only light pressure as much as possible. Immediate hard application glazes the new brake pads and greatly reduces their effectiveness.

**REAR BRAKE PADS**

**(LATE 1987-1999 MODELS)**

There is no recommended mileage interval for changing the brake pads. Pad wear depends on personal riding habits and the condition of the brake system. Inspect the rear brake pads for uneven wear, scoring, oil contamination or other damage. Replace the brake pads if the pad thickness is less than 0.062 in. (1.6 in.).

Always replace the rear brake pads as a set.

Do not disconnect the brake hose from the caliper for brake pad replacement. Only disconnect the brake hose if removing the caliper.

Review Brake Service in this chapter.

**Brake Pad/Pad Shim Identification**

**WARNING**

When replacing brake pads, do not mix late 1987-early 1991 and late 1991-1999 brake pads and pad shims. Otherwise, improper rear brake operation will occur. This may cause brake failure and loss of control. When purchasing new brake pads, provide the dealership with the frame serial number for parts verification.

There was a design change between early 1991 and late 1991 models regarding the brake pads and pad shims (Figure 105). When purchasing replacement parts, note the following while referring to Figure 106 (late 1987-early 1991 models) or Figure 107 (late 1991-1999 models):

1A. On late 1987-early 1991 models, the pad shim thickness is 0.015 in. (0.38 mm).

1B. On late 1991-1999 models, the pad shim thickness is 0.030 in. (0.76 mm).

2A. On late 1987-early 1991 models, the pad shims have a tab in the middle of each long side.

2B. On late 1991-1999 models, the pad shims have an open loop at one end of the shim.

3A. On late 1987-early 1991 models, the brake pads measure approximately 3.44 in. (87.4 mm) as shown in Figure 106.

3B. On late 1991-1999 models, the brake pads measure approximately 3.39 in. (86.1 mm) as shown in Figure 107.

4. On late 1987-early 1991 models, the outboard brake pads have an angle-cut, half-size insulator mounted on the back of the pad. The inboard brake pad has a full-size insulator.

5. On late 1991-1999 models, the brake pads have full-size insulators mounted on the back of each pad.

**Replacement**

Refer to Figure 105.

1. Tie the end of the brake pedal to the frame so it cannot be depressed. This prevents inadvertent application which may cause the piston to be pushed out of the caliper.
2. Remove the two caliper pin bolts (A, Figure 108) and lift the caliper (B) off the mounting bracket.

3. Secure the caliper to the motorcycle. Do not let it hang from the brake hose. Do not disconnect the brake line unless removing the caliper.

4. Pull the retainer clip (Figure 109) over the mounting bracket and remove it. See Figure 110.

**NOTE**
*If reusing the brake pads, mark each pad so it can be reinstalled in its original mounting position in the caliper.*

5. Remove the outer brake pad (Figure 111).

6. Remove the inner brake pad (A, Figure 112).

7. Remove the two pad shims (B, Figure 112) from the mounting bracket. Refer to Figure 105 for a comparison of the late 1987-early 1991 models and late 1991-1999 models pad shims.

8. Check the brake pads (Figure 113) for wear or damage. Replace the brake pads if they are worn to 0.062 in. (1.6 mm) or less. Replace both pads as a set.

9. Clean the pad shims thoroughly and check for cracks or damage. Replace if necessary.
10. Clean the pad shim mounting area on the mounting bracket thoroughly.

11. Check the retainer clip. If worn, cracked, rusted, deformed or corroded, replace it.

12. Inspect the caliper pin bolts and replace if cracked, corroded or otherwise damaged.

13. Check the piston dust boot. If the boot is swollen or cracked or if brake fluid is leaking from the caliper bore, remove the rear caliper and overhaul it as described in this chapter.

14. Inspect the brake disc for wear as described in Brake Disc in this chapter.

**CAUTION**

*Do not allow the master cylinder to overflow.*

Brake fluid back flows to the reservoir as the pistons are pushed back into their bores. Because brake fluid damages most surfaces, immediately wash spilled brake fluid off surfaces it contacts. Use soapy water and rinse completely.

15. Push the piston into the caliper cylinder. The piston should move freely. If not, and there is evidence of it sticking in the caliper bore, remove the rear caliper and service it as described in this chapter.

16. Reinstall the diaphragm and cover but do not install the cover screws.
17. Install the pad shims onto the caliper mounting bracket rails as follows:
   a. On late 1987-early 1991 models, insert the pad shim tabs (Figure 106) into caliper bracket shim holes (3, Figure 105).
   b. On late 1991-1999 models, install the pad shims so that their retaining loops face against the outer caliper mounting bracket rails as shown in B, Figure 112 and Figure 114.
   c. On all models, hold the pad shims in place when installing the rear brake pad in Step 18.

   **NOTE**
   On late 1987-early 1991 models, the outboard brake pad is different from the inboard brake pad. The outboard brake pad (piston side) has an angle-cut, half-size insulator mounted on the back of the pad (Figure 106). The inboard brake pad has a full-size insulator.

   **NOTE**
   On late 1991-1999 models, install used pads in their original mounting positions as identified during removal. New pads are identical and can be installed in either position (inboard or outboard).

18. Slide the inboard brake pad (A, Figure 112) over the pad shims so that it contacts the inner brake disc surface. Check that the pad shims did not move out of position.
19. Slide the outboard brake pad (Figure 111) over the pad shims so that it contacts the outer brake disc surface.
20. Make sure the pad shims did not move out of position.
21. Insert the ends of the retainer clip (Figure 110) into the two holes in the backside of the caliper mounting bracket
(Figure 115). Then pivot the clip over the top of the brake pads and snap it in place against the outer brake pad as shown in Figure 109.

CAUTION
After installing the retainer clip, check that both brake pads are still contacting the two pad shims; see Figure 116, typical. If the pads or shims are installed incorrectly, the rear brake will drag and cause uneven pad wear and caliper mounting bracket damage.

NOTE
The caliper should be installed over the brake pads so it does not knock against the brake pads and dislodge the pad shims.

22. Align the caliper with the brake pads and install it onto the pads (B, Figure 108). Align the caliper holes with the caliper mounting bracket threaded holes and install the two pin bolts. See Figure 117 and A, Figure 108. Start the bolts by hand, then tighten to 15-20 ft.-lb. (20-27 N•m).
23. If tied to the frame, untie the rear brake pedal so it can be operated.
24. Refill the master cylinder reservoir.
25. While the motorcycle is stationary with the engine off, apply the rear brake lever several times to seat the pads against the disc.

WARNING
Do not ride the motorcycle until the brakes are operating correctly. If necessary, bleed the brake as described in this chapter.

26. Bed the pads in gradually for the first 100 miles (160 km) of riding by using only light pressure as much as possible. Immediate hard application glazes the new brake pads and greatly reduces their effectiveness.

REAR BRAKE PADS
(2000-2003 MODELS)

There is no recommended mileage interval for changing the brake pads in the rear brake caliper. Pad wear depends on personal riding habits and the condition of the brake system. Inspect the rear brake pads for uneven wear, scoring, oil contamination or other damage. Replace the brake pads if the pad thickness is less than 0.062 in. (1.6 in.).

Always replace the rear brake pads as a set.

Do not disconnect the brake hose from the caliper for brake pad replacement. Only disconnect the brake hose if removing the caliper.

Review Brake Service in this chapter.
Refer to Figure 118.
Replacement

1. Tie the end of the brake pedal to the frame so it cannot be depressed. This prevents inadvertent application which may cause the piston to push out of the caliper.
2. Clean the top of the master cylinder.
3. Remove the screws securing the cover and remove the cover (Figure 119) and diaphragm.
4. Remove about 50 percent of the brake fluid from the reservoir. This prevents the master cylinder from overflowing when the pistons are compressed for reinstallation. Do not drain more than 50 percent of the brake fluid or air will enter the system.
5. Loosen the pad pin bolts (Figure 120).

**CAUTION**
Do not allow the master cylinder to overflow. Brake fluid back flows to the reservoir as the pistons are pushed back into their bores. Because brake fluid damages most surfaces, immediately wash spilled brake fluid off surfaces it contacts. Use soapy water and rinse completely.

**CAUTION**
The brake disc is thin and easily damaged. When pushing against the disc in the following step, support the disc adjacent to the caliper to prevent damage.

6. Hold the caliper body from the outside and push it toward the brake disc. This pushes the outer pistons into the caliper bores to make room for the new brake pads. Constantly check the master cylinder reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, prior to it overflowing. Install the diaphragm and cover. Tighten the screws finger-tight.
7. Remove the pad pins (Figure 120).

**NOTE**
If reusing the brake pads, mark each pad so it can be reinstalled in its original position in the caliper.

8. Remove the inboard and outboard brake pads from the caliper.
9. Check the brake pads for wear or damage. Measure the thickness of the brake pad friction material. Replace the brake pads if they are worn to 0.062 in. (1.6 mm).
10. Clean the pad pins.
11. Check the friction surface of the new pads for any debris or manufacturing residue. If necessary, clean the pads with an aerosol brake cleaner.

**NOTE**
When purchasing new pads, check with the dealer to make sure the friction compound of the new pad is compatible with the disc material. Remove any roughness from the backs of the new pads with a fine-cut file, then thoroughly clean them off.

**NOTE**
The brake pads are not symmetrical. The pad with one tab (A, Figure 121) must be installed on the outboard side. The pad with two tabs (B, Figure 121) must be installed on the inboard side of the caliper.

12. Install the outboard pad into the caliper.
13. Hold the pad in place and install the pad pin bolts part way in to hold the outboard pad in place.
14. Install the inboard pad into the caliper.
15. Push the pad pin bolts through the inboard pad and tighten to 180-204 in.-lb. (20-23 N•m).
16. If tied to the frame, untie the rear brake pedal so it can be operated.
17. Refill the master cylinder reservoir.
18. While the motorcycle is stationary with the engine off, apply the rear brake several times to seat the pads against the disc.

**WARNING**
Do not ride the motorcycle until the brakes are operating correctly. If necessary, bleed the brake as described in this chapter.
19. Bed the pads in gradually for the first 100 miles (160 km) of riding by using only light pressure as much as possible. Immediate hard application glazes the new friction pads and greatly reduces their effectiveness.

REAR BRAKE CALIPER
(1986-EARLY 1987 MODELS)

Review Brake Service in this chapter.

Removal/Installation

NOTE
If the caliper is being removed for rear wheel service, proceed to Step 3.

1. Drain the brake fluid as described in this chapter.
2. Remove the brake line fitting (Figure 122, typical). Account for any washers. Plug the end of the hose and place it in a plastic bag to prevent leaks and hose contamination.
3. Remove the brake pads as described in this chapter.

NOTE
If the caliper is being removed for rear wheel service, insert a spacer block between the piston and the opposite side of the caliper to prevent the piston from being pushed out of the bore if the brake pedal is accidentally depressed. Suspend the caliper from the frame. Do not let the caliper hang from the brake line.

4. If the caliper is not going to be serviced, place it in a plastic bag to keep it clean.
5. To install, reverse the removal steps. Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m).

Disassembly

The manufacturer does not provide specifications for wear limits on any of the rear caliper components except brake pads. Replace any parts that appear to be worn or damaged.

Refer to Figure 123.
1. Pry the retaining ring out of the caliper with an awl or small screwdriver.
2. Remove the piston boot.

WARNING
Compressed air forces the piston out of the caliper body with considerable force. Do not try to cushion the piston by hand as injury could result.

3. Position a wood block and shop rag in the caliper as shown in Figure 124. Gradually apply compressed air through the brake line port and remove the piston.
4. Remove the piston seal from the caliper bore.
5. If necessary, remove the bleed valve.
6. Inspect the caliper as described in this section.

Inspection

1. Clean the caliper body and piston in new DOT 5 brake fluid or isopropyl alcohol and dry with compressed air.
2. Make sure the fluid passageways in the piston bores are clear. Apply compressed air to the openings to make sure they are clear. Flush the passageways, if necessary, with new brake fluid.
3. Make sure the fluid passageways in the caliper body are clear. Apply compressed air to the opening to make sure it is clear. Flush the passageway, if necessary, with new brake fluid.
4. Inspect the piston ring retaining clip groove. Replace the caliper if the groove is damaged.
5. Inspect the brake hose threaded hole in the caliper body. If worn or damaged, renew with the correct size thread tap or replace the caliper body.
6. Inspect the bleed valve threaded hole in the caliper body. If worn or damaged, renew with the correct thread tap or replace the caliper body.
7. Inspect the bleed valve. Apply compressed air to the opening and make sure it is clear. Flush out, if necessary, with clean brake fluid. Install the bleed valve securely.
8. Inspect the piston. Clean it with new brake fluid. If it cannot be cleaned with brake fluid and a soft rag, replace the piston.
9. Inspect the piston bore. Replace if damage is found.
10. Never reuse the piston boot or seal. Replace the piston boot and seal during assembly.

Assembly

1. Coat the following parts with new DOT 5 brake fluid:
   a. Piston.
   b. Piston boot.
   c. Piston seal.
2. Install the piston seal into the caliper bore.
3. Align the piston with the piston bore and install it. Press the piston in all the way.
4. Install the front piston boot.
5. Install a new retaining ring so that it seats completely in the groove and presses against the piston dust boot.
6. If removed, install the pad spring.
7. Install the brake pads as described in this chapter.

**REAR BRAKE CALIPER**
**(LATE 1987-1999 MODELS)**

Review *Brake Service* in this chapter.

**Removal**

**NOTE**
*If the caliper is being removed for rear wheel service, do not remove the brake line as noted in Step 1.*

1. Loosen and remove the banjo bolt from the caliper (A, *Figure 125*). Remove the bolt and the two washers. Plug the open hose end in a plastic bag to prevent leaks and to keep out contamination.
2. Remove the two caliper pin bolts (B, *Figure 125*) and lift the caliper off the mounting bracket.

**NOTE**
*If the caliper is being removed for rear wheel service, insert a wooden or plastic spacer block between the piston and the opposite side of the caliper to prevent the piston from being pushed out of the bore. Suspend the caliper from the frame. Do not hang the caliper from the brake hose.*

3. If the brake caliper is not going to be serviced, place it in a plastic bag to keep it clean.

**Installation**

1. If removed, install the brake pads as described in this chapter.
2. Align the caliper (A, *Figure 126*) with the brake pads and install it over the pads. Align the caliper holes with the caliper mounting bracket threaded holes and install the two pin bolts. See *Figure 117* and B, *Figure 125*. Start the bolts by hand, then tighten to 15-20 ft.-lb. (20-27 N•m).
3. Tighten the bleed valve (B, *Figure 126*) if it was previously loosened.
4. If removed, assemble the brake line onto the caliper by placing a *new* washer (*Figure 127*) on both sides of the brake line fitting (*Figure 128*), then secure the fitting to the caliper with the banjo bolt (A, *Figure 125*). Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N•m).
5. Bleed the brakes as described in this chapter.
6. While the motorcycle is stationary with the engine off, press the rear brake pedal several times to seat the pads against the disc.

**WARNING**
*Do not ride the motorcycle until the brakes are operating correctly.*
7. Bed the pads in gradually for the first 10 miles (160 km) by using light pressure as much as possible. Immediate hard application glazes new brake pads and greatly reduces their effectiveness.

Disassembly

Refer to Figure 129.
1. Remove the brake pads as described in this chapter.
2. Insert a small screwdriver placed in the caliper notch (Figure 130) and carefully pry the retaining ring (Figure 131) out of the caliper body.
3. Remove the piston dust boot from the groove at the top of the piston (Figure 132).
4. Remove the piston from the caliper.

**WARNING**

*Compressed air will force the piston out of the caliper under considerable force. Do not block the piston by hand because injury will occur.*

5. If the piston did not come partially out of the caliper bore, perform the following:
   a. Place a rag and a piece of wood in the caliper (Figure 133). Keep fingers out of the way of the piston.
   b. Apply compressed air through the brake hose port and force the piston (Figure 134). out of the caliper.
6. Remove the piston seal (A, Figure 135) from the groove in the caliper body and discard it.
7. Remove the rubber bushings (Figure 136) in the mounting bracket.

Assembly

Refer to Figure 129.
1. Install the new piston seal (A, Figure 135) into the caliper body groove.
2. Coat the piston and the caliper bore with new DOT 5 brake fluid.
3. Position the piston (Figure 134) with the open end facing out and install it into the caliper bore. Then push the piston in until it bottoms.
4. Install the new piston dust boot (Figure 132) onto the end of the piston.
5. Locate the retaining wire groove in the end of the caliper bore and install the wire into the wire groove (Figure 131). Make sure the retaining wire is seated completely in the groove and that it is pushing against the piston dust boot.
6. Install new rubber bushings (Figure 136) into the mounting bracket if worn or damaged.
7. Install the brake pads as described in this chapter.

Inspection

Service specifications for the rear caliper components are not available from the manufacturer. Replace worn, damaged or questionable parts.
1. Clean the caliper body and piston in new DOT 5 brake fluid or isopropyl alcohol and dry with compressed air.
2. Make sure the fluid passageways in the piston bores are clear. Apply compressed air to the opening to make sure they are clear. Flush the passageways, if necessary, with new brake fluid.
3. Make sure the fluid passageways (Figure 137) in the caliper body are clear. Apply compressed air to the opening to make sure it is clear. Flush the passageway, if necessary, with new brake fluid.
4. Inspect the piston ring retaining clip groove. Replace the caliper if the groove is damaged.
5. Inspect the banjo bolt threaded hole in the caliper body. If worn or damaged, renew with the correct size thread tap or replace the caliper.
6. Inspect the bleed valve threaded hole in the caliper body. If worn or damaged, renew with the correct thread tap or replace the caliper body.
7. Inspect the bleed valve. Apply compressed air to the opening and make sure it is clear. Flush out, if necessary, with new brake fluid. Install the bleed valve securely.
8. Inspect the piston (Figure 138). Clean it with new brake fluid. If it cannot be cleaned with brake fluid and a soft rag or if there are scratches on the piston surface, replace the piston.
9. Inspect the piston bore (B, Figure 135). Replace the caliper body if damage is found. Do not hone the caliper cylinder.
10. Check the mounting bracket for cracks or damage. Check the threads in the plate for damage. If damaged, renew the threads with the correct thread tap or replace the mounting bracket.
11. Check the pin bolt shoulder for scoring or wear; replace if necessary.
12. Check the pad retainer for cracks or damage.
13. Never reuse the piston boot or seal. Replace the piston boot and seal during assembly.

REAR BRAKE CALIPER (2000-2003 MODELS)

Review Brake Service in this chapter.
Refer to Figure 139.

Removal

NOTE
If the caliper is being removed for rear wheel service, proceed to Step 4.

1. Drain the brake fluid as described in this chapter.
2. Remove the brake line fitting (Figure 122). Account for any washers. Plug the end of the hose and place it in a plastic bag to prevent leaks and hose contamination.
3. Loosen the caliper body bolts. Do not remove.
4. Loosen the caliper mounting bolts.
5. Remove the brake pads as described in this chapter.
6. Remove the rear wheel as described in Chapter Thirteen.

NOTE
If the caliper is being removed for rear wheel service, insert a spacer block between the piston and the opposite side of the caliper to prevent the piston from being pushed out of the bore if the brake pedal is accidentally depressed. Suspend the caliper from the frame. Do not let the caliper hang from the brake line.

Installation

1. If removed, reinstall the brake pads as described in this chapter.
2. Slide the caliper onto the swing arm so the slot on the caliper engages the lip on the swing arm.
3. Install the rear wheel as described in Chapter Thirteen.
4. Secure the brake line to the caliper with the banjo bolt. Lubricate new sealing washers with new DOT 5 brake fluid, and install a new sealing washer on each side of the hose fitting. Tighten the banjo bolt to 17-22 ft.-lb. (23-30 N·m).
5. Bleed the brake system as described in this chapter.
6. While the motorcycle is stationary with the engine off, press the brake pedal several times to seat the pads against the disc.

WARNING
Do not ride the motorcycle until the brakes operate correctly.

7. Bed the pads in gradually for the first 10 miles (160 km) by using light pressure as much as possible. Immediate hard application glazes new brake pads and greatly reduces their effectiveness.
Disassembly

1. Remove the caliper as described in this section.
2. Remove the caliper body bolts ([Figure 140]) loosened during the removal procedure.
3. Separate the caliper body halves. Remove the O-rings ([Figure 141]). New O-rings must be installed every time the caliper is disassembled.

**NOTE**
*If the pistons were partially forced out of the caliper body during removal, steps 4-6 may not be necessary. If the pistons or caliper bores are corroded or very dirty, a small amount of compressed air may be necessary to completely remove the pistons from the body bores.*

4. Place a piece of soft wood and a folded shop cloth over the end of the pistons and the caliper body. Turn the assembly over and place it on the workbench with the pistons facing down.

**WARNING**
*Compressed air forces the pistons out of the caliper body under considerable force. Do not block the piston by hand as injury will occur.*
5. Apply the air pressure in short spurts to the brake fluid passageway to force out the pistons. Repeat this for the other caliper body half.

**CAUTION**

*Do not use a sharp tool to remove the dust and piston seals from the caliper cylinders. Do not damage the cylinder surface.*

6. Use a piece of wood or a plastic scraper to carefully push the dust seal and the piston seal in toward the caliper cylinder and out of their grooves. Remove the dust and piston seals.

7. If necessary, unscrew and remove the bleed valve (Figure 142).

8. Inspect the caliper as described in this section.

**Inspection**

1. Clean both caliper body halves and pistons in new DOT 5 brake fluid or isopropyl alcohol and dry them with compressed air.
2. Make sure the fluid passageways (Figure 143) in the piston bores are clear by applying compressed air to the openings. Flush them, if necessary, with new brake fluid.
3. Make sure the fluid passageways (Figure 144) in both caliper body halves are clear by applying compressed air to the openings. Flush them, if necessary, with new brake fluid.
4. Inspect the piston and dust seal grooves in both caliper bodies for damage. If they are damaged or corroded, replace the caliper assembly.
5. Inspect the banjo bolt threaded hole in the caliper body. If it is worn or damaged, clean it out with a thread tap or replace the caliper assembly.
6. Inspect the bleed valve threaded hole in the caliper body. If it is worn or damaged, clean it out with a thread tap or replace the caliper assembly.
7. Inspect the bleed valve. Apply compressed air to the opening and make sure it is clear. Flush it, if necessary, with new brake fluid. Install the bleed valve and tighten 80-100 in.-lb. (9-11 N*m).
8. Inspect both caliper bodies for damage. Check the inboard caliper mounting bolt hole threads (Figure 145) for wear or damage. Renew them with a thread tap or replace the caliper.
9. Inspect the cylinder walls and pistons for scratches, scoring or other damage.
10. Check the anti-rattle spring for wear or damage.

**Assembly**

**WARNING**

*Never reuse old dust seals or piston seals.*

1. Soak the new dust and piston seals in new DOT 5 brake fluid.
2. Coat the piston bores and pistons with new DOT 5 brake fluid.
3. Install the new piston seals into the lower grooves. Make sure the seals are properly seated in their respective grooves.
4. Install the new dust seals into the upper grooves. Make sure all seals are properly seated in their respective grooves.
5. Repeat Step 3 and Step 4 for the other caliper body half.
6. Position the pistons with the open end facing out and install the pistons into the caliper cylinders. Push the pistons in until they bottom.
7. Repeat Step 6 for the other caliper body half. Make sure all pistons are installed correctly.
8. Coat the new O-ring seals with new DOT 5 brake fluid and install the O-rings into the inboard caliper half.
9. Install the anti-rattle spring (Figure 146) onto the boss on the outboard caliper half.
10. Make sure the O-rings are still in place and assemble the caliper body halves.
11. Install the caliper body bolts (Figure 140) and tighten them securely. They will be tightened to the specified torque after the caliper is installed on the rear disc.
12. Install a new rubber caliper bumper (Figure 147) if it was removed.
13. Install the bleed valve assembly (Figure 142) if it was removed and tighten it to 80-100 in.-lb. (9-11 N•m).
14. Install the caliper as described in this section.
15. Tighten the caliper mounting bolts to 28-38 ft.-lb. (38-52 N•m).
16. Bleed the brakes as described in this chapter.

REAR MASTER CYLINDER
(1986-EARLY 1987 MODELS)

Review Brake Service in this chapter. Refer to Figure 148.

Removal/Installation
1. Open the bleed valve (Figure 149). Attach one end of a hose to the bleed valve and insert the opposite end in an empty container. Drain the brake fluid as described in this chapter.
2. Remove the bolts (Figure 150) securing the master cylinder to the sprocket cover.
3. Disconnect the brake line from the master cylinder.
4. Pull the master cylinder clear of the pushrod.
5. Remove the cupped washer (14, Figure 148), spring (15) and rubber boot (16).
6. Install by reversing the preceding removal steps while noting the following.
7. Slide the rubber boot (16, Figure 148) over the pushrod. Turn the boot so that its drain hole faces down.
8. Slide the spring (15, Figure 148) and cupped washer (14) through the pushrod and into the boot.
9. Hold the master cylinder in one hand and align the master cylinder piston with the pushrod (Figure 151). Then align the master cylinder body with the cover mounting holes and install the mounting bolts (Figure 150). Tighten the bolts to 155-190 in.-lb. (18-21 N•m).
10. Install the brake hose onto the master cylinder. Tighten the hose securely.
11. Bleed the brake system as described in this chapter.
12. Adjust the rear brake as described in Chapter Three.

Disassembly
1. Remove the master cylinder cover and diaphragm.
2. Remove the retaining ring (13, Figure 148) from the body. Then remove the following parts in order:
   a. Piston assembly (12, Figure 148).
   b. Piston cup (10, Figure 148).
   c. Spring seat (9, Figure 148).
   d. Spring (8, Figure 148).
3. Remove the seal (11, Figure 148) from the piston.

Inspection
1. Clean all parts in new DOT 5 brake fluid. Inspect the cylinder bore and piston contact surfaces for signs of wear or damage. If either part is less than perfect, replace it.
2. Check the end of the piston for wear caused by the pushrod. Replace the entire piston assembly if any portion of it is worn or damaged.
REAR MASTER CYLINDER
(1986-EARLY 1987 MODELS)

1. Screw
2. Cover
3. Diaphragm
4. Brake line
5. Housing
6. Lockwasher
7. Bolt
8. Spring
9. Spring seat
10. Piston cup
11. Seal
12. Piston
13. Snap ring
14. Cupped washer
15. Spring
16. Rubber boot
17. Pushrod
18. Nut
19. Rod end
20. Pin
21. Snap ring
22. Brake pedal
23. Cotter pin
24. Adjusting screw
25. Locknuts
3. Make sure the passages in the bottom of the master cylinder are clear. Check the reservoir cap and diaphragm for damage and deterioration. Replace if necessary.
4. Inspect the threads in the master cylinder body where the brake line screws in. If the threads are damaged, replace the master cylinder body.

Assembly

1. Soak the new cups in new DOT 5 brake fluid for at least 15 minutes to make them pliable. Coat the inside of the cylinder with new brake fluid before assembling the parts.
2. Install a new seal (11, Figure 148) on the piston.
3. Push the spring seat (9, Figure 148) into the spring (8). Then install the assembly into the cylinder bore.
4. Slide the piston cup (10, Figure 148) into the bore and over the spring seat (9).
5. Install the piston assembly (12, Figure 148) into the bore and install the retaining ring (13) into the housing groove.

REAR MASTER CYLINDER
(LATE 1987-2003 MODELS)

Review Brake Service in this chapter. Refer to Figure 152.

Removal

1. Drain the brake fluid as described in this chapter.
2. Place shop towels under the banjo bolt (Figure 153) and remove the fitting and the washers securing the brake hose to the master cylinder. Plug the end of the brake hose and put it in a plastic bag to prevent leaks and to keep out contamination.
3. Remove the bolts (Figure 154) securing the master cylinder to the sprocket cover.
4. Loosen the rod end locknut (A, Figure 155). Then turn the pushrod (B, Figure 155) until it is free of the rod end (C).
5. Remove the master cylinder.

Installation

1. Slide the boot (D, Figure 155) over the pushrod. Turn the boot so that the drain hole faces down.
2. Position the master cylinder next to the sprocket cover. Thread the rod end (C, Figure 155) into the pushrod (B). Tighten the locknut (A, Figure 155) securely.
3. Align the master cylinder holes with the sprocket cover threaded holes and install the master cylinder mounting bolts and washers (Figure 154). Tighten the bolts to 155-190 in.-lb. (18-21 N•m).

NOTE
Some models are equipped with a solid metal washer on each side of the banjo bolt. Later models are equipped with steel/rubber washers (Figure 156). Be sure to install new washers that match the old washers.

4. Install a new washer (Figure 156) on each side of the brake hose banjo fitting. Insert the banjo bolt through the washers and banjo fitting as shown in Figure 157. Thread the bolt (Figure 153) into the cartridge locknut. Tighten the banjo nut to 17-22 ft.-lb. (23-30 N•m).
5. Bleed the rear brake as described in this chapter.
6. Adjust the rear brake as described in Chapter Three.

WARNING
Do not ride the motorcycle until the brakes operate properly.
REAR MASTER CYLINDER
(LATE 1987-2003 MODELS)

1. Banjo bolt
2. Banjo bolt washers
3. Brake hose
4. Cartidge locknut
5. Bolt
6. Washer
7. Master cylinder housing
8. Diaphragm
9. Cover
10. Screw
11. O-rings
12. Cartidge body
13. Pushrod
14. Spacer
15. Snap ring
16. Spring
17. Retainer
18. Rubber boot
19. Flat washer
20. Snap ring
21. Nut
22. Clevis
23. Rod end
24. Pin
25. Brake pedal
26. Nut
27. Circlip
Disassembly

1. Remove the master cylinder cover and diaphragm.
2. Press down on the large washer (A, Figure 158) and compress the spring. Then remove the snap ring (B, Figure 158) from the pushrod groove. Remove the large washer, rubber boot, retainer (inside boot) and spring (Figure 159).

   **CAUTION**
   Do not damage the pushrod when loosening the locknut.

3. Loosen and remove the cartridge locknut (Figure 160).
4. Withdraw the cartridge body (Figure 161) and pushrod assembly from the master cylinder housing.
5. Remove the snap ring (Figure 162) from inside the cartridge bore.
6. Pull the pushrod (A, Figure 163) and spacer (B) out of the cartridge.
7. Do not remove the O-rings from the cartridge body grooves unless replacement is required. The O-rings are available only as part of the master cylinder body and master cylinder repair kits. They cannot be purchased separately.
8. Further disassembly of the cartridge body is not recommended. While the piston and spring can be removed from the cartridge body, do not remove them as the piston cups, mounted on the piston, may be damaged. If the piston or any of its components (spring and pistons cups) are damaged, replace the cartridge body.

**Inspection**

1. Clean the master cylinder and cartridge body in new DOT 5 brake fluid. Make sure the reservoir vent hole (Figure 164) is clear.
2. Inspect the master cylinder bore (Figure 165). If the bore is cracked, corroded, scratched or damaged, replace the master cylinder assembly.
3. Check the reservoir cap and diaphragm for damage and deterioration. Replace if necessary.
4. Inspect the pushrod (A, Figure 163). If the pushrod is bent, cracked, corroded or damaged, replace it.
5. Inspect the cartridge body and the two O-rings (Figure 163). If the cartridge body threads or O-ring grooves are damaged, replace the cartridge body. Do not remove the piston assembly from the cartridge body.

**Assembly**

1. Wash the parts in clean DOT 5 brake fluid. Clean the cartridge body O-ring grooves with a soft brush.
2. Slide the spacer (B, Figure 163) onto the pushrod (A) and install the pushrod into the cartridge body with the ball end first. Then push the pushrod down to compress the piston and spring and install the snap ring (Figure 162) into the groove in the cartridge body. Release the pushrod and make sure the circlip is fully seated in the groove. Make sure the pushrod rotates freely after releasing it.
3. Lubricate the two new cartridge body O-rings with brake fluid and install them into the cartridge body O-ring grooves.
4. Lightly coat the cartridge body with brake fluid. Then insert the cartridge body (Figure 161) into the master cylinder bore with the threaded end first. Align the slot on the cartridge body with the key in the master cylinder body (Figure 166). Push the cartridge body through the master cylinder until it bottoms.
5. Install and tighten the cartridge body locknut (Figure 160) to 30-40 ft.-lb. (41-54 N•m).
6. Place the master cylinder housing in a vise with soft jaws so that the pushrod faces up.
7. Install the spring and the spring retainer over the pushrod. Install the rubber boot, with the large end first, over the pushrod and slide over the spring retainer and spring. Then seat the spring retainer into the small end of the rubber boot. Turn the rubber boot so that the drain hole will be facing down when the master cylinder is installed on the motorcycle. Refer to Figure 159.

8. Slide the large flat washer over the pushrod and rest it against the rubber boot. Then push the washer down to compress the spring and install a new snap ring in the pushrod groove (Figure 158). Make sure the snap ring seats in the groove completely. Release the spring and allow the large washer to seat against the snap ring.

9. Install the master cylinder as described in this section.

**WARNING**

*Do not ride the motorcycle until the brakes operate properly.*

**BRAKE HOSE AND LINE REPLACEMENT**

Review *Brake Service* in this chapter.

A combination of steel and flexible brake lines are used to connect the master cylinder to the brake caliper. Banjo bolts are used to connect brake hoses to the master cylinder or brake calipers. A threaded fitting connects the brake line to the rear master cylinder and rear brake caliper on 1986-early 1987 models. Steel/rubber banjo washers (Figure 167) are used to seal the hose fittings, except on early models which may use all-metal washers. Be sure to install new banjo bolt washers that match the old washers, otherwise, leaks may occur.

While there is no factory-recommended replacement interval for the brake hoses, it is a good idea to replace a hose when the flexible portion shows signs of swelling, cracking or other damage. Likewise, the brake hose should be replaced when the metal portion leaks or if there are dents or cracks.

**Front Brake Hose Removal/Installation**

A combination steel/flexible brake hose (Figure 168) is used to connect the front master cylinder to the front brake caliper.

When purchasing a new hose, compare it to the old hose to make sure that the length and angle of the steel hose portion is correct. Install new banjo bolt washers that match the old washers.

1. Drain the brake fluid from the front brake system as described in this chapter.
2. Before removing the brake line, note how the brake line is routed from the master cylinder to the caliper. In addition, note the number and position of the metal hose clamps and plastic ties used to hold the brake line in place. Install the
**FRONT BRAKE HOSE ASSEMBLY**

1. Banjo bolt
2. Washer
3. Hose

To master cylinder

To brake caliper
brake hose following the same path and secured at the same position.

3. Cut the plastic ties and discard them. New plastic ties must be installed.

4. Remove the screw or nut holding the metal clamps around the brake line. Spread the clamp and remove it from the brake line. See **Figure 169** and **Figure 170**, typical. The metal clamps can be reused.

**CAUTION**

*After disconnecting the brake hose, plug the open ends and put them in plastic bags to prevent spills and to keep out contamination.*

5. Remove the banjo bolt and washers securing the hose at the brake caliper (**Figure 171**).
6. Remove the banjo bolt and washers securing the hose at the master cylinder (**Figure 172**).
7. Remove the brake hose from the motorcycle.
8. If reusing the brake hose assembly, inspect it as follows:
   a. Check the metal pipe portion for cracks or fractures. Check the junction where the metal pipe enters and exits the flexible hose. Check the crimped clamp for looseness or damage.
   b. Check the flexible hose portion for swelling, cracks or other damage.
   c. Replace the hose assembly, if necessary.
9. Install the brake hose, banjo bolt washers and the banjo bolt in the reverse order of removal. Install the banjo bolt washers on both sides of the banjo hose fitting; see **Figure 168**. The hose must not be twisted or kinked.
10. Install the clips and guides to hold the brake hose in place.
11. Tighten the banjo bolts to 17-22 ft.-lb. (23-30 N•m).
12. Refill the master cylinder with new DOT 5 brake fluid as described in Chapter Three.
13. Bleed the brake system as described in this chapter.

**WARNING**

*Do not ride the motorcycle until the brakes operate properly.*

**Rear Brake Hose Removal/Installation**

A single combination steel/flexible brake hose (**Figure 173**) is used to connect the rear master cylinder to the rear brake caliper.
When purchasing a new hose, compare it to the old hose to make sure that the length and angle of the steel hose portion is correct. Install banjo bolt washers (Figure 167) that match the old washers.

1. Drain the hydraulic brake fluid from the rear brake system as described in this chapter.
2. Before removing the brake line, note how the brake line (Figure 174, typical) is routed from the master cylinder to the caliper. In addition, note the number and position of the metal hose clamps and plastic ties used to hold the brake line in place. Install the brake hose following the same path and secured at the same position.
3. Cut the plastic ties and discard them. New plastic ties must be installed.
4. Remove the screw or nut holding the metal clamps around the brake line. Spread the clamp and remove it from the brake line. The metal clamps can be reused.

**CAUTION**

*After disconnecting the brake hose plug the open ends and put them in plastic bags to prevent leaks and to keep out dirt.*

5. Remove the banjo bolt and washers securing the hose at the brake caliper (Figure 175).
6. Remove the banjo bolt and washers securing the hose at the master cylinder (Figure 176).
7. Disconnect the rear brake light switch electrical connectors at the switch (Figure 177).
8. Remove the brake hose from the motorcycle.
9. If reusing the brake hose assembly, inspect it as follows:
   a. Check the metal pipe portion for cracks or fractures. Check the junction where the metal pipe enters and exits the flexible hose. Check the crimped clamp for looseness or damage.
   b. Check the flexible hose portion for swelling, cracks or other damage.
   c. Replace the hose assembly, if necessary.
10. If necessary, remove the rear brake light switch from the tee fitting in the rear brake line (Figure 173). Reverse to install the switch. Tighten the rear brake light switch to 84-120 in.-lb. (9-14 N•m).
11. Install a new brake hose, banjo bolt washers in the reverse order of removal. Be sure to install new sealing washers on both sides of the hose fitting. See Figure 176 and Figure 178.
12. Refill the master cylinder with new DOT 5 brake fluid.
13. Bleed the rear brake system as described in this chapter.

**WARNING**

*Do not ride the motorcycle until the brakes operate properly.*

**BRAKE DISC**

Review *Brake Service* in this chapter.
A single brake disc is bolted to the front and rear wheels except on 1200S, which is equipped with two brake discs mounted on the front wheel. Brake discs should be checked for runout and thickness. The minimum disc thickness is stamped on original equipment brake discs (Figure 179). Table 1 lists disc brake specifications.

Removal/Installation

**CAUTION**

*Do not set the wheel down on the brake disc surface, as it may be damaged.*

1. Remove the front or rear wheel as described in Chapter Thirteen.

**NOTE**

*Place a spacer between the brake pads in place of the disc. If the brake lever is inadvertently applied, the pistons will not be forced out of the caliper. If the pistons are forced out, disassemble the caliper and reseat the pistons as described in this chapter.*

2. Remove the bolts and locknuts securing the brake disc to the hub and remove the disc. See Figure 180, typical.

3. Check the brake disc bolts and locknuts for thread damage. Replace worn or damaged fasteners.

4. Clean the disc and the disc mounting surface with brake cleaner or contact cleaner. Allow surfaces to dry before installation.

5. To install the front brake disc perform the following:
   a. On 1986-1994 models, align the notch in the disc with the 1/4 in. (6.3 mm) diameter hole in the hub and install the disc; see A, Figure 181.
   b. Install new T-40 Torx bolts (B, Figure 181). Tighten to the bolts to 16-24 ft.-lb. (22-33 N•m).

6A. To install the rear brake disc on 1986-1991 models perform the following:
   a. On cast wheels, install new bolts and tighten them to 23-27 ft.-lb. (31-37 N•m).
   b. On laced wheels, install new bolts and locknuts and tighten them to 23-27 N•m (31-37 ft.-lb.).

6B. To install the rear brake disc on 1992-2003 models perform the following:
   a. The Torx bolts (Figure 182) used to secure the rear brake disc were originally equipped with a patch of thread locking compound. The manufacturer specifies that these bolts can be used for three removal and installation cycles. After the third cycle, discard the bolts and install a new set.
   b. On cast wheels, install bolts and tighten to 30-45 ft.-lb. (41-61 N•m).
   c. On laced wheels, install the bolts and locknuts. Tighten to 30-45 ft.-lb. (41-61 N•m).
Inspection

It is not necessary to remove the disc from the wheel to inspect it. Small marks on the disc are not important, but radial scratches deep enough to snag a fingernail reduce braking effectiveness and increase brake pad wear. If these grooves are found, the disc should be resurfaced or replaced.

1. Measure the thickness around the disc at several locations (Figure 183). The disc must be replaced if the thickness at any point is less than the minimum thickness stamped on the disc (Figure 179). Refer to Table 1 for thickness specifications.

2. Clean any rust or corrosion off the disc and wipe clean with brake cleaner or lacquer thinner. Never use an oil-based solvent that may leave an oil residue on the disc.

BLEEDING

WARNING
Do not ride the motorcycle until the brakes are operating correctly.

WARNING
Dispose of the brake fluid expelled during the bleeding process. Do not reuse brake fluid.

NOTE
These procedures are shown on the front wheel and apply to the rear wheel as well.

NOTE
Some calipers are equipped with two bleed screws. Perform the bleeding procedure for both bleed screws.

NOTE
Before bleeding the brake, make sure all brake hoses and lines are tight.

NOTE
If bleeding is difficult, allow the fluid to stabilize for a few hours. Repeat the bleeding procedure when the tiny bubbles in the system settle out.

NOTE
Do not allow the master cylinder reservoir to empty during the bleeding operation or more air will enter the system. If this occurs, repeat the procedure.

General Bleeding Tips

When bleeding the brakes, not the following:

1. Review Brake Service in this chapter.

2. Clean the bleed valves and the area around the valves of debris. Make sure the passageways in the end of the bleed valves are clear and open.

3. Use a box-end wrench to open and close the bleed valves. This helps prevent damages to the valves.

4. Replace damaged bleed valves.

5. Install the box-end wrench on the bleed valve before installing the catch hose. This allows the wrench to remain in place during the procedure.

6. Use a clear plastic hose to allow visual inspection of the brake fluid as it leaves the caliper. Air bubbles visible in the catch hose indicate air in the brake system.

7. Depending on the play of the bleed valve when it is loosened, it may be possible to see air in the catch hose even though no air is in the system. A loose or damaged catch hose can also cause air leaks. In both cases, air is being introduced into the hose at the bleed valve threads and the catch hose connection, and not from within the brake system.

8. Open the bleed valve just enough to allow fluid to pass through the valve and into the catch bottle. The farther the bleed valve is opened, the looser the valve becomes. This allows air to be drawn into the system from around the valve threads.

9. If air is suspected of entering from around the bleed valve threads, pack the area around the valve with silicone brake grease.

WARNING
Do not force grease into the caliper past the bleed valve threads. This can block the bleed
valve passageways and contaminate the brake fluid.

10. If the system is difficult to bleed, lightly tap the banjo bolt on the master cylinder a few times. It is not uncommon for air bubbles to become trapped in this hose connection where the brake fluid exits the master cylinder. When a number of bubbles appear in the master cylinder reservoir after tapping the banjo bolt, it means air is trapped in this area.

11. When the front master cylinder cover is removed and brake fluid is in the reservoir, brake fluid can spurt out of the reservoir any time the lever is operated. To prevent this, make sure to leave the reservoir cover in place except when filling it with fluid.

12. When adding brake fluid to the reservoir, do not allow fluid to enter the cover bolt holes. This fluid leaks out when the cover bolts are installed and tightened. Before installing the cover, inspect the holes for fluid and remove any residual fluid.

Vacuum Bleeding

This one-person procedure uses a hydraulic brake bleeding tool (Figure 184, typical).

1. Support the motorcycle on a suitable stand.
2. Remove the cap (Figure 185) from the caliper bleed valve.
3. Place a clean shop cloth over the caliper to protect it from accidental brake fluid spills.
4. Assemble the bleeding tool according to the manufacturer’s instructions. Connect it to the caliper bleed valve (Figure 185).
5. Clean the top of the master cylinder reservoir.
6. Refer to Chapter Three and verify that the master cylinder reservoir is full.
7. Operate the pump several times to create a vacuum in the line. Open the bleed valve. Brake fluid will quickly draw from the caliper into the bleed tool reservoir. Tighten the caliper bleed valve before the fluid stops flowing through the hose. To prevent air from being drawn into the system through the master cylinder, add fluid to maintain its level at the top of the reservoir.
8. Continue the bleeding process until the fluid drawn from the caliper is bubble free. If bubbles are withdrawn with the brake fluid, more air is trapped in the line. Repeat Step 7 while being sure to refill the master cylinder to prevent air from being drawn into the system.
9. When the brake fluid is free of bubbles, tighten the bleed valve and remove the brake bleeder tool. Reinstall the bleed valve cap.
10. If necessary, add fluid to correct the level in the master cylinder reservoir as described in Chapter Three.
11. On 1200S models, repeat Steps 1-10 for the other front brake caliper.
12. Reinstall the reservoir diaphragm, diaphragm plate and cover.
13. Test the feel of the brake lever or pedal. It must be firm and offer the same resistance each time it is operated. If it feels spongy, air is still in the system and it must be bled again. After bleeding the system, check for leaks and tighten all fittings and connections as necessary.
14. Test ride the motorcycle slowly at first to make sure that the brakes are operating properly.

Manual Bleeding

1. Support the motorcycle on a suitable stand.
2. Remove the dust cap (Figure 185) from the caliper bleed valve.
3. Place a clean shop cloth over the caliper to protect it from accidental brake fluid spills.
4. Clean the top of the master cylinder reservoir of all dirt and foreign matter.
5. Refer to Chapter Three and verify that the master cylinder reservoir is full.
6. Connect a length of clear tubing to the bleed valve on the caliper (Figure 185). Place the other end of the tube into a clean container (Figure 186). Fill the container with enough new DOT 5 brake fluid to keep the end of the tube submerged. The tube must be long enough so that a loop can be made higher than the bleed valve to prevent air from being drawn into the caliper during bleeding.
7. Slowly apply the brake lever or brake pedal several times. Hold the lever in the applied position and open the bleed valve about 1/2 turn. Allow the lever to travel to its limit. When the limit is reached, tighten the bleed valve, then release the brake lever. As the brake fluid enters the system, the level will drop in the master cylinder reservoir. Maintain the full fluid level in the reservoir to prevent air from being drawn into the system.

8. Continue the bleeding process until the fluid coming from the hose is completely free of air bubbles. If the fluid is being replaced, continue until the fluid emerging from the hose is clean.

9. Hold the lever in the applied position and tighten the bleed valve. Remove the bleed tube and install the bleed valve dust cap.

10. If necessary, adjust the fluid level in the master cylinder reservoir as described in Chapter Three.

11. On 1200S models, repeat Steps 1-10 for the other caliper.

12. Install the diaphragm, diaphragm plate and cover.

13. Test the feel of the brake lever or pedal. It must be firm and offer the same resistance each time it is operated. If it feels spongy, it is likely that there is still air in the system and it must bleed it again. After bleeding the system check for leaks and tighten all fittings and connections as necessary.

14. Test ride the motorcycle slowly at first to make sure that the brakes are operating properly.

**BRAKE FLUID DRAINING**

Before disconnecting a brake hose from the front or rear brake, drain the brake fluid as described in this section. Doing so reduces the amount of brake fluid that can spill out when disconnecting the brake hoses and lines from the system.

Review *Brake Service* in this chapter. Review *Brake Bleeding* in this chapter.

---

**Front Brake Lever Line**

1. Support the motorcycle on a suitable stand.
2. Turn the handlebars to level the front master cylinder and remove the reservoir cover (Figure 187), diaphragm plate and diaphragm.
3A. Attach a vacuum bleeding tool as described in *Bleeding the System* in this chapter.
3B. Attach a tube to the bleed valve and submerge the tube into a container as described in *Bleeding the System* in this chapter.
4A. Open the bleed valve and operate the vacuum bleeder tool to draw out as much of the fluid as possible from the brake line.
4B. Open the bleed valve and apply the brake lever to pump to force brake fluid from the line.
5. Close the bleed valve and disconnect the vacuum tool or the hose.
6. On 1200S models, repeat for the other caliper.
7. Service the brake components as described in this chapter.

**Rear Brake Pedal Line**

1. Support the motorcycle on a suitable stand.
2. Remove the rear brake master cylinder reservoir cap (Figure 188) from the reservoir.
3A. Attach a vacuum bleeding tool as described in *Bleeding the System* in this chapter.
3B. Attach a tube to the bleed valve and submerge the tube into a container as described in *Bleeding the System* in this chapter.
4A. Open the bleed valve and operate the vacuum bleeder tool to draw out as much of the fluid as possible from the brake line.
4B. Open the bleed valve and apply the brake lever to pump to force brake fluid from the line.
4. Disconnect the brake bleeder and remove it from the brake caliper.
5. Service the brake components as described in this chapter.

**FLUSHING THE BRAKE SYSTEM**

*WARNING*

Never reuse old brake fluid. Properly discard all brake fluid flushed from the system.

When flushing the brake system, use DOT 5 brake fluid as a flushing fluid. Flushing consists of pulling new brake fluid through the system until the new fluid appears at the caliper and without the presence of any air bubbles. To flush the brake system, follow one of the bleeding procedures described in the *Bleeding the System* section in this chapter.

---

**Table 1 BRAKE SYSTEM SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake fluid</td>
<td>DOT 5</td>
</tr>
<tr>
<td>Brake pad thickness (min.)</td>
<td>0.062 in. (1.6 mm)</td>
</tr>
<tr>
<td>Brake disc runout (max.)</td>
<td>0.008 in. (0.2 mm)</td>
</tr>
<tr>
<td>Rear master cylinder pushrod free play</td>
<td>0.04 in. (1.02 mm)</td>
</tr>
<tr>
<td>Brake disc thickness (min.)</td>
<td></td>
</tr>
<tr>
<td>Front</td>
<td>0.180 in. (4.57 mm)</td>
</tr>
<tr>
<td>Rear</td>
<td>0.205 in. (5.21 mm)</td>
</tr>
</tbody>
</table>

**Table 2 BRAKE SYSTEM TORQUE SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Ft.-Lb.</th>
<th>In.-Lb.</th>
<th>N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banjo bolt</td>
<td>17-22</td>
<td>–</td>
<td>23-30</td>
</tr>
<tr>
<td>Bleed valve</td>
<td>–</td>
<td>80-100</td>
<td>9-11</td>
</tr>
<tr>
<td>Brake pad pin, front and rear (2000-2003 models)</td>
<td>–</td>
<td>180-204</td>
<td>20-23</td>
</tr>
<tr>
<td>Brake pad retainer screw (1986-1999 models)</td>
<td>40-50</td>
<td>–</td>
<td>5-6</td>
</tr>
<tr>
<td>Front caliper lower mounting pin (1986-1999 models)</td>
<td>25-30</td>
<td>–</td>
<td>34-41</td>
</tr>
<tr>
<td>Front caliper mounting bolts (2000-2003 models)</td>
<td>28-38</td>
<td>–</td>
<td>38-52</td>
</tr>
<tr>
<td>Master cylinder clamp screws</td>
<td>–</td>
<td>70-80</td>
<td>8-9</td>
</tr>
<tr>
<td>Master cylinder cover screws</td>
<td>–</td>
<td>6-8</td>
<td>0.5-1</td>
</tr>
<tr>
<td>Rear brake light switch</td>
<td>–</td>
<td>84-120</td>
<td>9-14</td>
</tr>
<tr>
<td>Rear caliper mounting bolts (late 1987-1999 models)</td>
<td>15-20</td>
<td>–</td>
<td>20-27</td>
</tr>
<tr>
<td>Rear caliper mounting bolts (2000-2003 models)</td>
<td>28-38</td>
<td>–</td>
<td>38-52</td>
</tr>
<tr>
<td>Rear master cylinder cartridge body locknut (late 1987-2003 models)</td>
<td>30-40</td>
<td>–</td>
<td>41-54</td>
</tr>
<tr>
<td>Rear master cylinder mounting bolts</td>
<td>–</td>
<td>155-190</td>
<td>18-21</td>
</tr>
<tr>
<td>Brake disc mounting bolts</td>
<td>16-24</td>
<td>–</td>
<td>22-23</td>
</tr>
<tr>
<td>Front</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This chapter covers body components including the seat, fenders, footrests, forward controls, sidestand and fork lock.

Fuel tank removal is covered in Chapter Ten or Chapter Eleven.

Table 1 is at the end of this chapter.

SEAT

Removal/Installation

1. Remove the seat retaining bolt (Figure 1).
2. Move the seat towards the rear of the motorcycle so the seat disengages from the frame tab.

   NOTE
   On 1997-2003 models, account for the nylon retaining clip that retains the seat bolt nut in the fender.

3. Reverse the removal steps to install the seat. Be sure the seat is secure before operating the motorcycle.

FRONT FENDER

Removal/Installation

Refer to Figure 2.

1. Hold the front fender so it cannot fall after removal of the mounting bolts.
2. Remove the locknuts and bolts on both sides of the fender.
3. Remove the front fender.
4. Reverse the removal steps to install the front fender. Tighten the locknuts to 96-156 in.-lb. (11-18 N•m).

REAR FENDER

Removal/Installation

1986-1993 models

Refer to Figure 3.
1. Remove the seat as described in this chapter.
2. Disconnect the negative battery cable (Chapter Twelve).
3. Locate the turn signal and taillight/brake light terminal block in the area beneath the seat. Disconnect the terminal block connectors. Remove the connector on the wire lead to the rear fender as described in Chapter Twelve.
4. Remove the circuit breakers (A, Figure 4) from the retaining clips on the rear fender.
5A. On 1986-1989 models, remove the turn signal mounting bolts inside the fender and remove turn signals.
5B. On 1990-1993 models, remove the turn signal retaining nuts inside the fender and remove turn signals.
6. Note the location of spacers when removing fender retaining fasteners. Remove the mounting bolt, spacer and locknut that attaches the front of the fender to the frame bracket (B, Figure 4).
7. Remove bolts on both sides of the fender (Figure 5, typical) and remove the fender.
8. Reverse the removal steps to install the rear fender while noting the following:
   a. Install the short fender mounting bolts in the rear fender mounting holes.
   b. Install the fender mounting bolt (B, Figure 4) so the nut is on top. Tighten the nut to 120 in.-lb. (13.6 N•m).
   c. On 1986-1989 models, tighten the turn signal mounting bolt to 33 ft.-lb. (45 N•m).
   d. On 1990-1993 models, tighten the turn signal retaining nut to 96-156 in.-lb. (11-17 N•m).

1994-2003 models

Refer to Figure 6, typical.
1. Remove the seat as described in this chapter.
2. Note the location of spacers when removing fender retaining fasteners. Remove the mounting bolt, spacer and locknut that attaches the front of the fender to the frame bracket (Figure 7).
3. On both sides, remove the rear turn signal retaining nut and spacer on the inside of the rear fender.
4. On both sides, remove the strut cover retaining screws, nuts and spacers (Figure 5). Move the strut covers out of the way.
5. On 1994-1998 models, locate the turn signal and taillight/brake light connectors in the area beneath the seat. Disconnect the connectors. Remove the connector on the taillight/brake light wire lead to the rear fender as described in Chapter Twelve.
6. On 1999-2003 models, depress the locking tab on the top of the connectors and remove the left- and right-turn
REAR FENDER
(1986-1993 MODELS)

1. Bolt
2. Washer
3. Fender
4. Bolt
5. Lockwasher
6. Rivet
7. Clip
8. Lockwasher
9. Locknut
10. Washer
11. Fender extension
12. Rivet
13. Washer
14. Splash guard
16. Nut
17. Cup washer
18. Bolt
19. Insert
20. Bolt
21. Reflector
22. Mounting plate
23. Support (1990-1993 models)
24. Bolt
25. Bolt
26. Reflector
27. Carriage bolt
28. Clamp
29. Bracket
30. Washer
31. Lockwasher
32. Nut
33. Nut
34. License plate bracket
35. Reflector
8. Remove the rear fender, including the taillight base and turn signal module.
9. If necessary, remove the taillight base and turn signal module (1998-2003 models) from the rear fender.
10. Reverse the removal steps to install the rear fender while noting the following:
   a. Tighten the turn signal and strut cover mounting fasteners (Figure 5) to 96-156 in.-lb. (11-18 N•m).
b. Install the fender mounting bolt (Figure 7) so the nut is on top. Tighten the nut to 120 in.-lb. (14 N·m).

FOOTRESTS

Removal/Installation

Refer to Figure 9 or Figure 10.

1. Remove the footrest retaining bolt. On models so equipped, do not lose the spring washer between the footrest and clevis.

2. Remove the footrest.

3. Install the footrest by reversing the removal steps. Install the spring washer, if so equipped, so the square end is toward the motorcycle.

FORWARD FOOT CONTROLS

(1999-2003 883C AND 1200C MODELS)

The shift and brake pedals are mounted on the left- and right-lower front engine mounting brackets. Both forward foot-control assemblies must be removed during engine re-
moval. Remove the controls as described in this chapter at the appropriate place during the engine removal procedure. Refer to Figure 11.

### Shift Pedal Removal/Installation

1. Remove the bolts and washers securing the shift rod to the shift lever and to the shift pedal, and then remove the shift rod.
2. Remove the two bolts securing the left engine-mounting bracket to the frame (A, Figure 12). Note the location of the P-clamp (B, Figure 12). The clamp must be reinstalled in the same location during assembly.
3. Remove the two bolts securing the left engine-mounting bracket to the engine (C, Figure 12), and remove the shift pedal mounting plate assembly.
4. If necessary, disassemble the shift pedal mounting plate assembly as described in this section.
5. Installation is the reverse of removal. Note the following:
   a. Make sure the mounting plate is outboard of the frame mounting tabs.
   b. Tighten the engine-mounting plate bolts to 25-30 ft.-lb. (34-41 N•m).
   c. Tighten the shift-rod mounting bolts to 180 in.-lb. (20 N•m).
   d. If necessary, adjust the shift rod so the shift pedal is at a 45° angle relative to the ground (Figure 13).

### Brake Pedal Removal/Installation

1. Remove the bolt, then remove the footrest from the footrest clevis.
2. Remove the clevis mounting bolts, then remove the footrest clevis from the footrest support.
3. Slide the brake pedal assembly from the footrest support.

**CAUTION**

The clevis pin that secures the brake rod to the brake pedal is pressed into place. It must not be removed. Do not try to separate the brake rod from the brake pedal.

4. Rotate the entire brake-pedal assembly counterclockwise, and unthread the brake rod from the master cylinder (Figure 14).
5. Pull the brake rod from the boot in the master cylinder, and remove the brake pedal assembly.
6. Remove the two bolts (Figure 15) securing the mounting plate to the frame, and then remove the bolts securing the plate to the engine. Remove the mounting plate.
FORWARD FOOT CONTROLS
(1999-2003 883C AND 1200C MODELS)

1. Brake rod
2. Spring washer
3. Nut
4. Footrest
5. Bolt
6. Footrest clevis
7. Bushing
8. Brake pedal
9. Clevis pin
10. Cotter pin
11. Footrest support
12. Right mounting plate
13. Circlip
14. Left mounting plate
15. Shift pedal
16. Shift rod
17. Washer
18. Shift lever
19. Shifter peg
7. Installation is the reverse of removal. Note the following:
   a. Make sure the engine-mounting plate is inboard of the mounting tabs on the frame.
   b. Tighten the bolts to 25-30 ft.-lb. (34-41 N•m).
   c. Insert the brake rod through the master cylinder boot. Use the flats of the rod to turn the rod and thread it into the master cylinder. Turn the brake rod/pedal assembly until the brake pedal can slide onto the footrest support.
   d. Apply threadlock (Loctite 243 or equivalent) to the clevis mounting bolt, and secure the footrest clevis to the footrest support. Tighten the clevis mounting bolt securely.
   e. Install the footrest onto the footrest clevis. Make sure the flat side of the spring washer faces the inside of the clevis.
   f. If necessary, adjust the brake rod length so the brake pedal is at a 45° angle relative to the ground. See Figure 16.

Shift Pedal/Mounting Bracket Disassembly/Assembly

1. Remove the shift pedal from the footrest support by performing the following:
   a. Remove the securing bolt and remove the footrest from the footrest clevis. Account for the spring washer inside the clevis.
b. Remove the clevis mounting bolt and remove the footrest clevis from the footrest support.
c. Slide the pedal assembly from the footrest support.

2. Remove the retaining clip, and unscrew the footrest support from the mounting plate.

3. Assembly is the reverse of disassembly. Note the following:
   a. Apply threadlock (Loctite 243 or equivalent) to the threads of the footrest support and screw the support securely into the engine mounting plate.
   b. Secure the footrest support with a new retaining clip.
   c. Apply threadlock (Loctite 243 or equivalent) to the threads of the clevis mounting bolts and tighten the bolt securely.
   d. When installing the footrest onto the footrest clevis, make sure the flat side of the spring washer faces the inside of the clevis.

**SIDESTAND**

*WARNING*

The sidestand is spring-loaded. Exercise caution when working on the sidestand assembly.

**Removal/Installation**

**1986-1988 models**

Refer to Figure 17.

1. Place the motorcycle on a suitable stand so the sidestand can move freely without contacting the ground.
2. Raise the sidestand and disconnect the return spring.
3. Remove the bolt, lockwasher, washer and stop at the top of the sidestand and remove the sidestand from the leg bracket.
4. Check the sidestand for cracks or damage. Check the pivot area at the top of the sidestand for deep scoring, excessive wear or damage.
5. Check the return spring for fatigue, stretching, cracks or other damage. If the spring has not been holding the sidestand securely in its retracted position, replace it.
6. Check the spring supports for cracks, hole elongation or other damage.
7. Check the frame for damage.
8. Replace all worn or defective parts.
9. Installation is the reverse of these steps while noting the following:
   a. Clean all the components.
   b. Apply a light coat of multipurpose grease to the pivot surfaces on the sidestand and leg bracket.
   c. Check sidestand operation. The sidestand is designed to lock when it is placed in its full down (or forward) position with the weight of the motorcycle resting on it. If the motorcycle is raised momentarily while the sidestand is in place, the sidestand may retract slightly from its full down position. Before resting the weight of the motorcycle on the sidestand, make sure the sidestand is in its full down position. Make sure the sidestand retracts fully.

**1989-2003 models**

Refer to Figure 18.

1. Place the motorcycle on a suitable stand so the sidestand can be moved freely without contacting the ground.
2. Remove the rubber frame bumper to allow greater sidestand travel.
3. Place the sidestand in the retracted position.
4. Remove the cotter pin.
5. Hold the sidestand securely, then remove the pin from the upper mounting hole.
6. Disconnect the return spring.
7. Remove the sidestand.
8. Reverse the removal procedure to install the sidestand.
   Note the following:
   a. Install the bushing so the shouldered end is down.
b. Clean all components. Lubricate the clevis pin, spring mounting points and sidestand with bearing grease.

c. Check sidestand operation. The sidestand is designed to lock when it is placed in its full down position with the weight of the motorcycle resting on it. If the motorcycle is raised momentarily while the sidestand is in place, the sidestand may retract slightly from its full down position. Before resting the weight of the motorcycle on the sidestand, make sure the sidestand is in its full down position. Make sure the sidestand retracts fully.

---

**FORK LOCK**

**Replacement**

1. Disconnect the negative battery cable from the crankcase (Chapter Twelve).
2. Remove the fuel tank (Chapter Ten or Chapter Eleven).

**NOTE**

Depending on the tools used, it may be necessary to remove or move handlebar components for access to the fork lock. Refer to Chapter Fourteen.

**NOTE**

Align the drill bit in Step 3 so it is centered on the lockpin. Misalignment will make lockpin removal difficult.

3. Using a 5/64-inch drill bit, drill a hole in the center of the lockpin (Figure 19, typical).
4. Install a screw extractor into the lockpin and pull out the lockpin.
5. Remove the lock assembly.
6. Install the new lock so the lockpin holes in the lock and frame are aligned.
7. Drive in a new lockpin so it is flush with the frame.
8. Check lockpin operation. Be sure the handlebar can be moved through a full range of motion.

---

**Table 1 is on the following page.**
<table>
<thead>
<tr>
<th>Component</th>
<th>ft.-lb.</th>
<th>in.-lb.</th>
<th>N•m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine-mounting plate bolts (883C and 1200C models)</td>
<td>25-30</td>
<td>–</td>
<td>34-41</td>
</tr>
<tr>
<td>Front fender locknuts</td>
<td>–</td>
<td>96-156</td>
<td>11-18</td>
</tr>
<tr>
<td>Rear fender front mounting bolt</td>
<td>–</td>
<td>120</td>
<td>14</td>
</tr>
<tr>
<td>Shift-rod mounting bolts (883C and 1200C models)</td>
<td>–</td>
<td>180</td>
<td>20</td>
</tr>
<tr>
<td>Strut cover bolts (1994-2003 models)</td>
<td>–</td>
<td>96-156</td>
<td>11-18</td>
</tr>
<tr>
<td>Turn signal bolts (1994-2003 models)</td>
<td>–</td>
<td>96-156</td>
<td>11-18</td>
</tr>
<tr>
<td>Turn signal mounting bolt (1986-1989 models)</td>
<td>33</td>
<td>–</td>
<td>45</td>
</tr>
<tr>
<td>Turn signal retaining nut (1990-1993 models)</td>
<td>–</td>
<td>96-156</td>
<td>11-18</td>
</tr>
</tbody>
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- Speed sensor
- Function/tripmeter/reset switch
- Speedometer lights
- Right turn signal indicator
- Oil press. indicator
- Neutral indicator
- High beam indicator
- Left turn signal indicator
- Tachometer (1995 1200 models only, 1996 1200 and 1200S models only)
- Right front turn signal
- Position light
- Headlight
- Left front turn signal
- Turn signal module
- Ignition switch
- Front brake switch
- Starter switch
- Emergency stop switch
- Right turn signal switch

5 Turn signal module
20 Tachometer
65 Ignition switch
39 Speedometer lights
20 Right front turn signal
1994-1996 ALL MODELS (EXCEPT 1996 1200C MODELS)
1998 ALL MODELS (EXCEPT 1200S MODELS)

- Speed sensor
- Function/trip meter/reset switch
- Speedometer/Solid state
- Right turn signal indicator
- Oil pressure indicator
- Neutral indicator
- High beam indicator
- Left turn signal indicator
- Tachometer (Models so equipped)
- Right front turn signal (DOM only)
- Position light
- Headlight
- Left front turn signal

Ignition switch
- Off
- Acc
- Ign

Front brake switch
- Starter switch
- Emergency stop switch
- Right turn signal switch

Turn signal module
- Left turn signal switch
- Headlight dimmer switch
- Horn switch
- Horn
1999-2002 ALL MODELS (EXCEPT 1200S MODELS)
2003 ALL MODELS (EXCEPT 1200S MODELS)

- Speed sensor
- Function/tripmeter reset switch
- Speedometer/Solid state
- Right turn signal indicator
- Oil press. indicator
- Neutral indicator
- High beam indicator
- Left turn signal indicator
- Right front turn signal (DOM only)
- Position light (HDI only)
- Headlight
- Tachometer (May not be present on all models)
- Left front turn signal

Components:
- Ignition switch
- Front brake switch
- Emergency stop switch
- Right turn signal switch
- Horn switch
- Lights 15A
- Instr 15A
- Acc 15A
- Ign. 15A
- Emergency stop switch
- Horn switch
- Turn signal dimmer switch
- Off
- Acc
- Ign

Connector 38 on 1200C models only
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