Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Hose Bracket Bolt	10 N·m	89 lb in
Brake Hose Fitting Bolt	44 N·m	32 lb ft
Brake Pedal Bracket Bolt	33 N·m	24 lb ft
Brake Pipe Fitting - Brake Hose	25 N·m	18 lb ft
Brake Pipe Fitting - Combination Valve	30 N·m	22 lb ft
Brake Pipe Fitting - Master Cylinder with JL4	32 N·m	24 lb ft
Brake Pipe Fitting - Master Cylinder without JL4	25 N·m	18 lb ft
Combination Valve Bolt	10 N·m	89 lb in
Master Cylinder Nut	36 N·m	27 lb ft
Master Cylinder Reservoir Bolt	8 N·m	71 lb in
Power Brake Booster Hose Fitting	33 N·m	24 lb ft
Power Brake Booster Nut	36 N·m	27 lb ft
Power Brake Booster Pushrod Retaining Clip Bolt	10 N·m	89 lb in

Brake Component Specifications

Application	Specification	
	Metric	English
Brake Pressue Modulator Bleeder Valves	9 N·m	80 lb in
Brake Caliper Bleeder Valve (Front)	13 N·m	115 lb in
Wheel Cylinder Bleeder Valve (Rear)	11 N·m	97 lb in

Brake System Specifications

Application	Specification	
	Metric	English
Brake Pedal Maximum Travel		
Hydraulic Assist*	72 mm	2.83 in
Brake System Flushing		
- Brake Fluid Volume from the ABS Modulator Bleeder Valves	118 ml	4 oz
- Brake Fluid Volume from the Brake Calipers	235 ml	8 oz
Brake System Pressure Bleed		
- Initial Pressure Adjustment Setting (Leak Testing the Hydraulic Brake System)	70 kPa	10 psi
- Pressure Bleed Procedure Setting	240 kPa	35 psi
*Specification with 450 N (100 lb) of force applied to the brake pedal, the ignition OFF and the brake booster power reserve depleted.		

Master Cylinder Reservoir Filling

Caution: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.

Caution: Refer to Brake Fluid Damage to Electrical Connections Caution in the Preface section.

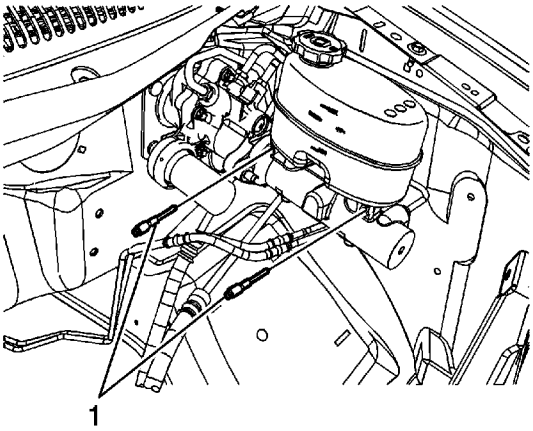
1. Visually inspect the brake fluid level through the brake master cylinder reservoir.
2. If the brake fluid level is at or below the half-full point during routine fluid checks, the brake system should be inspected for wear and possible brake fluid leaks.
3. If the brake fluid level is at or below the half-full point during routine fluid checks, and an inspection of the brake system did not reveal wear or brake fluid leaks, the brake fluid may be topped-off up to the maximum-fill level.
4. If brake system service was just completed, the brake fluid may be topped-off up to the maximum-fill level.
5. If the brake fluid level is above the half-full point, adding brake fluid is not recommended under normal conditions.
6. If brake fluid is to be added to the master cylinder reservoir, clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667) or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.

Master Cylinder Reservoir Replacement

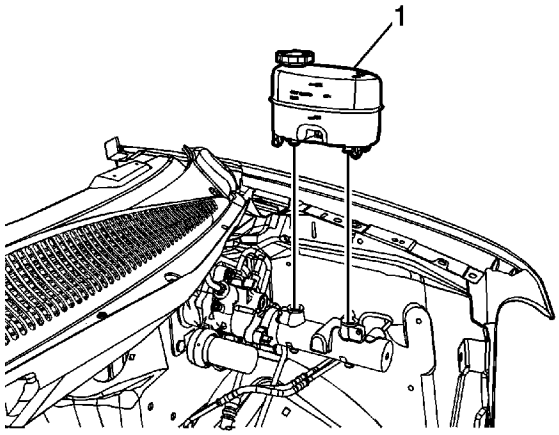
Removal Procedure

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

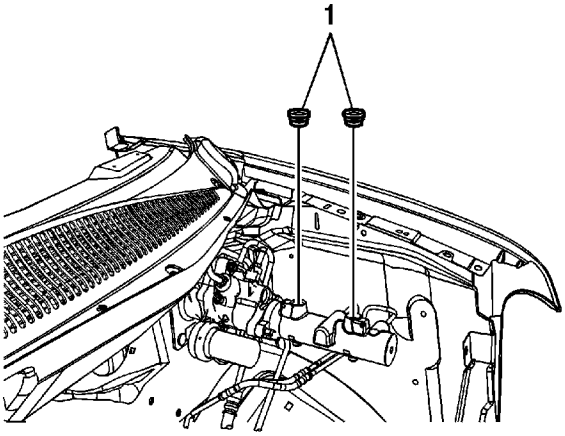
Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.



1. Using a suitable tool, remove the brake fluid from the brake master cylinder reservoir.
2. Discard the brake fluid into an approved container.
3. Disconnect the brake fluid level indicator switch electrical connector.
4. Remove the master cylinder reservoir bolts (1).

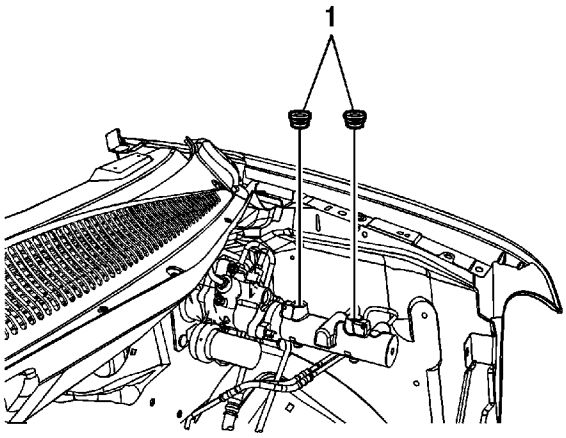


5. Carefully lift the master cylinder reservoir (1) straight upward and remove the reservoir from the master cylinder.



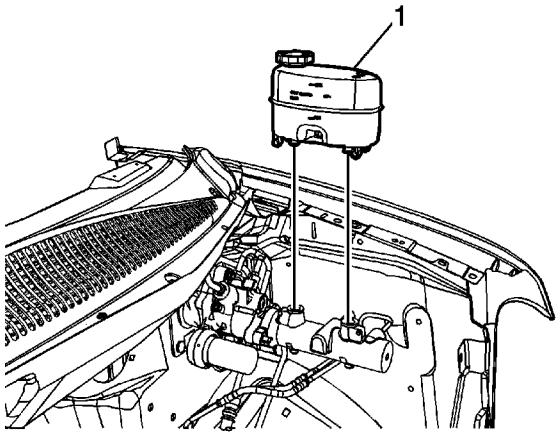
6. Remove the master cylinder reservoir seals (1).

Installation Procedure



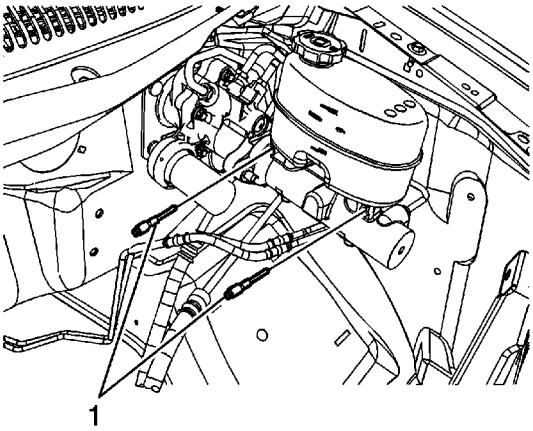
1. Lubricate the master cylinder reservoir seals (1) and the outer surface area of the reservoir-to-housing barrels with GM approved brake fluid from a clean, sealed brake fluid container.
2. If reinstalling the master cylinder reservoir, clean the reservoir with denatured alcohol, or equivalent and allow to dry.
3. Install the master cylinder reservoir seals to the master cylinder.

   Ensure the master cylinder reservoir seals are fully seated in the master cylinder body.



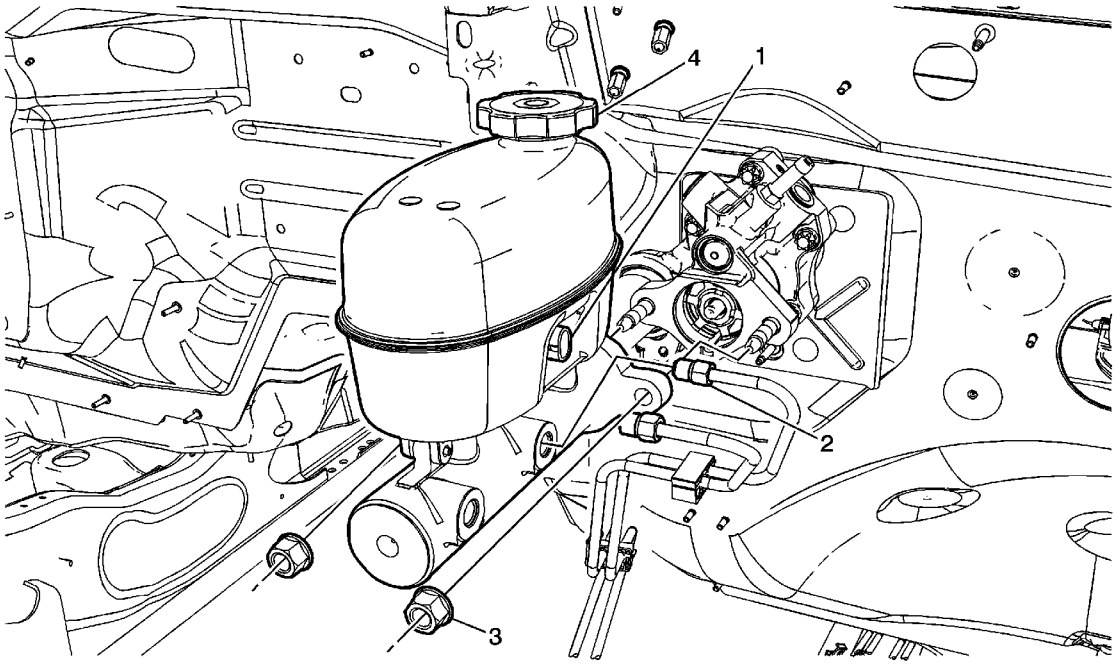
4. Lubricate the master cylinder reservoir-to-master cylinder barrels with GM approved brake fluid from a clean, sealed brake fluid container.
5. Carefully press the master cylinder reservoir (1) straight downward and install the reservoir to the master cylinder.

Caution: Refer to Fastener Caution in the Preface section.



6. Install the master cylinder reservoir bolts (1) and tighten to **8 N·m (71 lb in)**.
7. Connect the brake fluid level indicator switch electrical connector.
8. Fill the master cylinder reservoir. Refer to Master Cylinder Reservoir Filling.

Master Cylinder Replacement

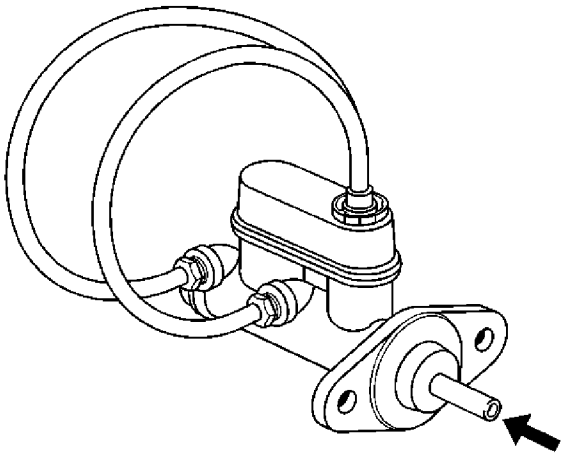


Callout	Component Name
	Warning: Refer to Brake Fluid Irritant Warning in the Preface section. **Caution:** Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section. **Preliminary Procedures** 1. Apply the park brake and block the wheels. 2. Using a suitable tool, remove the brake fluid from the brake master cylinder reservoir. 3. Discard the brake fluid into an approved container. 4. Remove the driver side upper fender support.
1	Master Cylinder Fluid Level Sensor Electrical Connector (if equipped)
2	Brake Pipe Fitting (Qty: 2) **Caution:** Refer to Fastener Caution in the Preface section. **Procedure** 1. Remove any dirt or debris from the brake pipe fitting.

	2. Cap the brake pipe fittings to prevent brake fluid loss and contamination. **Tighten** Without RPO JL4: 25 N·m (18 lb ft) **Tighten** With RPO JL4: 32 N·m (24 lb ft)
3	Brake Master Cylinder Nut (Qty: 2) **Tighten** 36 N·m (27 lb ft)
4	Brake Master Cylinder Assembly **Procedure** 1. Remove and discard the push-on nuts on the master cylinder mounting studs, if equipped. 2. Bench bleed the master cylinder. Refer to Master Cylinder Bench Bleeding. 3. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.

Master Cylinder Bench Bleeding

Caution: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.



1. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible.
2. Remove the master cylinder reservoir cap and diaphragm.
3. Install suitable fittings to the master cylinder ports that match the type of flare seat required and also provide for hose attachment.
4. Install transparent hoses to the fittings installed to the master cylinder ports, then route the hoses into the master cylinder reservoir.
5. Fill the master cylinder reservoir to at least the half-way point with Delco Supreme 11® (GM P/N 12377967, Canadian P/N 992667) or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
6. Ensure that the ends of the transparent hoses running into the master cylinder reservoir are fully submerged in the brake fluid.
7. Using a smooth, round-ended tool, depress and release the primary piston as far as it will travel, a depth of about 25 mm (1 in), several times. Observe the flow of fluid coming from the ports.

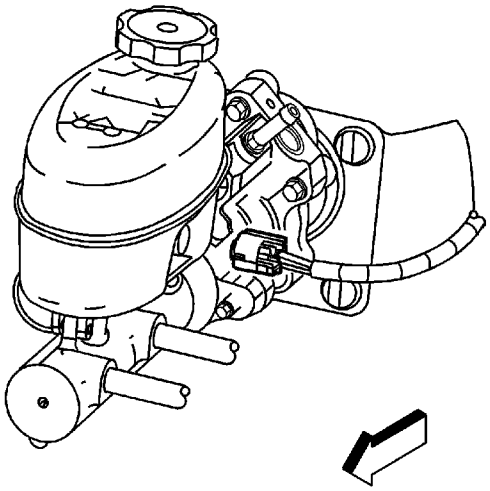
   As air is bled from the primary and secondary pistons, the effort required to depress the primary piston will increase and the amount of travel will decrease.

8. Continue to depress and release the primary piston until fluid flows freely from the ports with no evidence of air bubbles.
9. Remove the transparent hoses from the master cylinder reservoir.

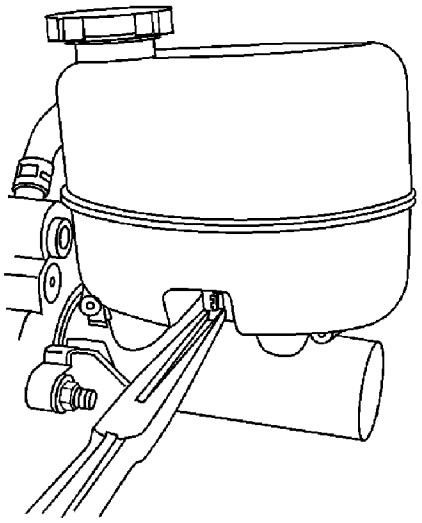
10. Install the master cylinder reservoir cap and diaphragm.
11. Remove the fittings with the transparent hoses from the master cylinder ports. Wrap the master cylinder with a clean shop cloth to prevent brake fluid spills.
12. Remove the master cylinder from the vise.

Brake Fluid Level Indicator Switch Replacement

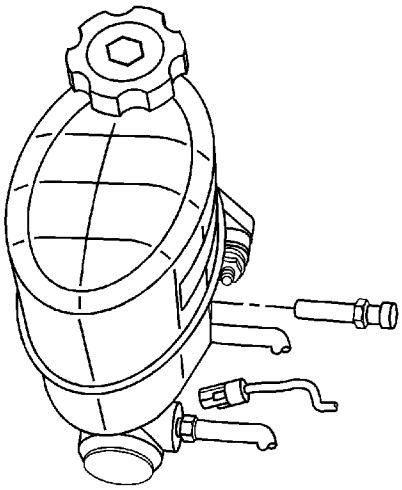
Removal Procedure



1. Disconnect the brake fluid level indicator switch electrical connector.

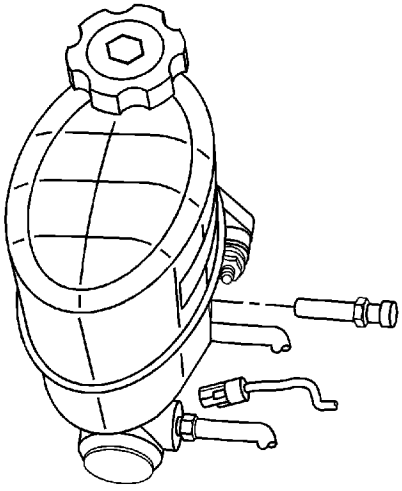


2. Using a suitable tool, carefully compress the brake fluid level indicator switch locking tabs.



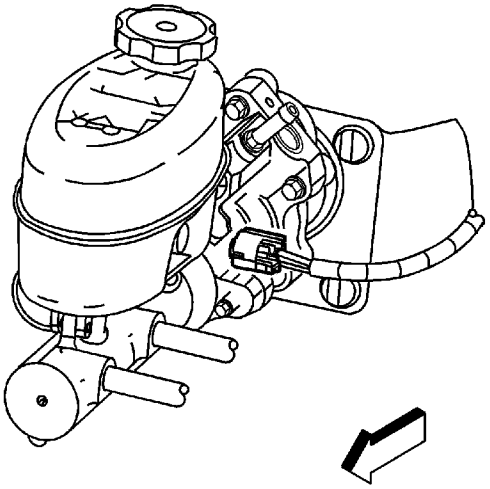
3. Remove the brake fluid level indicator switch.

Installation Procedure



1. Install the brake fluid level indicator switch.

   Ensure the brake fluid level indicator switch locking tabs are fully engaged in the master cylinder reservoir.

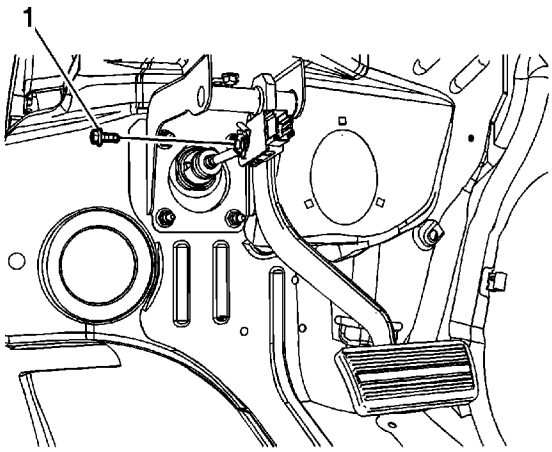


2. Connect the brake fluid level indicator switch electrical connector.

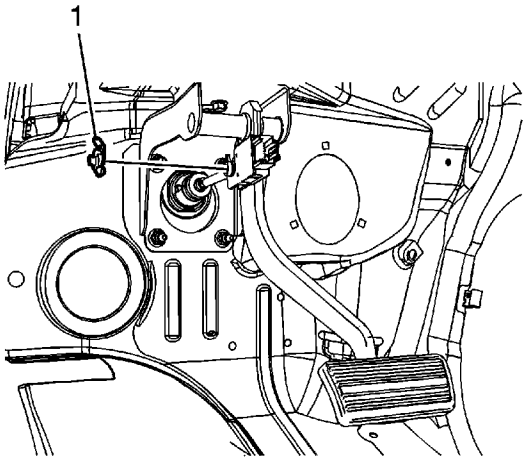
Brake Pedal Assembly Replacement

Removal Procedure

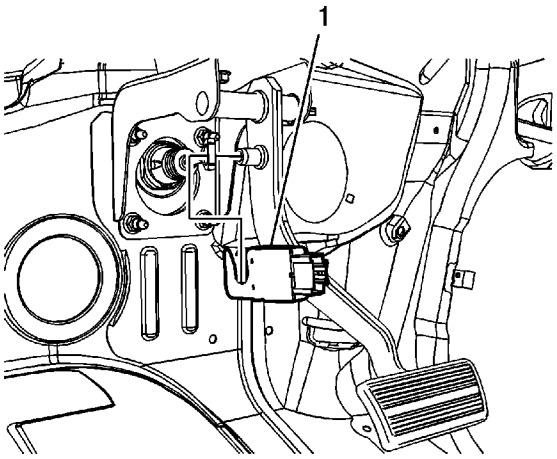
1. Block the drive wheels.



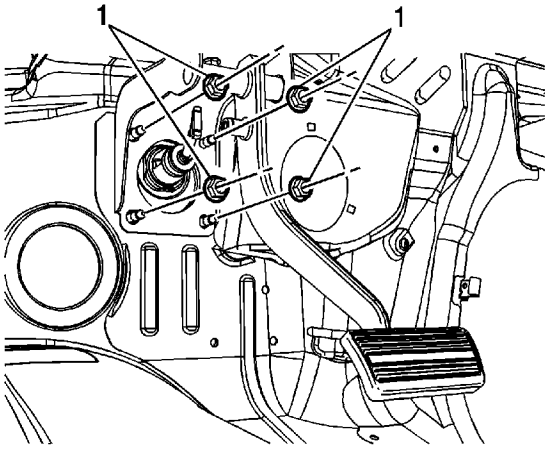
2. Remove the power brake booster pushrod retaining clip bolt (1).



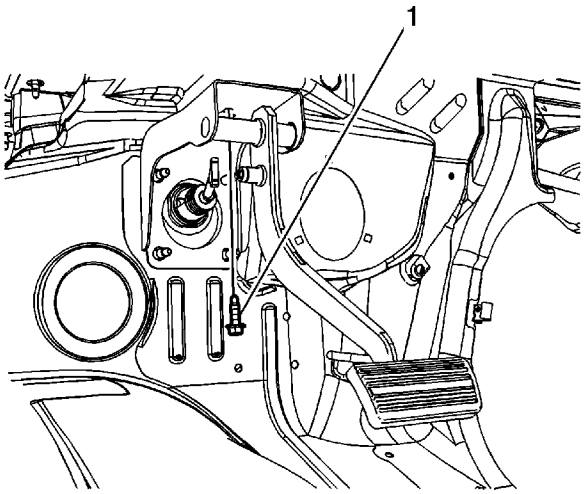
3. Remove the power brake booster pushrod retaining clip (1).



4. Disconnect the stoplamp switch electrical connector.
5. Disconnect the power brake booster pushrod and remove the stoplamp switch (1).

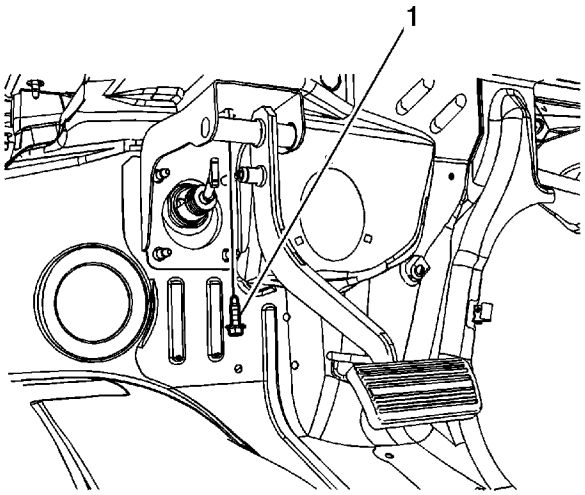


6. Remove the power brake booster nuts (1).



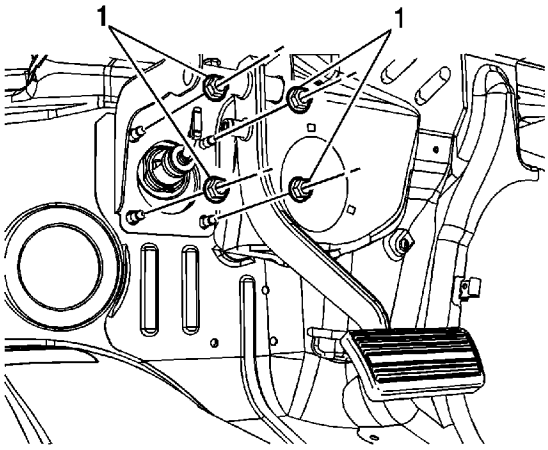
7. Remove the brake pedal bracket bolt (1).
8. Remove the brake pedal assembly.

Installation Procedure

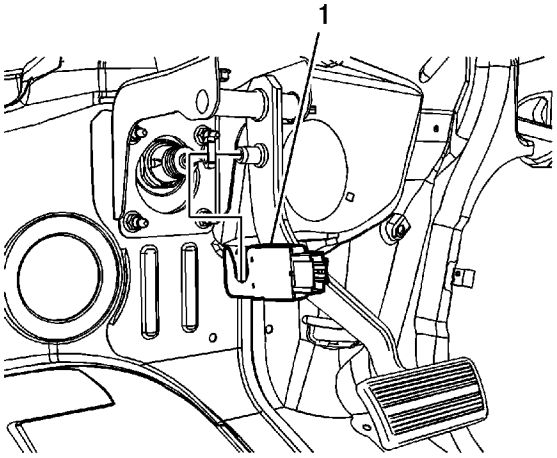


1. Install the brake pedal assembly.
2. Loosely install the brake pedal bracket bolt (1).

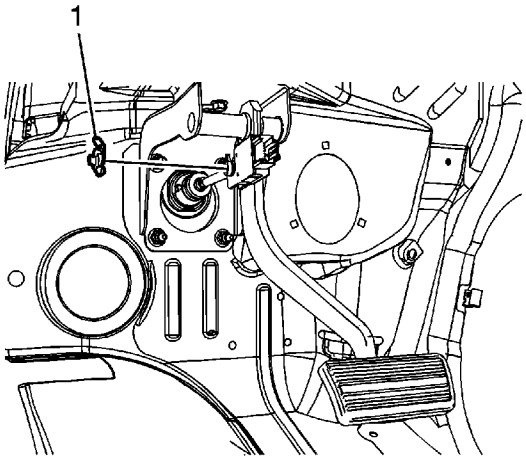
Caution: Refer to Fastener Caution in the Preface section.



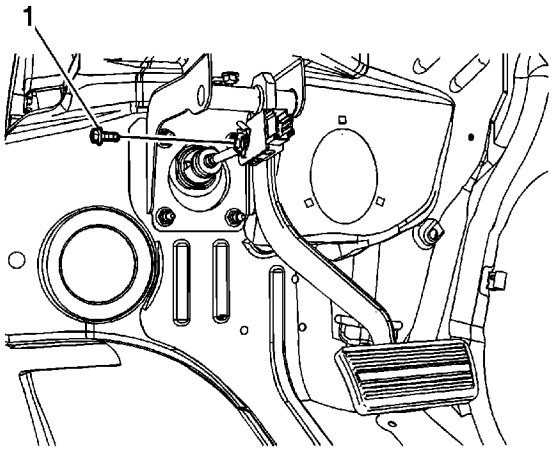
3. Install the power brake booster nuts (1) and tighten to **36 N·m (27 lb ft)**.
4. Tighten the brake pedal bracket bolt to **33 N·m (24 lb ft)**.



5. Apply a thin coat of high temperature lubricant, GM P/N 12345994 (Canadian P/N 10953501) to the brake pedal pivot pin.
6. Install the stoplamp switch (1) and simultaneously connect the power brake booster pushrod.
7. Connect the stoplamp switch electrical connector.



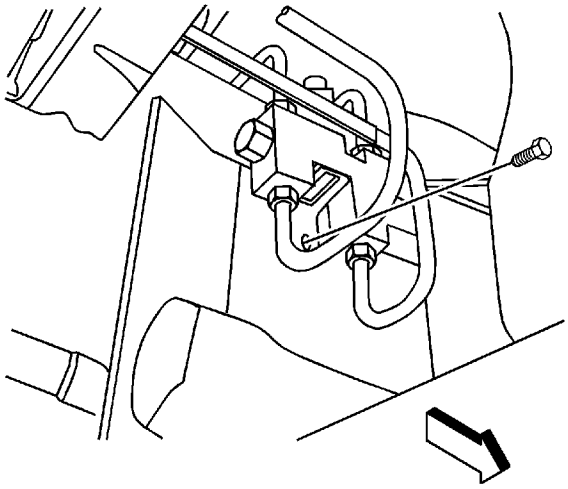
8. Install the power brake booster pushrod retaining clip (1).
9. Rotate the power brake booster retaining clip 360 degrees to ensure the clip is fully engaged in the brake pedal pivot pin groove.



10. Install the power brake booster pushrod retaining clip bolt (1) and tighten to **10 N·m (89 lb in)**.

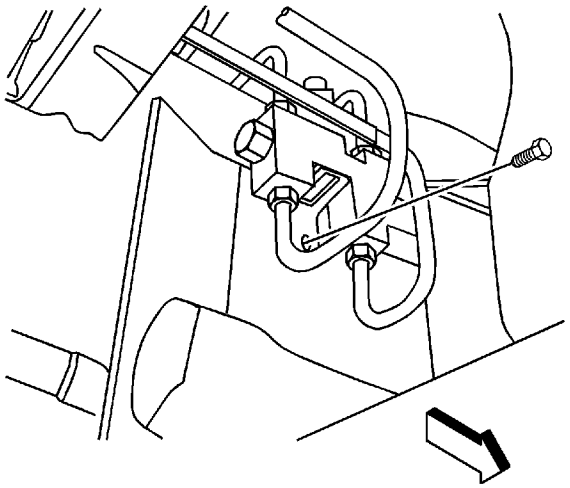
Combination Valve Replacement

Removal Procedure



1. Raise the vehicle and properly support it with safety stands. Refer to Lifting and Jacking the Vehicle.
2. Disconnect the electrical connector from the combination valve.
3. Disconnect the front and rear brake pipes from the combination valve.
4. Remove the bolt holding the combination valve to the frame.
5. Remove the combination valve.

Installation Procedure



1. Install the combination valve to the frame.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the bolt to the combination valve and the frame and tighten to **10 N·m (89 lb in)**.
3. Connect the front and rear brake pipes to the combination valve and tighten to **30 N·m (22 lb ft)**.
4. Connect the electrical connector to the combination valve.
5. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.

Brake Pipe Replacement

Special Tools

J 45405 Pipe Flaring Tool Kit

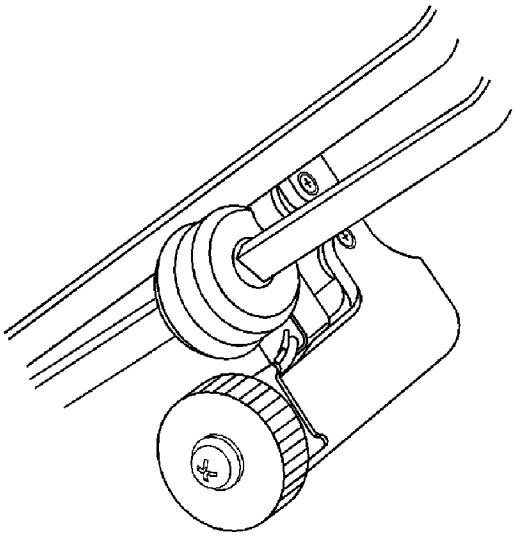
Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Warning: Always use double walled steel brake pipe when replacing brake pipes. The use of any other pipe is not recommended and may cause brake system failure. Carefully route and retain replacement brake pipes. Always use the correct fasteners and the original location for replacement brake pipes. Failure to properly route and retain brake pipes may cause damage to the brake pipes and cause brake system failure.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

Note: When servicing the brake pipes, note the following:

- If sectioning the brake pipe, use replacement pipe of the same type and outside diameter.
- Use fittings of the appropriate size and type.
- Only create flares of the same type or design as originally equipped on the vehicle.



1. Inspect the area of brake pipe to be repaired or replaced.
2. Release the brake pipe to be replaced from the retainers, as required.
3. Select an appropriate location to section the brake pipe, if necessary.
   - Allow adequate clearance in order to maneuver the J 45405 .
   - Avoid sectioning the brake pipe at bends or mounting points.

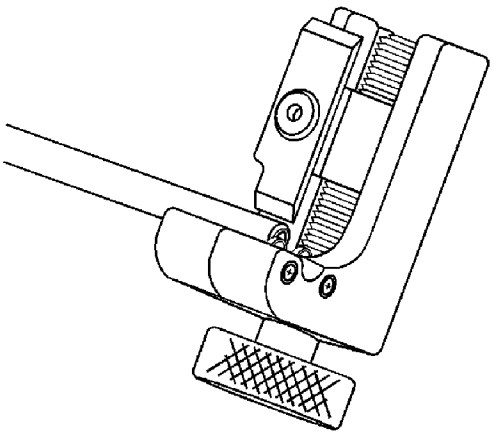
4. Using a string or wire, measure the length of the pipe to be replaced including all pipe bends.
5. Add to the measurement taken the appropriate additional length required for each flare to be created.

Specification

- 6.35 mm (0.250 in) for 4.76 mm (3/16 in) diameter pipe
- 9.50 mm (0.374 in) for 6.35 mm (1/4 in) diameter pipe
- 12.67 mm (0.499 in) for 7.94 mm (5/16 in) diameter pipe

Note: Ensure that the brake pipe end to be flared is cut at a square, 90 degree angle to the pipe length.

6. Using the pipe cutter included in the J 45405 , carefully cut the brake pipe squarely to the measured length.
7. Remove the sectioned brake pipe from the vehicle.
8. Select the appropriate size of brake pipe and tube nuts, as necessary. The brake pipe outside diameter determines brake pipe size.



9. Strip the nylon coating from the brake pipe end to be flared, if necessary.
   - Select the appropriate blade on the coating stripping tool included in the J 45405 , by unthreading the blade block from the stripping tool and installing the block with the desired blade facing the tool rollers.

Specification

- 6.35 mm (0.250 in) blade for 4.76 mm (3/16 in) diameter pipe
- 9.50 mm (0.374 in) blade for 6.35 mm (1/4 in) and 7.94 mm (5/16 in) diameter pipe

- Insert the brake pipe end to be flared into the stripping tool to the depth of the ledge on the tool rollers.
- While holding the brake pipe firmly against the stripping tool roller ledges, rotate the thumbwheel of the tool until the blade contacts the brake pipe coated surface.

Note: Do not gouge the metal surface of the brake pipe.

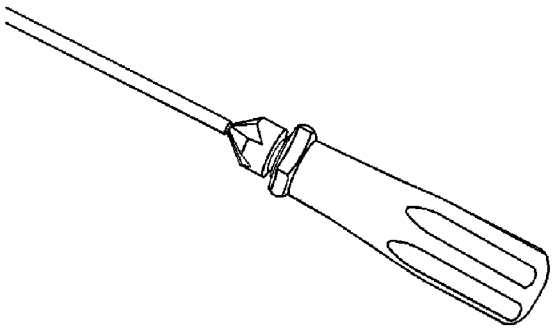
- Rotate the stripping tool in a clockwise direction, ensuring that the brake pipe end remains against the tool roller ledges.
- After each successive revolution of the stripping tool, carefully rotate the thumbwheel of the tool clockwise, in order to continue stripping the coating from the brake pipe until the metal pipe surface is exposed.
- Loosen the thumbwheel of the tool and remove the brake pipe.

Note: Ensure that all loose remnants of the nylon coating have been removed from the brake pipe.

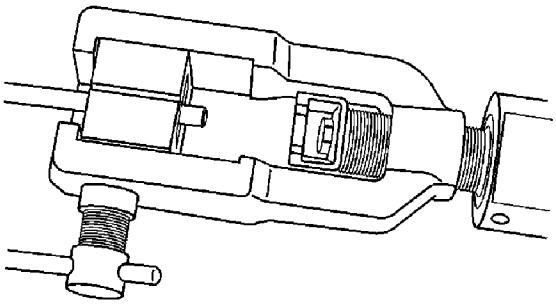
- Inspect the stripped end of the brake pipe to ensure that the proper amount of coating has been removed.

Specification

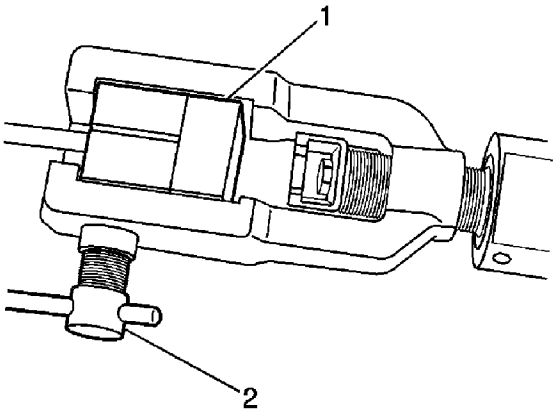
- 6.35 mm (0.250 in) for 4.76 mm (3/16 in) diameter pipe
- 9.50 mm (0.374 in) for 6.35 mm (1/4 in) and 7.94 mm (5/16 in) diameter pipe



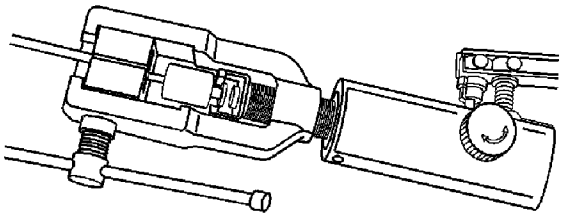
10. Chamfer the inside and outside diameter of the pipe with the de-burring tool included in the J 45405 .
11. Install the tube nuts on the brake pipe, noting their orientation.
12. Clean the brake pipe and the J 45405 of lubricant, contaminants, and debris.



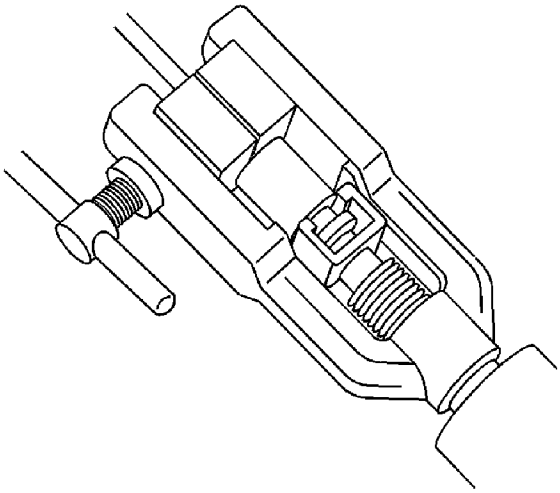
13. Loosen the die clamping screw of the J 45405 .
14. Select the corresponding die set and install the die halves into the die cage with the full, flat face of one die facing the clamping screw, and the counterbores of both dies facing the forming ram.



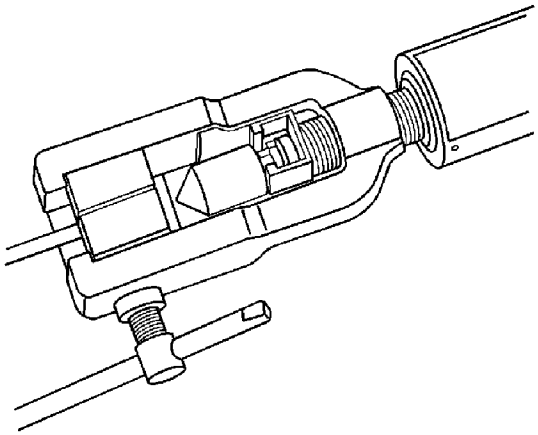
15. Place the flat face of an unused die (1) against the die halves in the clamping cage and hold firmly against the counterbored face of the dies.
16. Insert the prepared end of the pipe to be flared through the back of the dies until the pipe is seated against the flat surface of the unused die (1).
17. Remove the unused die (1).
18. Ensure that the rear of both dies are seated firmly against the enclosed end of the die cage.
19. Firmly hand tighten the clamping screw (2) against the dies.



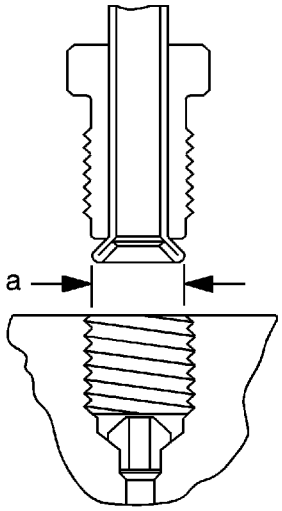
20. Select the appropriate forming mandrel and place into the forming ram.
21. Rotate the hydraulic fluid control valve clockwise to the closed position.
22. Rotate the body of the J 45405 until it bottoms against the die cage.



23. While guiding the forming mandrel into the exposed end of pipe to be flared, operate the lever of the J 45405 until the forming mandrel bottoms against the clamping dies.
24. Rotate the hydraulic fluid control valve counterclockwise to the open position to allow the hydraulic forming ram to retract.



25. Insert the finishing cone into the forming ram.
26. Rotate the hydraulic fluid control valve clockwise to the closed position.
27. Rotate the body of the J 45405 until it bottoms against the die cage.
28. While guiding the finishing cone into the exposed end of pipe to be flared, operate the lever of the J 45405 until the finishing cone bottoms against the dies.
29. Rotate the hydraulic fluid control valve counterclockwise to the open position to allow the hydraulic forming ram to retract.
30. Loosen the die clamping screw and remove the dies and pipe.
31. If necessary, lightly tap the dies until the die halves separate.



32. Inspect the brake pipe flare for correct shape and diameter (a).

Specification

- 6.74-7.10 mm (0.265-0.279 in) flare diameter for 4.76 mm (3/16 in) diameter pipe

- 8.57-9.27 mm (0.344-0.358 in) flare diameter for 6.35 mm (1/4 in) diameter pipe
- 10.42-10.79 mm (0.410-0.425 in) flare diameter for 7.94 mm (5/16 in) diameter pipe

33. If necessary, using the removed section of brake pipe as a template, shape the new pipe with a suitable brake pipe bending tool.

Note: When installing the pipe, maintain a clearance of 19 mm (3/4 in) from all moving or vibrating components.

34. Install the pipe to the vehicle with the appropriate brake pipe unions, as required.
35. If previously released, secure the brake pipe to the retainers.
36. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.
37. With the aid of an assistant, inspect the brake pipe flares for leaks by starting the engine and applying the brakes.

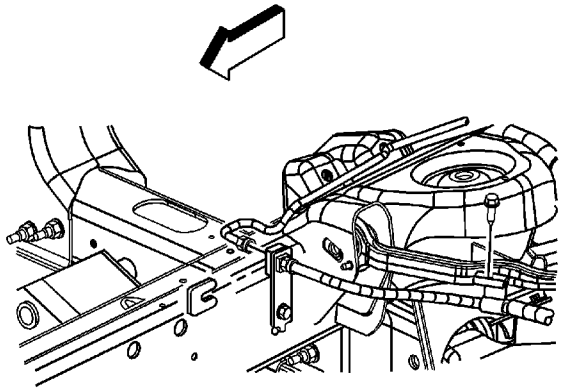
Front Brake Hose Replacement

Removal Procedure

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

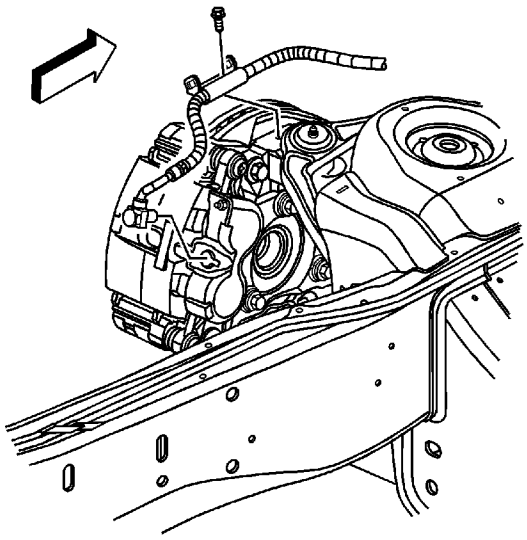
Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
3. Clean all dirt and foreign material from the brake hose end and brake pipe fitting.



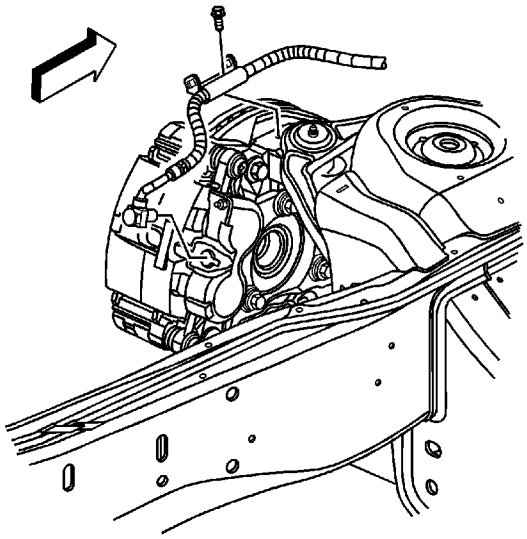
Note: Install a rubber cap or plug to the exposed brake pipe fitting end in order to prevent brake fluid loss and contamination.

4. Use a backup wrench on the brake hose fitting end, disconnect the brake pipe fitting end from the brake hose then cap or plug the brake pipe fitting end.
5. Remove the brake hose retaining clip from the brake hose mounting bracket.
6. Remove the brake hose bracket bolt from the upper control arm.
7. Remove the brake hose bracket bolt from the steering knuckle.



8. Remove the brake hose to caliper bolt from the brake caliper.
9. Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end.

Installation Procedure

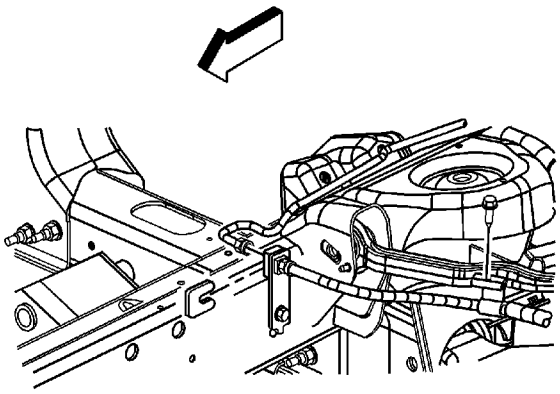


Note: Install 2 new copper brake hose gaskets.

1. Assemble the 2 new copper brake hose gaskets and the brake hose bolt to the brake hose.

Caution: Refer to Fastener Caution in the Preface section.

2. Install the brake hose to caliper bolt and 2 new washers to the brake caliper and tighten to **44 N·m (32 lb ft)**.



Note: The brake hose must not be twisted. Make sure the brake hose is not in contact with any suspension component.

3. Install the brake hose bracket bolt and the bracket to the steering knuckle and tighten to **10 N·m (89 lb in)**.
4. Install the brake hose bracket bolt and the bracket to the upper control arm and tighten to **10 N·m (89 lb in)**.
5. Install the brake hose into the brake hose bracket.
6. Install the brake hose retaining clip.
7. Remove the rubber cap or plug from the brake pipe fitting end.
8. Connect the brake pipe fitting end to the brake hose:
   - Use a backup wrench on the brake hose fitting end.
   - Do not bend the mounting bracket or the brake pipe and tighten to **25 N·m (18 lb ft)**.
9. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.
10. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.

Note: Ensure that the brake hose does not make contact with any part of the suspension or the tire/wheel assembly. Inspect the brake hose in extreme right and left turn conditions. If the brake hose makes contact remove the brake hose and correct the condition.

11. Lower the vehicle.

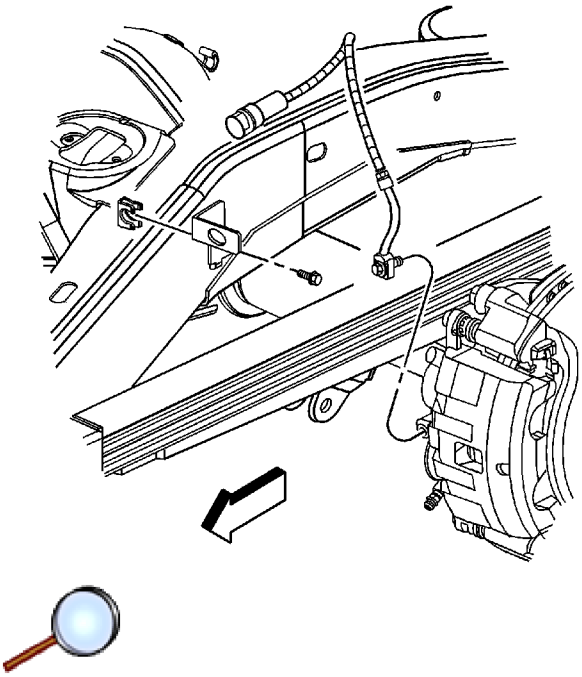
Rear Brake Hose Replacement (Caliper)

Removal Procedure

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

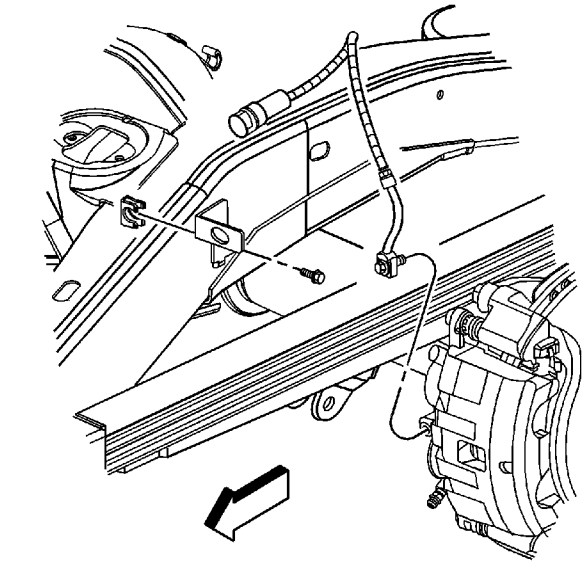
1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
3. Clean all dirt and foreign material from the brake hose end and brake pipe fitting.



Note: Install a rubber cap or plug to the exposed brake pipe fitting end in order to prevent brake fluid loss and contamination.

4. Using a backup wrench on the brake hose fitting end, disconnect the brake pipe fitting end from the brake hose, then cap or plug the brake pipe fitting end.
5. Remove the brake hose retaining clip from the brake hose mounting bracket.
6. Remove the brake hose from the mounting bracket.
7. Remove the brake hose to caliper bolt from the brake caliper.
8. Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end.

Installation Procedure



Note: Install 2 new copper brake hose gaskets.

1. Assemble the 2 new copper brake hose gaskets and the brake hose bolt to the brake hose.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the brake hose to caliper bolt and 2 new washers to the brake caliper and tighten to **44 N·m (33 lb ft)**.

   Note: The brake hose must not be twisted. Make sure the brake hose is not in contact with any suspension component.

3. Install the brake hose into the mounting bracket.
4. Install the brake hose retaining clip.
5. Remove the rubber cap or plug from the exposed brake pipe fitting end.
6. Connect the brake pipe fitting end to the brake hose:
   - Use a backup wrench on the brake hose fitting end.
   - Do not bend the mounting bracket or the brake pipe and tighten to **25 N·m (18 lb ft)**.
7. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.
8. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.

   Note: Ensure that the brake hose does not make contact with any part of the suspension or the tire/wheel assembly. If the brake hose makes contact remove the brake hose and correct the condition.

9. Lower the vehicle.

Rear Brake Hose Replacement (Frame to Axle)

Removal Procedure

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
3. Clean all dirt and foreign material from the brake hose and brake pipe fittings.
4. Using a backup wrench on the hose fitting, disconnect the brake pipe fitting from the brake hose, then cap or plug the brake pipe fitting end.
5. Remove the brake hose retaining clip from the hose mounting bracket.
6. Remove the jounce hose from the bracket.

   Note: Install a rubber cap or plug to the exposed brake pipe fitting ends in order to prevent brake fluid loss and contamination.

7. Remove the brake hose to caliper bolt from the brake caliper.
8. Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end.
9. Remove the brake hose from the vehicle.

Installation Procedure

Note: Install 2 new copper brake hose gaskets.

1. Assemble the 2 new copper brake hose gaskets and the brake hose bolt to the brake hose.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the brake hose to the caliper bolt and 2 new washers to the brake caliper and tighten to **44 N·m (32 lb ft)**.

   Note: The brake hose must not be twisted. Make sure the brake hose is not in contact with any suspension component.

3. Install the brake hose to the bracket.
4. Remove the rubber cap or plug from the exposed brake pipe fitting end.
5. Connect the brake pipe fitting to the brake hose.
   - Use a backup wrench on the hose fitting.
   - Do not bend the bracket or the pipe and tighten to **25 N·m (18 lb ft)**.
6. Install the brake hose retaining clip to the hose mounting bracket.
7. Ensure that the hose does not make contact with any part of the suspension. If the hose makes contact, remove the hose and correct the condition.
8. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.
9. Lower the vehicle.

Hydraulic Brake System Bleeding (Manual)

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

Caution: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:
   3.1. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary add Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.

   If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.

   3.2. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.
   3.3. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
   3.4. Reconnect the brake pipe to the master cylinder port and tighten securely.
   3.5. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
   3.6. Loosen the same brake pipe to purge air from the open port of the master cylinder.
   3.7. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
   3.8. Wait 15 seconds, then repeat steps 3.3-3.7 until all air is purged from the same port of the master cylinder.
   3.9. With the front brake pipe installed securely to the master cylinder - after all air has been purged from the front port of the master cylinder - loosen and separate the rear brake pipe from the master cylinder, then repeat steps 3.3-3.8.
   3.10. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.
4. Fill the brake master cylinder reservoir with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. Ensure that the brake master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to maintain the proper level.

   Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap

and diaphragm.

5. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
6. Install a transparent hose over the end of the bleeder valve.
7. Submerge the open end of the transparent hose into a transparent container partially filled with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
8. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
9. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
10. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
11. Wait 15 seconds, then repeat steps 8-10 until all air is purged from the same wheel hydraulic circuit.
12. With the right rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right rear hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.
13. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
14. With the left rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left rear hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.
15. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
16. With the right front wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right front hydraulic circuit, install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.
17. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
18. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves are properly tightened.
19. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
20. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
21. If the brake pedal feels spongy, repeat the bleeding procedure again. If the brake pedal still feels spongy after repeating the bleeding procedure, perform the following steps:
    21.1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection.
    21.2. Pressure bleed the hydraulic brake system in order to purge any air that may still be trapped in the system.
22. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

Note: If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired.

23. If the brake system warning lamp remains illuminated, refer to Symptoms - Hydraulic Brakes.

Hydraulic Brake System Bleeding (Pressure)

Special Tools

- J 29532 Diaphragm Type Brake Pressure Bleeder, or equivalent
- J 35589-A Brake Pressure Bleeder Adapter

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

Caution: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:
   3.1. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary add Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.

   If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.

   3.2. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.
   3.3. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
   3.4. Reconnect the brake pipe to the master cylinder port and tighten securely.
   3.5. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
   3.6. Loosen the same brake pipe to purge air from the open port of the master cylinder.
   3.7. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
   3.8. Wait 15 seconds, then repeat steps 3.3-3.7 until all air is purged from the same port of the master cylinder.
   3.9. With the front brake pipe installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brake pipe from the master cylinder, then repeat steps 3.3-3.8.
   3.10. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.

4. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.

   Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.

5. Install the J 35589-A to the brake master cylinder reservoir.
6. Check the brake fluid level in the J 29532 , or equivalent. Add Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container as necessary to bring the level to approximately the half-full point.
7. Connect the J 29532 , or equivalent, to the J 35589-A .
8. Charge the J 29532 , or equivalent, air tank to 175-205 kPa (25-30 psi).
9. Open the J 29532 , or equivalent, fluid tank valve to allow pressurized brake fluid to enter the brake system.
10. Wait approximately 30 seconds, then inspect the entire hydraulic brake system in order to ensure that there are no existing external brake fluid leaks.

    Any brake fluid leaks identified require repair prior to completing this procedure.

11. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
12. Install a transparent hose over the end of the bleeder valve.
13. Submerge the open end of the transparent hose into a transparent container partially filled with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
14. Loosen the bleeder valve to purge air from the wheel hydraulic circuit. Allow fluid to flow until air bubbles stop flowing from the bleeder, then tighten the bleeder valve.
15. With the right rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right rear hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.
16. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
17. With the left rear wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left rear hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.
18. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
19. With the right front wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the right front hydraulic circuit, install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.
20. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
21. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves are properly tightened.
22. Close the J 29532 , or equivalent, fluid tank valve, then disconnect the J 29532 , or equivalent, from the J 35589-A .
23. Remove the J 35589-A from the brake master cylinder reservoir.
24. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11®, GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
25. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
26. If the brake pedal feels spongy perform the following steps:
    26.1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection.
    26.2. Using a scan tool, perform the antilock brake system automated bleeding procedure to remove any air that may have been trapped in the BPMV. Refer to Antilock Brake

System Automated Bleed Procedure.

27. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

Note: If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired.

28. If the brake system warning lamp remains illuminated, refer to Symptoms - Hydraulic Brakes.

Hydraulic Brake System Flushing

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
   - Fluid separation, indicating 2 types of fluid are present; a substance other than the recommended brake fluid has been introduced into the brake hydraulic system
     - Swirled appearance - oil-based substance
     - Layered appearance - silicone-based substance
   - Fluid discoloration, indicating the presence of moisture or particles that have been introduced into the brake hydraulic system
     - Cloudy appearance - moisture
     - Dark appearance/suspended particles in fluid - dirt, rust, corrosion, brake dust
2. Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating brake fluid contamination.
3. If the brake fluid WAS contaminated with an oil-based or a silicone-based substance, indicated by fluid separation and/or a swollen master cylinder reservoir cap diaphragm and/or swollen reservoir-to-master cylinder grommets, perform the following:
   3.1. Remove ALL of the following components listed from the vehicle. Each component contains internal rubber seals/linings which have been contaminated by the contaminated brake fluid in the brake hydraulic system.

   Refer to the procedures indicated:

   - Master Cylinder Replacement
   - Front Brake Hose Replacement
   - Rear Brake Hose Replacement
   - Front Brake Caliper Replacement
   - Rear Brake Caliper Replacement
   - Brake Pressure Modulator Valve Replacement

   3.2. Clean out all the hydraulic brake pipes using denatured alcohol, or equivalent.

   3.3. Dry the brake pipes using non-lubricated, filtered air.

   3.4. Repair or replace ALL of the following components listed and install them to the vehicle. Each component contains internal rubber seals/linings which have been contaminated by the contaminated brake fluid in the brake hydraulic system.

   Refer to the procedures indicated:

   - Master Cylinder Replacement ; also perform the following:
   - Clean the brake master cylinder reservoir using denatured alcohol, or equivalent, then dry the reservoir using non-lubricated, filtered air. Inspect the reservoir for cracks and/or damage and replace if necessary. Refer to Master Cylinder Reservoir

Replacement.

- Replace the brake master cylinder reservoir cap diaphragm.
- Front Brake Hose Replacement
- Rear Brake Hose Replacement
- Front Brake Caliper Overhaul or Front Brake Caliper Replacement
- Rear Brake Caliper Overhaul or Rear Brake Caliper Replacement
- Brake Pressure Modulator Valve Replacement

4. If the brake fluid was NOT contaminated with an oil-based or a silicone-based substance, but WAS contaminated with water or dirt, rust, corrosion, and/or brake dust, replace the brake master cylinder reservoir cap diaphragm. The diaphragm may have allowed the moisture or particles to enter the hydraulic system.
5. Fill the brake master cylinder reservoir to the maximum-fill level with approved brake fluid from a clean, sealed brake fluid container as specified in the owners manual.
6. Pressure bleed the hydraulic brake system. Begin the procedure with the pressure bleeder reservoir filled to the maximum-fill level with the correct brake fluid as indicated. Refer to Hydraulic Brake System Bleeding.

Power Brake Booster Replacement

Warning: Refer to Brake Fluid Irritant Warning in the Preface section.

Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution in the Preface section.

Caution: Hydraulic brake systems use two distinct and incompatible fluids. Power steering fluid is used in the hydraulic brake booster system. Brake fluid is used in the master cylinder and brake pipes. Use extreme care when selecting brake system fluids, or seal damage can result. Refer to General Information to select the correct fluid.

Checking and Adding Fluid

For information on checking and adding fluid to the power brake booster system, refer to Checking and Adding Power Steering Fluid.

Bleeding the Power Brake Booster System

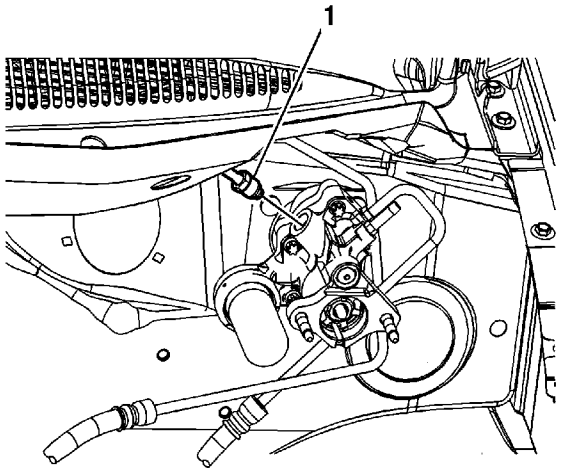
For information on bleeding the power brake booster system, refer to Power Steering System Bleeding.

Flushing the Power Brake Booster System

For information on flushing the power brake booster system, refer to Power Steering System Flushing.

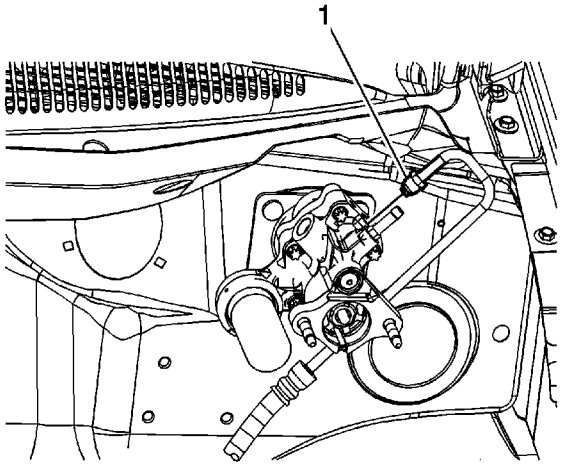
Removal Procedure

1. Apply the park brake and block the wheels.
2. Without disconnecting the brake pipes, remove the master cylinder and support with heavy mechanics wire or equivalent. Refer to Master Cylinder Replacement.



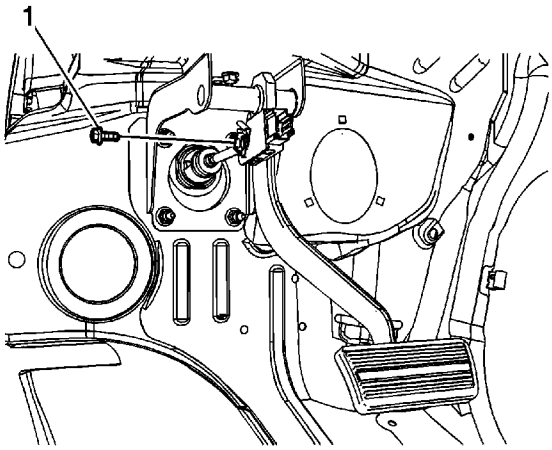
3. Disconnect the power brake booster inlet hose fitting (1).

   Inspect the O-ring seal for damage and replace, if necessary.

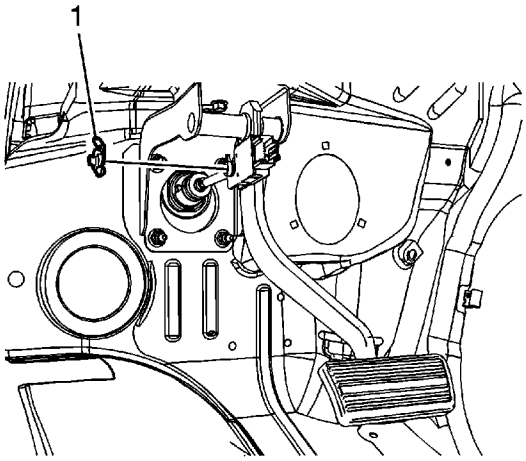


4. Disconnect the power brake booster outlet hose fitting (1).

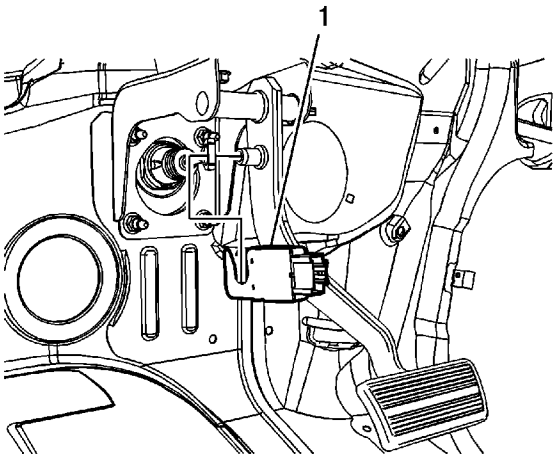
   Inspect the O-ring seal for damage and replace, if necessary.



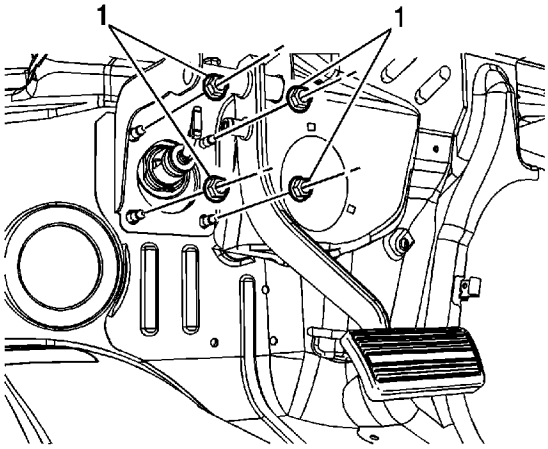
5. Remove the power brake booster pushrod retaining clip bolt (1).



6. Remove the power brake booster pushrod retaining clip (1).



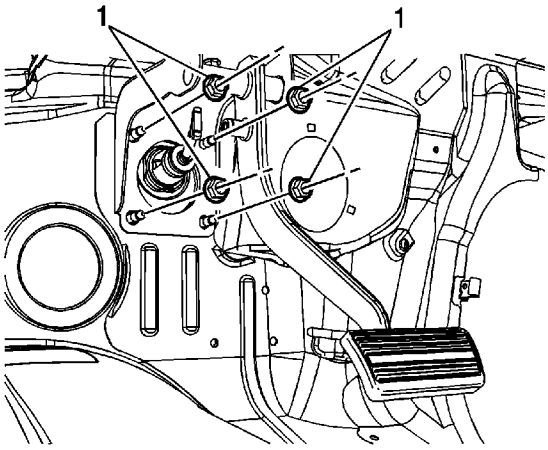
7. Disconnect the stoplamp switch electrical connector.
8. Disconnect the power brake booster pushrod and remove the stoplamp switch (1).



9. Remove the power brake booster nuts (1).
10. Remove the power brake booster.
11. Remove the power brake booster gasket.

Inspect the power brake booster gasket for damage and replace, if necessary.

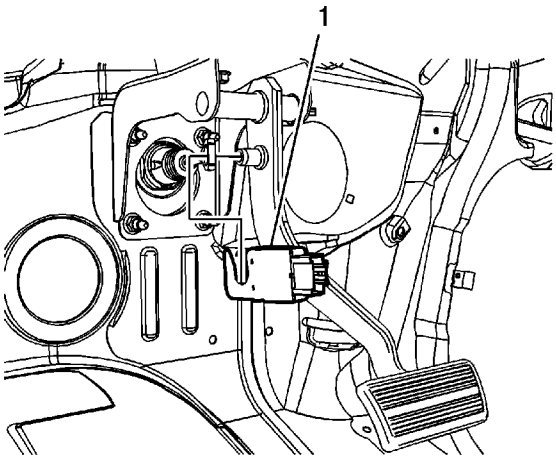
Installation Procedure



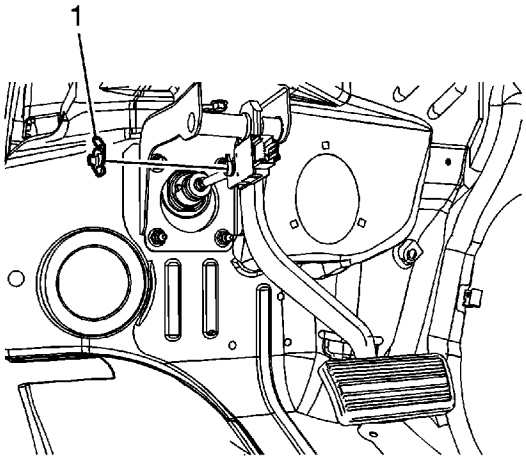
1. Install the power brake booster gasket.
2. Install the power brake booster.

Caution: Refer to Fastener Caution in the Preface section.

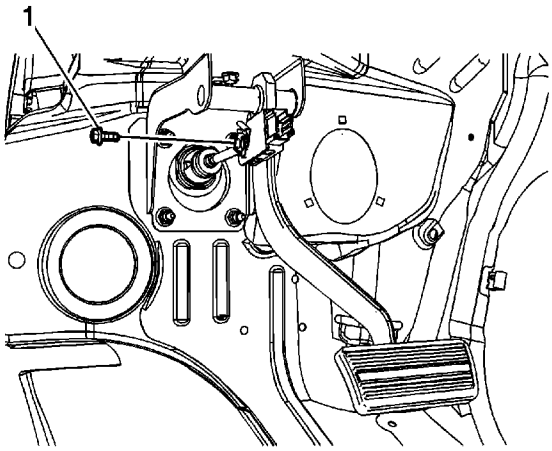
3. Install the power brake booster nuts (1) and tighten to **36 N·m (27 lb ft)**.



4. Apply a thin coat of high temperature lubricant, GM P/N 12345994 (Canadian P/N 10953501) to the brake pedal pivot pin.
5. Install the stoplamp switch (1) and simultaneously connect the power brake booster pushrod.
6. Connect the stoplamp switch electrical connector.

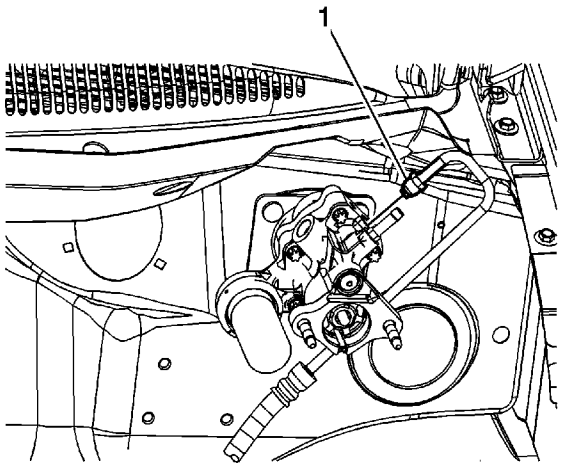


7. Install the power brake booster pushrod retaining clip (1).
8. Rotate the power brake booster retaining clip 360 degrees to ensure the clip is fully engaged in the brake pedal pivot pin groove.

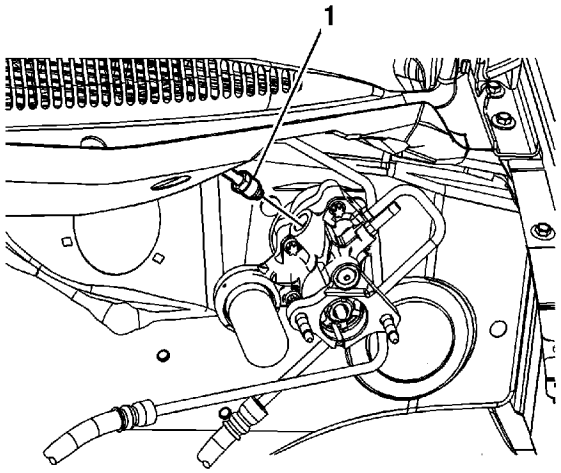


9. Install the power brake booster pushrod retaining clip bolt (1) and tighten to **10 N·m (89 lb in)**.

Note: Ensure the O-ring seals are properly positioned on the power brake booster inlet and outlet hose fittings.



10. Connect the power brake booster outlet hose fitting (1) and tighten the fitting to **33 N·m (24 lb ft)**.



11. Connect the power brake booster inlet hose fitting (1) and tighten the fitting to **33 N·m (24 lb ft)**.
12. Install the master cylinder. Refer to Master Cylinder Replacement.
13. Bleed the power steering system. Refer to Power Steering System Bleeding.

Power Brake Booster Pump Fluid Accumulator Replacement

Special Tools

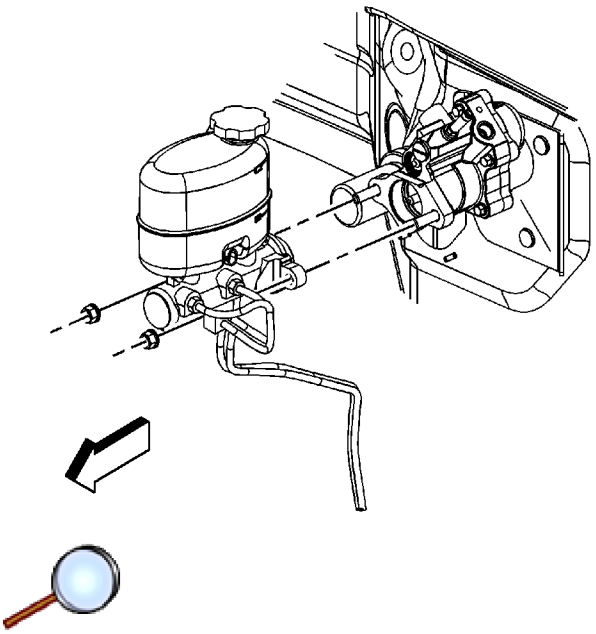
J 26889 Accumulator Piston Compressor

Removal Procedure

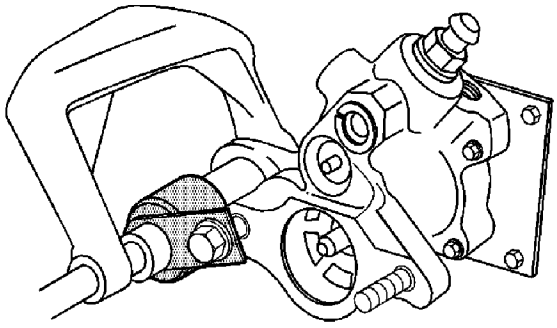
Warning: The accumulator contains compressed gas. Always use the proper tools and follow the recommended procedures or personal injury may result. Do not apply heat to accumulator. Do not attempt to repair an inoperative accumulator. Always replace an inoperative accumulator with a new one. Dispose of an inoperative accumulator by drilling a 1.5 mm (1/16 in) diameter hole through the end of the accumulator can, opposite the O-ring.

Warning: Push rod removal is not recommended. Improper staking of the push rod to the Hydroboost reaction piston can result in a loss of brakes. If the rod or seals require service, the entire unit must be replaced.

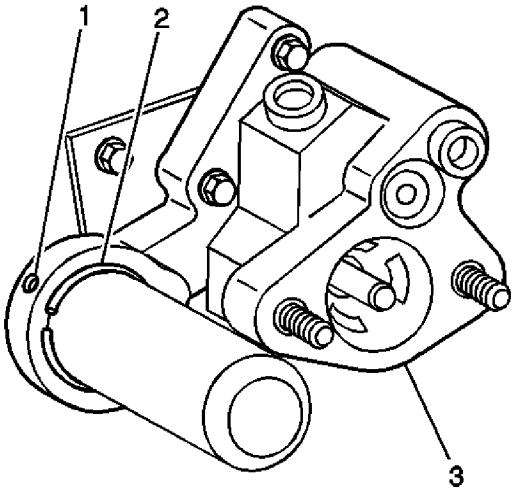
1. Depress brake pedal at least ten times to relieve pressure in the accumulator.



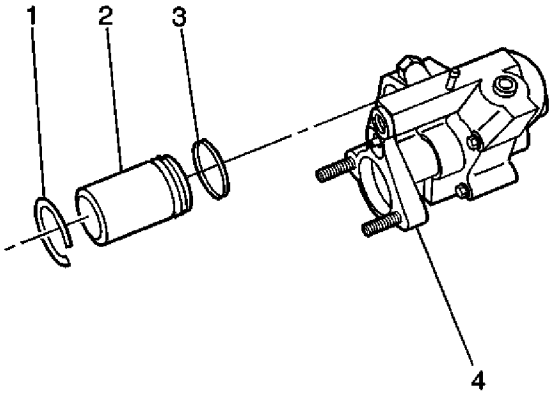
2. Remove the master cylinder from the hydraulic booster. Do not remove the brake pipes. Set the master cylinder aside in the engine compartment.



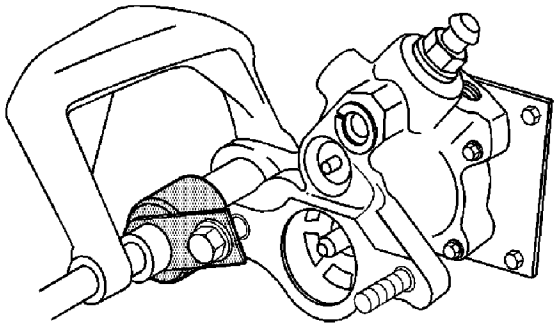
3. Place the J 26889 over the end of the accumulator.
4. Install the nut on the stud.
5. Depress the accumulator with a C-clamp. If accumulator doesn't move with moderate pressure, remove the C-clamp and depress brake pedal ten times to relieve pressure in the accumulator.



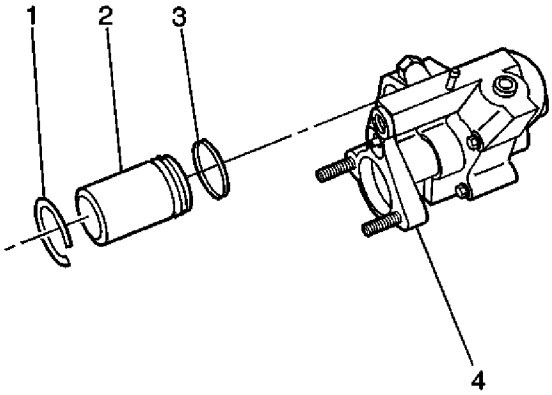
6. Rotate retaining ring (2) until either end of the ring is under the access hole (1).
7. Depress and hold the retaining ring (2) with a small tool inserted into the access hole (1).



8. Remove the accumulator retainer ring (1) using a small hook shaped tool.

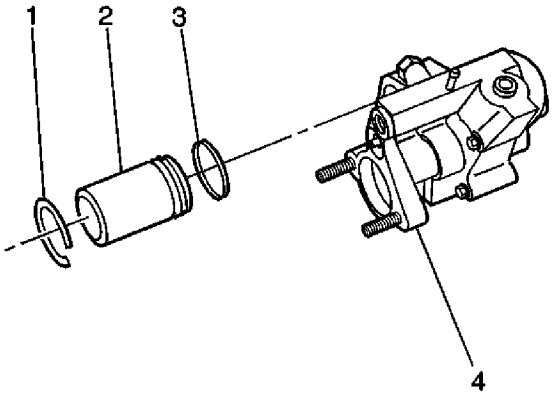


9. Release the C-clamp.
10. Remove the nut from the stud.
11. Remove the J 26889 .

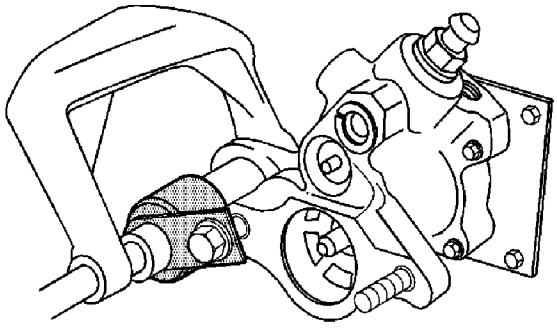


12. Remove the accumulator (2) and O-ring seal (3).

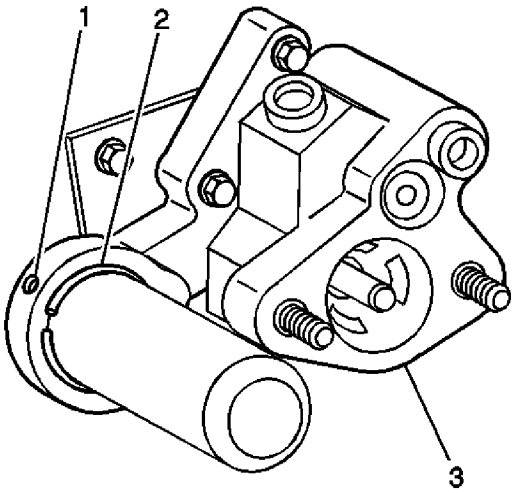
Installation Procedure



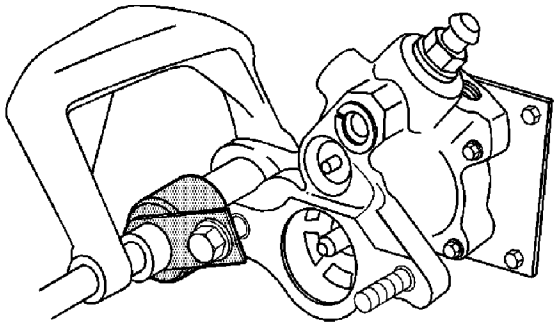
1. Lubricate all seals and metal friction points with power steering fluid GM P/N 1052884 (Canadian P/N 993294) or equivalent.
2. Install the accumulator (2) and O-ring seal (3).



3. Place the J 26889 over the end of the accumulator.
4. Install the nut on the stud.
5. Depress the accumulator with a C-clamp.

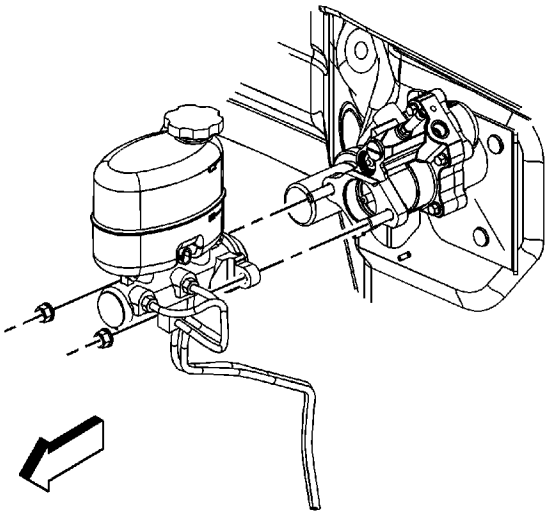


6. Install the accumulator retainer ring (2).



7. Release the C-clamp.
8. Remove the nut from the stud.
9. Remove the J 26889 .

Caution: Refer to Fastener Caution in the Preface section.



10. Install the master cylinder to the hydraulic booster.

Tighten
Tighten the nuts to 36 N·m (27 lb ft).