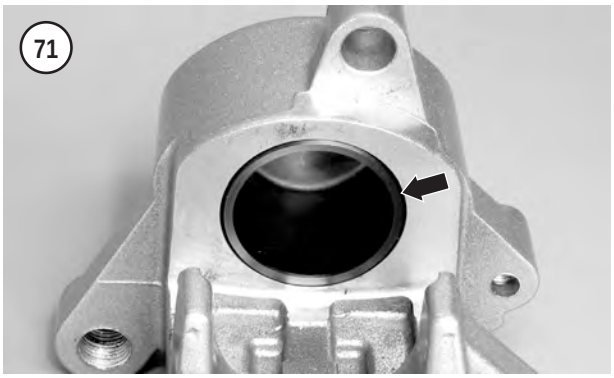
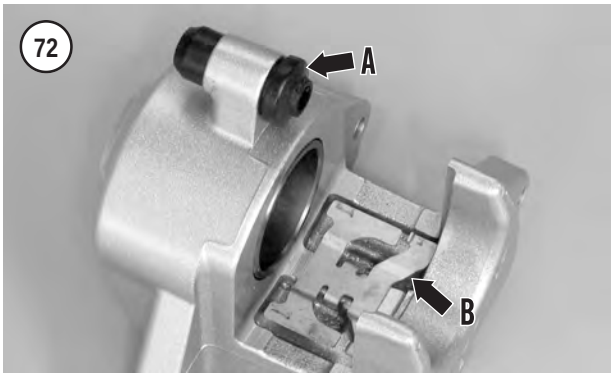
11. Inspect the stud and bolt pins (**Figure 69**) for wear or damage. Replace if necessary.

12. Inspect the brake pads for uneven wear, damage or grease contamination.

NOTE

When the brake system is operating correctly, the inboard and outboard brake pads will show approximately the same amount of wear. If there is a large difference in pad wear, the caliper is not sliding properly along the mounting pins causing one pad to drag against the disc. Worn caliper piston seals also cause uneven pad wear.





Assembly

1. Coat the new dust seals, piston seals and piston bores with clean DOT 5 brake fluid.

2. Carefully install the new piston seal (A, **Figure 70**) into the inner groove. Make sure the seal properly seats in the groove.

3. Carefully install the new dust seal (B, **Figure 70**) into the outer groove. Make sure the seal properly seats in the groove.

4. Coat the piston with clean DOT 5 brake fluid.

5. Position the piston with the *closed end facing in* and install the piston into the caliper cylinder. Push the piston in until it bottoms (**Figure 71**).

6. Install the bleed valve and tighten it to 35-61 in.-lb. (4.0-6.9 N•m).

7. Install the mounting pin boot (A, **Figure 72**).

8. Install the brake pad spring (B, **Figure 72**) and make sure it is properly seated.

9. Install the caliper and brake pads as described in this chapter.

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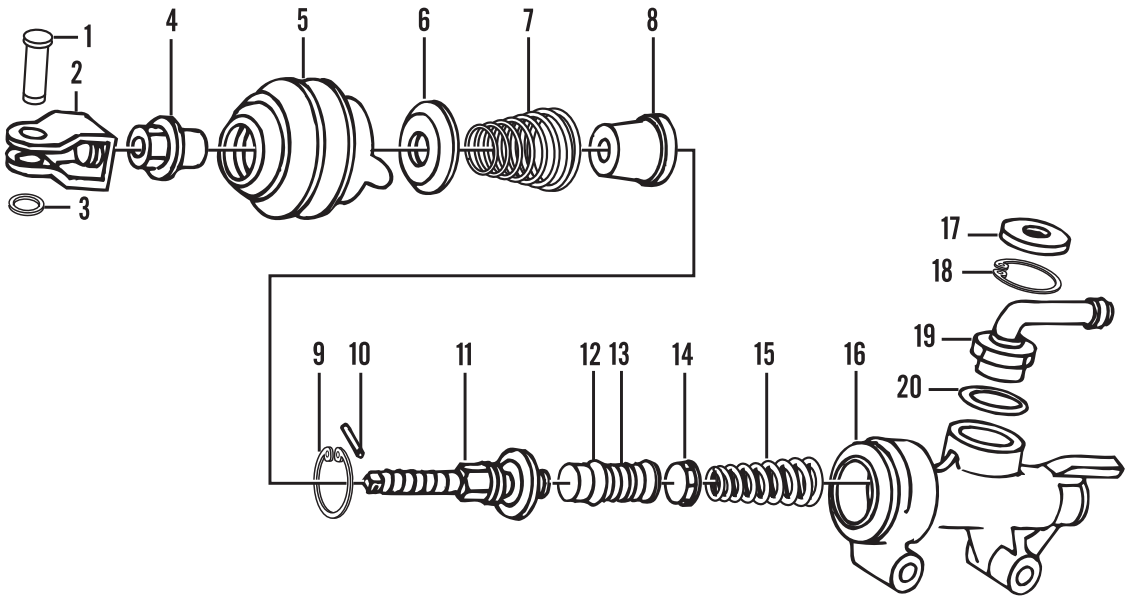
REAR BRAKE MASTER CYLINDER



1. Clevis pin
2. Clevis
3. Retaining ring
4. Bolt
5. Boot
6. Spring retainer
7. Spring
8. Boot
9. Snap ring
10. Spring pin
11. Pushrod assembly
12. Secondary cup
13. Piston
14. Primary cup
15. Spring
16. Master cylinder
17. Dust cover
18. Snap ring
19. Hose fitting
20. O-ring

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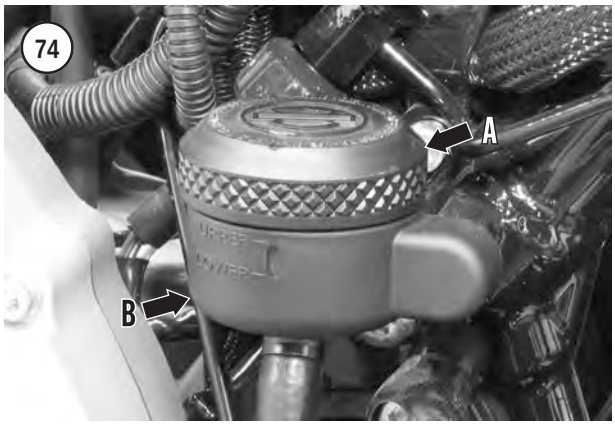


REAR MASTER CYLINDER

Removal

WARNING
Do not ride the bike until the rear brake is working properly.

Refer to **Figure 73**.

1. Support the motorcycle on a suitable stand.
2. Remove the reservoir cap (A, **Figure 74**).
3. Remove the rear brake reservoir cover (B, **Figure 74**).

NOTE

*If necessary, remove the plastic washer (A, **Figure 75**) and rubber insert (B) when draining the reservoir.*

4. Hold the reservoir and remove the reservoir mounting bolt. Tip the reservoir over and drain the brake fluid in the reservoir and hose into a container.
5. If removed, reinstall the rubber insert (B, **Figure 75**) and plastic washer (A). Install the resevoir cap (A, **Figure 74**). Then reinstall the resevoir and mounting bolt.

CAUTION

Be prepared to catch brake fluid that will flow from disconnected brake hoses in the following steps.

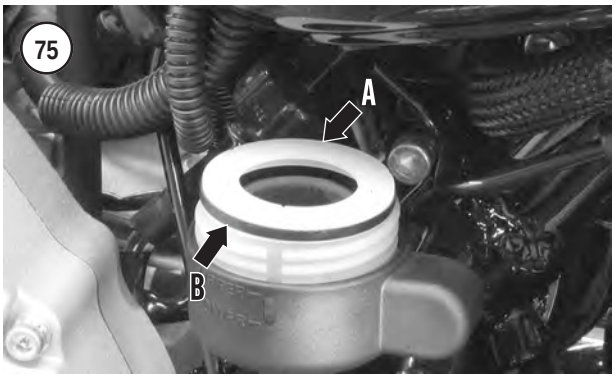
6. Move the clamp (A, **Figure 76**) from the end of the feed hose, then disconnect the feed hose from the rear master cylinder fitting (B).
7. Unscrew the union bolt (C, **Figure 76**) securing the brake hose to the master cylinder. Do not lose the sealing washer on each side of the hose fitting.
8. Remove the retaining ring from the pivot pin (A, **Figure 77**).
9. Disengage the clevis (B, **Figure 77**) from the bellcrank end (C).
10. Remove the master cylinder mounting bolts and washers (A, **Figure 78**), then remove the master cylinder (B).

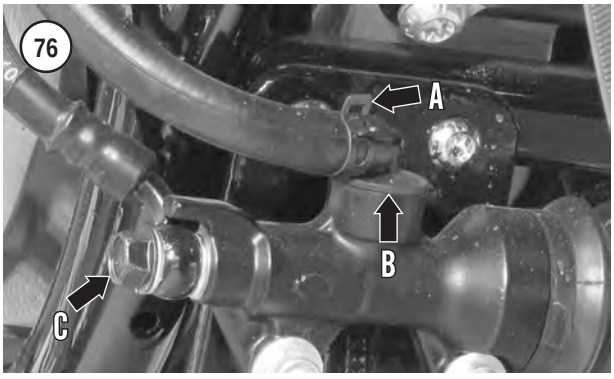
Installation

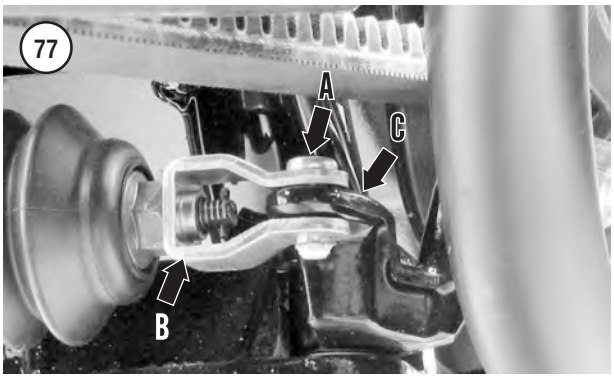
1. Install the master cylinder onto the frame. Tighten the master cylinder mounting bolts (A, **Figure 78**) to 15-20 ft.-lb. (21-27 N•m).
2. Secure the brake hose to the master cylinder with the union bolt (C, **Figure 76**). Install a new washer on each side of the brake hose fitting. The fitting must contact the boss on the master cylinder. Tighten the union bolt to 20-25 ft.-lb. (27-34 N•m).
3. Connect the feed hose to the fitting (B, **Figure 76**) and move the clamp around the end of the hose.
4. Connect the brake bellcrank lever to the master cylinder clevis, then install the clevis pin (A, **Figure 77**) and a new retaining ring.
5. Refill the master cylinder with brake fluid and bleed the brake system as described in this chapter.

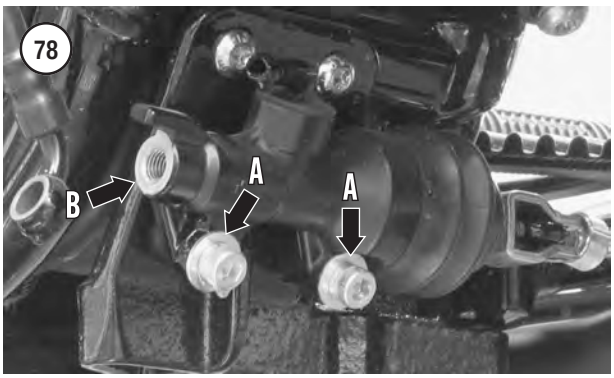
Disassembly

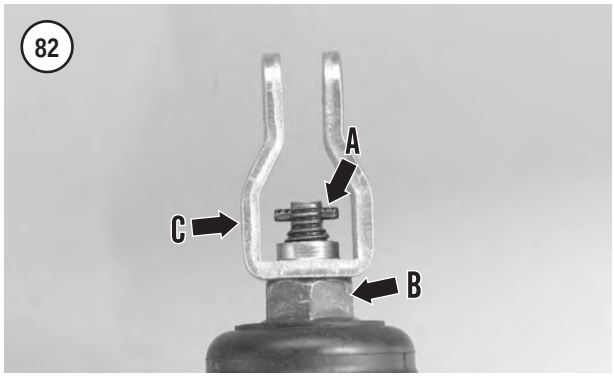
Refer to **Figure 73**.

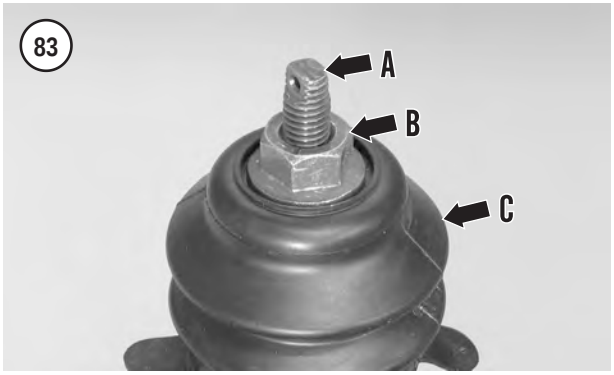


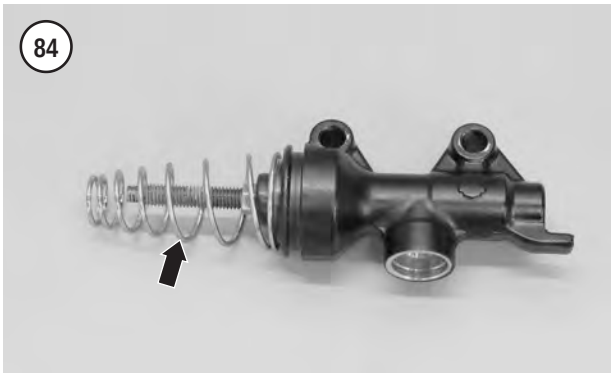












1. Remove the master cylinder as described in this section.
2. Remove the dust cover (**Figure 79**) around the hose fitting .
3. Remove the snap ring (**Figure 80**) and pull the hose fitting out of the master cylinder.
4. Remove the O-ring (**Figure 81**) from the master cylinder.
5. Drive out the spring pin (A, **Figure 82**).

CAUTION

When tightening the clevis, grasp the clevis on the edges, not the flats, which may bend the clevis.

6. Hold the nut (B, **Figure 82**), then unscrew the clevis (C).
7. Hold the pushrod flats (A, **Figure 83**), then unscrew the nut (B) and remove the boot (C).

NOTE

The spring retainer will remain inside the boot.

8. Remove the spring (**Figure 84**).
9. Remove the boot (**Figure 85**).

10. Compress the piston, then remove the snap ring (**Figure 86**) from the groove in the master cylinder.
11. Remove the pushrod (**Figure 87**) and piston assembly (**Figure 88**) from the master cylinder bore.

Inspection

WARNING

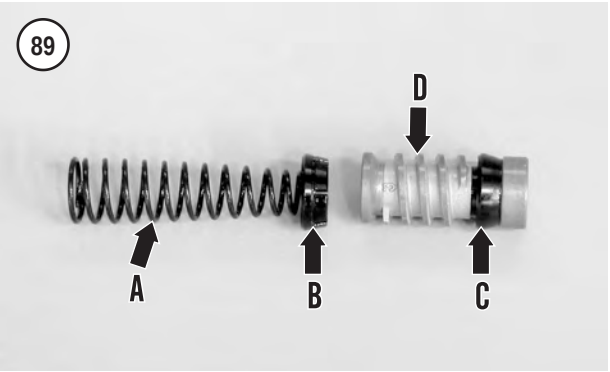
Do not get any oil or grease onto any of the master cylinder components. Petroleum based chemicals will cause the rubber parts in the brake system to swell, causing brake system failure.

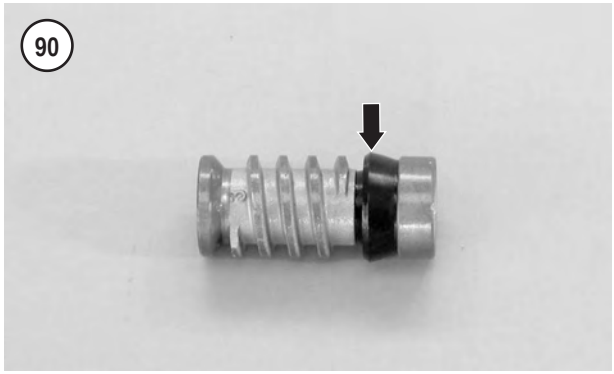
1. Clean and dry the master cylinder housing and the other metal parts. Clean parts using denatured alcohol or new DOT 5 brake fluid and then place them on a clean lint-free cloth until reassembly.

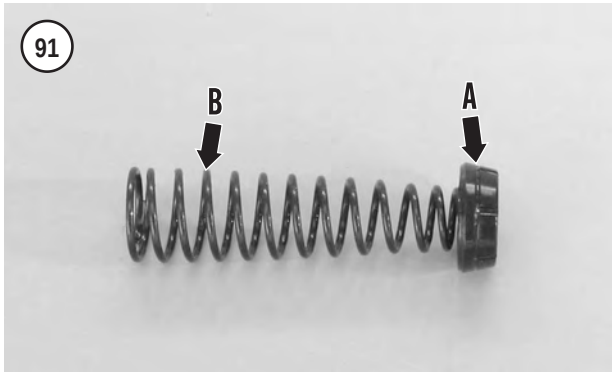
CAUTION

Do not remove the secondary cup from the piston assembly. If the cups are damaged, replace the piston assembly.

2. Check the piston assembly (**Figure 89**) for:
   a. Broken, distorted or collapsed piston return spring (A).
   b. Worn, cracked, damaged or swollen primary (B) and secondary cups (C).
   c. Scratched, scored or damaged piston (D).
   d. Excessively worn or damaged pushrod cover.
   e. If any of these parts are worn or damaged, replace the piston assembly.
3. If the master cylinder was leaking brake fluid, the pushrod (**Figure 87**) may be corroded. Carefully inspect the pushrod assembly for:
   a. Bent or damaged clevis.
   b. Damaged pushrod.
   c. Cracked or swollen boots.
   d. Corroded, bent or damaged snap ring.







e. Damaged pushrod washer.

NOTE

A piston kit includes the piston, spring and both cups. The snap ring and boots are available separately.

4. To assemble a new piston assembly, perform the following:
   a. When replacing the piston, installation of the new secondary cup (**Figure 90**) onto the piston is necessary.
   b. Use the original piston assembly as a reference when installing the new cups.
   c. Before installing the new piston cups, soak them in DOT 5 brake fluid for approximately 15 minutes. This will soften them and ease installation. Clean the new piston in brake fluid.
   d. Install the secondary cup (**Figure 90**) onto the piston.
   e. Install the primary cup (A, **Figure 91**) onto the spring (B) so it seats on the tapered end of the spring.
5. Inspect the master cylinder bore (**Figure 92**). Replace the master cylinder if the bore is corroded, scored or damaged in any way. Do not hone the master cylinder bore to remove scratches or other damage.
6. Check for plugged supply and relief ports in the master cylinder (**Figure 93**). Clean with compressed air.
7. Replace the O-ring (**Figure 81**) if it is excessively worn, deteriorated or damaged.

Assembly

1. Clean all components before reassembly.
2. If installing a new piston assembly, assemble it as described in *Inspection* in this section.
3. Lubricate the piston assembly and cylinder bore with DOT 5 brake fluid.
4. If not previously installed, install the primary piston cup (A, **Figure 91**) onto the tapered end of the spring (B).

CAUTION

Do not allow the piston cups to tear or turn inside out when installing the piston into the master cylinder bore. Both cups are larger than the bore. To ease installation, lubricate the cups and piston with DOT 5 brake fluid.

5. Install the spring and primary cup into the master cylinder so the large end of the spring enters first.
6. Insert the piston assembly into the master cylinder bore so the secondary cup end enters last.

7. Compress the piston assembly and install the pushrod, washer and snap ring (**Figure 86**). Install the snap ring with the flat side facing out.

NOTE

*The snap ring must seat in the groove (**Figure 86**) completely. Push and release the pushrod a few times to make sure it moves smoothly and that the snap ring does not pop out.*

8. Slide the boot over the pushrod (**Figure 85**) and seat it against the snap ring.

9. Install the spring (A, **Figure 94**), spring retainer (B) and nut (C).

10. Install the clevis (A, **Figure 95**) onto the pushrod (B), but do not install the retaining pin.

CAUTION

When tightening the clevis, grasp the clevis on the edges, not the flats, which may bend the clevis.

11. Adjust the position of the clevis to the dimension shown in **Figure 96**. Tighten the clevis and nut securely.

12. Install the retaining pin (A, **Figure 82**).

13. If removed, lubricate and install the O-ring into the master cylinder (**Figure 81**).

14. Install the inlet fitting into the master cylinder so it points toward the brake hose end of the master cylinder.

15. Install the snap ring—flat edge facing up—into the groove in the master cylinder (**Figure 80**). Make sure the snap ring sits in the groove completely.

16. Install the dust cover (**Figure 79**) around the hose fitting.

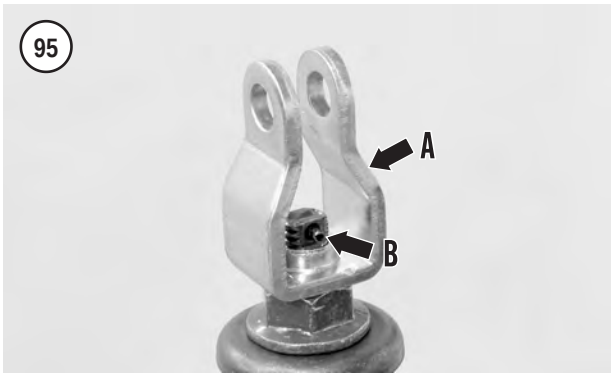
17. Install the master cylinder as described in this section.

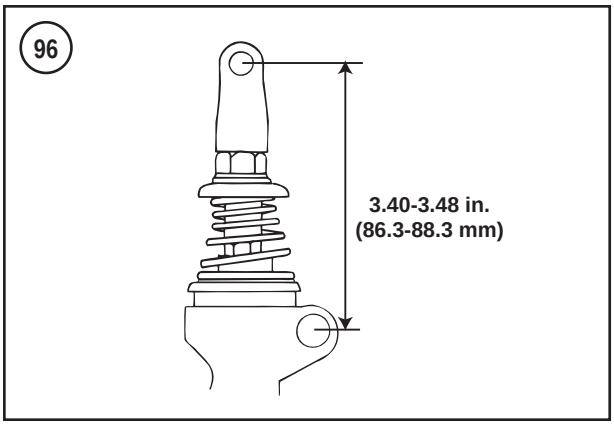
BRAKE HOSE AND LINE REPLACEMENT

A combination of steel and flexible brake lines connect the master cylinder to the brake calipers. Union fittings and bolts connect brake hoses to the master cylinder and brake calipers. Steel washers seal the union fittings.

Replace a hose if the flexible portion is swelling, cracking or damaged. Replace the brake hose if the metal portion leaks or if there are dents or cracks.

Review *Brake Fluid Type* and *Brake Service* in this chapter.





Front Brake Hose Removal/Installation

WARNING

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

A single combination steel/flexible brake hose (**Figure 97**) connects the front master cylinder to the front brake caliper on all models except XL1200R.

On XL1200R models (**Figure 97**) a single hose connects the master cylinder to the manifold. From the mani-

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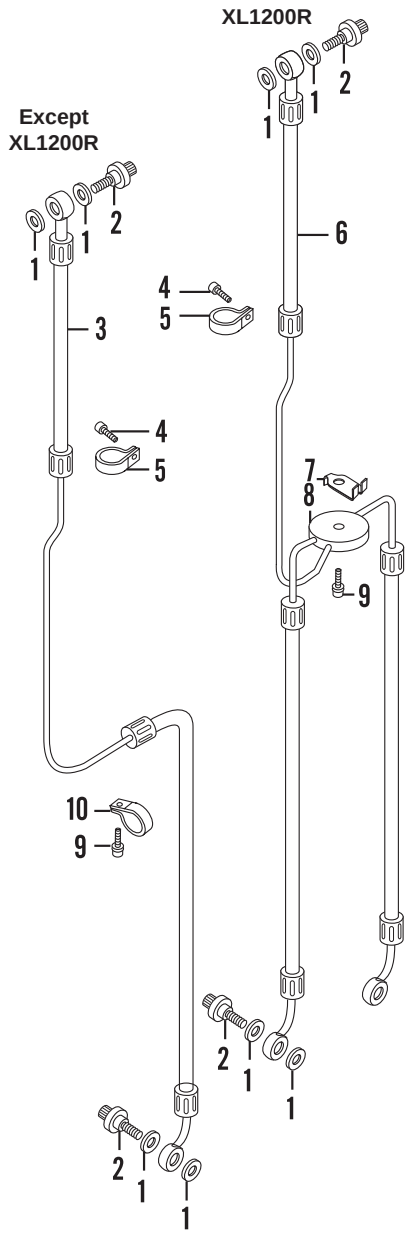
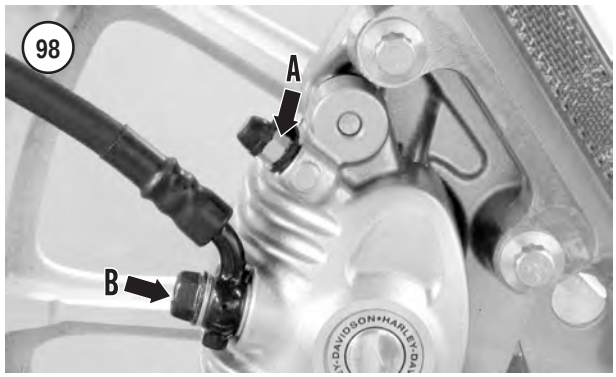
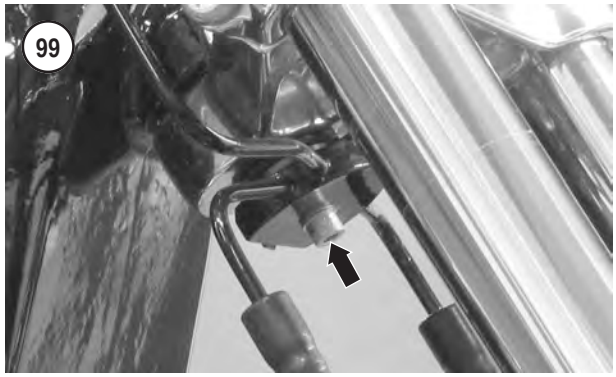
FRONT BRAKE HOSE



1. Washer
2. Union bolt
3. Brake hose
4. Screw
5. Clamp
6. Brake hose
7. Clamp
8. Manifold
9. Screw
10. Clamp



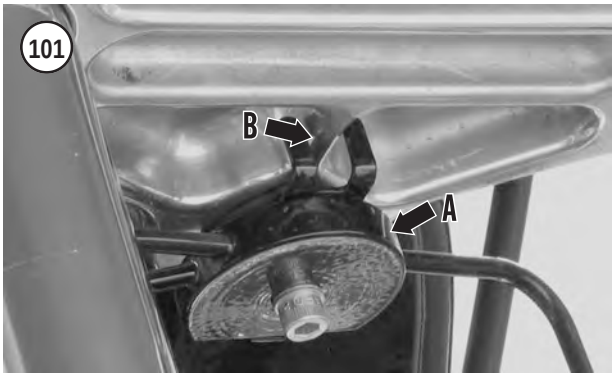


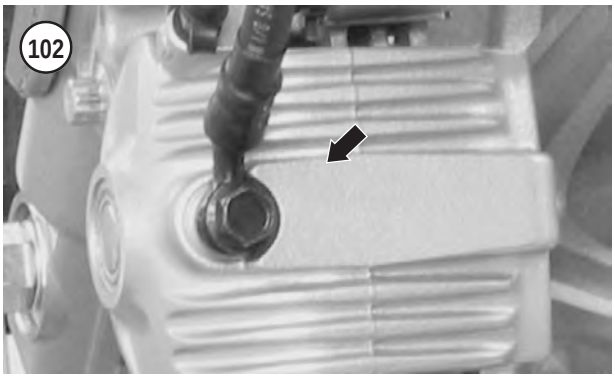
fold two brake hoses run to the brake calipers. The hoses and manifold are only available as a unit assembly.

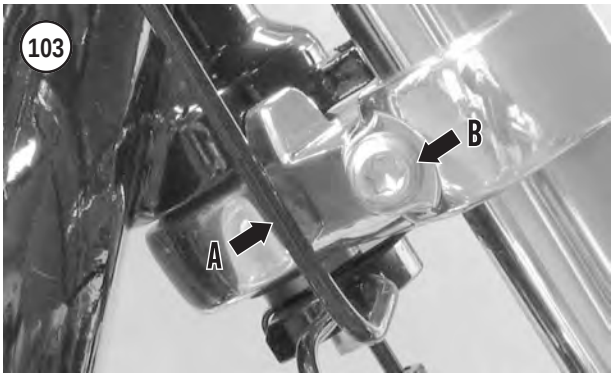
When purchasing a new hose, compare it to the old hose to make sure the length and angle of the steel hose portion are correct. Install new union bolt washers at both ends.

1. Drain the front brake system as follows:
   a. Connect a hose to the bleed valve (A, **Figure 98**) on the brake caliper. On the Model XL1200R brake system, connect hoses to the bleed valve on each caliper.
   b. Insert the loose end of the hose into a container to catch the brake fluid.
   c. Open the bleed valve and apply the front brake lever to pump the fluid out of the master cylinder and brake line. Continue until the fluid is removed.
   d. Close the bleed valve(s) and disconnect the hose.
2. Before removing the brake line assembly, note the brake line routing from the master cylinder to the caliper. Note the number and position of metal hose clamps and/or plastic ties used to hold the brake line in place.
3. Remove any metal clamps or cut any plastic ties.
4. On XL1200R models, remove the bolt securing the brake hose manifold (**Figure 99**) to the lower steering bracket. Do not lose the clamp.

5. Remove the screw or nut securing the metal clamps around the brake line. Spread the clamp and remove it from the brake line.
6. Remove the union bolt (B, **Figure 98**) and washers securing the hose to the brake caliper.
7. Remove the union bolt (**Figure 100**) and washers securing the hose to the front master cylinder.
8. Cover the ends of the brake hose to prevent brake fluid from leaking out.
9. Remove the brake hose assembly from the motorcycle.
10. If the existing brake hose assembly is going to be reinstalled, inspect it as follows:
    a. Check the metal tubes where they enter and exit at the flexible hoses. Check the crimped clamp for looseness or damage.
    b. Check the flexible hose portions for swelling, cracks or other damage.
    c. If there is wear or damage, replace the brake hose assembly.
11. Install the brake hose, new sealing washers and union bolts (B, **Figure 98** and **Figure 100**) in the reverse order of removal. Note the following:
    a. On XL1200R models, install the brake hose manifold (A, **Figure 101**) so the prongs straddle the rib (B) on the lower steering bracket.
    b. Install new sealing washers against the side of each hose fitting.
    c. Carefully install the clips and guides to hold the brake hose in place, but do not tighten the clamp screws.
    d. Position the master cylinder and caliper hose end against the locating boss on the master cylinder or caliper (**Figure 102**). Tighten the union bolts to 20-25 ft.-lb. (27-34 N•m).
    e. Position the brake tube (A, **Figure 103**) so it is 1/4 in. (6.4 mm) from the fork clamp bolt (B). Tighten the clamp screws, and on XL1200R models, the manifold clamp bolt (**Figure 99**).
    f. Refill the front master cylinder with clean DOT 5 brake fluid. Bleed the front brake system as described in this chapter.





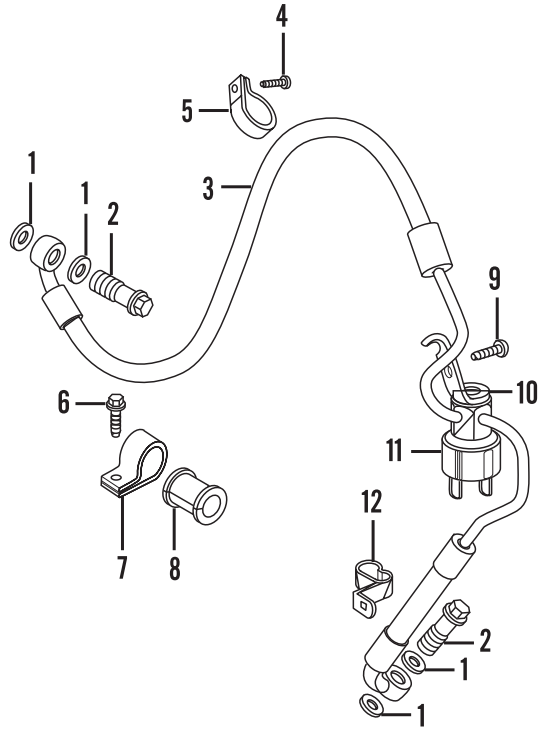


Rear Brake Hose Removal/Installation

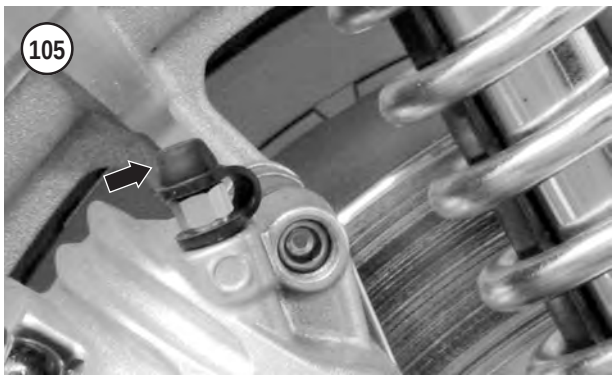
WARNING
Do not ride the motorcycle until the rear brake is operating correctly.

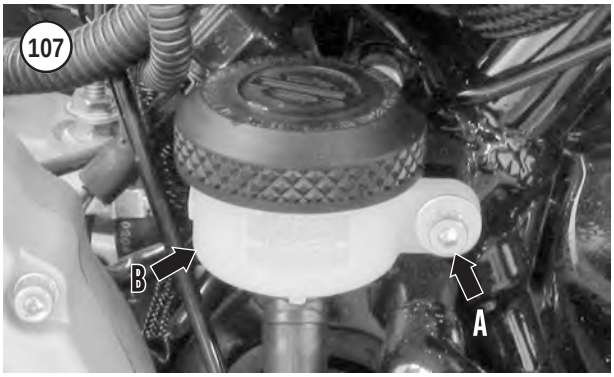
A single combination steel and rubber brake hose (**Figure 104**) connects the rear master cylinder to the rear brake caliper. The rear brake switch is installed in the rear brake hose. When buying a new hose, compare it to the

104 **REAR BRAKE HOSE**



1. Washer
2. Union bolt
3. Brake hose
4. Screw
5. Clamp
6. Screw
7. Clamp
8. Bushing
9. Bolt
10. Tee
11. Brake switch
12. Clamp

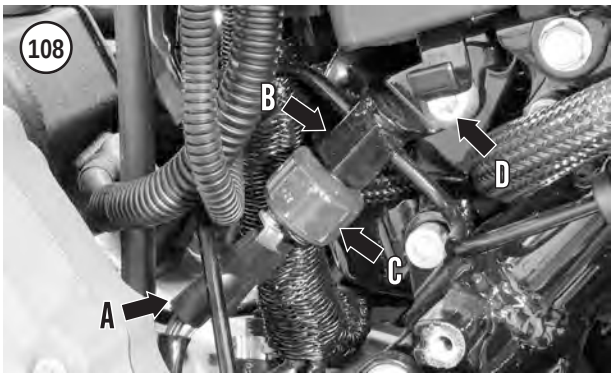


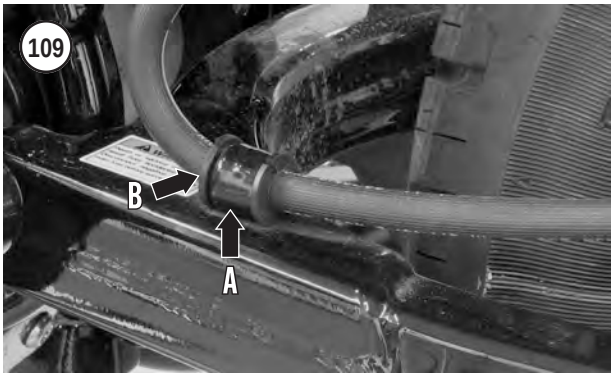


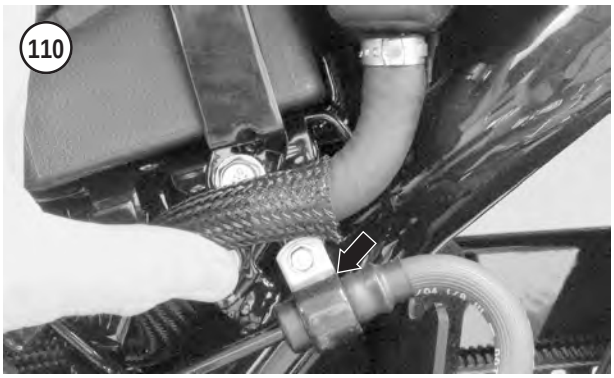
old hose. Make sure the length and angle of the steel hose portion are correct. Install new union bolt washers at both hose ends.

1. Drain the hydraulic brake fluid from the rear brake system as follows:
   a. Connect a hose to the rear caliper bleed valve (**Figure 105**).
   b. Insert the loose end of the hose in a container to catch the brake fluid.
   c. Open the caliper bleed valve and operate the rear brake pedal to pump the fluid out of the master cylinder and brake line. Continue until all the fluid is removed.
   d. Close the bleed valve and disconnect the hose.
2. Remove the left side cover as described in Chapter Fourteen.
3. Remove the rear brake master cylinder reservoir cover (**Figure 106**) from the reservoir.
4. Remove the reservoir mounting bolt (A, **Figure 107**), then move the reservoir (B) out of the way.
5. Disconnect the electrical connector from the rear brake switch (A, **Figure 108**).
6. Hold the tee nut (B, **Figure 108**) with a wrench, then unscrew and remove the switch (C).

7. Remove the brake switch bracket mounting bolt (D, **Figure 108**).
8. Before removing the brake line, note the brake line routing from the master cylinder to the caliper. Note the number and position of the clamps.
9. Remove the mounting screw and detach the clamp (A, **Figure 109**) from the swing arm.
10. Remove the mounting screw and detach the clamp (**Figure 110**) from the battery tray bracket .
11. Remove the union bolt (**Figure 111**) and washers securing the hose fitting to the brake caliper.
12. Remove the union bolt (**Figure 112**) and washers securing the hose fitting to the master cylinder.
13. Remove the rear brake hose through the lower hose clamp (**Figure 113**).
14. If the existing brake hose assembly is going to be reinstalled, inspect it as follows:
    a. Check the metal pipe where it 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. If there is wear or damage, replace the brake hose.
15. Installation is the reverse of removal. Note the following:
    a. Install and tighten the rear brake switch to 80-123 in.-lb. (9-14 N•m).
    b. Install new sealing washers against the side of each hose fitting.
    c. Do not stretch or twist the hose. Make sure the hose and bushing (B, **Figure 109**) fit squarely in the clamp.
    d. Tighten the clamp screws to 30-40 in.-lb. (3.4-4.5 N•m).
    e. Tighten the union bolts to 20-25 ft.-lb. (27-34 N•m).
    f. Refill the master cylinder with clean DOT 5 brake fluid. Bleed the rear brake system as described in this chapter.





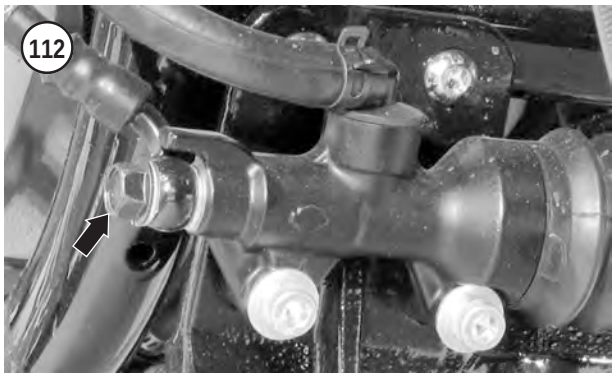


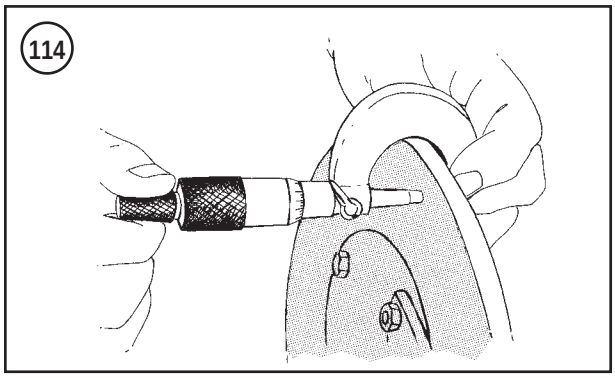
BRAKE DISC

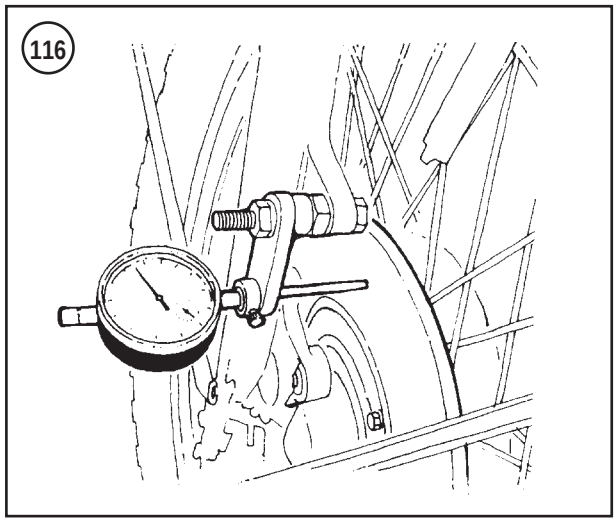
The brake discs are separate from the wheel hubs and can be removed once the wheel is removed from the motorcycle.

Inspection

The front and rear brake discs can be inspected while installed on or removed from the motorcycle. Small marks on the disc are not important, but deep scratches or other







marks may reduce braking effectiveness and increase brake pad wear. If these grooves are evident and the brake pads are wearing rapidly, replace the brake disc.

The specifications for the standard and service limits are in **Table 1**. Each disc is also marked with the minimum (MIN) thickness. If the specification marked on the disc differs from the one in **Table 1**, use the specification on the disc.

When servicing the brake discs, do not have the discs surfaced to compensate for warp. The discs are thin, removing material only reduces their thickness, causing them to warp rapidly. A warped disc may be caused by dragging brake pads.

1. Measure the thickness of the disc at several locations around the disc with a vernier caliper or a micrometer (**Figure 114**). Replace the disc if the thickness in any area is less than the MIN dimension on the disc (**Figure 115**).
2. Make sure the disc mounting bolts are tight prior to performing this check. Check the disc runout with a dial indicator as shown in **Figure 116**.

NOTE

When checking the front disc, turn the handlebar all the way to one side, then to the other side.

3. Slowly rotate the wheel and watch the dial indicator. If the runout exceeds the specification in **Table 1**, replace the disc.
4. If the disc is warped, consider the following:
   a. The brake caliper piston seals are worn or damaged.
   b. The master cylinder relief port is plugged.
   c. The primary cup on the master cylinder piston is worn or damaged.

5. Clean the disc of any rust or corrosion and wipe it clean with brake cleaner. Never use an oil-based solvent that may leave an oil residue on the disc.

Removal/Installation

1. Remove the front or rear wheel as described in Chapter Ten.
2. Remove the Torx bolts (**Figure 117**) securing the brake disc to the hub and remove the disc.
3. Check the brake disc bolts for thread damage. Replace worn or damaged fasteners.
4. Check the threaded bolt holes for the brake disc in the wheel hub for thread damage. True them with a tap if necessary.
5. Clean the disc and the disc mounting surface thoroughly with brake cleaner. Allow the surfaces to dry before installation.
6. Install the disc onto the wheel hub.
7. Apply Loctite 243 or an equivalent to the threads of new Torx bolts prior to installation.
8. Install the bolts and tighten to 16-24 ft.-lb. (22-32 N•m).

REAR BRAKE PEDAL

Removal/Installation

WARNING

Do not ride the motorcycle until the rear brake, brake pedal and brake light operate properly.

Refer to **Figure 118** or **Figure 119**. The XL1200R model is shown in the following illustrations; other models are similar.

1. Remove the right footrest assembly as described in Chapter Fourteen.
2. Remove the retaining ring (A, **Figure 120**) at the end of the clevis.
3. Remove the retaining bolt (B, **Figure 120**).
4. Separate the clevis (A, **Figure 121**) and brake pedal (B).
5. Inspect the brake pedal bushing (C, **Figure 121**) for fractures or damage, and replace it if necessary.
6. Install the pedal by reversing the preceding removal steps. Tighten the clevis retaining bolt (B, **Figure 120**) to 96-156 in. lb. (11-17 N•m).

BRAKE BLEEDING

Bleeding the brakes removes air from the brake system. Air in the brake system increases brake lever or pedal travel while causing it to feel spongy and less responsive. Under extreme braking (heat) conditions, it can cause complete loss of brake action.

The brake hose systems can be filled manually or with the use of a vacuum pump. Both methods are described in this section. When the brake lines are full of brake fluid, the brakes are bled manually. Both procedures are described in this section.

When adding brake fluid during the bleeding process, use DOT 5 brake fluid. Do not reuse brake fluid drained from the system or use DOT 3, 4 or 5.1 (glycol based) brake fluid. Wipe up any spills immediately.

WARNING

Do not ride the motorcycle until the front and/or rear brake are operating correctly.

NOTE

When bleeding the brakes, check the fluid level in the front and rear master cylinders frequently to prevent them from running dry, especially when using a vacuum pump. If air enters the system it must be bled again.

General Bleeding Tips

When bleeding the brakes, note the following:

1. Review *Brake Fluid Type* and *Brake Service* in this chapter.
2. Clean the bleed valves and the area around the valves of all debris. Make sure the passageway in the end of the valve is open and clear.
3. Use a box-end wrench to open and close the bleed valves. This prevents damage to the hex-head, especially if the valve is rusted.

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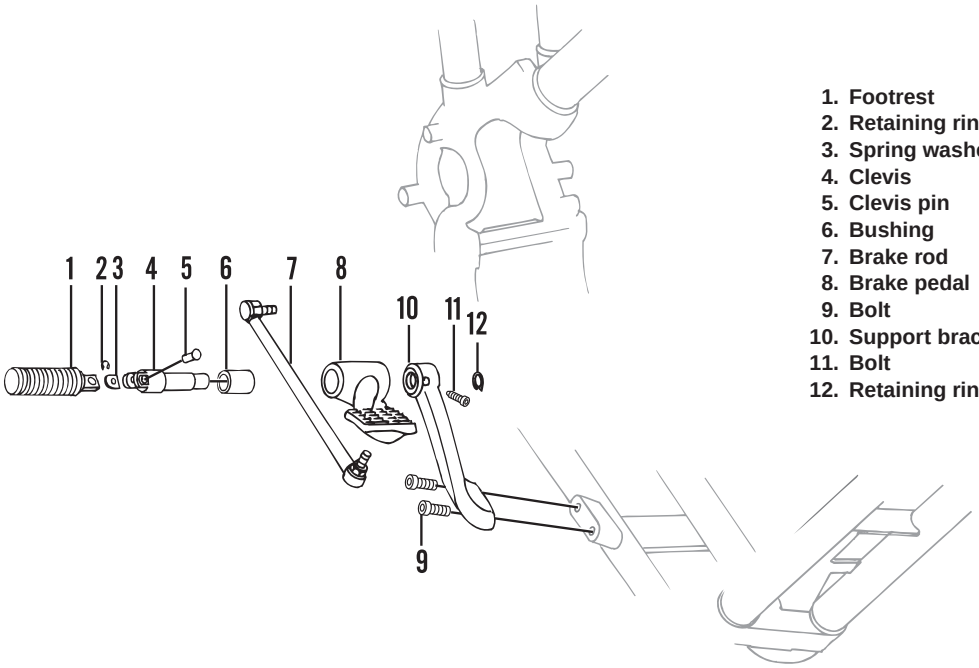
REAR BRAKE PEDAL
(XL883, L, R AND XL1200L, R MODELS)



1. Footrest
2. Retaining ring
3. Spring washer
4. Clevis
5. Clevis pin
6. Bushing
7. Brake rod
8. Brake pedal
9. Bolt
10. Support bracket
11. Bolt
12. Retaining ring

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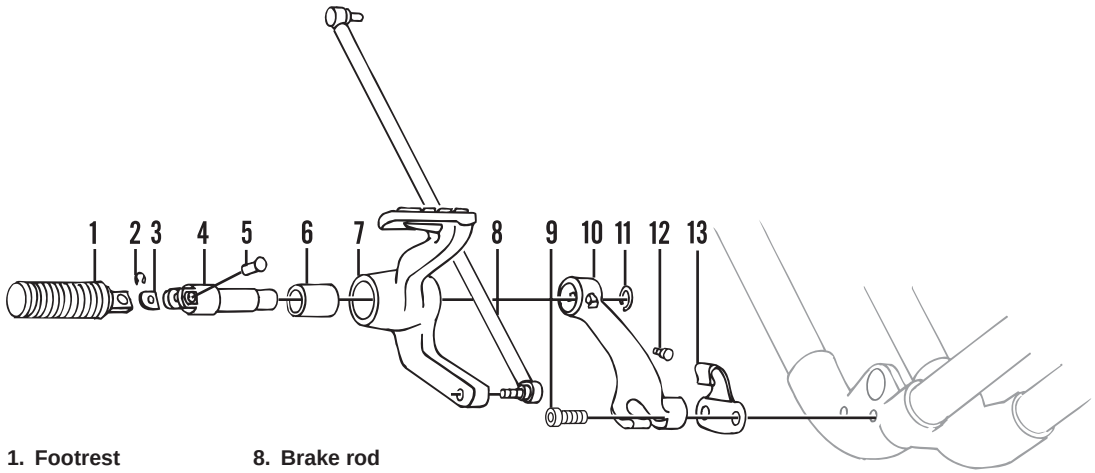
REAR BRAKE PEDAL
(XL883C AND XL1200C MODELS)



1. Footrest
2. Retaining ring
3. Spring washer
4. Clevis
5. Clevis pin
6. Bushing
7. Brake pedal
8. Brake rod
9. Bolt
10. Support bracket
11. Retaining ring
12. Bolt
13. J-clip

4. Install a box-end wrench (**Figure 122**) on the bleed valve before installing the catch hose. This allows operation of the wrench without having to disconnect the hose.

NOTE

*The catch hose (**Figure 122**) is the hose installed between the bleed valve and catch bottle.*

5. Replace damaged bleed valves. If rounded off, the valves cannot be tightened fully and are also difficult to loosen.

6. Use a clear catch hose to allow visible inspection of the brake fluid as it leaves the caliper. Air bubbles visible in the catch hose indicate that there still may be air trapped in the brake system.

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

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.

WARNING

Do not apply an excessive amount of grease to the bleed valve threads. This can block the bleed valve passageway and contaminate the brake fluid.

9. If air is suspected of entering the bleed system from around the bleed valve threads, remove the bleed valve and apply silicone brake grease to the valve's threads to prevent air from passing by them. Then reinstall the bleed valve into the brake caliper.

10. If the system is difficult to bleed, tap the union bolt on the master cylinder as well as the brake caliper and connecting hoses a few times. It is not uncommon for air bubbles to become trapped in the hose connection where the brake fluid exits the master cylinder and caliper. When a number of bubbles appear in the master cylinder reservoir after tapping the union bolt, air was trapped in this area.

Brake Bleeder Procedure

This one-person procedure uses the Mityvac hydraulic brake bleeding kit (**Figure 123**). This tool and equivalents