

2003-04 BRAKES

Disc - Hummer

MODEL IDENTIFICATION

Vehicle model can be identified by fifth character of Vehicle Identification Number (VIN), stamped on metal pad on top of left end of instrument panel, near windshield.

DESCRIPTION & OPERATION

NOTE: This article covers base brake systems only. For information on Anti-Lock Brake System (ABS), see appropriate ANTI-LOCK article.

HYDRAULIC BRAKE SYSTEM DESCRIPTION

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure. Hydraulic output pressure is distributed from the master cylinder through 2 hydraulic circuits, supplying front-rear opposed wheel apply circuits.

Hydraulic Brake Pressure Balance Control System

Regulates brake fluid pressure delivered to hydraulic brake wheel circuits, in order to control the distribution of braking force. Pressure balance control is achieved through Dynamic Rear Proportioning (DRP), which is a function of the ABS modulator. To identify DRP description, see DYNAMIC REAR PROPORTIONING under DESCRIPTION & OPERATION in appropriate ANTI-LOCK article.

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

HYDRAULIC BRAKE SYSTEM OPERATION

Mechanical force is converted into hydraulic pressure by the master cylinder, regulated to meet braking system demands by the pressure balance control system, and delivered to the hydraulic brake wheel circuits by the pipes and flexible hoses. The wheel apply components then convert the hydraulic pressure back into mechanical force which presses linings against rotating brake system components.

BRAKE WARNING SYSTEM

The Instrument Panel Cluster (IPC) illuminates the brake warning indicator when one or more of the following occurs:

- The Electronic Brake Control Module (EBCM) detects a low brake fluid condition. The IPC receives a class 2 message from the EBCM requesting illumination.
- The IPC detects the park brake is engaged. The IPC receives a Class 2 input from the Body Control Module (BCM) requesting illumination.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 3 seconds.

BRAKE HYDRAULIC ASSIST SYSTEM ASSIST DESCRIPTION

Brake Pedal

Receives, multiplies and transfers brake system input force from driver.

Brake Pedal Pushrod

Transfers multiplied input force received from brake pedal to brake booster.

Hydraulic Brake Booster

Uses power steering fluid pressure to decrease effort required by driver when applying brake system input force. When brake system input force is applied, pressurized power steering fluid is admitted to the rear of an apply piston, providing a decrease in brake pedal effort required. When input force is removed, pressurized power steering fluid is blocked off from the piston.

Power Steering System

Supplies pressurized power steering fluid used by hydraulic brake booster to decrease brake pedal effort.

BRAKE ASSIST SYSTEM - HYDRAULIC ASSIST OPERATION

Brake system input force is multiplied by the brake pedal and transferred by the pedal pushrod to the hydraulic brake master cylinder. Effort required to apply the brake system is reduced by the hydraulic brake booster.

DISC BRAKE SYSTEM DESCRIPTION

Disc Brake Pads

Applies mechanical output force from the hydraulic brake calipers to friction surfaces of brake rotors.

Disc Brake Rotors

Uses mechanical output force applied to friction surfaces from the disc brake pads to slow speed of tire and

wheel assembly rotation.

Disc Brake Pad Hardware

Secures disc brake pads firmly in proper relationship to the hydraulic brake calipers and enables a sliding motion of brake pads when mechanical output force is applied.

Disc Brake Caliper Hardware

Provides mounting for hydraulic brake caliper and secures the caliper firmly in proper relationship to caliper bracket. Enables a sliding motion of the brake caliper to the brake pads when mechanical output force is applied.

DISC BRAKE SYSTEM OPERATION

Mechanical output force is applied from the hydraulic brake caliper pistons to the inner brake pads. As the pistons press the inner brake pads outward, the caliper housings draw the outer brake pads inward. This allows the output force to be equally distributed. The brake pads apply the output force to the friction surfaces on both sides of the brake rotors, which slows the rotation of the tire and wheel assemblies. The correct function of both the brake pad and brake caliper hardware is essential for even distribution of braking force.

PARK BRAKE SYSTEM DESCRIPTION

Park Brake Pedal Assembly

Releases applied park brake system when pulled.

Park Brake Cables

Transfers input force received from park brake pedal, through park brake cable equalizer, to park brake apply lever.

Park Brake Cable Equalizer

Evenly distributes input force to both the left and right park brake units. Threaded park brake cable equalizers are also used to remove slack in park brake cables.

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator/adjuster.

Park Brake Actuator/Adjuster

Uses multiplied input force from apply lever to expand park brake shoe (rear disc, drum-in-hat system), or drum brake shoes toward the friction surface of the drum-in-hat of the rear brake rotor, or the brake drum. Threaded park brake actuators/adjusters are also used to control clearance between the park brake shoe (rear disc, drum-in-hat system), or the drum brake shoes and the friction surface of the drum-in-hat (of the rear brake rotor), or

the brake drum.

Park Brake Shoe

Applies mechanical output force from park brake actuator to friction surface of the drum-in-hat portion of the rear brake rotor.

PARK BRAKE SYSTEM OPERATION

Park brake apply input force is received by the park brake pedal assembly being depressed, transferred and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators/adjusters which expand the park brake shoe (rear disc, drum-in-hat system), or the drum brake shoes toward the friction surface of the drum-in-hat (of the rear brake rotor), or the brake drum in order to prevent the rotation of the rear tire and wheel assemblies. The park brake pedal assembly releases an applied park brake system when it is depressed again.

BLEEDING BRAKE SYSTEM

BRAKE BLEEDING SEQUENCE

BRAKE BLEEDING SEQUENCE

Application	Sequence
H2	RR, LR, RF, LF

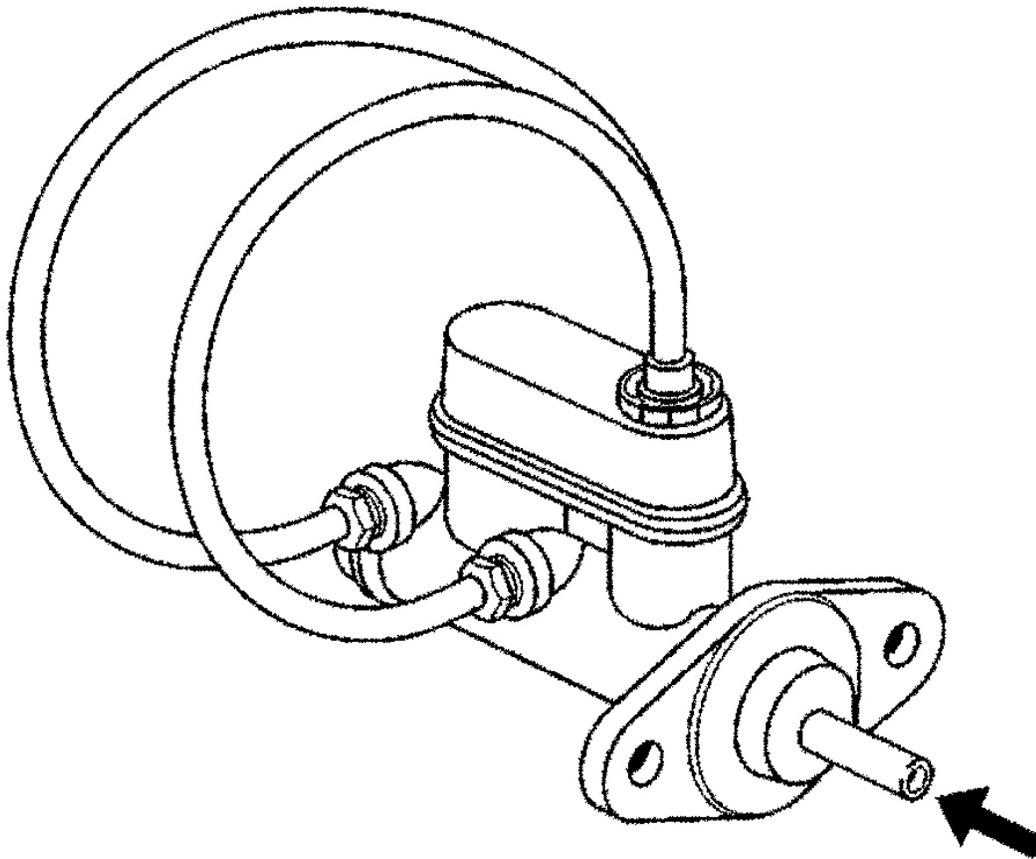
MASTER CYLINDER BENCH BLEEDING

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. In case of ingestion, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

CAUTION: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11(R) (GM P/N 12377967), 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. See **Fig. 1** .
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(R) (GM P/N 12377967), 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 1" (25 mm), 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.



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Fig. 1: Accessing Rear Of Primary Piston
Courtesy of GENERAL MOTORS CORP.

MANUAL BLEEDING

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CAUTION: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11(R) (GM P/N 12377967), 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. 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.
2. 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:
 - A. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add Delco Supreme 11(R) (GM P/N 12377967) 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.
 - B. 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.
 - C. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
 - D. Reconnect the brake pipe to the master cylinder port and tighten securely.
 - E. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
 - F. Loosen the same brake pipe to purge air from the open port of the master cylinder.
 - G. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
 - H. Wait 15 seconds, then repeat steps C - G until all air is purged from the same port of the master cylinder.
 - I. 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 C - H
 - J. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.
3. Fill the brake master cylinder reservoir with Delco Supreme 11(R) (GM P/N 12377967), 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.
4. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
5. Install a transparent hose over the end of the bleeder valve.
6. Submerge the open end of the transparent hose into a transparent container partially filled with Delco Supreme 11(R) (GM P/N 12377967) or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
7. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
8. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.

9. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
10. Wait 15 seconds, then repeat steps 8 - 10 until all air is purged from the same wheel hydraulic circuit.
11. 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 FRONT wheel hydraulic circuit bleeder valve.
12. Install a transparent hose over the end of the bleeder valve, then repeat steps 7 - 11 .
13. With the left front wheel hydraulic circuit bleeder valve tightened securely, after all air has been purged from the left front hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.
14. Install a transparent hose over the end of the bleeder valve, then repeat steps 7 - 11 .
15. With the right front 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.
16. Install a transparent hose over the end of the bleeder valve, then repeat steps 7 - 11 .
17. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves are properly tightened.
18. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11(R) (GM P/N 12377967), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
19. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
20. 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:
 - A. Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK INSPECTION** under ADJUSTMENT & INSPECTION.
 - B. Pressure bleed the hydraulic brake system in order to purge any air that may still be trapped in the system.
21. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning light remains illuminated.
- 22.

CAUTION: DO NOT allow the vehicle to be driven until it is diagnosed and repaired

If the brake system warning light remains illuminated, see **BRAKE WARNING INDICATOR ALWAYS ON** under SYMPTOM TESTS.

PRESSURE BLEEDING

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. In case of ingestion, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections,

wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

CAUTION: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11(R) (GM P/N 12377967), 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:
 - A. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add Delco Supreme 11(R) (GM P/N 12377967), 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.
 - B. 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.
 - C. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
 - D. Reconnect the brake pipe to the master cylinder port and tighten securely.
 - E. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
 - F. Loosen the same brake pipe to purge air from the open port of the master cylinder.
 - G. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
 - H. Wait 15 seconds, then repeat steps C - G until all air is purged from the same port of the master cylinder.
 - I. 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 C - H .
 - J. 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(R) (GM P/N 12377967), 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 Master Cylinder Bleeder Adapter (J-35589-A) to the brake master cylinder reservoir.
6. Check the brake fluid level in the Diaphragm Type Brake Pressure Bleeder (J-29532), or equivalent. Add Delco Supreme 11(R) (GM P/N 12377967), 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 diaphragm type brake pressure bleeder, or equivalent, to the master cylinder bleeder adapter.
8. Charge the diaphragm type brake pressure bleeder, or equivalent, air tank to 25-30 Psi (175-205 kPa).
9. Open the diaphragm type brake pressure bleeder, 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(R) (GM P/N 12377967), 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 front 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 left rear 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 diaphragm type brake pressure bleeder, or equivalent, fluid tank valve, then disconnect the diaphragm type brake pressure bleeder, or equivalent, from the master cylinder bleeder adapter.
23. Remove the master cylinder bleeder adapter from the brake master cylinder reservoir.
24. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11(R) (GM P/N 12377967), 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:
 - Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK INSPECTION** under ADJUSTMENTS & INSPECTION.
 - Using a scan tool, perform the anti-lock brake system automated bleeding procedure to remove any air that may have been trapped in the BPMV. See appropriate See ANTI-LOCK article in BRAKES.
27. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning light remains

illuminated.

28.

CAUTION: DO NOT allow the vehicle to be driven until it is diagnosed and repaired.

If the brake system warning light remains illuminated, see **BRAKE WARNING INDICATOR ALWAYS ON** under SYMPTOM TESTS.

MASTER CYLINDER RESERVOIR FILLING

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. In case of ingestion, consult a physician immediately.

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CAUTION: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11(R) (GM P/N 12377967), 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. 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(R) (GM P/N 12377967), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.

HYDRAULIC BRAKE SYSTEM FLUSHING

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. In case of ingestion, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

CAUTION: When adding fluid to the brake master cylinder reservoir, use only Delco Supreme 11(R) (GM P/N 12377967), 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. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
 - A. 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:
 - If its a swirled appearance, then it is an oil-based substance.
 - If its a layered appearance, then it is a silicone-based substance.
 - B. Fluid discoloration, indicating the presence of moisture or particles that have been introduced into the brake hydraulic system:
 - If its a cloudy appearance, then its due to moisture.
 - If its a dark appearance/suspended particles in fluid, then its due to 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:
 - A. 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:
 - Replace master cylinder. See **MASTER CYLINDER** under REMOVAL & INSTALLATION.
 - Replace appropriate brake hose. See **BRAKE HOSE** under REMOVAL & INSTALLATION.
 - Replace appropriate brake hose. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - Replace Brake Pressure Modulator Valve (BPMV). See appropriate ANTI-LOCK article.

- B. Clean out all the hydraulic brake pipes using denatured alcohol (or equivalent).
- C. Dry the brake pipes using non-lubricated, filtered air.
- D. 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:
 - See **MASTER CYLINDER** under OVERHAUL; or see **MASTER CYLINDER** under REMOVAL & INSTALLATION. 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. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION. Replace the brake master cylinder reservoir cap diaphragm.
 - See **BRAKE HOSE** under REMOVAL & INSTALLATION.
 - See **BRAKE CALIPER** under OVERHAUL; or see **BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - Replace Brake Pressure Modulator Valve (BPMV). See appropriate ANTI-LOCK article.
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 which 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 Delco Supreme 11(R) (GM P/N 12377967), or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
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. See **MANUAL BLEEDING** or **PRESSURE BLEEDING**.

ADJUSTMENTS & INSPECTION

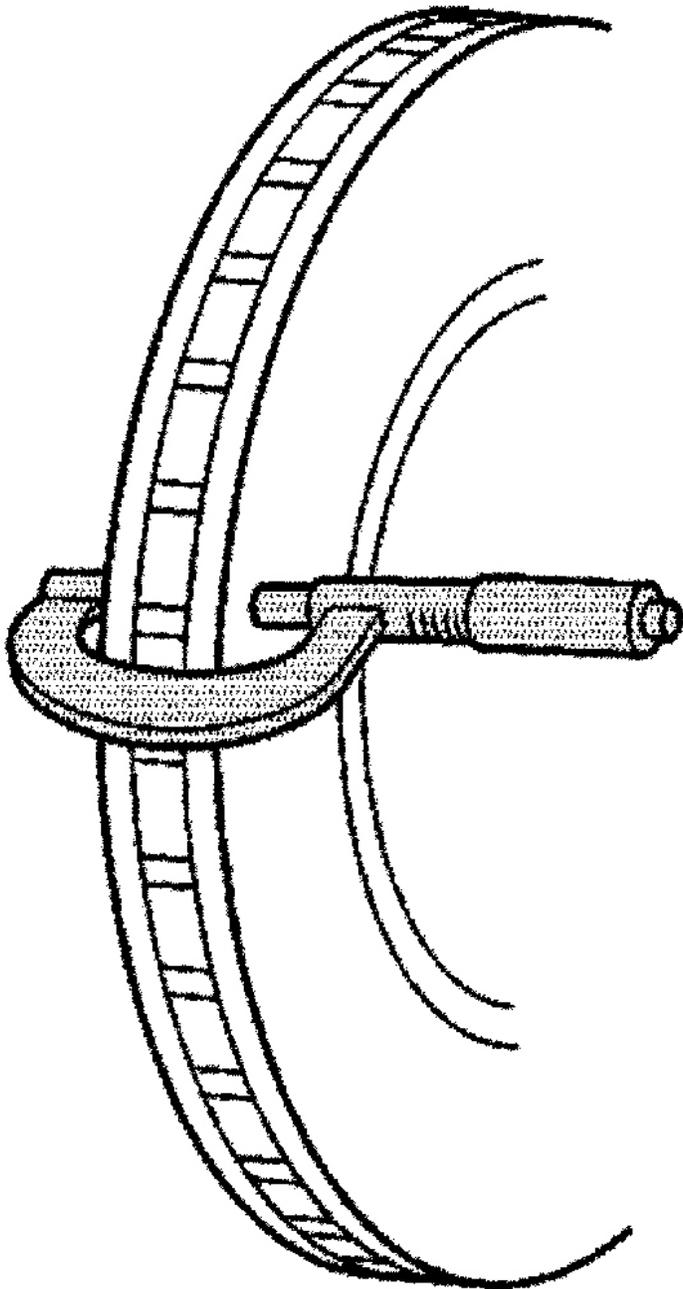
BRAKE ROTOR THICKNESS MEASUREMENT

CAUTION: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. See **BRAKE PADS** under REMOVAL & INSTALLATION.
2. Clean the brake pad lining contact surface of the brake rotor with denatured alcohol or an equivalent brake cleaner.
3. Using a calibrated micrometer, measure and record the lowest thickness of the brake rotor at 4 or more points, equally spaced around the rotor. See **Fig. 2**. Ensure that the measurements are only taken within

the brake pad lining contact area and that the micrometer is positioned the same distance from the outside edge of the rotor for about 1/2" (13 mm), for each measurement.

4. Compare the lowest thickness measurement recorded to the rotor minimum allowable thickness after refinishing and the rotor discard thickness specifications. See **DISC BRAKE SPECIFICATIONS**.
5. If the lowest thickness measurement of the brake rotor is above the minimum allowable thickness after refinishing specification; the rotor may be able to be refinished, depending upon surface and wear conditions which may be present. See **BRAKE ROTOR REFINISHING** under OVERHAUL.
6. If the lowest thickness measurement of the brake rotor is at or below the minimum allowable thickness after refinishing specification, the rotor may not be refinished.
7. If the lowest thickness measurement of the brake rotor is at or below the discard thickness specification then the rotor requires replacement. See **BRAKE ROTOR** under REMOVAL & INSTALLATION.



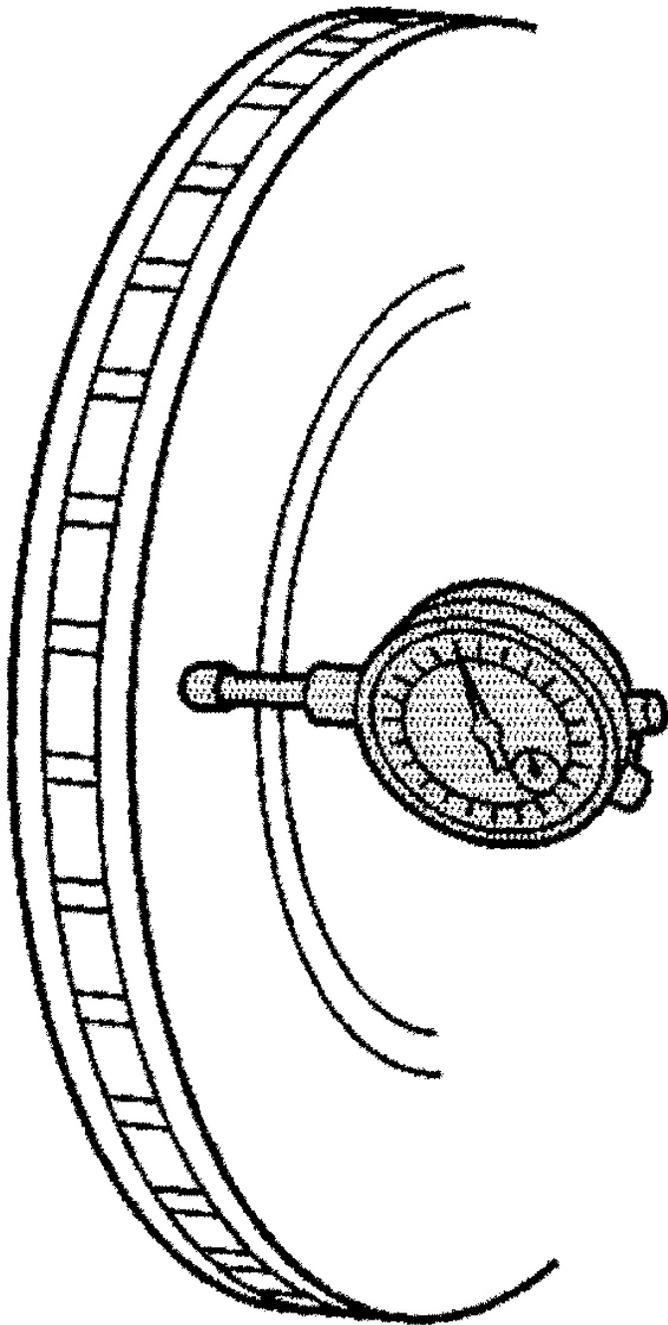
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Fig. 2: Measuring Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

BRAKE ROTOR SURFACE & WEAR INSPECTION

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. See **BRAKE PADS** under REMOVAL & INSTALLATION.
2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
3. Inspect the friction surfaces of the brake rotor for the following braking surface conditions:
 - Heavy rust and/or pitting Light surface rust can be removed with an abrasive disc. Heavy surface rust and/or pitting must be removed by refinishing the rotor. See **BRAKE ROTOR REFINISHING** under OVERHAUL.
 - Cracks and/or heat spots.
 - Excessive blueing discoloration.
4. If the friction surfaces of the brake rotor exhibit one or more of the braking surface conditions, the rotor requires refinishing or replacement.
5. Using a micrometer, measure and record the scoring depth of any grooves present on the rotor friction surfaces. See **Fig. 3**.
6. Compare the lowest thickness measurement recorded to the rotor minimum allowable thickness after refinishing and the rotor discard thickness specifications. See **DISC BRAKE SPECIFICATIONS**.
7. If the brake rotor scoring depth exceeds the specification, or if an excessive amount of scoring is present, the rotor requires refinishing or replacement. See **BRAKE ROTOR** under REMOVAL & INSTALLATION.



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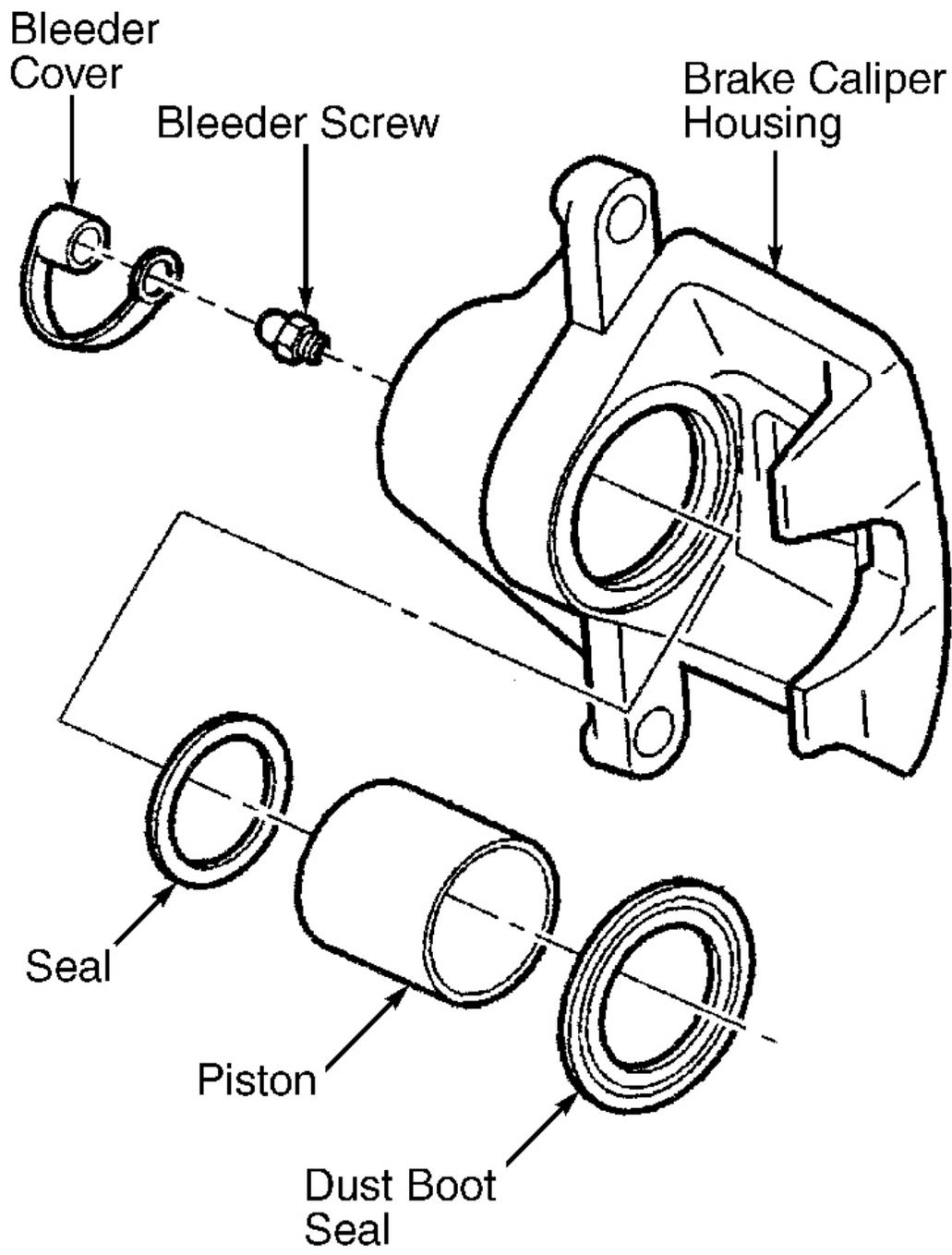
Fig. 3: Measuring Rotor Runout
Courtesy of GENERAL MOTORS CORP.

BRAKE CALIPER INSPECTION

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. If ingested, consult a physician immediately.

1. Inspect the brake caliper housing for cracks, excess wear, and/or damage. If any of these conditions are present, the brake caliper requires replacement. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
2. Inspect the caliper piston dust boot seal for cracks, tears, cuts, deterioration and/or improper seating in the caliper body. See **Fig. 4** . If any of these conditions are present, the brake caliper requires overhaul or replacement.
 - For overhaul, see **BRAKE CALIPER** under OVERHAUL.
 - For replacement, see **BRAKE CALIPER** under REMOVAL & INSTALLATION.
3. Inspect for brake fluid leakage around the caliper piston dust boot seal and on the disc brake pads. If there is any evidence of brake fluid leakage, the brake caliper requires overhaul or replacement.
 - For overhaul, see **BRAKE CALIPER** under OVERHAUL.
 - For replacement, see **BRAKE CALIPER** under REMOVAL & INSTALLATION.
4. Inspect for smooth and complete travel of the caliper piston, or pistons, into the caliper bore, or bores. The movement of a caliper piston into a caliper bore should be smooth and even.
 - For single piston caliper applications, insert a discarded inner brake pad or block of wood in front of the piston. Using a large C-clamp installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the piston in the bore. See **Fig. 4** .
 - For dual piston caliper applications, insert a discarded inner brake pad or block of wood in front of the pistons. Using 2 large C-clamps installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the pistons evenly into the bores.
5. If a caliper piston is frozen or difficult to bottom, the caliper requires overhaul or replacement.
 - For overhaul, see **BRAKE CALIPER** under OVERHAUL.
 - For replacement, see **BRAKE CALIPER** under REMOVAL & INSTALLATION.



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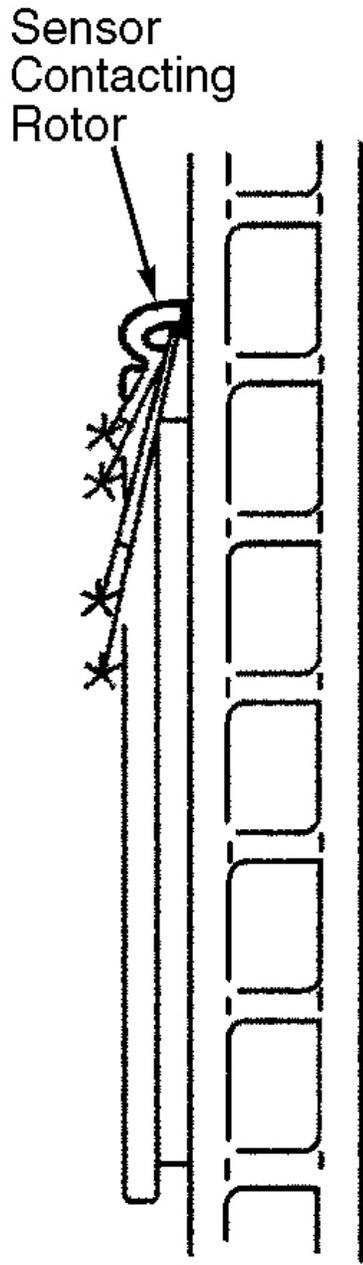
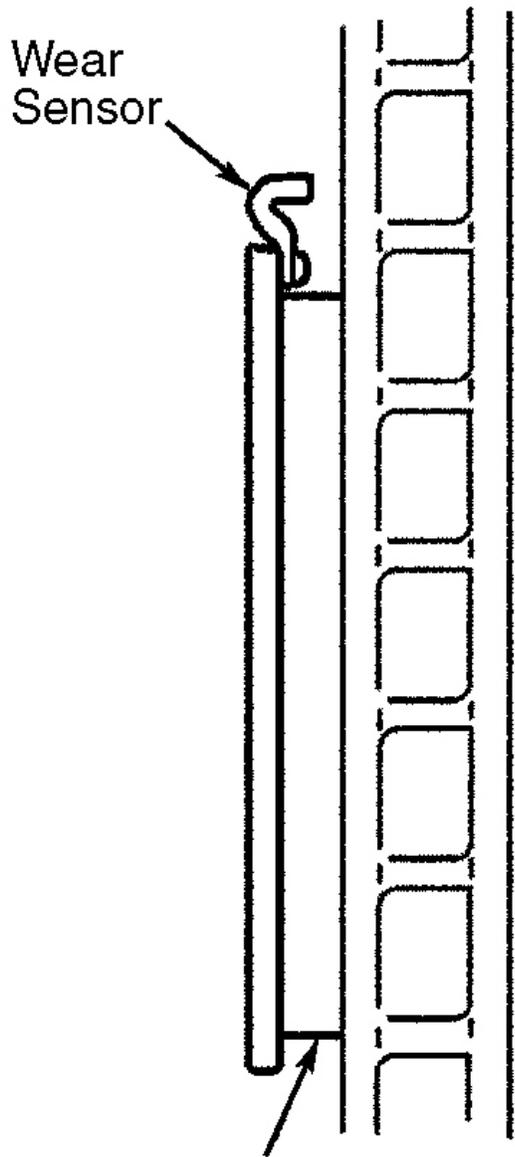
Fig. 4: Identifying Brake Caliper Assembly Components
Courtesy of GENERAL MOTORS CORP.

BRAKE PAD INSPECTION

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

NOTE: Inspect the disc brake pads at regular intervals, or whenever the tire and wheel assemblies are removed from the vehicle.

- If replacement is necessary, always replace disc brake pads in axle sets. See **BRAKE PADS** under REMOVAL & INSTALLATION.
- Inspect both edges of the disc brake pad friction surfaces. The highest rate of wear normally occurs at the trailing edge of the disc brake pads.
- Inspect the thickness of the disc brake pads in order to ensure that they have not worn prematurely. The disc brake pad wear should be approximately even per axle set.
- Both front and rear disc brake pads have integral, audible wear sensors. See **Fig. 5**. When the disc brake pad wear reaches the minimum allowable thickness, the wear sensor contacts the disc brake rotor. The wear indicator will then produce an audible, high-pitched warning noise during wheel rotation.
- Replace the disc brake pads when the friction surface is worn to within 0.03" (0.76 mm) of the mounting plates. See **BRAKE PADS** under REMOVAL & INSTALLATION.
- Remove the brake calipers and inspect the friction surfaces of the inner and outer disc brake pads to ensure that they are level. Place the disc brake pad friction surfaces together and measure the gap between the surfaces. If more than 0.005" (0.13 mm) gap exists midway between the length of the disc brake pads, replace the disc brake pads. See **BRAKE PADS** under REMOVAL & INSTALLATION.
- Verify that any disc brake pad shims that may be required are in place and not damaged or excessively corroded. Replace any missing or damaged shims in order to preserve proper disc brake performance.
- Replace the disc brake pads if any have separated from the mounting plates. See **BRAKE PADS** under REMOVAL & INSTALLATION.
- Inspect the disc brake pads friction surfaces for cracks, fractures, or damage which may cause noise or otherwise impair disc brake performance.



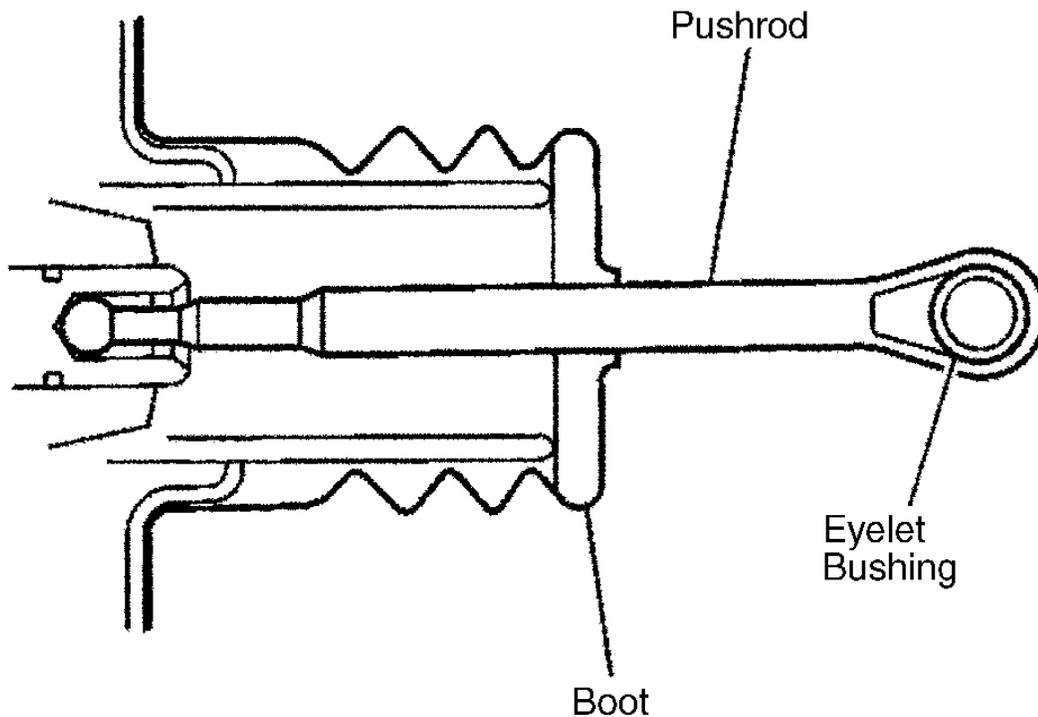
Pad Friction Surface

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Fig. 5: Inspecting Brake Pad
Courtesy of GENERAL MOTORS CORP.

BRAKE PEDAL PUSHROD INSPECTION

1. Disconnect the brake pedal pushrod from the brake pedal.
2. Inspect the brake pedal pushrod eyelet bushing for cracks and/or excessive wear. See **Fig. 6**.
3. Reposition the pedal pushrod boot toward the front of the vehicle to expose as much of the pedal pushrod as possible.
4. Inspect the brake pedal pushrod for straightness.
5. If the brake pedal pushrod eyelet bushing exhibited cracks and/or excessive wear, then the bushing requires replacement.
6. If the brake pedal pushrod is not straight, then the pushrod requires replacement. Return the pedal pushrod boot to its original position on the pedal pushrod.
7. Connect the brake pedal pushrod to the brake pedal.



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Fig. 6: Inspecting Brake Pedal Pushrod
Courtesy of GENERAL MOTORS CORP.

BRAKE PIPE & HOSE INSPECTION

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse

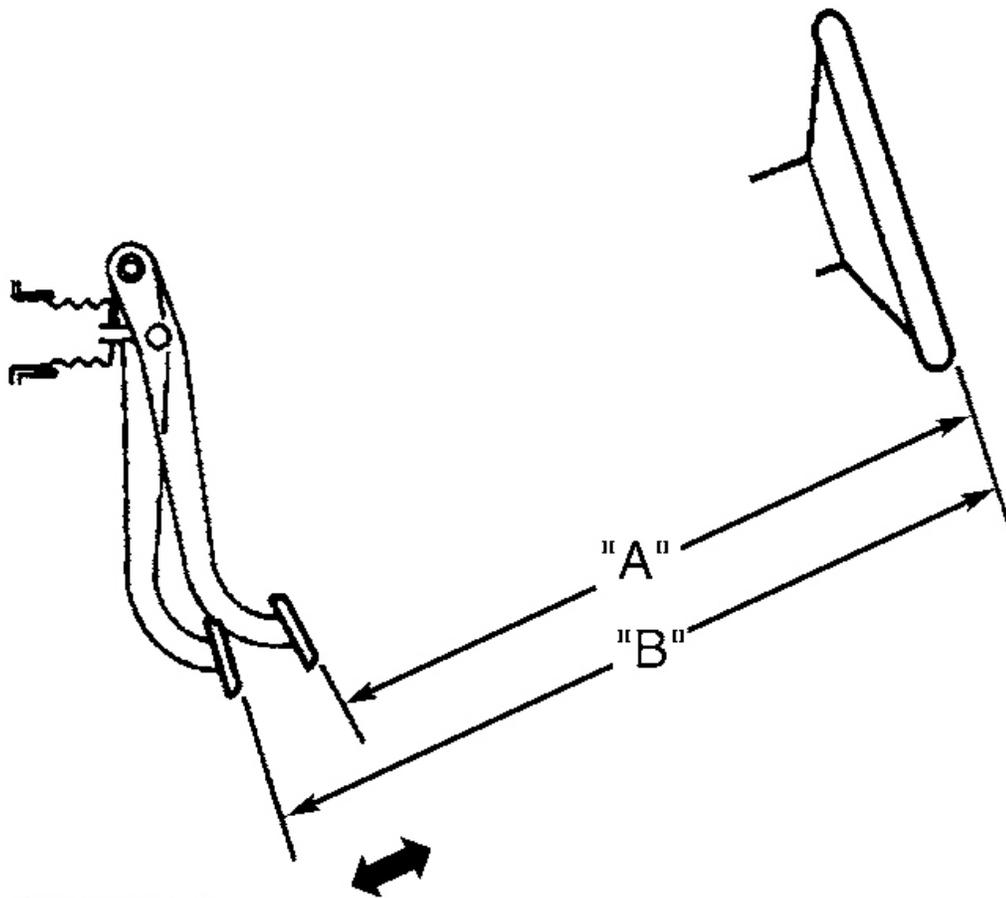
thoroughly with water. In case of skin contact, wash with soap and water. If ingested, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

1. Visually inspect all of the brake pipes for kinks, improper routing, missing or damaged retainers, leaking fittings and excessive corrosion.
2. If any of the brake pipes exhibited any of the conditions listed, then the identified pipe, or pipes, require replacement. See **BRAKE PIPE** under REMOVAL & INSTALLATION.
3. Ensure that the vehicle axles are properly supported at ride height in order to maintain the proper relationship of the flexible brake hoses to the chassis.
4. Visually inspect all of the flexible brake hoses for kinks, improper routing, twists, chafing, missing or damaged retainers, leaking connections, cracking, dry-rot, blisters or bulges.
5. If any of the flexible brake hoses exhibited any of the conditions listed, then the identified flexible brake hose, or hoses require replacement. See **BRAKE HOSE** under REMOVAL & INSTALLATION.
6. Squeeze the flexible brake hoses with firm finger pressure to check for soft spots, indicating an internal restriction. Check the entire length of each flexible brake hose.
7. If any of the flexible brake hoses were found to have soft spots, then the identified flexible brake hose, or hoses require replacement. See **BRAKE HOSE** under REMOVAL & INSTALLATION.

BRAKE PEDAL TRAVEL MEASUREMENT & INSPECTION

1. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.
2. Install the Brake Pedal Effort Gauge (J-28662) to the brake pedal.
3. Measure and record the distance from the brake pedal to the rim of the steering wheel; note the points of measurement. See **Fig. 7**.
4. Apply and maintain the brakes with 100 Lbs. (445 N) of force to the brake pedal, as indicated on the brake pedal effort gauge.
5. While maintaining 100 Lbs. (445 N) of force to the brake pedal, measure and record the distance from the same point on the brake pedal to the same point on the rim of the steering wheel.
6. Release the brakes and repeat steps 4 and 5 to obtain a second measurement. After obtaining a second measurement, proceed to next step.
7. Average the first and second measurements recorded during the 2 applies of the brakes.
8. Subtract the initial measurement, un-applied, from the averaged, applied measurement to obtain the brake pedal travel distance. For hydraulic assist equipped, maximum brake pedal travel (measured with the ignition OFF, brake booster power assist depleted, and the brakes cool) is 3.54" (90 mm).



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Fig. 7: Measuring Brake Pedal Travel
Courtesy of GENERAL MOTORS CORP.

BRAKE SYSTEM EXTERNAL LEAK INSPECTION

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. If ingested, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a

clean shop cloth to wipe away the fluid.

1. In order to inspect for external brake fluid leaks, first check the fluid level in the master cylinder. While a slight brake fluid level drop can be considered a normal condition due to brake lining wear, a very low level may indicate a brake fluid leak in the hydraulic system.
2. If the fluid level is abnormally low, adjust the brake fluid level. See **MASTER CYLINDER RESERVOIR FILLING** under BLEEDING BRAKE SYSTEM.
3. Start the engine and allow it to idle.
4. Apply constant, moderate foot pressure to the brake pedal. If the brake pedal gradually falls away while under foot pressure, there may be a brake fluid leak.
5. Turn OFF the ignition.
6. Visually inspect the following brake system components for brake fluid leaks, excessive corrosion, and damage. Give particular attention to all brake pipe and flexible hose connections to ensure that there are not any slight brake fluid leaks, even though the brake pedal may feel firm and hold steady:
 - Master cylinder brake pipe fittings.
 - All brake pipe connections.
 - Brake pipes.
 - Brake hoses and connections.
 - Brake calipers and/or wheel cylinders (if equipped).
7. While slight dampness around the master cylinder reservoir can be considered acceptable, brake fluid leaking from any of the brake system components requires immediate attention. If any of these components exhibit signs of brake fluid leakage, repair or replace those components. After the repair or replacement, reinspect the hydraulic brake system to assure proper function.

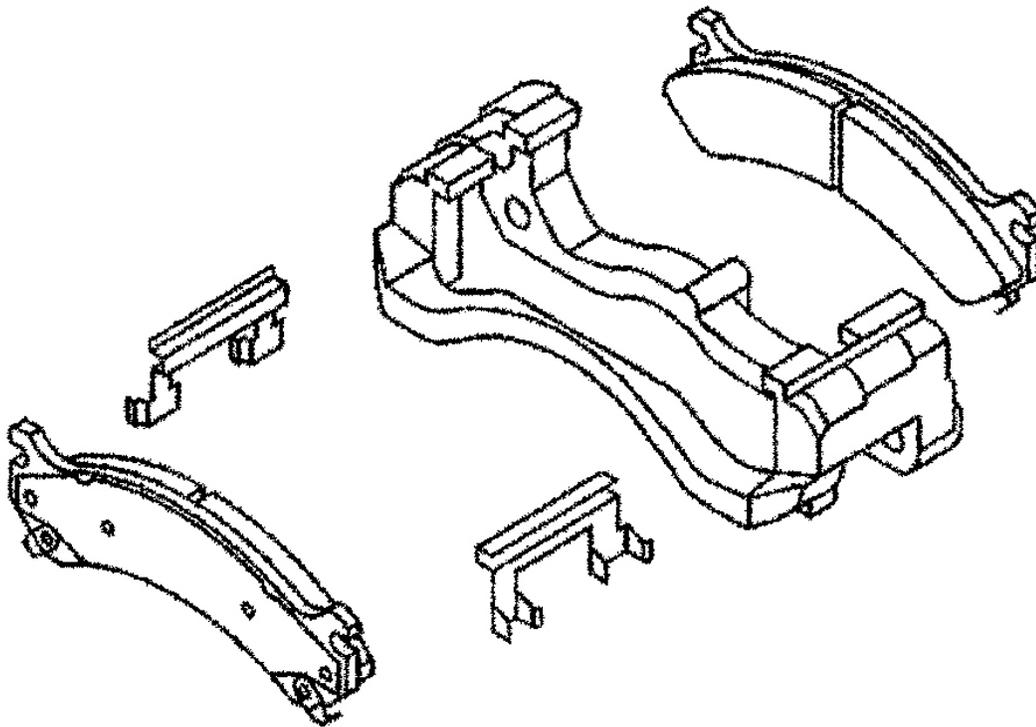
DISC BRAKE MOUNTING & HARDWARE

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

Inspection (Front)

1. Inspect the fluid level in the brake master cylinder reservoir.
2. If the brake fluid level is midway between the maximum-full point and the minimum allowable level then no brake fluid needs to be removed from the reservoir before proceeding.
3. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level then remove brake fluid to the midway point before proceeding.
4. Raise and support the vehicle.

5. Remove the tire and wheel assembly.
6. Grasp the brake caliper housing and try to move the brake caliper housing up/down and forward/reverse in relation to the brake caliper mounting bracket. If excessive looseness is observed the brake caliper bracket bushings and/or the brake caliper mounting bolts may need to be replaced.
7. Compress the front caliper pistons:
 - A. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad.
 - B. Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores.
 - C. Remove the C-clamp from the caliper.
8. With the pistons compressed into the caliper bores, grasp the brake caliper housing and slide it back and forth on the brake caliper mounting bolts. Check for smooth operation. If the brake caliper housing slide force is high or the brake caliper housing does not slide smoothly, inspect the brake caliper mounting bolts and/or the brake caliper mounting bracket bushings for wear or damage. If wear or damage conditions are found, replacement of the brake caliper mounting bolts and/or the brake caliper mounting bracket bushings is necessary.
9. Remove the brake caliper mounting bolts from the brake caliper mounting bracket and support the brake caliper using heavy mechanics wire. DO NOT remove the hydraulic brake hose from the caliper. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
10. Remove the disc brake pads from the brake caliper mounting bracket.
11. Inspect the disc brake pad mounting hardware for missing mounting hardware, excessive corrosion, bent mounting tabs, looseness at the brake caliper mounting bracket, looseness at the disc brake pads, or excessive contaminants in the brake caliper mounting bracket surface and threads. See **Fig. 8**.
12. If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.
13. Ensure the disc brake pads are held firmly in place on the brake caliper mounting bracket, yet slide easily on the mounting hardware without binding.
14. Inspect the caliper bolts for binding, seizing, looseness in the brake caliper mounting bracket, bent or damaged brake caliper mounting bolts, cracked or torn boots, missing boots, or a bent or damaged brake caliper mounting bracket.
15. If any of the conditions listed are found then the brake caliper mounting hardware requires replacement.
16. Install the disc brake pads to the brake caliper mounting bracket.
17. Install the disc brake caliper to the brake caliper mounting bracket. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.



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Fig. 8: Inspecting Disc Brake Mounting & Hardware
Courtesy of GENERAL MOTORS CORP.

Inspection (Rear)

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

1. Remove the disc brake caliper from the caliper mounting bracket. See **BRAKE CALIPER** under **REMOVAL & INSTALLATION**.
2. Remove the disc brake pads from the caliper mounting bracket.
3. Inspect the disc brake pad mounting hardware for missing mounting hardware, excessive corrosion, bent mounting tabs, looseness at the caliper mounting bracket and looseness at the disc brake pads. See **Fig. 8**.
4. If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.

5. Ensure the disc brake pads are held firmly in place on the caliper mounting bracket, yet slide easily on the mounting hardware without binding.
6. Install the disc brake pads to the caliper mounting bracket. Install the disc brake caliper to the mounting bracket. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.

HYDRAULIC BRAKE ASSIST SYSTEM NOISE INSPECTION

1. Install the Brake Pedal Effort Gage (J-28662) to the brake pedal.
2. Start the engine and allow it to idle. Ensure that the wheels are directed straight ahead.
3. Apply and maintain the brakes with 25 Lbs. (111 N) of force to the brake pedal, as indicated on the brake pedal effort gage. Observe for noises.
4. Quickly release the brakes. Observe for noises.
5. If chatter and/or a vibration of the brake pedal was apparent during the brake system apply of 25 Lbs. (111 N) of force, the power steering drive belt is probably slipping and would require replacement.
6. If any significant noise was apparent during the quick release of the brakes following the brake system apply of 25 Lbs. (111 N) of force, there is likely a restriction in the hydraulic brake booster power steering return hose and it would require replacement.

CAUTION: DO NOT apply 100 Lbs. (445 N) of force or more to the brake system pedal for more than 5 seconds at a time.

7. Apply the brakes with 40 Lbs. (178 N) of force to the brake pedal, as indicated on the brake pedal effort gage, then gradually increase pedal effort up to 100 Lbs. (445 N) of force for not more than 5 seconds at a time. Observe for noises.
8. Quickly release the brakes. Observe for noises.
9. If a hiss noise was apparent and increased during the brake system increasing apply of 40-100 Lbs. (178-445 N) of force, the hydraulic brake booster assist system is operating normally from an audible standpoint.
10. If a clunk, chatter, and/or clicking noise was apparent during the quick release of the brakes following the brake system increasing apply of 40-100 Lbs. (178-445 N) of force, the hydraulic brake booster assist system is operating normally from an audible standpoint.

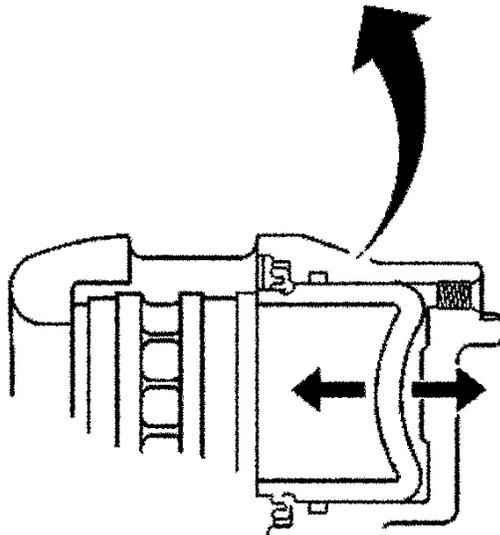
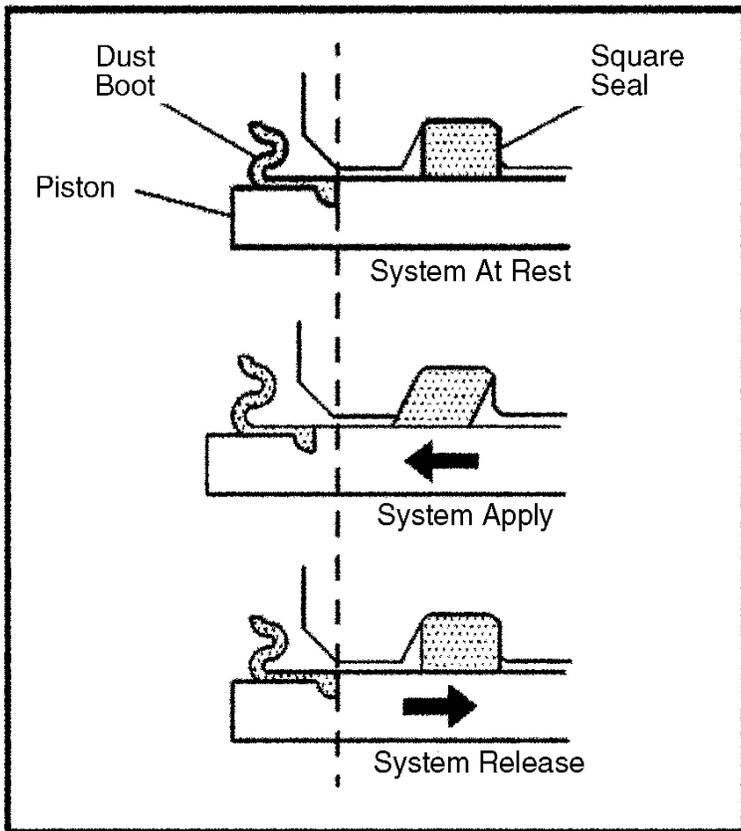
HYDRAULIC BRAKE COMPONENT OPERATION VISUAL INSPECTION

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. If ingested, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a

clean shop cloth to wipe away the fluid.

1. With the tire and wheel assemblies removed and the brake rotors retained by wheel lug nuts, visually inspect the caliper piston dust boot sealing area to ensure that there are no brake fluid leaks.
2. If any evidence of a brake fluid leak is present, the brake caliper requires overhaul or replacement.
 - For overhaul, see **BRAKE CALIPER** under OVERHAUL.
 - For replacement, see **BRAKE CALIPER** under REMOVAL & INSTALLATION.
3. While the brake system is at rest, observe the position of the caliper piston in relation to the caliper housing. See **Fig. 9**.
4. Have an assistant apply and release the brake pedal several times while you observe the operation of the hydraulic brake caliper.
 - Observe the caliper piston for unrestricted and even movement during each apply of the brake system.
 - Observe the caliper piston for an unrestricted and even return motion during each release of the brake system.
5. If the caliper piston did not exhibit unrestricted and even movement during brake system apply and/or release, the piston square seal may be worn or damaged and the caliper may require overhaul or replacement:
 - For overhaul, see **BRAKE CALIPER** under OVERHAUL.
 - For replacement, see **BRAKE CALIPER** under REMOVAL & INSTALLATION.



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Fig. 9: Identifying Hydraulic Brake Component Operation
 Courtesy of GENERAL MOTORS CORP.

PARK BRAKE SHOE INSPECTION

WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

1. Raise and support the vehicle.
2. Remove the tire and wheel.
3. Remove the rear brake caliper bracket with the rear brake caliper. See **BRAKE CALIPER BRACKET** under REMOVAL & INSTALLATION.
4. Remove the rear brake rotor. See **BRAKE ROTOR** under REMOVAL & INSTALLATION.
5. Inspect and replace the park brake shoe and lining if any excessive wear is indicated by the park brake lining being worn down to the shoe, the brake lining is cracking or if there is oil or fluid contamination of the brake lining.
6. Adjust the park brake shoe. See **PARK BRAKE ADJUSTMENT**.
7. Install the rear brake rotor. See **BRAKE ROTOR** under REMOVAL & INSTALLATION.
8. Install the rear brake caliper with the rear brake caliper bracket. See **BRAKE CALIPER BRACKET** under REMOVAL & INSTALLATION.
9. Install the tire and wheel.
10. Lower the vehicle.

PARK BRAKE ADJUSTMENT

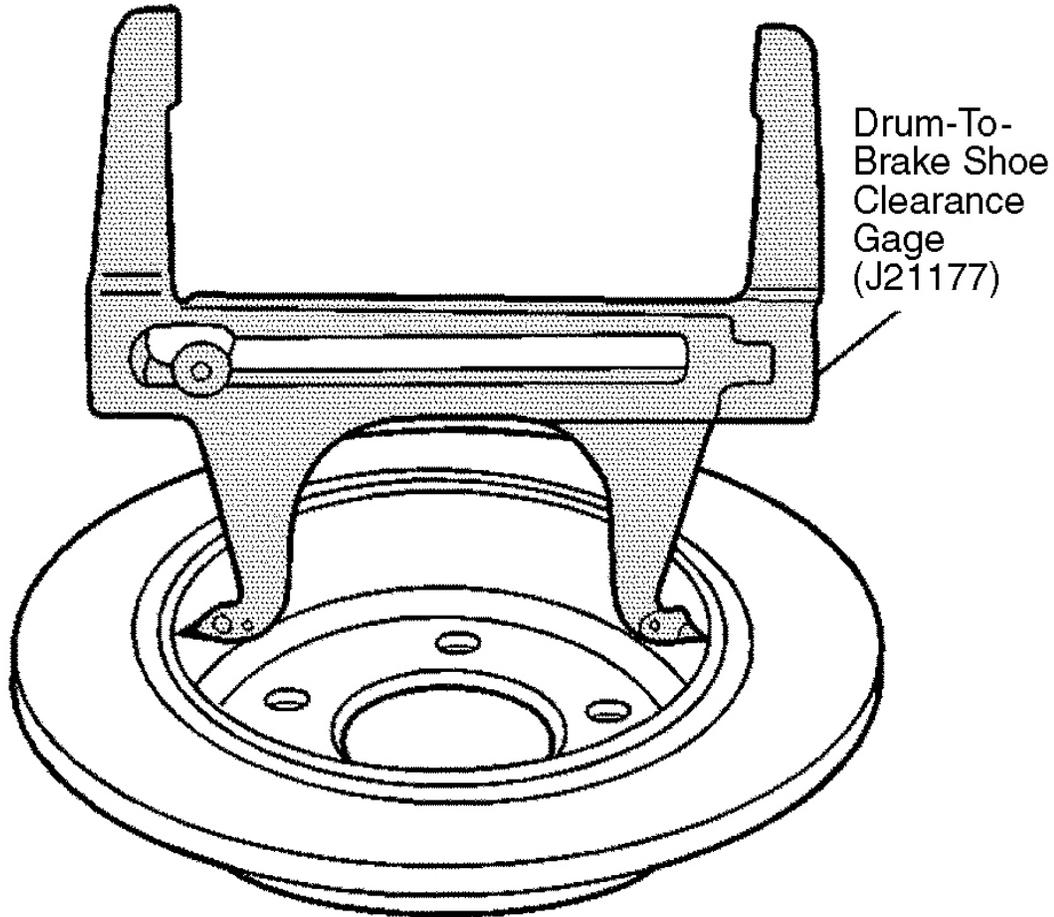
WARNING: Avoid grinding brake linings, sanding brake linings or cleaning wheel brake parts with a dry brush or with compressed air, when servicing wheel brake parts. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

NOTE: The park brake shoes must be adjusted before the park brake pedal is adjusted.

Park Brake Shoe Adjustment

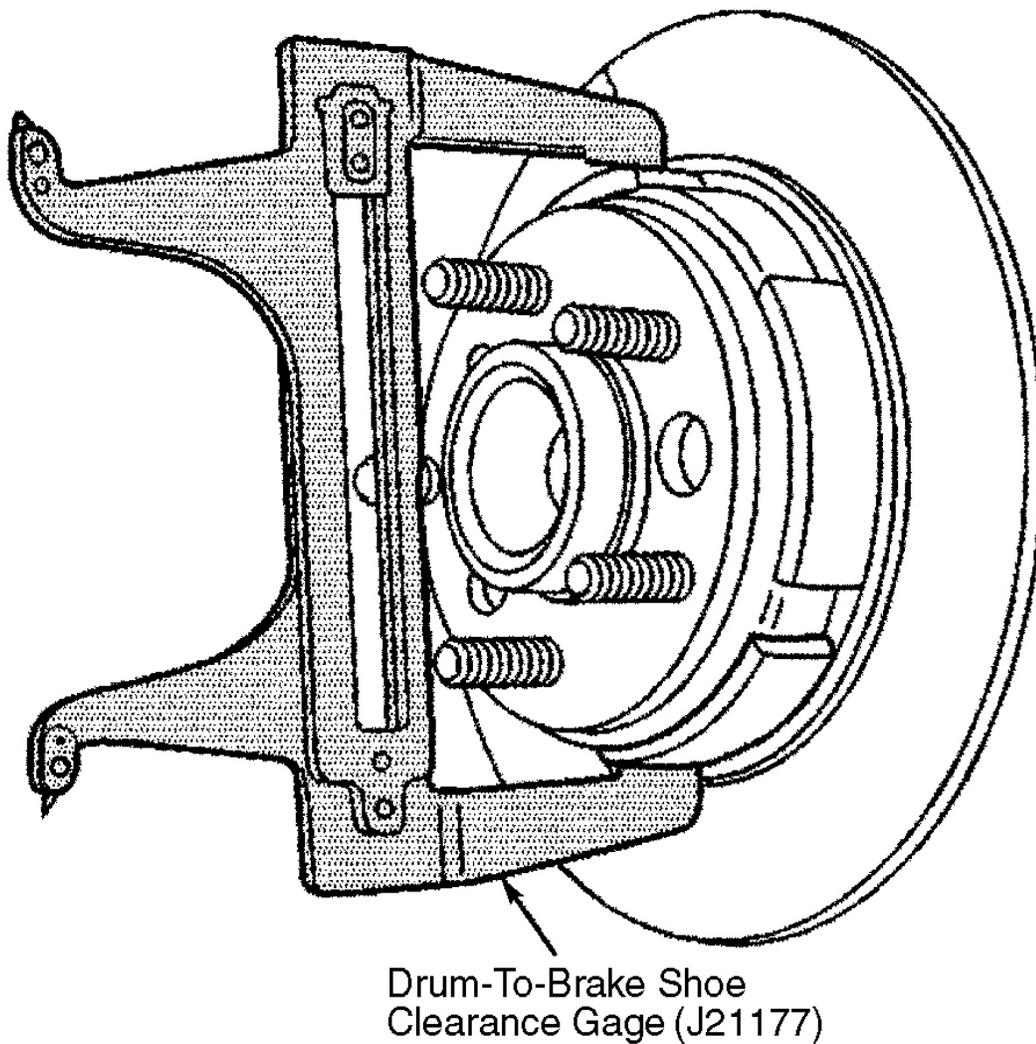
1. Set the Drum-To-Brake Shoe Clearance Gage (J-21177-A) so that it contacts the inside diameter of the rotor. See **Fig. 10**.
2. Position the drum-to-brake shoe clearance gage over the shoe and the lining at the widest point. See **Fig. 11**.

3. Turn the adjuster nut until the lining just contacts the drum-to-brake shoe clearance gage.
4. Repeat steps 1 - 3 for the opposite side.
5. The clearance between the park brake shoe and the rotor is 0.026" (0.6604 mm).



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Fig. 10: Setting Gauge On Inside Diameter Of Rotor
Courtesy of GENERAL MOTORS CORP.



G00310130

Fig. 11: Positioning Gauge On Shoe & Lining
Courtesy of GENERAL MOTORS CORP.

Park Brake Pedal Adjustment

NOTE: Before you adjust the park brake, verify that the park brake shoes are adjusted to provide a clearance of 0.026" (0.6604 mm).

Verify that the self adjuster lock-out pin has been removed. Fully apply and release the park brake pedal 3 times.

TROUBLESHOOTING

DIAGNOSTIC STARTING POINTS

Hydraulic Brake System

Begin the system diagnosis by reviewing the system description and operation. See **HYDRAULIC BRAKE SYSTEM DESCRIPTION** and **HYDRAULIC BRAKE SYSTEM OPERATION** under DESCRIPTION & OPERATION. Reviewing the description and operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and operation information will also help you determine if the condition described by the customer is normal operation. See **GENERAL DIAGNOSIS** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

Disc Brake System

Begin the disc brake system diagnosis with hydraulic brakes. See **HYDRAULIC BRAKE SYSTEM**. The use of the diagnostic starting point will lead to the identification of the correct procedure for diagnosing the system and where the procedure is located.

Park Brake System

Begin the system diagnosis by reviewing the system description and operation. See **PARK BRAKE SYSTEM DESCRIPTION** and **PARK BRAKE SYSTEM OPERATION** under DESCRIPTION & OPERATION. Reviewing the description and operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and operation information will also help you determine if the condition described by the customer is normal operation. See **PARK BRAKE SYSTEM** under GENERAL DIAGNOSIS in order to identify the correct procedure for diagnosing the system and where the procedure is located.

GENERAL DIAGNOSIS

Hydraulic Brake System

Perform the brake system vehicle road test before using the brake symptom tables in order to duplicate the customer's concern. See **BRAKE SYSTEM VEHICLE ROAD TEST**. Review the system description and operation in order to familiarize yourself with the system functions. See **DESCRIPTION & OPERATION**.

Inspect for aftermarket devices which could affect the operation of the hydraulic brake system. See **CHECKING AFTERMARKET ACCESSORIES**. Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom. Inspect the brake fluid reservoir for the proper brake fluid level. Faulty electrical connections or wiring may be the cause of intermittent conditions.

Park Brake System

Review the system operation in order to familiarize yourself with the system functions. See **PARK BRAKE SYSTEM** under DESCRIPTION & OPERATION.

Inspect for aftermarket devices which could affect the operation of the park brake system. Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Symptom List

NOTE: Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom.

- See **BRAKE WARNING INDICATOR ALWAYS ON** under SYMPTOM TESTS.
- See **BRAKE WARNING INDICATOR INOPERATIVE** under SYMPTOM TESTS.
- See **BRAKE PULSATION** under SYMPTOM TESTS.
- See **BRAKE SYSTEM NOISE** under SYMPTOM TESTS.
- See **BRAKING ACTION UNEVEN (PULLS TO ONE SIDE)** under SYMPTOM TESTS.
- See **BRAKING ACTION UNEVEN (FRONT TO REAR)** under SYMPTOM TESTS.
- See **BRAKE PEDAL EXCESSIVE TRAVEL** under SYMPTOM TESTS.
- See **BRAKE PEDAL EXCESSIVE EFFORT** under SYMPTOM TESTS.
- See **BRAKES DRAG** under SYMPTOM TESTS.
- See **BRAKE SYSTEM SLOW RELEASE** under SYMPTOM TESTS.
- See **BRAKE FLUID LOSS** under SYMPTOM TESTS.

CHECKING AFTERMARKET ACCESSORIES

WARNING: When you are performing service on or near the SIR components or the SIR wiring, you must disable the SIR system. See **AIR BAG RESTRAINT SYSTEMS** under RESTRAINTS. Failure to follow the correct procedure could cause air bag deployment, personal injury, or unnecessary SIR system repairs.

NOTE: The OBD II symbol is used on the circuit diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the Malfunction Indicator light (MIL) to turn ON, or causes emissions-related component damage, is identified as an OBD II circuit.

DO NOT connect aftermarket accessories into the SIR circuits (all such circuits are indicated on circuit diagrams with the SIR symbol) and the OBD II circuits (all such circuits are indicated on circuit diagrams with the OBD II symbol).

Always check for aftermarket accessories (non-OEM) as the first step in diagnosing electrical problems. If the vehicle is so equipped, disconnect the system to verify that these add-on accessories are not the cause of the problems.

Possible causes of vehicle problems related to aftermarket accessories include:

- Power feeds connected to points other than the battery.
- Antenna location.
- Transceiver wiring located too close to vehicle electronic modules or wiring.
- Poor shielding or poor connectors on antenna feed line.
- Check for recent service bulletins detailing installation guidelines for aftermarket accessories.

DISC BRAKE SYSTEM DIAGNOSIS

1. If you sent here from a brake symptom test, go to step 2 . If you were not sent here from a brake symptom, see **HYDRAULIC BRAKE SYSTEM** under DIAGNOSTIC STARTING POINTS.
2. Visually inspect the disc brake pads for the following conditions:
 - Lining thickness below specifications.
 - Uneven and/or abnormal wear, edge-to-edge and/or side-to-side.
 - Looseness or damage, including pad hardware.
 - Evidence of contamination from an external substance.

If any of the conditions were found and indicated a concern with any of the front and/or rear disc brake pads, go to step 3 . If any of the conditions were not found and did not cause any concern, go to step 12 .

3. If any of the front and/or rear disc brake pads are contaminated, go to step 8 . If any of the front and/or rear disc brake pads are not contaminated, go to step 4 .
4. If any of the front and/or rear disc brake pads are worn unevenly, go to step 7 . If any of the front and/or rear disc brake pads are not worn unevenly, go to step 5 .
5. If any of the front and/or rear disc brake pads and/or pad hardware are loose or damaged, go to step 7 . If any of the front and/or rear disc brake pads and/or pad hardware are not loose or damaged, go to step 6 .
6.
 - Remove and inspect the worn disc brake pads for glazing, looseness, heat spots or damage.
 - Replace the worn disc brake pads as a complete axle set. See **BRAKE PADS** under REMOVAL & INSTALLATION.

If the inspection and replacement was completed, go to step 12 .

7.

CAUTION: DO NOT disconnect the hydraulic brake flex hoses from the calipers.

NOTE: **Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.**

- A. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets and support the calipers. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
- B. Inspect the disc brake caliper mounting bracket and the mounting/sliding hardware for the

following conditions:

- Binding or seized hardware.
- Worn, damaged or missing hardware components.
- Loose, bent, cracked, or damaged caliper mounting bracket.

See **DISC BRAKE MOUNTING & HARDWARE** under ADJUSTMENTS & INSPECTION.

- C. Replace components as required. Refer to the following procedures as required:
- Replace the front and/or rear brake caliper bracket. See **BRAKE CALIPER BRACKET** under REMOVAL & INSTALLATION.
 - Replace the front and/or rear disc brake hardware. See **DISC BRAKE HARDWARE** under REMOVAL & INSTALLATION.
- D. Replace the unevenly-worn, loose or damaged disc brake pads as a complete axle set. See **BRAKE PADS** under REMOVAL & INSTALLATION.

If the inspection and replacement was completed, go to step 12 .

- 8.
- A. Inspect the disc brake calipers, brake hoses and brake pipes for evidence of an external brake fluid leak.
- B. Replace any components found to be leaking brake fluid. Refer to the following procedures as required:
- Perform brake caliper overhaul. See **BRAKE CALIPER** under OVERHAUL.
 - Replace appropriate brake hose. See **BRAKE HOSE** under REMOVAL & INSTALLATION.
 - Replace brake pipe. See **BRAKE PIPE** under REMOVAL & INSTALLATION.

If the source of the leak causing contamination of the pads was found and corrected, go to step 11 .
If the source of the leak causing contamination of the pads was not found and corrected, go to step 9 .

- 9.
- A. Inspect the wheel drive shaft outer seals, if equipped, for damage and evidence of a grease leak.
- B. Replace any wheel drive shaft seal that is found to be leaking grease which may be the source of the contamination to the pads. See AXLE SHAFTS article in DRIVELINE/AXLES.
- C. Inspect the rear axle seals for damage and evidence of a lubricant leak.
- D. Replace any rear axle seal that is found to be leaking lubricant which may be the source of the contamination to the pads. See AXLE SHAFTS article in DRIVELINE/AXLES.

If the source of the leak causing contamination of the pads was found and corrected, go to step 11 . If the source of the leak causing contamination of the pads was not found and corrected, go to step 10 .

- 10.
- A. Inspect the automatic transmission cooling system lines, if equipped, for damage and evidence of an external fluid leak which may be the source of the contamination to the pads.
- B. Inspect the power steering system hoses for damage and evidence of an external fluid leak which may be the source of the contamination to the pads.
- C. Replace any components found to be leaking fluid which may be the source of the contamination to

the pads.

If the source of the leak causing contamination of the pads was found and corrected, go to step 11 .

11.

CAUTION: DO NOT disconnect the hydraulic brake flex hoses from the calipers.

NOTE: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

- A. Clean the remaining disc brake system components to remove any traces of the contaminant.
- B. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets and support the calipers. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
- C. Inspect the disc brake caliper mounting/sliding hardware for the following conditions: See **DISC BRAKE MOUNTING & HARDWARE** under ADJUSTMENTS & INSPECTION.
 - Binding or seized hardware.
 - Distorted, worn, damaged or missing hardware components.
- D. Replace the caliper mounting/sliding hardware components as required. See **DISC BRAKE HARDWARE** under REMOVAL & INSTALLATION.
- E. Replace the contaminated disc brake pads as a complete axle set. See **BRAKE PADS** under REMOVAL & INSTALLATION.

If the cleaning, inspection and replacement was completed, go to step 12 .

12. Visually inspect each of the disc brake rotor shields/backing plates for evidence of contact with the brake rotors. If any of the brake rotor shields/backing plates are contacting the brake rotors, go to step 13 . If any of the brake rotor shields/backing plates are not contacting the brake rotors, go to step 14 .
13. Repair or replace the disc brake rotor shields/backing plates as required. See **DISC BRAKE SPLASHSHIELD** under REMOVAL & INSTALLATION. If the repair or replacement was completed, go to step 14 .
14. Make the following determination individually for each rotor:
 - A. Check the thickness of each of the disc brake rotors.
 - B. Make a determination for each brake rotor if the rotor can be refinished and remain above the minimum requirements.

See **BRAKE ROTOR THICKNESS MEASUREMENT** under ADJUSTMENTS & INSPECTION. If the disc brake rotors meet the minimum requirements for refinishing, go to step 15 . If the disc brake rotors DO NOT meet the minimum requirements for refinishing, go to step 18 .

15.

NOTE: Make the following determination individually for each rotor.

Inspect each of the disc brake rotors for thickness variation that exceeds the maximum acceptable level.

See **BRAKE ROTOR THICKNESS MEASUREMENT** under ADJUSTMENTS & INSPECTION. If the brake rotor exhibits thickness variation that exceeds the maximum acceptable level, go to step 17 . If the brake rotor does not exhibit thickness variation that exceeds the maximum acceptable level, go to step 16 .

16. Make the following determination individually for each rotor:

- Heavy rust and/or pitting.
- Cracks and/or heat spots.
- Excessive blueing discoloration.
- Deep or excessive scoring beyond maximum acceptable level.

Make a determination for each brake rotor if the rotor requires refinishing based upon the results of the inspection. If the brake rotor exhibits any of the conditions listed previously, it requires refinishing. If the brake rotors require refinishing, go to step 17 . If the brake rotors DO NOT require finishing, go to step 22 .

- 17.
- Refinish the brake rotor. See **BRAKE ROTOR REFINISHING** under OVERHAUL.
 - Inspect the brake rotor thickness. See **BRAKE ROTOR THICKNESS MEASUREMENT** under ADJUSTMENTS & INSPECTION.

If you were able to refinish the brake rotor within the minimum requirements, go to step 22 . If you were not able to refinish the brake rotor within the minimum requirements, go to step 21 .

18. If the brake rotor is at or below the discard requirements, go to step 21 . If the brake rotor is not at or below the discard requirements, go to step 19 .

19.

NOTE: Make the following determination individually for each rotor.

Inspect each of the disc brake rotors for thickness variation that exceeds the maximum acceptable level. See **BRAKE ROTOR THICKNESS MEASUREMENT** under ADJUSTMENTS & INSPECTION. If the brake rotor exhibits thickness variation that exceeds the maximum acceptable level, go to step 21 . If the brake rotor does not exhibit thickness variation that exceeds the maximum acceptable level, go to step 20 .

20.

A. Inspect each of the disc brake rotors for the following surface and wear conditions:

- Heavy rust and/or pitting.
- Cracks and/or heat spots.
- Excessive blueing discoloration.
- Deep or excessive scoring beyond maximum acceptable level.

See **BRAKE ROTOR SURFACE & WEAR INSPECTION** under ADJUSTMENTS & INSPECTION.

B. Make a determination for each brake rotor if the rotor requires replacement based upon the results of the inspection. If the brake rotor exhibits any of the conditions listed previously, it requires replacement. If the brake rotor requires replacement, go to step 21 . If the brake rotor does not require replacement, go to step 22 .

21. **NOTE:** Whenever a brake rotor is replaced, the assembled Lateral Runout (LRO) of the rotor must be measured to ensure optimum performance of the disc brakes. See appropriate ANTI-LOCK article.

Replace the brake rotor. See **BRAKE ROTOR** . After repairs are complete, go to step 24 .

22. **NOTE:** Make the following determination individually for each rotor.

Inspect each of the disc brake rotors for assembled LRO that exceeds the maximum acceptable level. See appropriate ANTI-LOCK article. If the brake rotor exhibits assembled LRO that exceeds the maximum acceptable level, go to step 23 . If the brake rotor does not exhibit assembled LRO that exceeds the maximum acceptable level, go to step 24 .

23. Correct the LRO for each brake rotor that was determined to have LRO exceeding the maximum acceptable level. See appropriate ANTI-LOCK article. If the operation was completed, go to step 24 .
24. Install or connect components that were removed or disconnected during diagnosis. If the operation was completed, disc brake system okay. If the operation was not completed, return to symptom list.

HYDRAULIC BRAKE SYSTEM DIAGNOSIS

1. If were you sent here from a brake symptom test, go to step 2 . If you were not sent here from a brake symptom test, see **HYDRAULIC BRAKE SYSTEM** under GENERAL DIAGNOSIS.
2. Inspect and adjust the brake fluid level in the brake master cylinder. See **MASTER CYLINDER RESERVOIR FILLING** under BLEEDING BRAKE SYSTEM. If the brake fluid level was low, go to step 3 . If the brake fluid level was not low, go to step 4 .
3. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
 - A. Fluid separation, indicating 2 types of fluid are present:
 - Swirled appearance, oil-based substance.
 - Layered appearance, silicone-based substance.
 - B. Fluid discoloration:
 - Cloudy appearance, moisture.
 - Dark appearance/suspended particles in fluid, dirt, rust, corrosion and brake dust.

Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. If any of the above conditions exist, go to step 5 . If any of the above conditions DO NOT exist, go to step 6 .

4. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
 - A. Fluid separation, indicating 2 types of fluid are present:
 - Swirled appearance, oil-based substance.
 - Layered appearance, silicone-based substance.
 - B. Fluid discoloration:
 - Cloudy appearance, moisture.

- Dark appearance/suspended particles in fluid, dirt, rust, corrosion and brake dust.

Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. If any of the above conditions exist, go to step 5 . If any of the above conditions DO NOT exist, go to step 12 .

5. Flush the hydraulic brake system. See **HYDRAULIC BRAKE SYSTEM FLUSHING** under **BLEEDING BRAKE SYSTEM**. If the brake fluid WAS contaminated with an oil-based or a silicone-based fluid, indicated by fluid separation and/or a swollen master cylinder reservoir cap diaphragm and/or swollen reservoir-to-master cylinder grommets, perform the following steps. Refer to the procedures indicated:

- Remove all of the following components listed. Each component contains internal rubber seals/linings which have been contaminated.
- Clean out the hydraulic brake pipes using denatured alcohol, or equivalent.
- Dry the brake pipes using non-lubricated, filtered air.
- Repair or replace all of the following components listed. Each component contains internal rubber seals/linings which have been contaminated.
 - A. Perform master cylinder overhaul and/or master cylinder replacement. See **MASTER CYLINDER** under OVERHAUL; or **MASTER CYLINDER** under REMOVAL & INSTALLATION.
 - B. Clean the brake master cylinder reservoir using denatured alcohol, or equivalent, then dry the reservoir using non-lubricated, filtered air, or if necessary, replace the brake master cylinder reservoir. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION.
 - C. Replace the brake master cylinder reservoir cap diaphragm.
 - D. Replace front and/or rear brake hose. See **BRAKE HOSE** under REMOVAL & INSTALLATION.
 - E. Perform front and/or rear brake caliper overhaul. See **BRAKE CALIPER** under OVERHAUL. Replace front and/or rear brake caliper. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - F. Replace Brake Pressure Modulator Valve (BPMV). See appropriate ANTI-LOCK article.

If the brake fluid was NOT contaminated with an oil-based fluid, but was contaminated with water or dirt, rust, corrosion, and/or brake dust, replace the brake master cylinder reservoir cap diaphragm which may have allowed moisture or dirt to enter the system. Refill and bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** . If the operation and any required repairs and/or replacements were completed, go to step 9 .

6.
 - A. Inspect the following hydraulic brake system components for external fluid leaks. Repair or replace any of the components found to be leaking brake fluid. Refer to the appropriate procedures:
 - Perform master cylinder overhaul and/or master cylinder replacement. See **MASTER CYLINDER** under OVERHAUL; or **MASTER CYLINDER** under REMOVAL & INSTALLATION.
 - Replace front and/or rear brake hose. See **BRAKE HOSE** under REMOVAL & INSTALLATION.

- Replace Brake Pipe. See **BRAKE PIPE** under REMOVAL & INSTALLATION.
- Perform front and/or rear brake caliper overhaul. See **BRAKE CALIPER** under OVERHAUL. Replace front and/or rear brake caliper. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.
- Replace Brake Pressure Modulator Valve (BPMV). See BRAKE PRESSURE MODULATOR VALVE. See appropriate ANTI-LOCK article.

B. If you repaired or replaced any of the brake system components listed, bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM**. While bleeding the hydraulic brake system, observe for the following conditions:

- The presence of air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced.
- An unrestricted and even flow of brake fluid per axle during the bleeding procedure.

If the condition was found and corrected, go to step 7 . If the condition was not found and corrected, go to step 12 .

7. If there was air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced, go to step 19 . If there was nor air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced, go to step 8 .
8. If the flow of brake fluid was unrestricted and even per axle during the bleeding procedure, go to step 9 . If the flow of brake fluid was not unrestricted and even per axle during the bleeding procedure, go to step 10 .
9. Inspect the hydraulic function of the brake calipers for proper operation. See **HYDRAULIC BRAKE COMPONENT OPERATION VISUAL INSPECTION** under ADJUSTMENTS & INSPECTION. If the hydraulic function of the brake calipers was operating properly, go to step 21 . If the hydraulic function of the brake calipers was not operating properly, go to step 14 .
10. If the flow of brake fluid was restricted or uneven through front axle hydraulic components during the bleeding procedure, go to step 13 . If the flow of brake fluid was not restricted or uneven through front axle hydraulic components during the bleeding procedure, go to step 11 .
11. If the flow of brake fluid was restricted or uneven through rear axle hydraulic components during the bleeding procedure, go to step 17 .
12. Inspect the hydraulic function of the brake calipers for proper operation. See **HYDRAULIC BRAKE COMPONENT OPERATION VISUAL INSPECTION** under ADJUSTMENTS & INSPECTION. If the hydraulic function of the brake calipers are operating properly, go to step 15 . If the hydraulic function of the brake calipers are not operating properly, go to step 13 .
13. Determine if the brake caliper is restricting the flow of brake fluid and/or not operating properly:
 - Raise and support the vehicle.
 - Remove the tire and wheel assemblies.
 - Open the suspected caliper bleeder valve.
 - Using a large C-clamp, compress the caliper piston and observe for an unrestricted flow of brake fluid and for free movement of the caliper piston.
 - Close the caliper bleeder valve.

If the flow of brake fluid was unrestricted and if the caliper piston moved freely, go to step 17 . If the flow of brake fluid was not unrestricted and if the caliper piston did not move freely, go to step 14 .

14. Repair or replace any brake caliper that was not operating properly. Refer to the appropriate procedure. Perform brake caliper overhaul. See **BRAKE CALIPER** under OVERHAUL. If the repair and/or replacement was completed, go to step 21 .
15. Bleed the hydraulic brake system to observe for the presence of air in the system and to observe for an unrestricted and even flow of brake fluid per axle during the bleeding procedure. See **BLEEDING BRAKE SYSTEM** . If there was air in the system, go to step 19 . If there was no air in the system, go to step 16 .
16. If the flow of brake fluid was unrestricted and even per axle during the bleeding procedure, go to step 21 . If the flow of brake fluid was not unrestricted and even per axle during the bleeding procedure, go to step 17 .
17.
 - A. Inspect the hydraulic brake pipes and flexible brake hoses for signs of a fluid restriction; such as being bent, kinked, pinched or damaged. See **BRAKE PIPE & HOSE INSPECTION** under ADJUSTMENTS & INSPECTION.
 - B. Replace any of the hydraulic brake pipes and/or flexible brake hoses found to be bent, kinked, pinched, or damaged. Refer to the following procedures as necessary:
 - Replace brake hose. See **BRAKE HOSE** under REMOVAL & INSTALLATION.
 - Replace brake pipe. See **BRAKE PIPE** under REMOVAL & INSTALLATION.
 - C. If none of the hydraulic brake pipes or flexible brake hoses were visibly bent, kinked, pinched, or damaged, replace the hydraulic brake flex hose at the restricted location.

If the condition was found and corrected, go to step 21 . If the condition was not found and corrected, go to step 18 .

18. Replace the brake pressure modulator valve (BPMV), in order to correct the hydraulic brake dynamic rear proportioning mechanical operation. See **BRAKE PRESSURE MODULATOR VALVE** in appropriate ANTI-LOCK article in BRAKES. After repairs are complete, go to step 21 .
19.
 - A. Inspect the hydraulic brake system components for brake fluid seepage at a seal and/or fitting location, which may have drawn air into the system.
 - B. Inspect the hydraulic brake system components for evidence of a recent repair, which may have introduced air into the system.
 - C. Repair or replace any of the components found to be installed incorrectly or seeping brake fluid.

If the condition was found and corrected, go to step 21 . If the condition was not found and corrected, go to step 20 .

20.
 - A. Inspect the brake master cylinder for internal fluid leaks. See **BRAKE SYSTEM INTERNAL LEAK TEST** under SYSTEM TESTS.
 - B. Repair or replace the brake master cylinder if it is found to be leaking brake fluid internally. See **MASTER CYLINDER** under OVERHAUL and/or **MASTER CYLINDER** under REMOVAL & INSTALLATION.

If the condition was found and corrected, go to step 21 . If the condition was not found and corrected, return to symptom test.

21. Install or connect components that were removed or disconnected during diagnosis. If the operation was

completed, hydraulic brake system okay. If the operation was not completed, return to symptom tests.

PARK BRAKE SYSTEM DIAGNOSIS

1. If you were sent here from a hydraulic brake symptom test, go to step 4 . If you were not sent here from a hydraulic brake symptom test, go to step 2 .
2. If you were sent here from a park brake symptom test, go to step 4 . If you were sent here from a park brake symptom test, go to step 3 .
3. If the symptom is related to the ability of the park brake system to hold and/or release, see **PARK BRAKE SYSTEM** under GENERAL DIAGNOSIS. If the symptom is not related to the ability of the park brake system to hold and/or release, see **HYDRAULIC BRAKE SYSTEM** under GENERAL DIAGNOSIS.
4.
 - A. Raise and support the vehicle with the rear axle supported by jack stands.
 - B. Shift the transmission into neutral.
 - C. With the park brake released, attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag.

If the rear brakes have a significant amount of drag, go to step 11 . If the rear brakes DO NOT have a significant amount of drag, go to step 5 .

5.
 - Shift the transmission into neutral.
 - Apply the park brake.
 - Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag.

If the rear brakes have a significant amount of drag, go to step 6 . If the rear brakes DO NOT have a significant amount of drag, go to step 7 .

6. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction in the amount of drag. If the rear brakes exhibit a significant reduction in the amount of drag, go to step 22 . If the rear brakes DO NOT exhibit a significant reduction in the amount of drag, go to step 11 .
7. Visually check the park brake cable connections and the cables that are accessible on the underside of the vehicle for disconnections and/or damage. If any or the park brake cables were disconnected and/or damaged, go to step 8 . If any or the park brake cables were not disconnected and/or damaged, go to step 9 .
8. Reconnect or replace the park brake cables as necessary. See **PARK BRAKE CABLE** under REMOVAL & INSTALLATION. If the repair and/or replacement was completed, go to step 9 .
9. Check the adjustment of the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the park brake was adjusted properly, go to step 11 . If the park brake was not adjusted properly, go to step 10 .
10. Adjust the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the adjustment of the park brake was attainable, go to step 16 . If the adjustment of the park brake was not attainable, go to step 11 .
- 11.

NOTE: DO NOT depress the brake pedal with the brake rotors and/or the brake drums removed or with the brake calipers repositioned away from the brake rotors. Damage to the brake system may result.

Remove the rear brake rotors. See **BRAKE ROTOR** in REMOVAL & INSTALLATION. Inspect the park brake shoe hardware for looseness, damaged, broken or missing components. Check the park brake actuators for a seized condition. If the park brake hardware and/or the park brake actuators require replacement, go to step 12 . If the park brake hardware and/or the park brake actuators DO NOT require replacement, go to step 13 .

12. Replace park brake hardware components as necessary. See **PARK BRAKE SHOES** under REMOVAL & INSTALLATION. Replace the park brake actuators as necessary. See **PARK BRAKE ACTUATOR** under REMOVAL & INSTALLATION. After repairs are complete, go to step 13 .
13. Have an assistant apply and release the park brake, while you observe the park brake cables for free movement. If the park brake cables moved freely, go to step 14 . If the park brake cables did not move freely, go to step 17 .
14. Check the adjustment of the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the park brake was adjusted properly, go to step 16 . If the park brake was not adjusted properly, go to step 15 .
15. Adjust the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the adjustment of the park brake was attainable, go to step 16 . If the adjustment of the park brake was not attainable, go to step 25 .
16. With the transmission still in neutral, apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. If the park brake applied and released properly, go to step 27 . If the park brake did not apply and release properly, return to symptom tests.
17. Disconnect the park brake cable connections that are accessible on the underside of the vehicle one at a time and check each cable for free movement. If any of the park brake cables that are accessible on the underside of the vehicle require replacement, go to step 18 . If any of the park brake cables that are accessible on the underside of the vehicle DO NOT require replacement, go to step 19 .
18. Replace any of the park brake cables that DO NOT have free movement and/or are not releasing properly. See **PARK BRAKE CABLE** under REMOVAL & INSTALLATION. After repairs are complete, go to step 19 .
19. Disconnect the front park brake cable connection accessible **INSIDE** the vehicle at the park brake pedal assembly and check for free movement. Replace the front park brake cable if it does not have free movement. See **PARK BRAKE CABLE** under REMOVAL & INSTALLATION. If the condition was found and corrected, go to step 25 . If the condition was not found and corrected, go to step 20 .
20. Disconnect the park brake release handle assembly cable connection from the park brake pedal assembly and check for free movement. Replace the park brake release handle assembly if the release cable does not have free movement. See **PARK BRAKE RELEASE HANDLE ASSEMBLY** under REMOVAL & INSTALLATION. If the condition was found and corrected, go to step 25 . If the condition was not found and corrected, go to step 21 .
21. Replace the park brake pedal assembly that is not releasing properly. See **PARK BRAKE PEDAL ASSEMBLY** under REMOVAL & INSTALLATION. After repairs are complete, go to step 25 .
22. Check the adjustment of the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS

& INSPECTION. If the park brake was adjusted properly, go to step 27 . If the park brake was adjusted properly, go to step 23 .

23. Adjust the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the adjustment of the park brake system attainable, go to step 26 . If the adjustment of the park brake system is not attainable, go to step 24 .

24.

- A. Remove the rear brake rotors, if they have not yet been removed. See **BRAKE ROTOR** in REMOVAL & INSTALLATION.
- B. Check the park brake actuators for a seized condition.
- C. Replace the park brake actuators as necessary. See **PARK BRAKE ACTUATOR** under REMOVAL & INSTALLATION.

If the condition was found and corrected, go to step 25 . If the condition was not found and corrected, return to symptom test.

25. Adjust the park brake. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. If the adjustment of the park brake system was attainable, go to step 26 . If the adjustment of the park brake system was not attainable, return to symptom test.
26. With the transmission still in NEUTRAL, apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. If the park brake applied and released properly, go to step 27 . If the park brake did not apply and release properly, return to symptom test.
27. Install or connect any components that were removed or disconnected during diagnosis. If the operation was completed, park brake system okay. If the operation was not completed, return to symptom table.

SYMPTOM TESTS

BRAKE WARNING INDICATOR ALWAYS ON

1. If the hydraulic brakes operation has been reviewed and the necessary inspection performed, go to step 2 . If the hydraulic brakes operation has not been reviewed and the necessary inspection has not been performed, see **HYDRAULIC BRAKE SYSTEM** under GENERAL DIAGNOSIS in TROUBLE SHOOTING.
2. Inspect the brake fluid level. If the brake fluid level is okay, go to step 3 . If the brake fluid level is not okay, see **BRAKE FLUID LOSS**.
3.
 - A. Turn ON the ignition, with the engine OFF.
 - B. Disengage the park brake.
 - C. With a scan tool, observe the park brake switch parameter in the BCM Inputs data list.

If the scan tool indicates that the park brake switch parameter is inactive, go to step 4 . If the scan tool does not indicate that the park brake switch parameter is inactive, go to step 5 .

4. With a scan tool, observe the brake warning light parameter in the Instrument Panel Cluster (IPC) inputs data list. If the scan tool indicates that the brake warning light parameter is on, go to step 12 . If the scan tool does not indicate that the brake warning light parameter is on, go to step 6 .

5. Disconnect the park brake warning light switch. With a scan tool, observe the park brake switch parameter. If the scan tool indicates that the park brake switch parameter is inactive, go to step 9 . If the scan tool indicates that the park brake switch parameter is inactive, go to step 7 .
6. Disconnect the brake fluid level switch. With a scan tool, observe the brake warning light parameter. If the scan tool indicates that the brake warning light parameter is on, go to step 10 . If the scan tool does not indicate that the brake warning light parameter is on, go to step 8 .
7. Turn OFF the ignition. Test the signal circuit of the park brake warning light switch for a short to ground. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 11 .
8. Turn OFF the ignition. Test the signal circuit of the brake fluid level switch for a short to ground. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 11 .
9. Inspect for poor connections at the harness connector of the park brake warning light switch. If the condition was not found and corrected, go to step 17 . If the condition was not found and corrected, go to step 13 .
10. Inspect for poor connections at the harness connector of the brake fluid level switch. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 14 .
11. Inspect for poor connections at the harness connector of the BCM. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 15 .
12. Inspect for poor connections at the harness connector of the instrument Panel cluster. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 16 .
13. Replace the park brake warning light switch. See **PARK BRAKE WARNING LIGHT SWITCH** under REMOVAL & INSTALLATION. If the repair was completed, go to step 17 .
14. Replace the brake fluid level switch. See **MASTER CYLINDER FLUID LEVEL SENSOR** under REMOVAL & INSTALLATION. If the repair was completed, go to step 17 .
15. Replace the Body Control Module. See appropriate BODY CONTROL MODULE article in COMMUNICATION DEVICES in ACCESSORIES & EQUIPMENT. After repairs are complete, go to step 17 .
16. Replace the IPC. If the repair was completed, go to step 17 .
17. Operate the system in order to verify the repair. If the condition was corrected, system okay. If the condition was not corrected, go to step 2 .

BRAKE WARNING INDICATOR INOPERATIVE

1. If the hydraulic brakes operation has been reviewed and the necessary inspection performed, go to step 2 . If the hydraulic brakes operation has not been reviewed and the necessary inspection has not been performed, see **HYDRAULIC BRAKE SYSTEM** under GENERAL DIAGNOSIS in TROUBLE SHOOTING.
2. Turn ON the ignition, with the engine OFF. Observe the brake warning indicator. If the brake warning indicator illuminates briefly during the bulb check, go to step 3 . If the brake warning indicator does not illuminate briefly during the bulb check, go to step 11 .
3. Turn ON the ignition, with the engine off. Apply the park brake. If the brake warning indicator illuminates, go to step 4 . If the brake warning indicator does not illuminate, go to step 7 .

4. Turn OFF the ignition. Release park brake. Disconnect the brake fluid level indicator switch. Connect a 3-amp fused jumper wire between the signal circuit of the brake fluid level indicator switch and a good ground. If the brake warning indicator illuminates, go to step 5 . If the brake warning indicator does not illuminate, go to step 9 .
5. Inspect for poor connections or a poor ground at the brake fluid level indicator switch. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 6 .
6. Inspect brake fluid level indicator switch for proper operation. If brake fluid level indicator switch works properly. If brake fluid level indicator switch does not work properly, go to step 15 .
7. Disconnect the park brake warning light switch. Connect a 3-amp fused jumper wire between the signal circuit of the park brake warning light switch and ground. If the brake warning indicator illuminated, go to step 10 . If the brake warning indicator does not illuminate, go to step 8 .
8. Turn OFF the ignition. Disconnect the body control module. Test the signal circuit of the park brake warning light switch for a high resistance or an open. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 12 .
9. Turn OFF the ignition. Disconnect the instrument panel cluster. Test the signal circuit of the brake fluid level indicator switch for a high resistance or an open. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 11 .
10. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 11 .
11. Inspect for poor connections at the harness connector of the instrument cluster. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 14 .
12. Inspect for poor connections at the harness connector of the Body Control Module. If the condition was found and corrected, go to step 17 . If the condition was not found and corrected, go to step 16 .
13. Replace the park brake warning light switch. See **PARK BRAKE WARNING LIGHT SWITCH** under REMOVAL & INSTALLATION. If the repair was completed, go to step 17 .
14. Replace the instrument cluster. See appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT. If the repair was completed, go to step 17 .
15. Replace the brake fluid level indicator switch. See **MASTER CYLINDER FLUID LEVEL SENSOR** under REMOVAL & INSTALLATION. If the repair was completed, go to step 17 .
16. Replace the Body Control Module. See appropriate BODY CONTROL MODULE article in COMMUNICATION DEVICES in ACCESSORIES & EQUIPMENT. If the repair was completed, go to step 17 .
17. Operate the system in order to verify the repair. If the condition was repaired, system okay. If the condition was not repaired, go to step 2 .

BRAKE PULSATION

1. If you were sent here from General Diagnosis, go to next step. If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the suspension system for proper operation. See appropriate SUSPENSION article. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go step 3 .
3. Inspect the anti-lock brake system for proper operation. See appropriate ANTI-LOCK BRAKES article. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to

step 4 .

4. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 5 .
5. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
6. Road test the vehicle in order to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKE SYSTEM NOISE

1. If you were sent here from General Diagnosis, go to step 2 . If no, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 3 .
3. Inspect the brake assist system for proper operation. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 4 .
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 5 .
5. Inspect the park brake system for proper operation. See **PARK BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
6. Road test the vehicle in order to confirm proper operation. If the condition still present, go to step 2 . If the condition is not present, system is okay.

BRAKING ACTION UNEVEN - PULLS TO ONE SIDE

1. If you were sent here from General Diagnosis, go to next step. If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the suspension system for proper operation. See appropriate SUSPENSION article. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 3 .
3. Inspect the steering system for proper operation. See appropriate POWER RECIRCULATING BALL article. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 4 .
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 5 .
5. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under

TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.

6. Road test the vehicle in order to confirm proper operation. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKING ACTION UNEVEN - FRONT TO REAR

1. If you were sent here from General Diagnosis, go to step 2 . If no, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the suspension system for proper operation. See appropriate SUSPENSION article. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 3 .
3. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, got step 6 . If the condition was not found and corrected, go to step 4 .
4. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to step 5 .
5. Inspect the brake assist system for proper operation. If the condition was found and corrected, go to step 6 . If the condition was not found and corrected, go to **DIAGNOSTIC STARTING POINTS** under TROUBLESHOOTING.
6. Road test the vehicle in order to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKE PEDAL EXCESSIVE TRAVEL

1. If you sent here from General Diagnosis, go to next step. If you were not, sent here from General Diagnosis see, **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL MEASUREMENT & INSPECTION** under ADJUSTMENTS & INSPECTION. If the brake pedal travel distance is within the acceptable level, go to step 5 . If the brake pedal travel distance is not within the acceptable, go to step 3 .
3. Inspect for worn, missing or damaged brake pedal system components. Replace the brake pedal system components that are worn, missing or damaged. See **BRAKE PEDAL ASSEMBLY** or **BRAKE BOOSTER** under REMOVAL & INSTALLATION. If any worn, missing or damaged brake pedal system components are found and replaced, go to step 4 . If any worn, missing or damaged brake pedal system components were not found and replaced, go to step 5 .
4. Reinspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL MEASUREMENT & INSPECTION** under ADJUSTMENTS & INSPECTION. If the brake pedal travel distance is within the acceptable level, go to step 8 . If the brake pedal travel distance is not within the acceptable level, go to step 5 .
5. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 8 . If the condition was not found and corrected, go to step 6 .

6. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 8 . If the condition was not found and corrected, go to step 7 .
7. Inspect the brake assist system for proper operation. If the condition was found and corrected, go to step 8 . If the condition was not found and corrected, go to **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
8. Road test the vehicle to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKE PEDAL EXCESSIVE EFFORT

1. If you were sent here from General Diagnosis, go to step 2 . If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the brake assist system for proper operation. If the condition was found and corrected, go step 5 . If the condition was not found and corrected, go step 3 .
3. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition is not found and corrected, go to step 4 .
4. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
5. Road test the vehicle to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKES DRAG

1. If you were sent here from General Diagnosis, go to step 2 . If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. If the vehicle is equipped with an adjustable stop light switch and/or an adjustable cruise control release switch, go to step 3 . If the vehicle is not equipped with an adjustable stop light switch and/or an adjustable cruise control release switch, go to step 4 .
3.
 - Inspect the stop light switch for proper adjustment to ensure that the brake pedal is fully releasing.
 - Inspect the cruise control release switch, if equipped, for proper adjustment to ensure that the brake pedal is fully releasing.

If the condition was found and corrected, go to step 11 If the condition was not found and corrected, go to step 4 .

4. Inspect the park brake system for proper operation. See **PARK BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected go to step 11 . If the condition was not found and corrected, go to step 5 .
5. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under

TROUBLE SHOOTING. If the condition was found and corrected, go to step 11 . If the condition was not found and corrected, go to step 6 .

6. Separate the brake booster pushrod from the brake pedal. Inspect the brake corners to determine if the brake drag condition is still present. If the brake corners still exhibit the brake drag condition, go to step 8 . If the brake corners DO NOT exhibit the brake drag condition, go to step 7 .
7. Replace the brake pedal assembly. If the replacement has been completed, go to step 11 .
8.
 - A. Separate the master cylinder from the brake booster. DO NOT disconnect any brake pipes.
 - B. Inspect the brake corners to determine if the brake drag condition is still present.

If the brake corners still exhibit the brake drag condition, go to step 10 . If the brake corners DO NOT exhibit the brake drag condition, go to step 9 .

9. Replace the brake booster assembly. See **BRAKE BOOSTER** under REMOVAL & INSTALLATION. After repairs are complete, go to step 11 .
10. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 11 . If the condition was not found and corrected, see **HYDRAULIC BRAKE SYSTEM** under DIAGNOSTIC STARTING POINTS in TROUBLE SHOOTING.
11. Install or connect components that were removed or disconnected during diagnosis. Road test the vehicle in order to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system okay.

BRAKE SYSTEM SLOW RELEASE

1. If you were sent here from General Diagnosis, go to step 2 . If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, go to step 3 .
3. Inspect the brake assist system for proper operation. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, go to step 4 .
4. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, go to **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
5. Road test the vehicle to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKE FLUID LOSS

1. If you were sent here from General Diagnosis, go to step 2 . If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 4 . If

the condition was not found, go to step 3 .

3. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 4 . If the condition was not found and corrected, go to step 4 .
4. Road test the vehicle to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

BRAKES SELF APPLY WHEN TURNING STEERING WHEEL

1. If you were sent here from General Diagnosis go to step 2 . If you were not sent here from General Diagnosis, see **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the steering system for proper operation. See appropriate POWER RECIRCULATING BALL article. If the condition was found and corrected, go to step 4 . If the condition was not found, go to step 3 .
3. Inspect the brake assist system for proper operation. See under TROUBLESHOOTING. If the condition was found and corrected, go to step 4 . If the condition was not found, go to **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
4. Road test the vehicle in order to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under TESTING. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

PARK BRAKE WILL NOT HOLD OR RELEASE

1. If you were sent here from the Park Brake Symptom Test, go to step 2 . If you were not sent here from the Park Brake Symptom Test, go to **DIAGNOSTIC STARTING POINTS** under TROUBLE SHOOTING.
2. Inspect the park brake system for proper operation. See **PARK BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, go to step 3 .
3. Inspect the disc brake system for proper operation. See **DISC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to step 5 . If the condition was not found and corrected, go to step 4 .
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE SYSTEM DIAGNOSIS** under TROUBLE SHOOTING. If the condition was found and corrected, go to next step. 5 If the condition was not found and corrected, go to **DIAGNOSTIC STARTING POINTS** under TROUBLESHOOTING.
5. Road test the vehicle in order to confirm proper operation. See **BRAKE SYSTEM VEHICLE ROAD TEST** under SYSTEM TESTS. If the condition is still present, go to step 2 . If the condition is not present, system is okay.

SYSTEM TESTS

BRAKE SYSTEM VEHICLE ROAD TEST

Preliminary Inspections

1. Visually inspect easily accessible brake system components for obvious damage and/or leaks which may indicate that the vehicle should not be driven until further inspections have been completed.
2. Inspect the brake master cylinder reservoir fluid level and adjust only if necessary for brake system road testing. See **MASTER CYLINDER RESERVOIR FILLING** under BLEEDING BRAKE SYSTEM.
3. Inspect the tire inflation pressures and adjust as necessary.
4. Inspect the tire tread patterns to ensure that they are the same or very similar, especially per axle.
5. Ensure that the vehicle is not loaded unevenly prior to brake system road testing.

Road Testing Procedure

WARNING: Road test a vehicle under safe conditions and while obeying all traffic laws. DO NOT attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

1. Start the engine and allow it to idle.
2. Check to see if the brake system warning light remains illuminated.
3. If the brake system warning light remains illuminated, DO NOT proceed to test drive the vehicle until it is diagnosed and repaired. See **GENERAL DIAGNOSIS** under TROUBLESHOOTING.
4. Select a smooth, dry, clean and level road or large lot that is as free of traffic and obstacles as possible for brake system low speed road testing.
5. With the transmission in PARK, lightly apply the brake pedal. Observe both the pedal feel and the pedal travel.
6. If the brake pedal apply felt spongy, or the pedal travel was excessive. DO NOT drive the vehicle until it is repaired.
7. If the brake pedal apply did not feel spongy and the pedal travel was not excessive, proceed to next step.
8. Release and apply the brakes.
9. While continuing to apply the brakes, shift the transmission into DRIVE, release the brakes and allow the engine to idle the vehicle away from the stopped position. Observe for a slow release of the brake system.
10. With the aid of an assistant to observe the vehicle's performance from outside of the vehicle, drive the vehicle at a low speed and lightly apply the brakes while driving past the assistant. Have the assistant observe for brake system noise from the side of the vehicle closest to them, while you observe both the pedal effort and the pedal travel.
11. If the brake pedal apply effort was excessive, or the pedal travel was excessive. DO NOT continue to test drive the vehicle until it is repaired.
12. If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to next step.
13. Drive the vehicle in the opposite direction, at the same low speed and lightly apply the brakes while driving past the assistant. Have the assistant observe for brake system noise from the side of the vehicle closest to him.
14. Drive the vehicle at a low speed and shift the transmission into NEUTRAL without applying the brakes. Observe for a rapid deceleration in vehicle speed, indicating possible brake drag.

15. Select a smooth, dry, clean and level road that is as free of heavy traffic as possible for brake system moderate speed road testing.
16. Drive the vehicle at a moderate speed. Observe for a pull and/or incorrect tracking of the vehicle without the brakes applied.
17. While continuing to drive the vehicle at a moderate speed, perform several light applies of the brakes. Observe the pedal effort and the pedal travel, observe for brake system noise, pulsation and/or brake drag.
18. If the brake pedal apply effort was excessive, or the pedal travel was excessive. DO NOT continue to test drive the vehicle until it is repaired.
19. If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to next step.
20. While continuing to drive the vehicle at a moderate speed, perform several moderate applies of the brakes. Observe the pedal effort and the pedal travel, observe for brake system pulsation and/or uneven braking action, either side to side, or front to rear. A small amount of vehicle front end dip is expected during a moderate apply of the brakes.
21. If the brake pedal apply effort was excessive, or the pedal travel was excessive. DO NOT continue to test drive the vehicle until it is repaired.

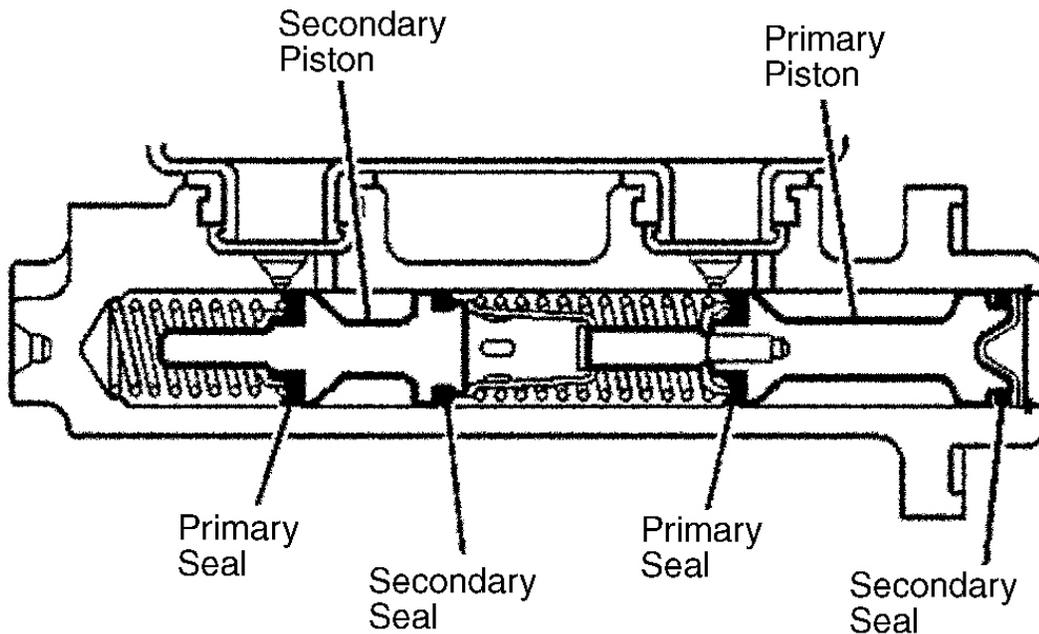
BRAKE SYSTEM INTERNAL LEAK TEST

WARNING: Brake fluid may irritate eyes and skin. In case of eye contact, rinse thoroughly with water. In case of skin contact, wash with soap and water. In case of ingestion, consult a physician immediately.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

1. Start the engine and allow it to idle.
2. Apply light, steady pressure to the brake pedal. Observe both the brake pedal feel and travel.
3. Release the brakes and turn OFF the ignition.
4. If the brake pedal apply felt spongy, but the brake pedal travel was not excessive, perform the following steps:
 - Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK INSPECTION** under ADJUSTMENTS & INSPECTION.
 - Pressure bleed the brake system in order to purge any air that may be trapped in the system. See **MANUAL BLEEDING** or **PRESSURE BLEEDING** under BLEEDING BRAKE SYSTEM.
5. If the brake pedal apply did not feel spongy, but the brake pedal travel was excessive, loosen the master cylinder-to-brake power booster mounting nuts. Carefully pull the master cylinder away from the brake power booster just enough to inspect the mounting surface of the master cylinder. Inspect the master cylinder mounting surface at the primary piston for brake fluid leaks. See **Fig. 12** .

6. If the master cylinder exhibits any leakage around the primary piston, then the primary piston primary seal and/or secondary seal is leaking and the master cylinder requires overhaul or replacement:
 - For overhaul, see **MASTER CYLINDER** under OVERHAUL.
 - For replacement, see **MASTER CYLINDER** under REMOVAL & INSTALLATION.
7. If the master cylinder primary piston does not exhibit any leakage, pressure bleed the brake system. See **MANUAL BLEEDING** or **PRESSURE BLEEDING** under BLEEDING BRAKE SYSTEM.
8. If the brake pedal apply did not feel spongy, and the brake pedal travel was initially steady and not excessive, but then gradually fell, then the master cylinder requires overhaul or replacement due to an internal leak past the secondary piston from the secondary piston primary seal or secondary seal.
9. If the brake pedal apply did not feel spongy, and the brake pedal travel was initially steady and not excessive, then fell slightly, then became steady again, then the Brake Pressure Modulator Valve (BPMV) may be leaking internally, and may require replacement. See appropriate ANTI-LOCK BRAKES article.



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Fig. 12: Inspecting Master Cylinder For Fluid Leaks
Courtesy of GENERAL MOTORS CORP.

SERVICING

BURNISHING PADS & ROTORS

CAUTION: Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control.

Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

Burnishing the brake pads and brake rotors is necessary in order to ensure that the braking surfaces are properly prepared after service has been performed on the disc brake system. This procedure should be performed whenever the disc brake rotors have been refinished or replaced, and/or whenever the disc brake pads have been replaced.

1. Select a smooth road with little or no traffic.
2. Accelerate the vehicle to 30 Mph (48 Km/h).
- 3.

CAUTION: Use care to avoid overheating the brakes while performing this next step.

Using moderate to firm pressure, apply the brakes to bring the vehicle to a stop. DO NOT allow the brakes to lock.

4. Repeat until approximately 20 stops have been completed. Allow sufficient cooling periods between stops in order to properly burnish the brake pads and rotors.

REMOVAL & INSTALLATION

CAUTION: Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. DO NOT use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

BRAKE BOOSTER

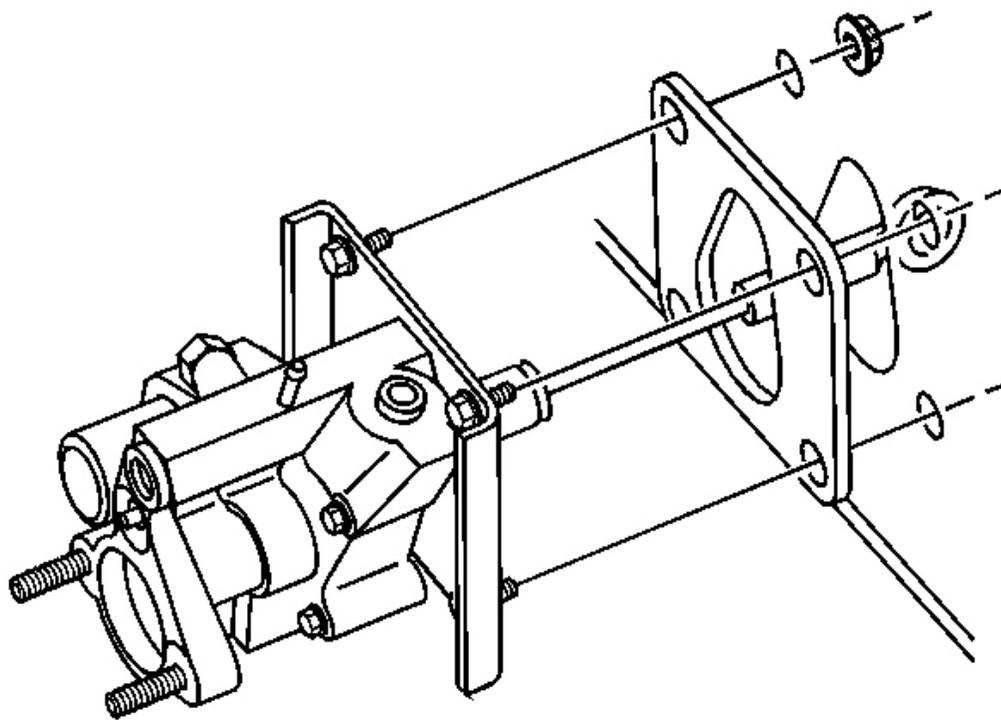
NOTE: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

Removal & Installation

1. Apply the park brake and block the wheels. Disconnect the inlet hose, the steering gear hose, and the return hoses from the booster assembly. Remove the master cylinder retaining nuts and remove the master

cylinder. DO NOT disconnect the brake pipes.

2. Remove the stop lamp switch retaining clip from the brake pedal pin. See **Fig. 13** . Remove the stop light switch and the pushrod from the brake pedal pin. Remove the booster to bulkhead nuts. Remove the booster assembly. Remove the gasket.
3. Install the gasket. Install the booster assembly.
4. Install the booster to bulkhead nuts. Tighten the nuts to specification. See **TORQUE SPECIFICATIONS** . Install the stop lamp switch and the pushrod to the brake pedal pin. Install the stop lamp switch retaining clip to the brake pedal pin.
5. Install the master cylinder and the master cylinder retaining nuts. Tighten the nuts to specification. Connect the return hose, the steering gear hose, and the inlet hoses.
6. Bleed the hydraulic brake booster system. See POWER RACK & PINION article in STEERING. Release the park brake and unblock the wheels.



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Fig. 13: Removing/Installing Hydraulic Brake Booster
Courtesy of GENERAL MOTORS CORP.

Removal (Front)

1. Inspect the fluid level in the brake master cylinder reservoir. If the brake fluid level is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding.
2. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, remove brake fluid to the midway point before proceeding. Raise and support the vehicle. Remove the tire and wheel assembly.
3. Compress the brake caliper pistons. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad. See **Fig. 14** . Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores. Remove the C-clamp from the caliper.

4.

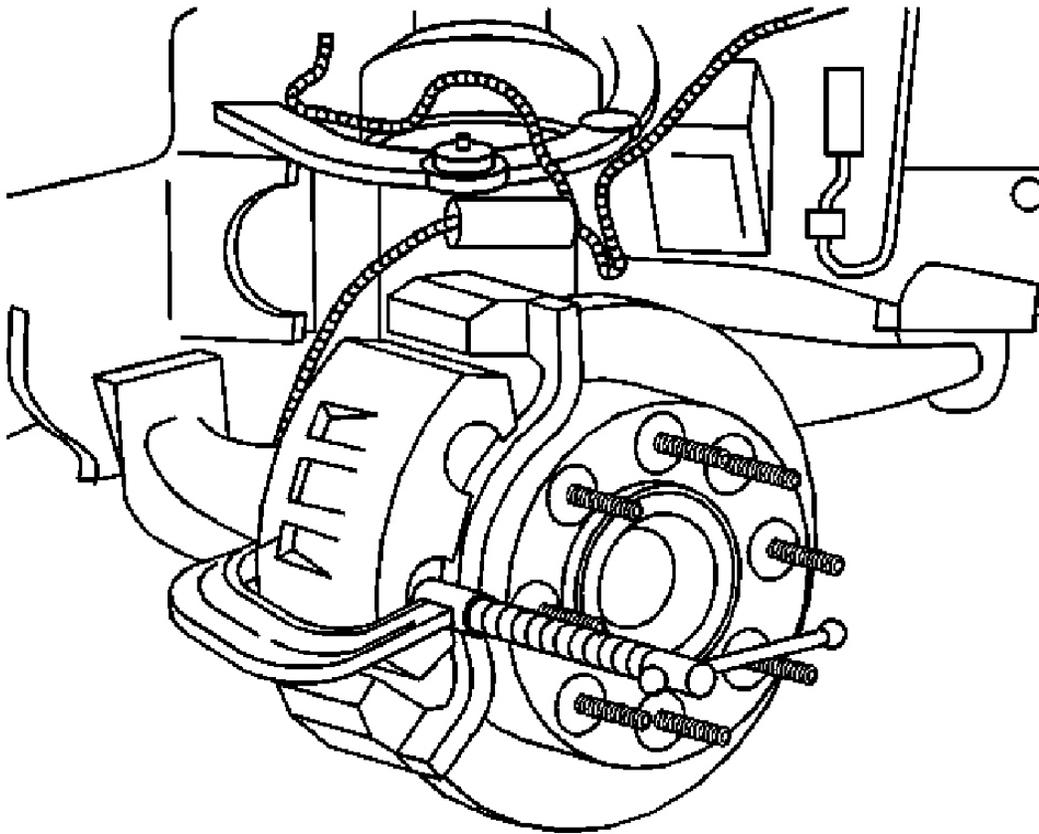
NOTE: Install a rubber cap or plug to the exposed brake pipe fitting end to prevent brake fluid loss and contamination.

Clean all dirt and foreign material from the brake hose end. Remove the brake hose to caliper bolt from the brake caliper. See **Fig. 15** . Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end. Remove the brake hose from the caliper.

5.

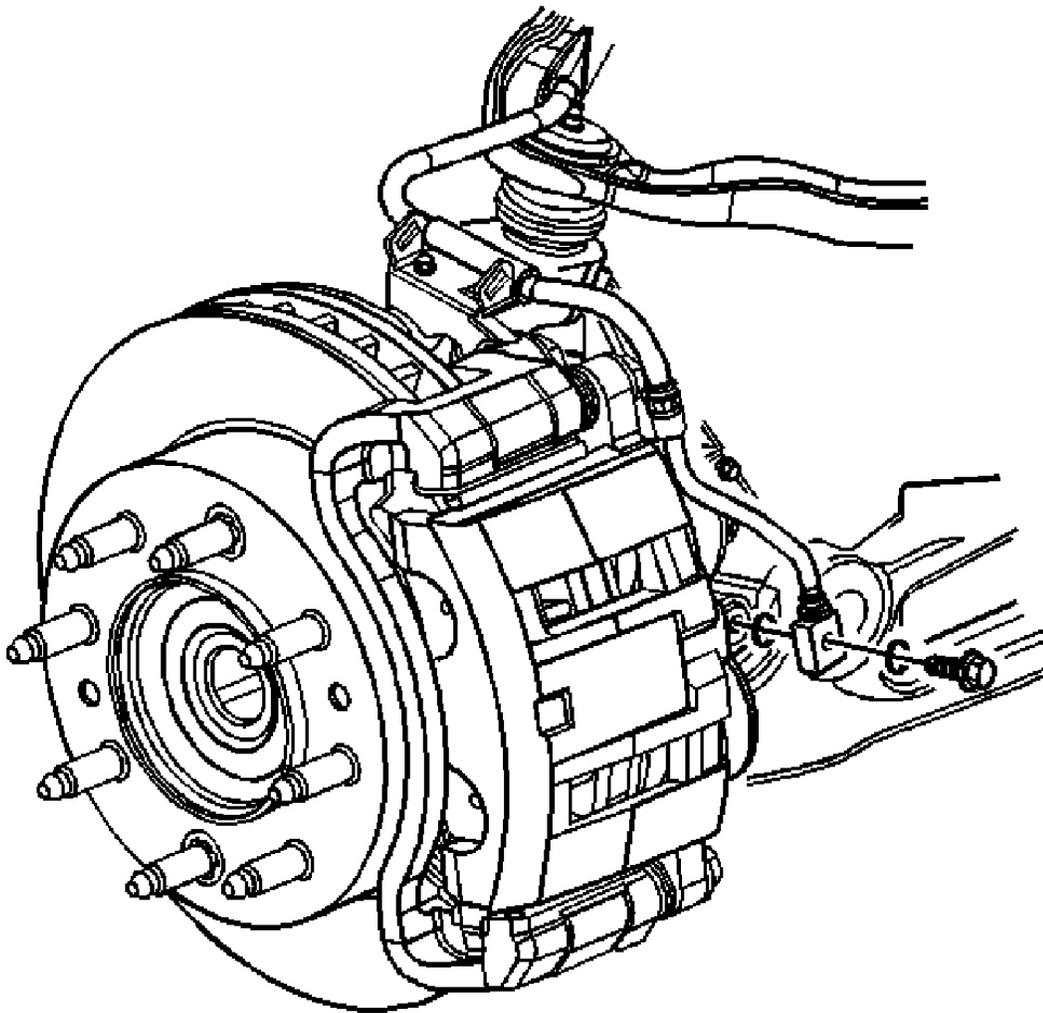
CAUTION: DO NOT depress the brake pedal with the brake rotors/calipers and/or the brake drums removed. Damage to the brake system may result. If brake system damage occurs and is not repaired, vehicle damage and/or personal injury or death may result.

Remove the 2 brake caliper mounting bolts. See **Fig. 25** . Remove the brake caliper from the brake caliper mounting bracket.



G00303311

Fig. 14: Removing Brake Caliper (Front Shown, Rear Similar)
Courtesy of GENERAL MOTORS CORP.



G00303312

Fig. 15: Removing/Installing Brake Hose Bolt From Brake Caliper (Front)
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the brake caliper to the brake caliper mounting bracket.
2. Perform the following procedure before installing the caliper guide pin bolts.
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with brake parts cleaner or the equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493) to the threads of the bolt.
3. Install the brake caliper guide pin bolts. Tighten the brake caliper guide pin bolts to specification. See **TORQUE SPECIFICATIONS**. Remove the rubber cap or plug from the exposed brake hose fitting

end.

4.

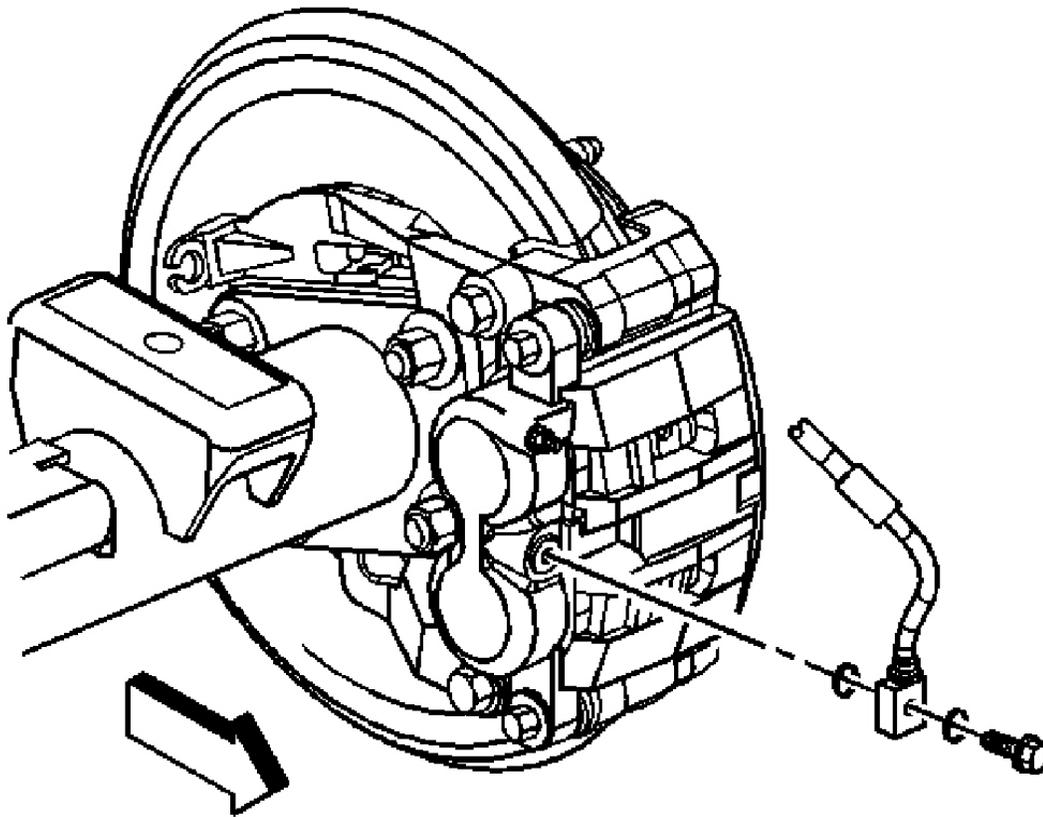
NOTE: Install 2 NEW copper brake hose gaskets.

Assemble the 2 NEW copper brake hose gaskets and the brake hose to caliper bolt to the brake hose. Install the brake hose to caliper bolt to the brake caliper. Tighten the brake hose to caliper bolt to specification.

5. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** .
6. Install the tire and wheel assembly. Lower the vehicle. Fill the master cylinder reservoir to the proper level with clean brake fluid.

Removal (Rear)

1. Inspect the fluid level in the brake master cylinder reservoir. If the brake fluid level is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding.
2. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, remove brake fluid to the midway point before proceeding. Raise and support the vehicle. Remove the tire and wheel assembly.
3. Compress the brake caliper pistons. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad. See **Fig. 14** . Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores. Remove the C-clamp from the caliper.
4. Clean all dirt and foreign material from the brake hose end. Install a rubber cap or plug to the exposed brake pipe fitting end to prevent brake fluid loss and contamination. Remove the brake hose to caliper bolt from the brake caliper. See **Fig. 16** .
5. Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end. Remove the brake hose from the caliper.
6. Remove the caliper guide pin bolts. See **Fig. 25** . Remove the brake caliper from the vehicle. Inspect the caliper assembly.



G00303313

Fig. 16: Removing/Installing Brake Hose Bolt From Brake Caliper (Rear)
Courtesy of GENERAL MOTORS CORP.

Installation

1. **NOTE:** Use denatured alcohol to clean the outside surface of caliper boots before installing NEW brake pads.

If you are installing NEW brake pads use a C-clamp in order to compress the pistons to the bottom of the caliper bores. Use the old brake pad, a metal plate or a wooden block across the face of the pistons in order to protect the pistons and the caliper boots.

2. **NOTE:** Use a small flat-bladed tool and lift the inner edge of the caliper boots next to both pistons to release any trapped air. See [Fig. 17](#) .

Ensure that the caliper boots are below the level of the face of both pistons. Install the brake caliper to the brake caliper mounting bracket.

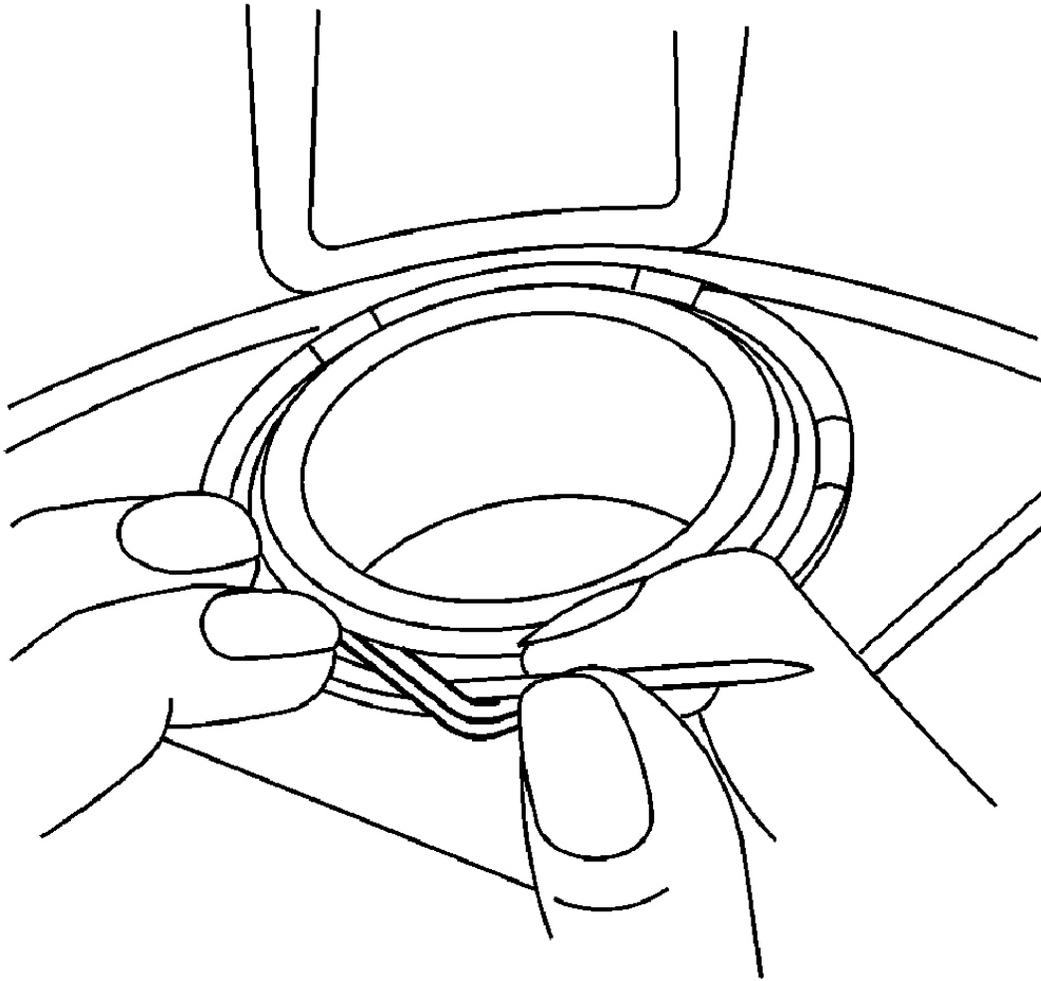
3. Perform the following procedure before installing the caliper guide pin bolts.
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with brake parts cleaner or the equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493) to the threads of the bolt.
4. Install the brake caliper mounting bolts. See **Fig. 25** . Tighten the brake caliper guide pin bolts to specification. See **TORQUE SPECIFICATIONS** . Remove the rubber cap or plug from the exposed brake hose fitting end.

5.

NOTE: Install 2 NEW copper brake hose gaskets.

Assemble the 2 NEW copper brake hose gaskets and the brake hose to caliper bolt to the brake hose.

6. Connect the brake hose at the caliper by installing the brake hose to caliper bolt. See **Fig. 16** . Tighten the brake hose to caliper bolt to specification. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** .
7. Install the tire and wheel assembly. Lower the vehicle. Fill the master cylinder reservoir to the proper level with clean brake fluid.



G00303314

Fig. 17: Releasing Trapped Air From Caliper Boots
Courtesy of GENERAL MOTORS CORP.

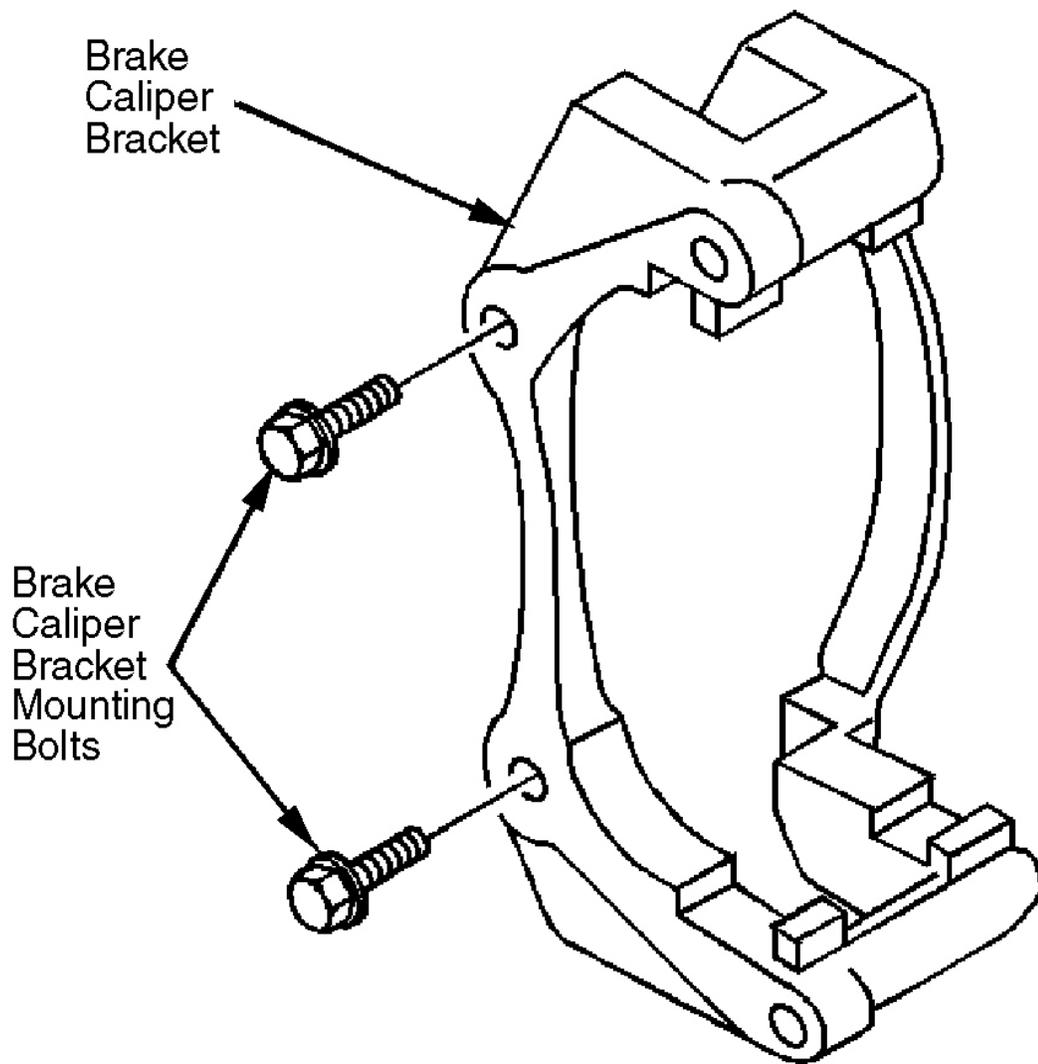
BRAKE CALIPER BRACKET

CAUTION: Avoid taking the following actions when you service wheel brake parts: **DO NOT** grind brake linings. **DO NOT** sand brake linings. **DO NOT** clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

NOTE: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

Removal (Front)

1. Remove the caliper from the mounting bracket and support the caliper with heavy mechanic's wire or equivalent. DO NOT disconnect the hydraulic brake flexible hose from the caliper.
2. Remove the brake pads. See **BRAKE PADS** . Remove the anti-rattle clips from the brake caliper bracket. Remove the brake caliper bracket mounting bolts. See **Fig. 18** . Remove the brake caliper bracket.
3. Remove any contaminants or foreign material from the inside ends of the brake caliper bracket. Clean the mounting surface and threads of the brake caliper bracket.



G00303315

Fig. 18: Removing/Installing Caliper Bracket Mounting Bolts (Front & Rear)
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the brake caliper bracket. Perform the following procedure before installing the brake caliper bracket mounting bolts.
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493).

2. Install the caliper bracket mounting bolts. Tighten the brake caliper bracket mounting bolts to specification. See **TORQUE SPECIFICATIONS** . Install the anti-rattle clips to the brake caliper bracket. Install the brake pads to the brake caliper bracket.
3. Slide the brake pads in until they contact the rotor. Install the brake caliper. See **BRAKE CALIPER** . Install the tire and wheel assembly. Lower the vehicle.
4. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat until a firm pedal is obtained. This will properly seat the brake caliper pistons and brake pads.

Removal (Rear)

1. Remove the caliper from the mounting bracket and support the caliper with heavy mechanic's wire or equivalent. See **BRAKE CALIPER** . DO NOT disconnect the hydraulic brake flexible hose from the caliper.
2. Remove the brake pads. See **BRAKE PADS** . Remove the anti-rattle clips from the brake caliper bracket. Remove the brake caliper bracket mounting bolts. See **Fig. 18** . Remove the brake caliper bracket.
3. Remove any contaminants or foreign material from the inside ends of the brake caliper bracket. Clean the mounting surface and threads of the brake caliper bracket.

Installation

1. Install the brake caliper bracket. Perform the following procedure before installing the brake caliper bracket mounting bolts.
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with denatured alcohol or equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493).
2. Install the caliper bracket mounting bolts. Tighten to specification. See **TORQUE SPECIFICATIONS** . Install the anti-rattle clips to the brake caliper bracket. Install the brake pads to the brake caliper bracket.
3. Slide the brake pads in until they contact the rotor. Install the brake caliper. See **BRAKE CALIPER** . Install the tire and wheel assembly. Lower the vehicle.
4. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat until a firm pedal is obtained. This will properly seat the brake caliper pistons and brake pads.

BRAKE HOSE

Removal (Front)

1. Raise and support the vehicle. Remove the tire and wheel assembly. Clean all dirt and foreign material from the brake hose end and brake pipe fitting. See **Fig. 19** .
2. Install a rubber cap or plug to the exposed brake pipe fitting end in order to prevent brake fluid loss and contamination. 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. Remove the brake hose retaining clip from the brake hose mounting bracket.

3. Remove the brake hose bracket bolt from the upper control arm. See **Fig. 20** . Remove the brake hose bracket bolt from the steering knuckle.
4. Remove the brake hose to caliper bolt from the brake caliper. See **Fig. 15** . Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end.

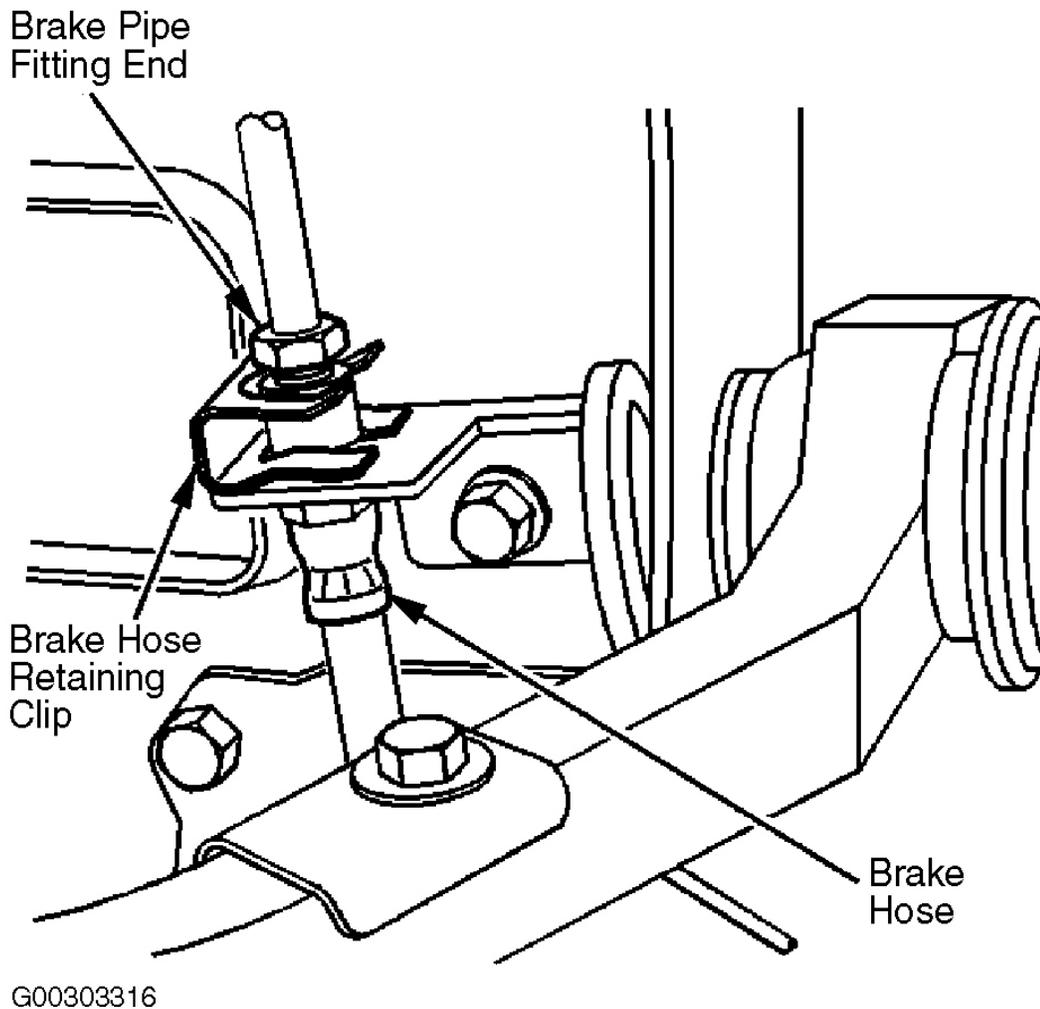
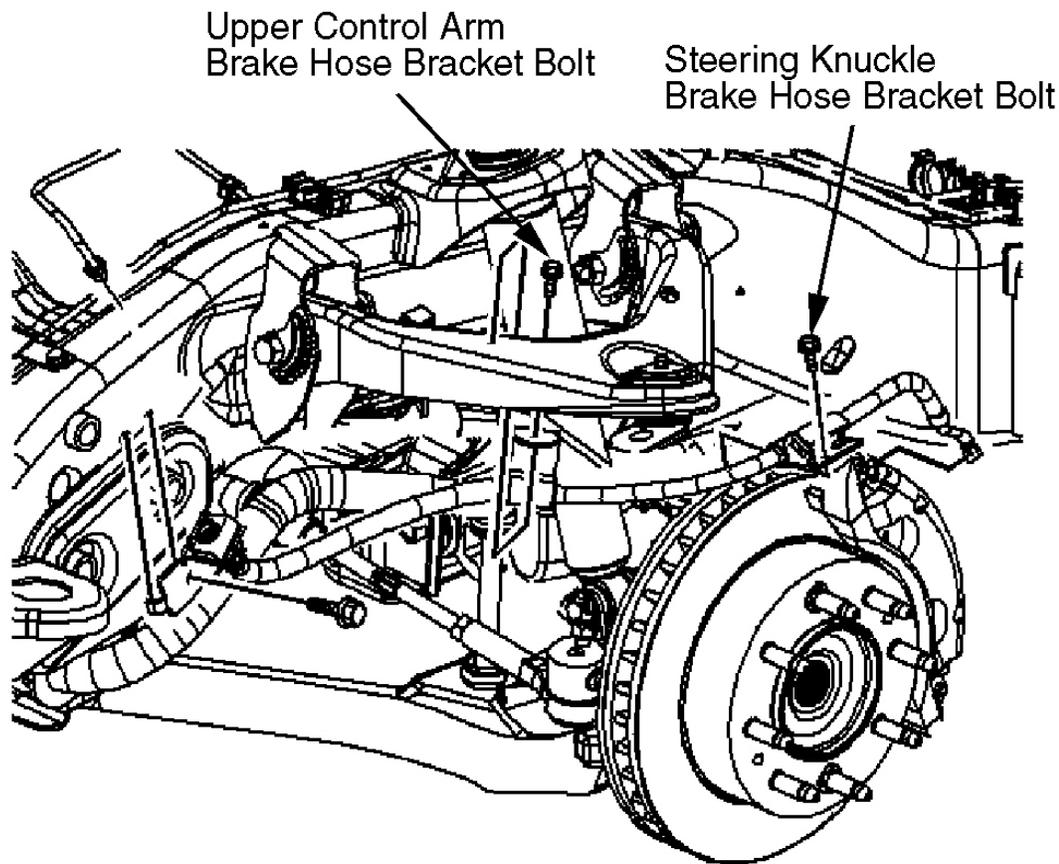


Fig. 19: Disconnecting/Connecting Brake Pipe Fitting End (Front)
Courtesy of GENERAL MOTORS CORP.



G00303317

Fig. 20: Removing/Installing Brake Hose Bracket Bolts (Upper Control Arm & Steering Knuckle - Front)
 Courtesy of GENERAL MOTORS CORP.

Installation

1. Install 2 NEW copper brake hose gaskets. Assemble the 2 NEW copper brake hose gaskets and the brake hose bolt to the brake hose. Install the brake hose to caliper bolt and 2 NEW washers to the brake caliper. Tighten the bolt to specification. See **TORQUE SPECIFICATIONS**.

2.

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

Install the brake hose bracket bolt and the bracket to the steering knuckle. See **Fig. 20** . Tighten the bolt to specification. Install the brake hose bracket bolt and the bracket to the upper control arm. Tighten the bolt to specification.

3. Install the brake hose into the brake hose bracket. See **Fig. 19** . Install the brake hose retaining clip.

Remove the rubber cap or plug from the brake pipe fitting end.

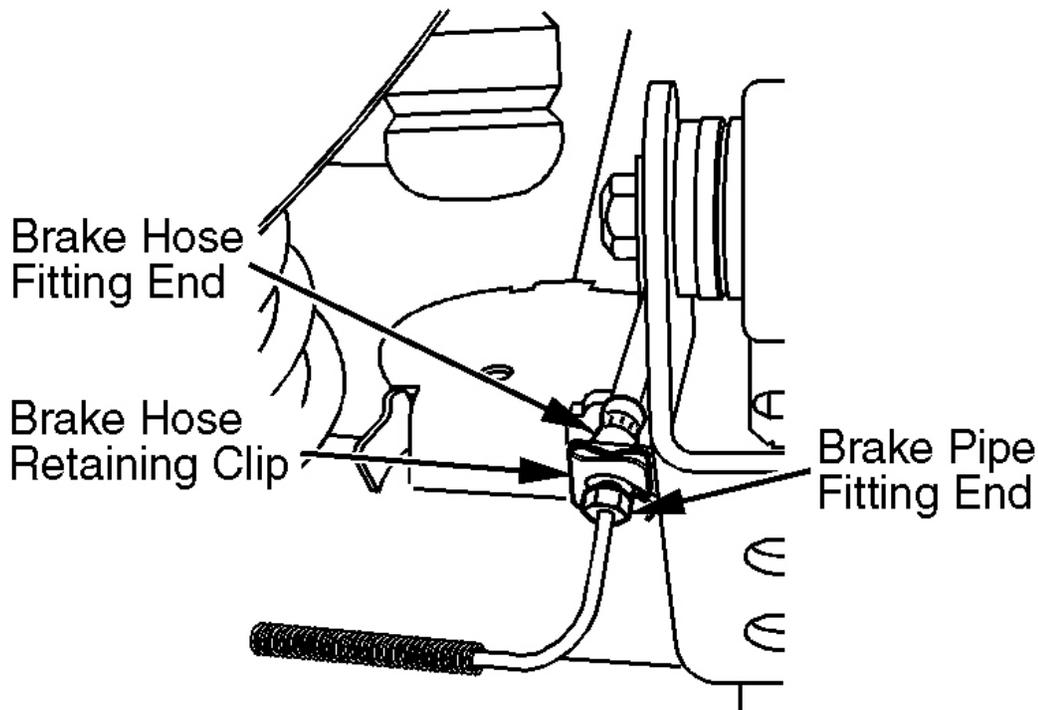
4. Connect the brake pipe fitting end to the brake hose:
 - Use a backup wrench on the brake hose fitting end.
 - DO NOT bend the mounting bracket or the brake pipe. Tighten the brake pipe fitting end to specification.

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

Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM**. Install the tire and wheel assembly. Lower the vehicle.

Removal (Rear)

1. Raise and support the vehicle. Remove the tire and wheel assembly. Clean all dirt and foreign material from the brake hose end and brake pipe fitting.
2. Install a rubber cap or plug to the exposed brake pipe fitting end in order to prevent brake fluid loss and contamination. See **Fig. 21**. 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.
3. Remove the brake hose retaining clip from the brake hose mounting bracket. See **Fig. 16**. Remove the brake hose from the mounting bracket. Remove the brake hose to caliper bolt from the brake caliper. Remove and discard the 2 copper brake hose gaskets. These gaskets may be stuck to the brake caliper housing or the brake hose end.



G00303318

Fig. 21: Removal/Installing Brake Hose (Rear)
 Courtesy of GENERAL MOTORS CORP.

Installation

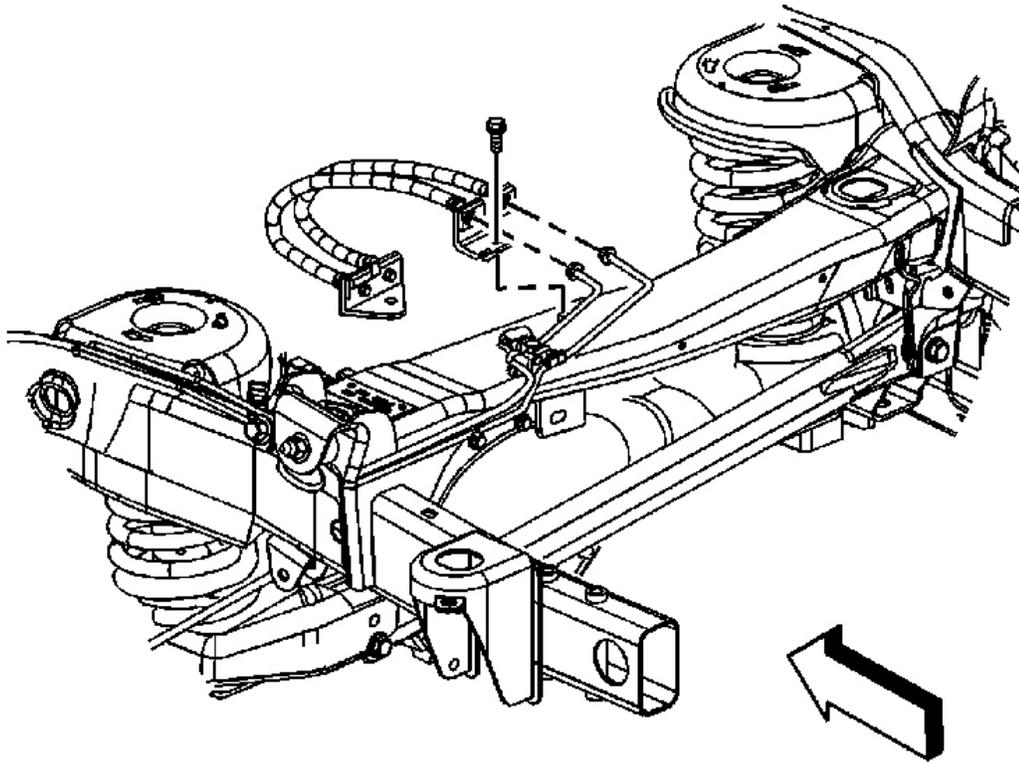
1. Install 2 NEW copper brake hose gaskets. Assemble the 2 NEW copper brake hose gaskets and the brake hose bolt to the brake hose. See **Fig. 16** . Install the brake hose to caliper bolt, and 2 NEW washers to the brake caliper. Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** .
2. The brake hose must not be twisted. Make sure the brake hose is not in contact with any suspension component. Install the brake hose into the mounting bracket. Install the brake hose retaining clip. Remove the rubber cap or plug from the exposed brake pipe fitting end. See **Fig. 21** .
3. 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. Tighten the brake pipe fitting end to specification. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** .
4. Install the tire and wheel assembly. 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. Lower the vehicle.

Removal (Rear Jounce)

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the following actions: Eye contact; rinse thoroughly with water. Skin contact; wash with soap and water. If ingested; consult a physician immediately.

NOTE: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

1. Raise and support the vehicle. Clean all dirt and foreign material from the brake hose and brake pipe fittings.
2. Install a rubber cap or plug to the exposed brake pipe fitting ends in order to prevent brake fluid loss and contamination. Use 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. See **Fig. 22** . Remove the brake hose upper bracket bolt.
3. Install a rubber cap or plug to the exposed brake pipe fitting ends in order to prevent brake fluid loss and contamination. Using a backup wrench on the hose fittings, disconnect the brake pipe fittings from the brake hoses, then cap or plug the brake pipe fitting ends. See **Fig. 23** . Remove the brake hose lower bracket bolt. Remove the jounce hoses.



G00303319

Fig. 22: Removal/Installation Brake Hose (Rear Jounce - 1 Of 2)
Courtesy of GENERAL MOTORS CORP.

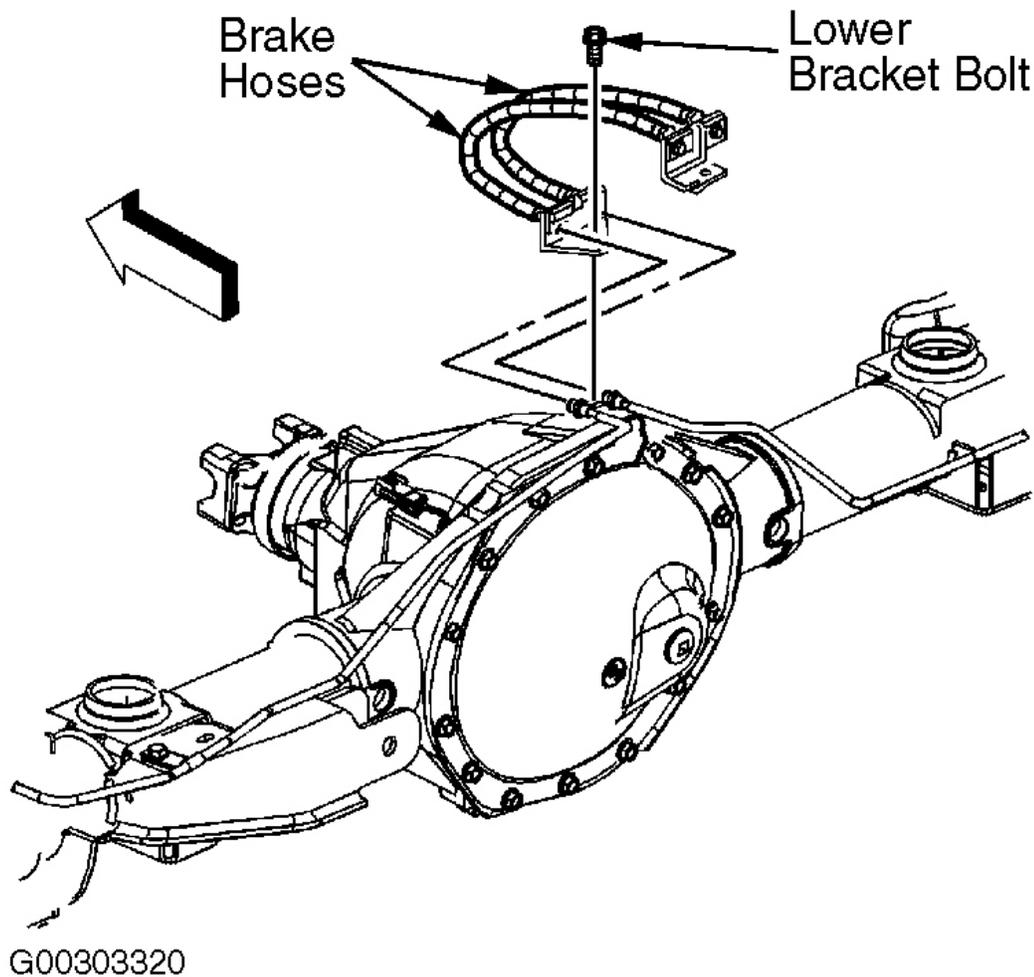


Fig. 23: Removal/Installation Brake Hose (Rear Jounce - 2 Of 2)
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the rear jounce brake hose. See **Fig. 23** . Install the brake hose lower bracket and bolt to the axle. Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** . Remove the caps or plugs from the rear jounce hoses and connect the pipes to the junction block on the axle. Tighten the fitting to specification.
- 2.

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

With the weight of the vehicle on the suspension, install the brake hose bracket bolt. Remove the rubber cap or plug from the exposed brake pipe fitting end. Connect the brake pipe fittings to the brake hoses. See **Fig. 22** . Use a backup wrench on the hose fitting. DO NOT bend the bracket or the pipe. Tighten the brake pipe fitting to specification.

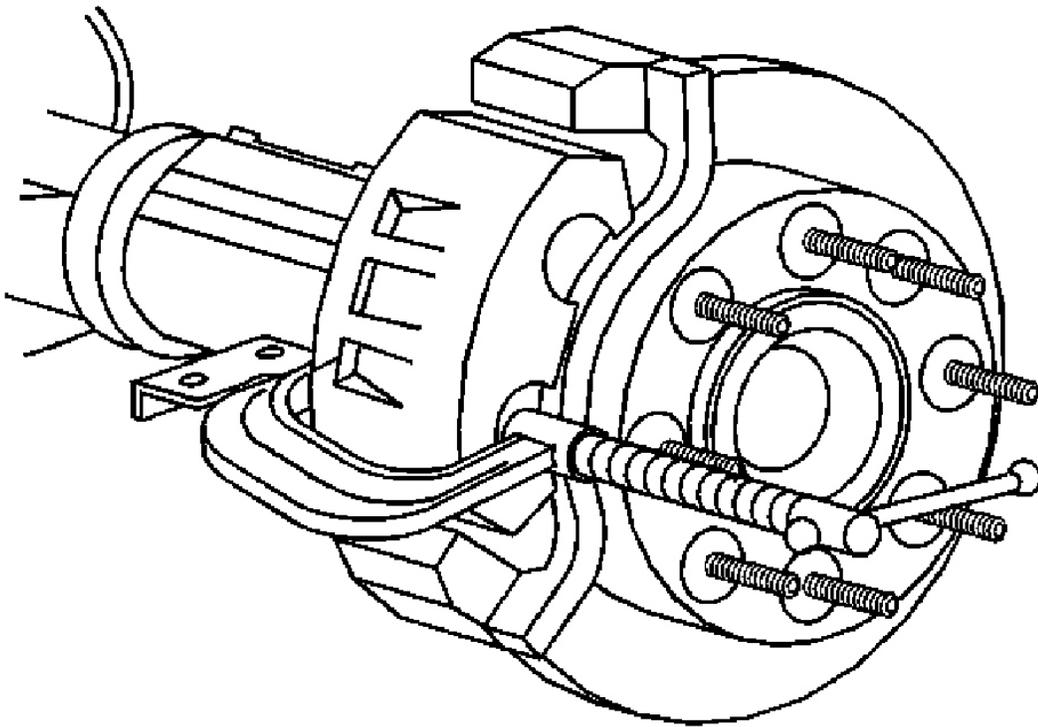
3. Ensure that the hose does not make contact with any part of the suspension. If the hose makes contact, remove the hose and correct the condition. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** . Lower the vehicle.

BRAKE PADS

CAUTION: Avoid taking the following actions when you service wheel brake parts: **DO NOT** grind brake linings. **DO NOT** sand brake linings. **DO NOT** clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

Removal (Front & Rear)

1. Inspect the fluid level in the brake master cylinder reservoir. If the brake fluid level is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding.
2. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, remove brake fluid to the midway point before proceeding. Raise and support the vehicle. Remove the tire and wheel assembly. Inspect the caliper operation.
3. For rear calipers, place a C-clamp as shown. See **Fig. 24** . Slowly bottom the pistons of the caliper. It may be necessary to reposition the C-clamp to allow both of the pistons to bottom into the caliper bores.
4. On all calipers, remove the caliper from the mounting bracket and support the caliper with heavy mechanic's wire or equivalent. See **Fig. 25** . DO NOT disconnect the hydraulic brake flexible hose from the caliper.
5. Remove the brake pads from the caliper mounting bracket. Remove and discard the anti-rattle clips from the brake caliper mounting bracket. See **Fig. 26** . Inspect the caliper and mounting bracket.



G00303310

Fig. 24: Removing Rear Brake Pads
Courtesy of GENERAL MOTORS CORP.

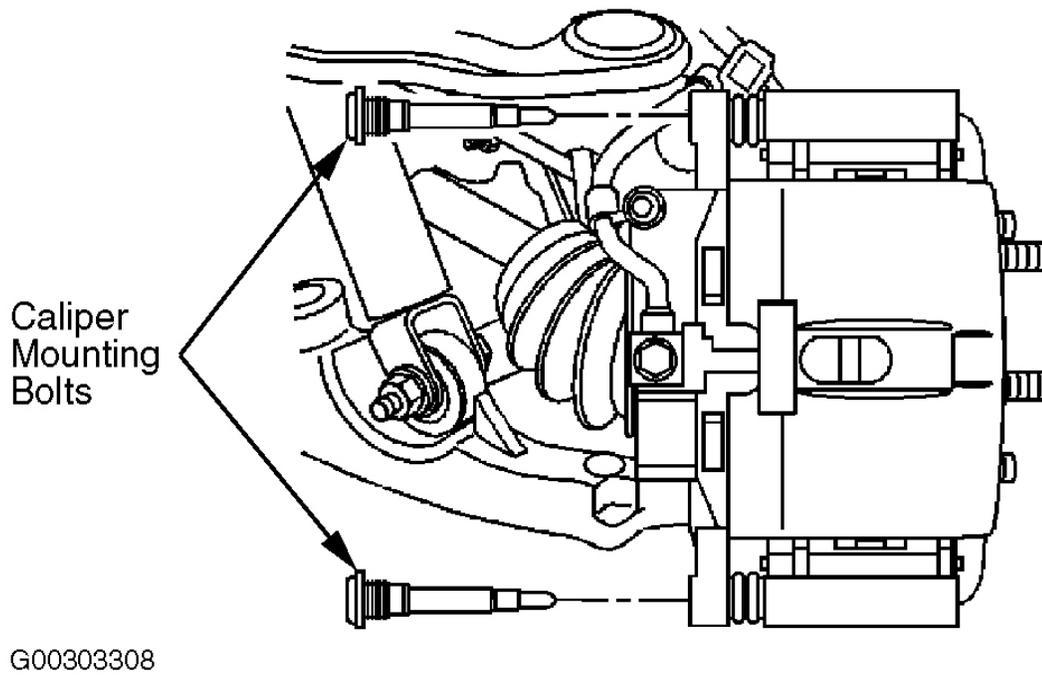
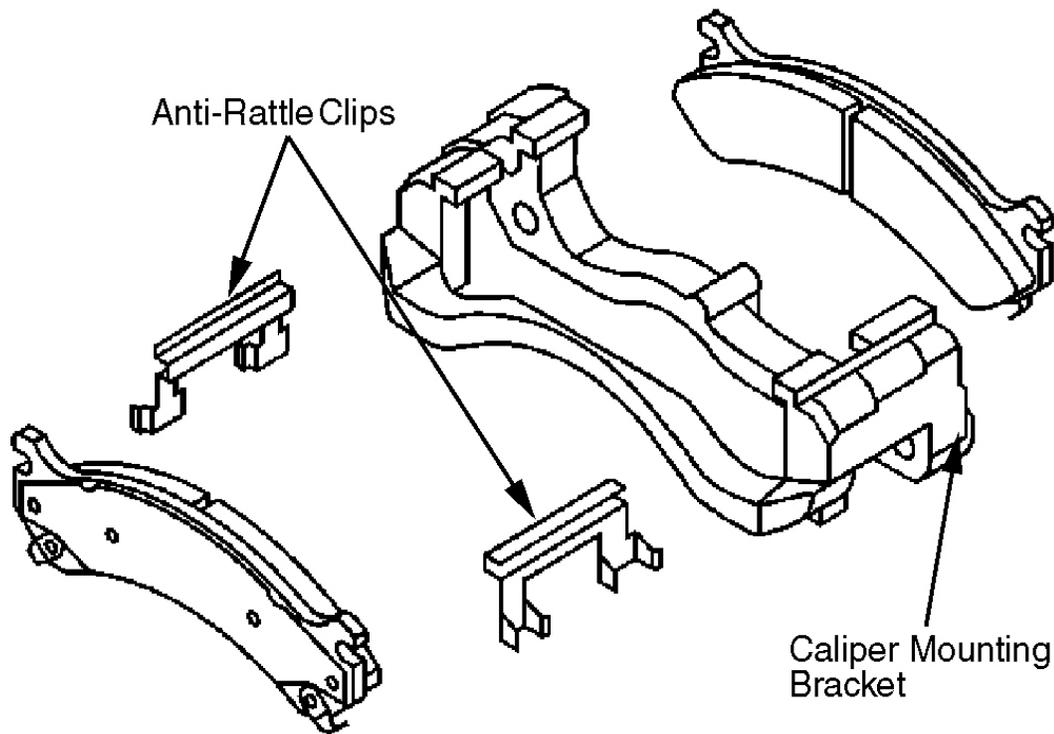


Fig. 25: Removing/Installing Caliper Mounting Bolts (Front Shown, Rear Similar)
Courtesy of GENERAL MOTORS CORP.



G00303309

Fig. 26: Discarding Anti-Rattle Clips (Front & Rear)
 Courtesy of GENERAL MOTORS CORP.

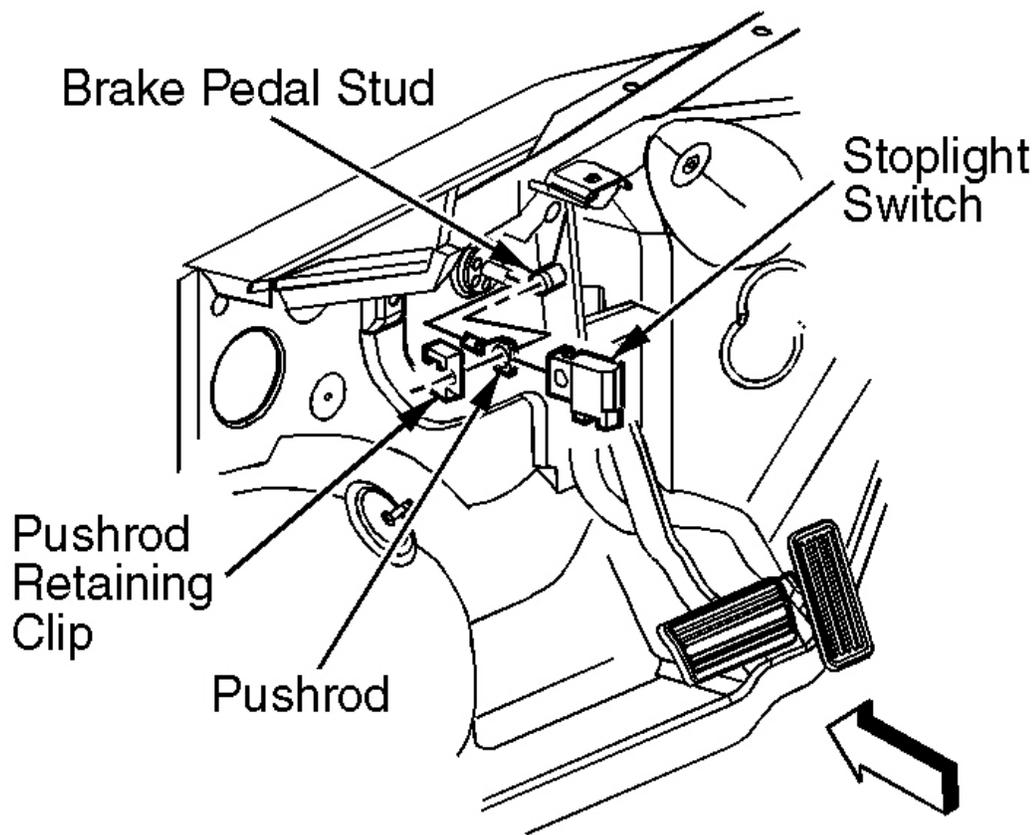
Installation

1. Install NEW anti-rattle clips to the inside ends of the caliper mounting bracket. Install the brake pads to the caliper mounting bracket. Install the brake caliper to the brake caliper bracket.
2. Perform the following procedure before installing the caliper guide pin bolts:
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with brake parts cleaner or the equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493) to the threads of the bolt.
3. Install the brake caliper guide pin bolts. Install the tire and wheel assembly. Remove the safety stands. Lower the vehicle.
4. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat this step until a firm pedal is obtained. This will properly seat the brake caliper pistons and brake pads.
5. Fill the master cylinder reservoir to the proper level with clean brake fluid. Burnish the brake pads and rotors. See **BURNISHING PADS & ROTORS** under SERVICING.

BRAKE PEDAL ASSEMBLY

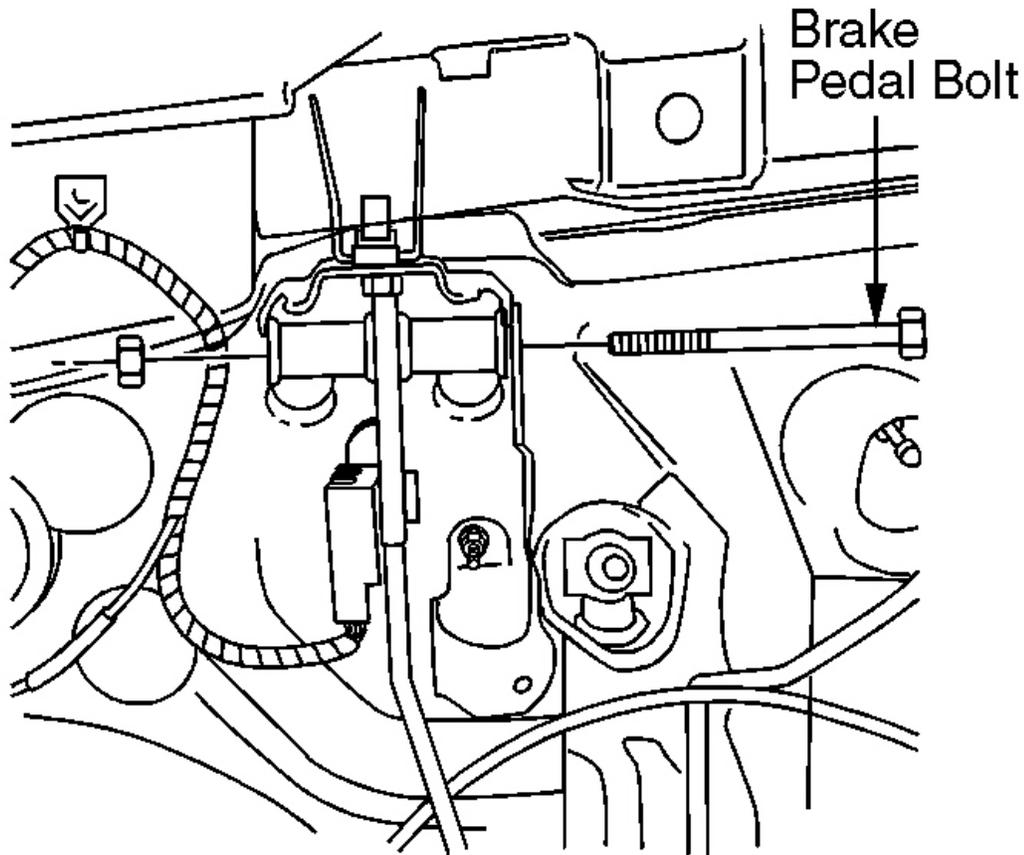
Removal & Installation

1. Remove the pushrod retaining clip. See **Fig. 27** . Remove the stop light switch and the pushrod from the brake pedal stud.
2. Remove the nut from the brake pedal bolt. See **Fig. 28** . Remove the brake pedal bolt. Remove the brake pedal.
3. To install, install the brake pedal. Install the brake pedal bolt. Install the nut to the brake pedal bolt. Hold the nut with a wrench and tighten the brake pedal bolt to specification. See **TORQUE SPECIFICATIONS** .
4. Install the pushrod and the stop light switch to the brake pedal pin. Install the pushrod retaining clip.



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Fig. 27: Removing/Installing Brake Pedal Assembly
Courtesy of GENERAL MOTORS CORP.



G00303322

Fig. 28: Removing/Installing Brake Pedal Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

BRAKE PIPE

CAUTION: 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 in the original location for replacement brake pipes. Failure to properly route and retain brake pipes may cause damage to the brake pipes and brake system resulting in personal injury.

Removal & Installation

1. Disconnect the brake pipe fittings. See **Fig. 21** . Remove the brake pipe fasteners from the vehicle.

Remove the brake pipe from the vehicle.

2. To install, bend the brake pipe to achieve proper fit. Install the brake pipe to the vehicle. Maintain a clearance of 3/4" (19 mm) for all moving or vibrating components. Install the brake pipe fasteners to the vehicle.
3. Connect the brake pipe fittings. Tighten the brake pipe fitting to specification. See **TORQUE SPECIFICATIONS**.
4. If the brake pipe that was replaced, was between the master cylinder and the BPMV, bleed ABS system. See appropriate ANTI-LOCK article. If the brake pipe that was replaced, was between the BPMV and the wheel jounce hoses, bleed hydraulic brake system. See **BLEEDING BRAKE SYSTEM**.

BRAKE ROTOR

NOTE: Any NEW rotor must have the protective coating removed from the friction surfaces before being placed in service. Use Goodwrench Brake Parts Cleaner (GM P/N 123777981), or the equivalent, and wipe the surface clean with clean cloths. DO NOT use gasoline, kerosene, or other oil base solvents which may leave an oily residue. This residue is damaging to the brake lining and is flammable.

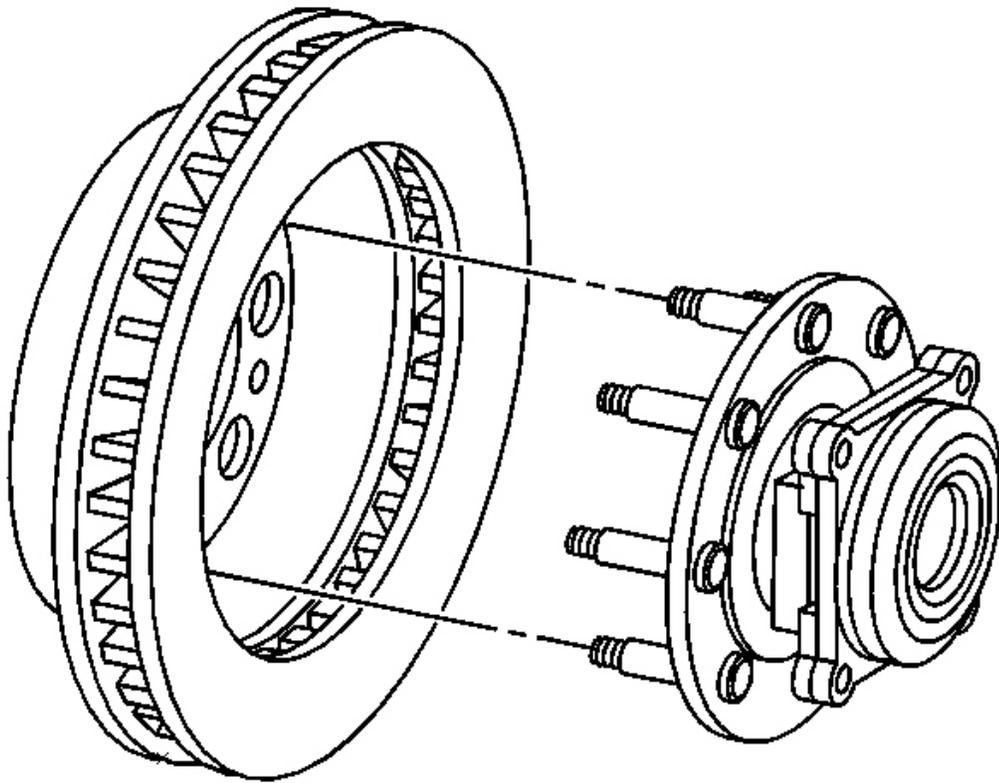
Removal (Front)

1. Raise and support the vehicle. Remove the tire and wheel assembly. Mark the relationship of the rotor to the hub.
2. Install a C-clamp over the body of the brake caliper, with the C-clamp ends against the rear of the caliper body and the outboard disc brake pad. See **Fig. 14**. Slowly tighten the C-clamp until the pistons are pushed into the caliper bores enough to remove the caliper from the pads. Remove the C-clamp from the caliper. Remove the 2 brake caliper bracket mounting bolts.
- 3.

NOTE: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

Remove the brake caliper and brake caliper mounting bracket as an assembly and support with heavy mechanic's wire or equivalent. DO NOT disconnect the hydraulic brake flexible hose from the caliper. Remove the rotor retaining push nuts from the wheel studs, if applicable. It may be necessary to strike the end of the hub or the rotor with a deadblow hammer to separate the rotor from the hub.

4. Remove the rotor. See **Fig. 29**. If the rotor is difficult to remove due to corrosion in the hub area use the following procedure to remove the rotor.
 - Clean all the surface areas and the threaded holes of contamination.
 - Generously apply penetrating oil or the equivalent to the hub/rotor area.
 - Insert M10 x 1.5" bolts (jack screws) into the threaded holes of the rotor.
 - Tighten both bolts evenly to force the rotor from the hub.



G00303323

Fig. 29: Removing/Installing Rotor (Front)
Courtesy of GENERAL MOTORS CORP.

Installation

CAUTION: Whenever the brake rotor has been separated from the hub/axle flange, any rust or contaminants should be cleaned from the hub/axle flange and the brake rotor mating surfaces. Failure to do this may result in excessive assembled lateral runout (LRO) of the brake rotor, which could lead to brake pulsation.

1. Use Rotor Resurfacing Kit (J-42450-A) to clean all rust and contaminants from the mating surface of the

hub flange. Use the Wheel Hub Resurfacing Kit (J-41013) to clean all rust and contaminants from the inside diameter of the hat section of the brake rotor to prevent any foreign material from getting between the brake rotor and the hub flange. Inspect the mating surfaces of the hub/axle flange and the rotor to ensure that there are no foreign particles or debris remaining.

2.

CAUTION: If the rotor was removed using the jack screw method you must ensure that the hub flange is free of nicks or marks caused by this procedure. Remove all raised nicks or marks before installing the rotor.

Align the rotor to its original position on the hub, if applicable, and install the rotor. If the brake rotor was removed and installed as part of a brake system repair, measure the assembled Lateral Runout (LRO) of the brake rotor to ensure optimum performance of the disc brakes. See appropriate ANTI-LOCK article.

3. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. See appropriate ANTI-LOCK article. Install the caliper and caliper mounting bracket assembly.
4. Perform the following procedure before installing the brake caliper bracket mounting bolts. Remove all traces of the original adhesive patch. Clean the threads of the bolt with brake parts cleaner or the equivalent and allow to dry. Apply Threadlocker (GM P/N 12345493) to the threads of the bolt.
5. Install the 2 caliper bracket mounting bolts. Tighten the brake caliper bracket mounting bolts to specification. See **TORQUE SPECIFICATIONS**. Install the tire and wheel assembly. Lower the vehicle.
6. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat step until a firm pedal is obtained. This will properly seat the brake caliper pistons and brake pads. Fill the master cylinder reservoir to the proper level with clean brake fluid.

Removal (Rear)

1. Release the park brake. Raise and suitably support the vehicle. Remove the tire and wheel assembly. Mark the relationship of the rotor to the hub.
2. Install a C-clamp over the body of the brake caliper, with the C-clamp ends against the rear of the caliper body and the outboard disc brake pad. See **Fig. 14**. Slowly tighten the C-clamp until the pistons are pushed into the caliper bores enough to remove the caliper from the pads. Remove the C-clamp from the caliper. Remove the 2 brake caliper bracket mounting bolts.

3.

NOTE: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

Remove the brake caliper and brake caliper mounting bracket as an assembly and support with heavy mechanic's wire or equivalent. DO NOT disconnect the hydraulic brake flexible hose from the caliper. Remove the rotor retaining push nuts from the wheel studs, if applicable. It may be necessary to strike the

end of the hub or the rotor with a deadblow hammer to separate the rotor from the hub.

4. Remove the rotor by slowly turning the rotor while pulling the rotor away from the axle. See **Fig. 30**.

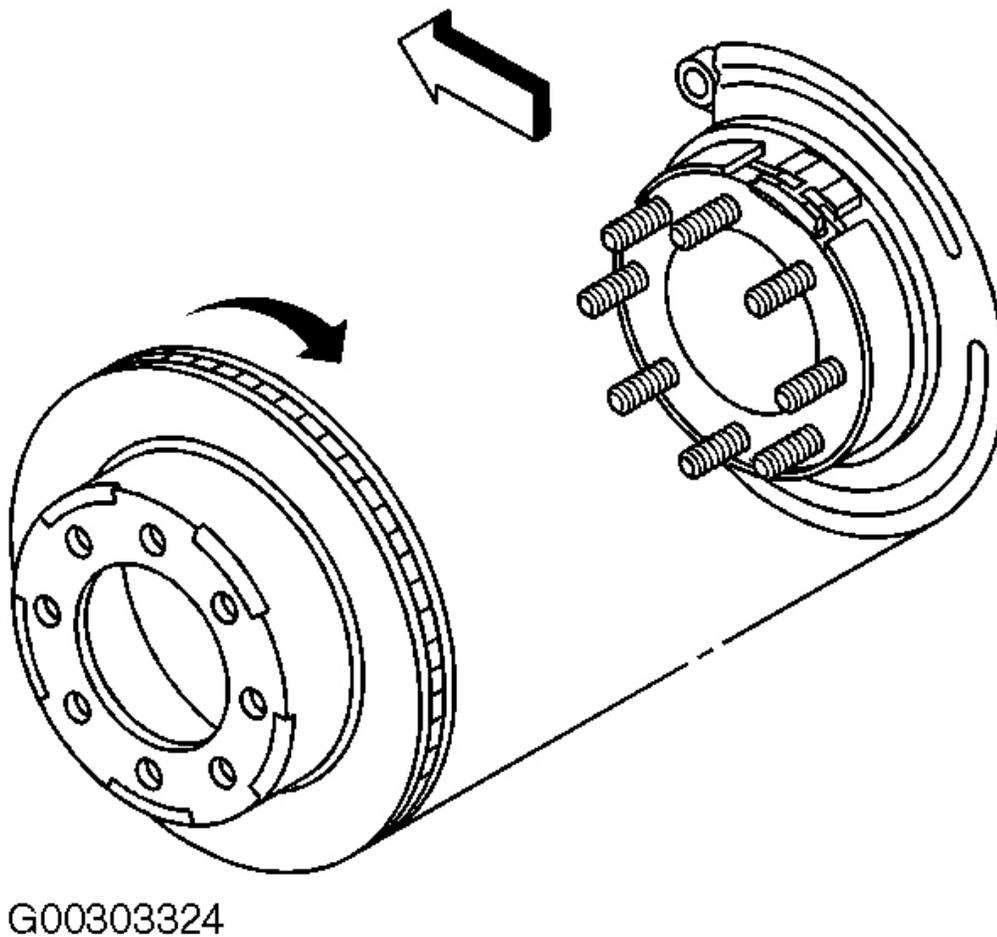


Fig. 30: Removing/Installing Brake Rotor (Rear)
Courtesy of GENERAL MOTORS CORP.

Installation

CAUTION: Whenever the brake rotor has been separated from the hub/axle flange, any rust or contaminants should be cleaned from the hub/axle flange and the brake rotor mating surfaces. Failure to do this may result in excessive assembled lateral runout (LRO) of the brake rotor, which could lead to brake pulsation.

1. Use the Wheel Hub Resurfacing Kit (J-42450-A) to clean all rust and contaminants from the mating surface of the hub flange. Use the Rotor Resurfacing Kit (J-41013) to clean all rust and contaminants from the inside diameter of the hat section of the brake rotor to prevent any foreign material from getting between the brake rotor and the hub flange.
2. Inspect the mating surfaces of the hub/axle flange and the rotor to ensure that there are no foreign particles or debris remaining. Align the rotor to its original position on the hub, if applicable, and install the rotor by slowly turning the rotor while pushing the rotor towards the axle.
3. If the brake rotor was removed and installed as part of a brake system repair, measure the Assembled Lateral Runout (LRO) of the brake rotor to ensure optimum performance of the disc brakes. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications.
4. Install the caliper and the bracket as an assembly to the vehicle. Perform the following procedure before installing the caliper bracket mounting bolts.
 - Remove all traces of the original adhesive patch.
 - Clean the threads of the bolt with brake parts cleaner or the equivalent and allow to dry.
 - Apply Threadlocker (GM P/N 12345493) to the threads of the bolt.
5. Install the caliper bracket mounting bolts. Tighten the brake caliper bracket mounting bolts to specification. See **TORQUE SPECIFICATIONS**. Install the tire and wheel assembly. Lower the vehicle.
6. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat step until a firm pedal is obtained. This will properly seat the brake caliper pistons and brake pads.
7. Fill the master cylinder reservoir to the proper level with clean brake fluid.

DISC BRAKE HARDWARE

Removal (Front)

1. Raise and support the vehicle. Remove the tire and wheel assembly. Remove the caliper from the mounting bracket and support the caliper with heavy mechanic's wire or equivalent. See **BRAKE CALIPER**. DO NOT disconnect the hydraulic brake flexible hose from the caliper.
2. Remove the disc brake pads from the disc brake caliper mounting bracket. See **BRAKE PADS**. Remove the disc brake pad retainers from the disc brake caliper mounting bracket.
3. Inspect the disc brake hardware. See **DISC BRAKE MOUNTING & HARDWARE INSPECTION** under ADJUSTMENTS & INSPECTION.
4. Remove the caliper pin boots from the disc brake caliper mounting bracket.

Installation

1. Lubricate the front brake caliper bushings, bolts and seals with high temperature silicone brake lubricant. Install the caliper pin boots to the disc brake caliper mounting bracket.
2. Install the disc brake pad retainers to the disc brake caliper mounting bracket. Install the disc brake pads to the disc brake caliper mounting bracket. See **BRAKE PADS**.
3. Install the disc brake caliper to the caliper mounting bracket. With the engine OFF, gradually apply the

brake pedal approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat step until a firm brake pedal is obtained. This will properly seat the brake caliper pistons and brake pads.

Removal (Rear)

1. Raise and support the vehicle. Remove the tire and wheel assembly. Remove the caliper from the mounting bracket and support the caliper with heavy mechanic's wire or equivalent. See **BRAKE CALIPER**. DO NOT disconnect the hydraulic brake flexible hose from the caliper.
2. Remove the rear disc brake pads from the disc brake caliper mounting bracket. See **BRAKE PADS**. Remove the disc brake pad retainers from the disc brake caliper mounting bracket.
3. Inspect the rear disc brake hardware. See **DISC BRAKE MOUNTING & HARDWARE** under ADJUSTMENTS & INSPECTION.
4. Remove the caliper pins from the disc brake caliper mounting bracket. Remove the caliper pin boots from the disc brake caliper mounting bracket.

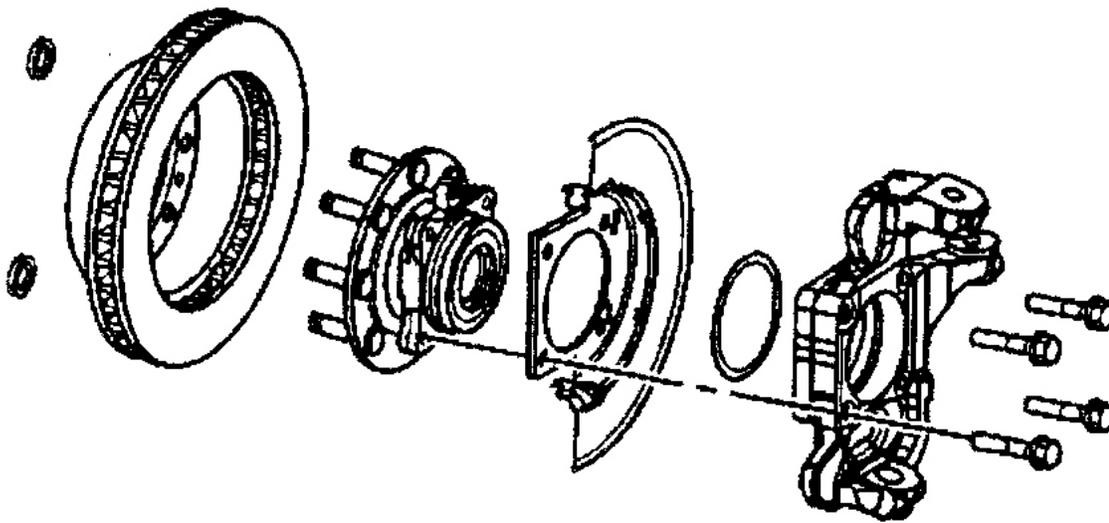
Installation

1. Lubricate the front brake caliper bushings, bolts and seals with high temperature silicone brake lubricant. Install the caliper pin boots to the disc brake caliper mounting bracket. Install the caliper pins to the disc brake caliper mounting bracket.
2. Install the disc brake pad retainers to the disc brake caliper mounting bracket. See **BRAKE PADS**. Install the disc brake pads to the disc brake caliper mounting bracket.
3. Install the disc brake caliper to the caliper mounting bracket. See **BRAKE CALIPER**. With the engine OFF, gradually apply the brake pedal approximately 2/3 of its travel distance. Slowly release the brake pedal. Wait 15 seconds, then repeat until a firm brake pedal is obtained. This will properly seat the brake caliper pistons and brake pads.

DISC BRAKE SPLASHSHIELD

Removal & Installation (Front Only)

Raise and support the vehicle. Remove the tire and wheel assembly. Remove the hub and bearing assembly. See appropriate FRONT article in SUSPENSION. Remove the splash shield. To install the splash shield, install the hub and bearing assembly. Install the tire and wheel assembly. Remove the safety stands. Lower the vehicle.



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Fig. 31: Removing & Installing Front Splash Shield
 Courtesy of GENERAL MOTORS CORP.

HYDRAULIC BRAKE BOOSTER ACCUMULATOR

Removal & Installation

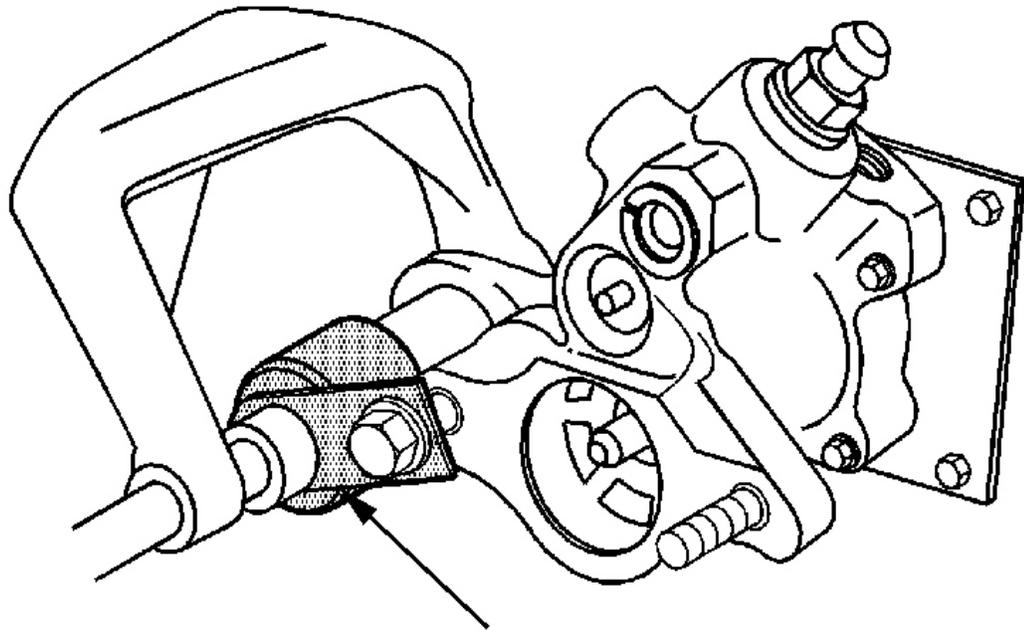
CAUTION: The accumulator contains compressed gas. Always use the proper tools and follow the recommended procedures or personal injury may result. **DO NOT** apply heat to accumulator. **DO NOT** attempt to repair an inoperative accumulator. Always replace an inoperative accumulator with a **NEW** one.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

CAUTION: 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. Apply the park brake and block the wheels. Depress brake pedal at least 10 times in order to relieve pressure in the accumulator. Remove the master cylinder from the hydraulic booster. See **MASTER CYLINDER**.
2. Place the Accumulator Piston Compressor (J-26889) over the end of the accumulator. See **Fig. 32**. Install the nut on the stud. Depress the accumulator with a C-clamp. If the accumulator does not move with moderate pressure, remove the C-clamp and depress the brake pedal 10 times in order to relieve pressure in the accumulator.
3. Rotate the retaining ring until either end of the ring is under the access hole. See **Fig. 33**. Depress and hold the retaining ring with a small tool inserted into the access hole.
4. Remove the accumulator retainer ring using a small hook shaped tool. See **Fig. 34**. Release the C-clamp. Remove the nut from the stud. Remove the Accumulator Piston Compressor (J-26889). Remove the

accumulator and the "O" ring seal.

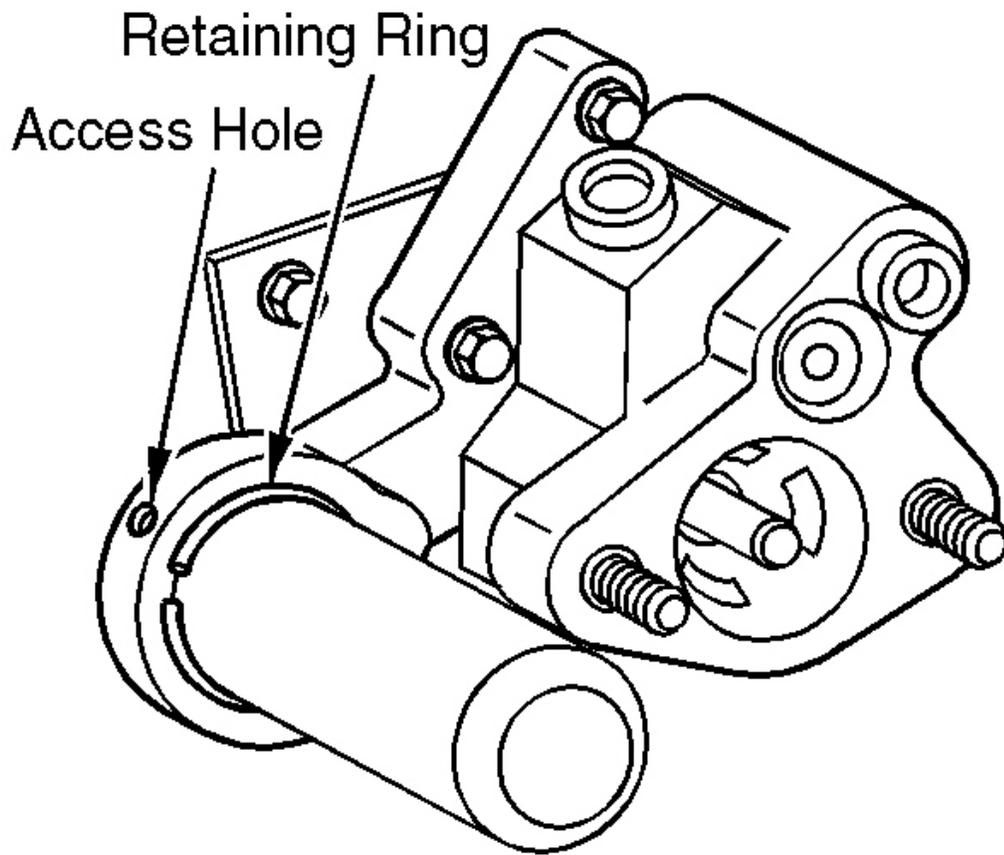
5. To install, lubricate all of the seals and the metal friction points with power steering fluid. Install the accumulator and the "O" ring seal. Place the Accumulator Piston Compressor (J-26889) over the end of the accumulator.
6. Install the nut on the stud. Depress the accumulator with a C-clamp. Install the accumulator retainer ring. Release the C-clamp. Remove the nut from the stud. Remove the Accumulator Piston Compressor (J-26889).
7. Install the master cylinder to the hydraulic booster. See **MASTER CYLINDER** . Release the park brake and unblock the wheels.



Accumulator Piston Compressor
(J-26889)

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Fig. 32: Using Accumulator Piston Compressor Tool
Courtesy of GENERAL MOTORS CORP.



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Fig. 33: Rotating Retaining Ring
Courtesy of GENERAL MOTORS CORP.

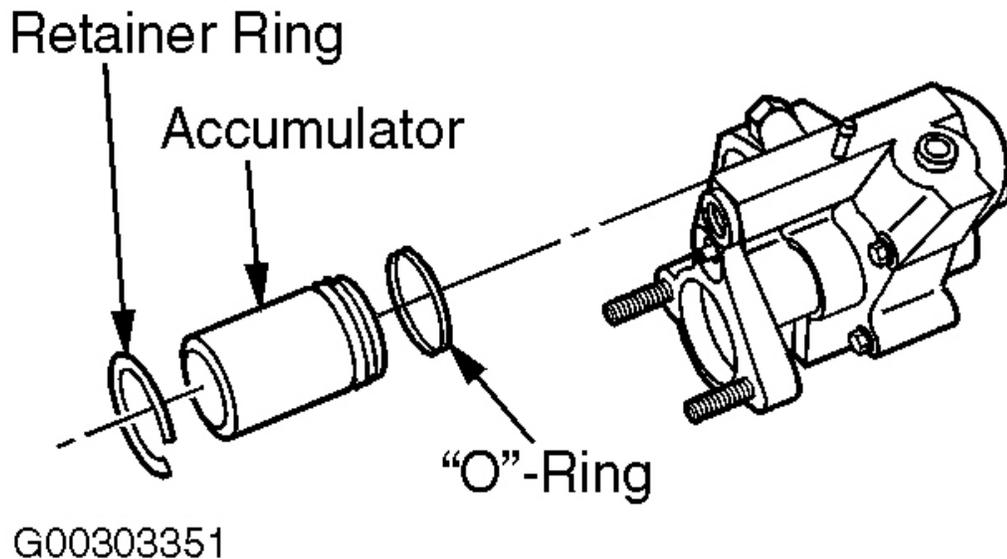


Fig. 34: Exploded View Of Accumulator Components
Courtesy of GENERAL MOTORS CORP.

MASTER CYLINDER

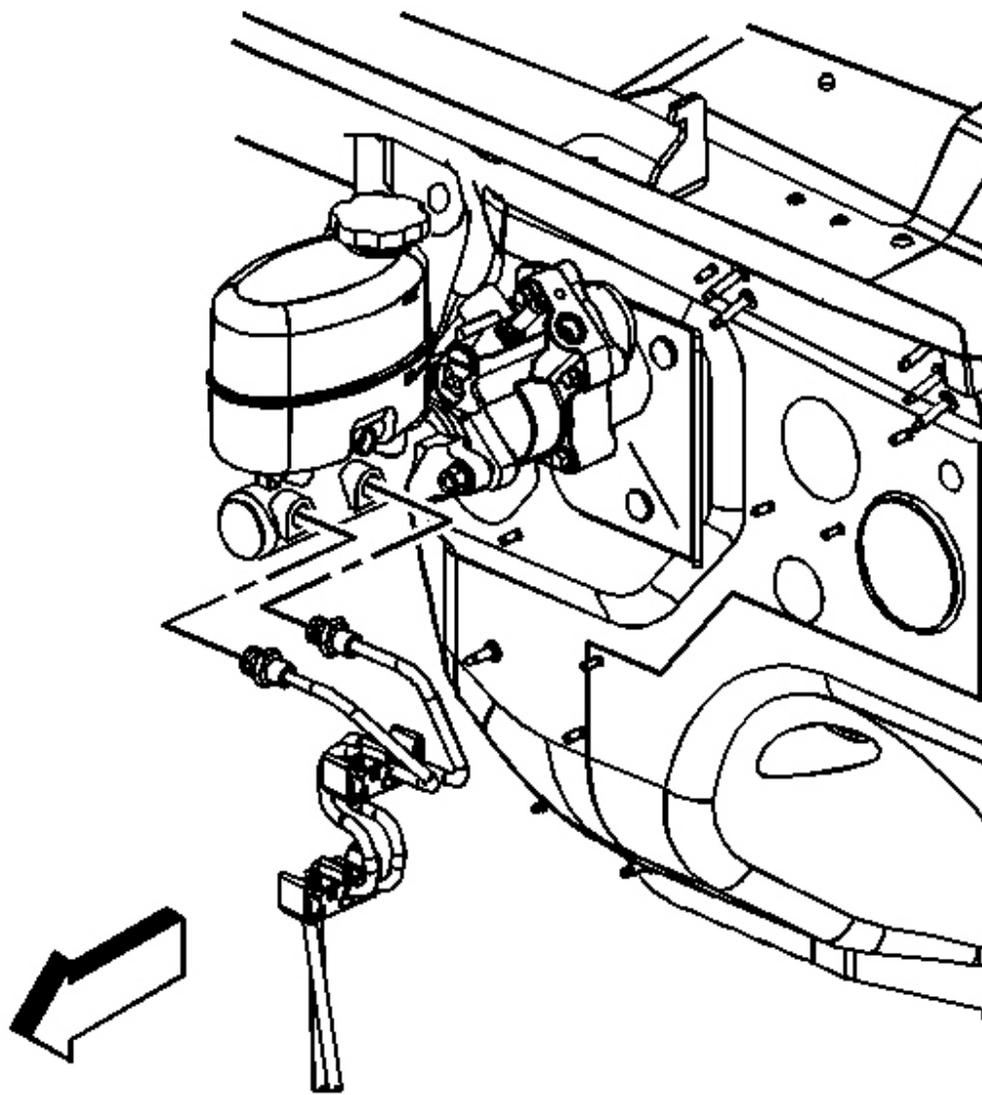
Removal

1. Apply the park brake and block the wheels. Disconnect the electrical connector from the brake fluid level sensor. See **Fig. 35**.
- 2.

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

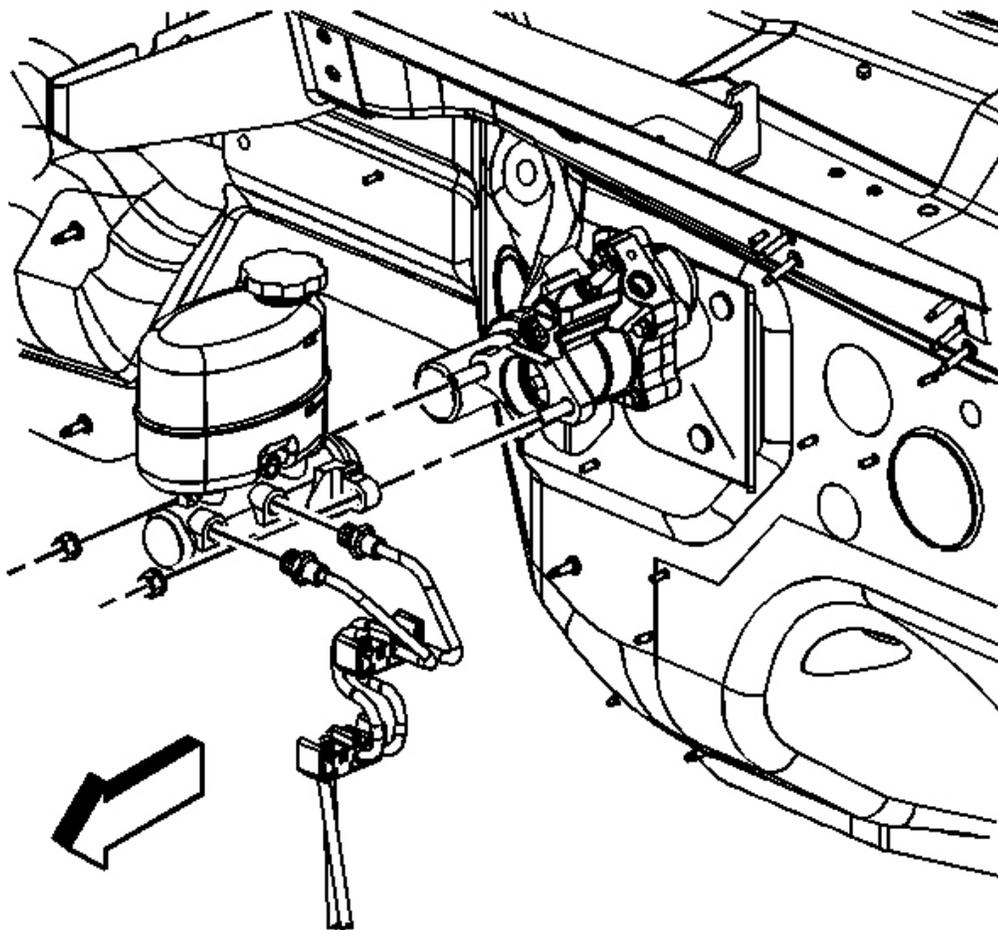
Disconnect the brake pipes from the master cylinder. See **Fig. 36**.

3. Plug the open brake pipe ends. Remove the master cylinder mounting nuts. Remove the master cylinder from the vehicle. Remove the master cylinder reservoir. See **MASTER CYLINDER RESERVOIR**.



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Fig. 35: Disconnecting/Connecting Master Cylinder Electrical Connector
Courtesy of GENERAL MOTORS CORP.



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Fig. 36: Removing/Installing Master Cylinder
Courtesy of GENERAL MOTORS CORP.

Installation

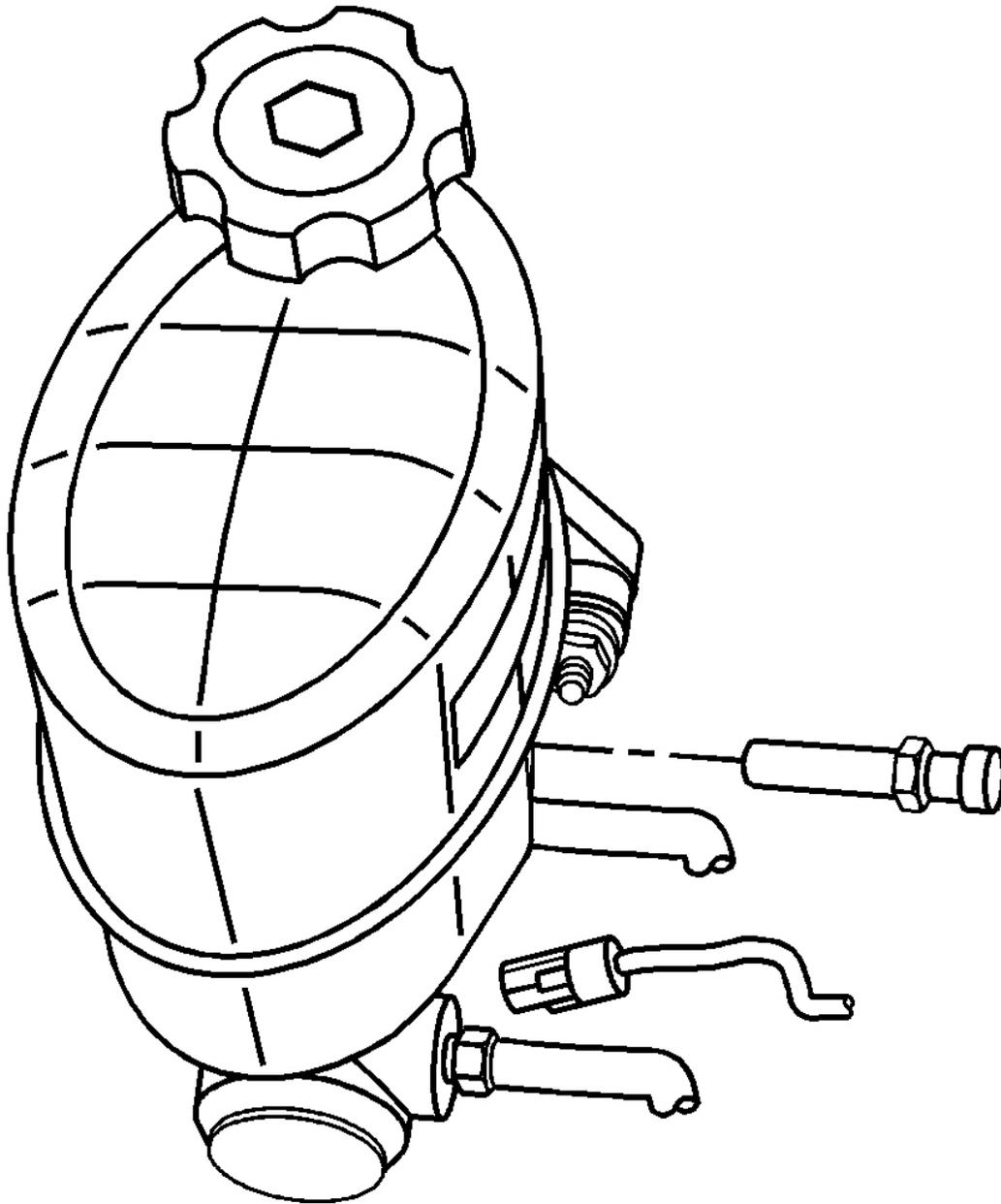
1. Install the master cylinder reservoir. See **MASTER CYLINDER RESERVOIR**. Bench bleed the master cylinder. See **MASTER CYLINDER BENCH BLEEDING** under BLEEDING BRAKE SYSTEM.
2. Install the master cylinder to the vehicle. Install the master cylinder mounting nuts. Tighten the nuts to specification. See **TORQUE SPECIFICATIONS**. Remove the rubber cap or plug from the exposed brake pipe fitting ends.
3. Connect the brake pipes. Tighten the fittings to specification. Connect the electrical connector to the

brake fluid level sensor. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM**.
Release the park brake and unblock the wheels.

MASTER CYLINDER FLUID LEVEL SENSOR

Removal & Installation

Disconnect the electrical connector from the fluid level sensor. Remove the fluid level sensor. See **Fig. 37**. Use a needle nose pliers in order to compress the locking tabs at the opposite side of the master cylinder. To install, install the fluid level sensor until the locking tabs snap into place. Connect the electrical connector to the fluid level sensor.



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Fig. 37: Removing/Installing Master Cylinder Fluid Level Sensor
Courtesy of GENERAL MOTORS CORP.

MASTER CYLINDER RESERVOIR

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the

following actions: Eye contact; rinse thoroughly with water. Skin contact; wash with soap and water. If ingested; consult a physician immediately.

NOTE: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

Removal

1. Apply the park brake and block the wheels. Remove the master cylinder. See **MASTER CYLINDER**. Drain the master cylinder reservoir.
2. Secure the master cylinder in a vise. DO NOT clamp the master cylinder body, secure only at the flange. Remove the brake fluid level sensor by carefully depressing the retaining tabs and pushing the sensor through the reservoir.
3. Carefully remove the reservoir retaining pins. Remove the reservoir from the master cylinder by pulling the reservoir straight up and away from the cylinder. See **Fig. 38**. Remove the seals from the master cylinder.

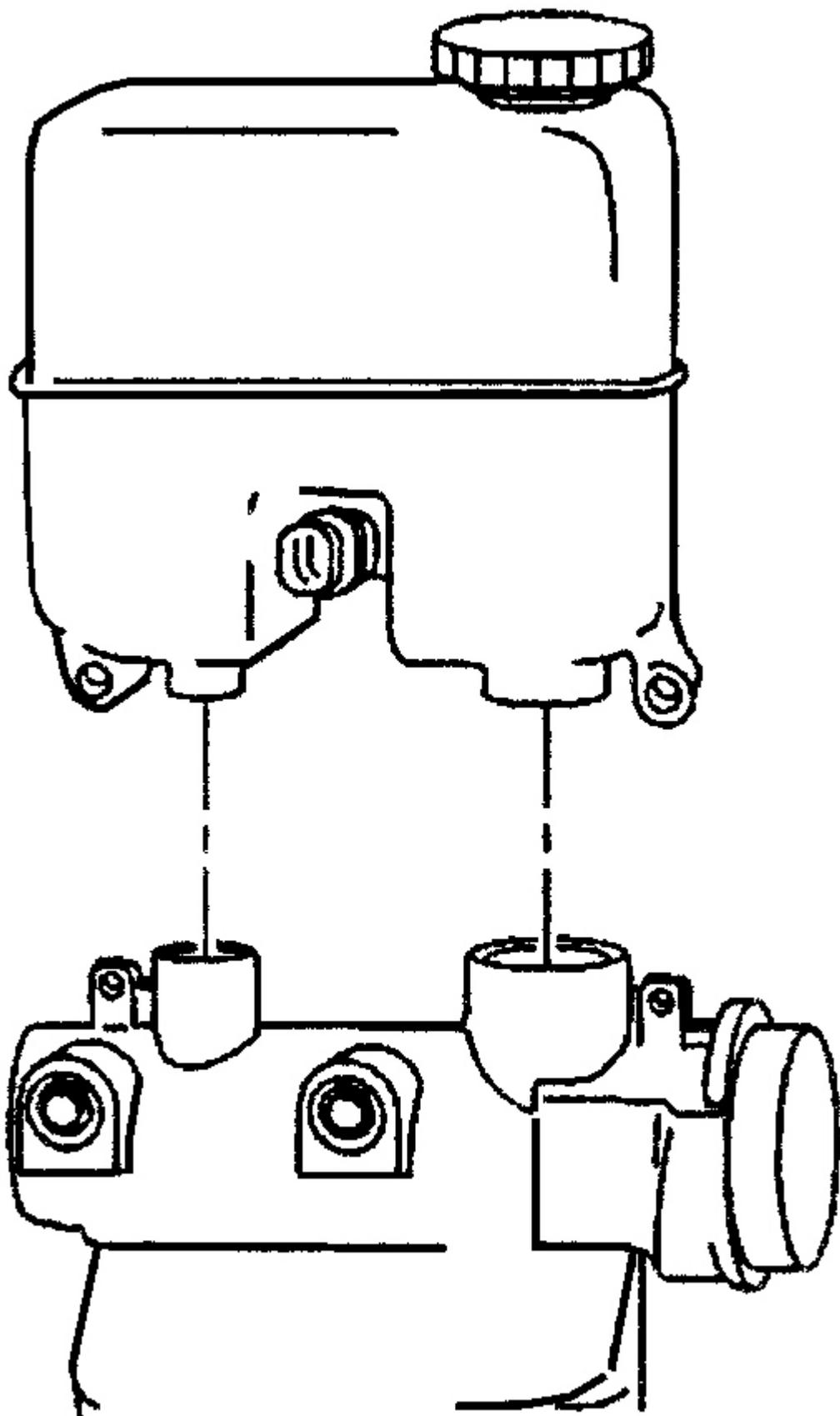


Fig. 38: Removing & Installing Master Cylinder Reservoir
Courtesy of GENERAL MOTORS CORP.

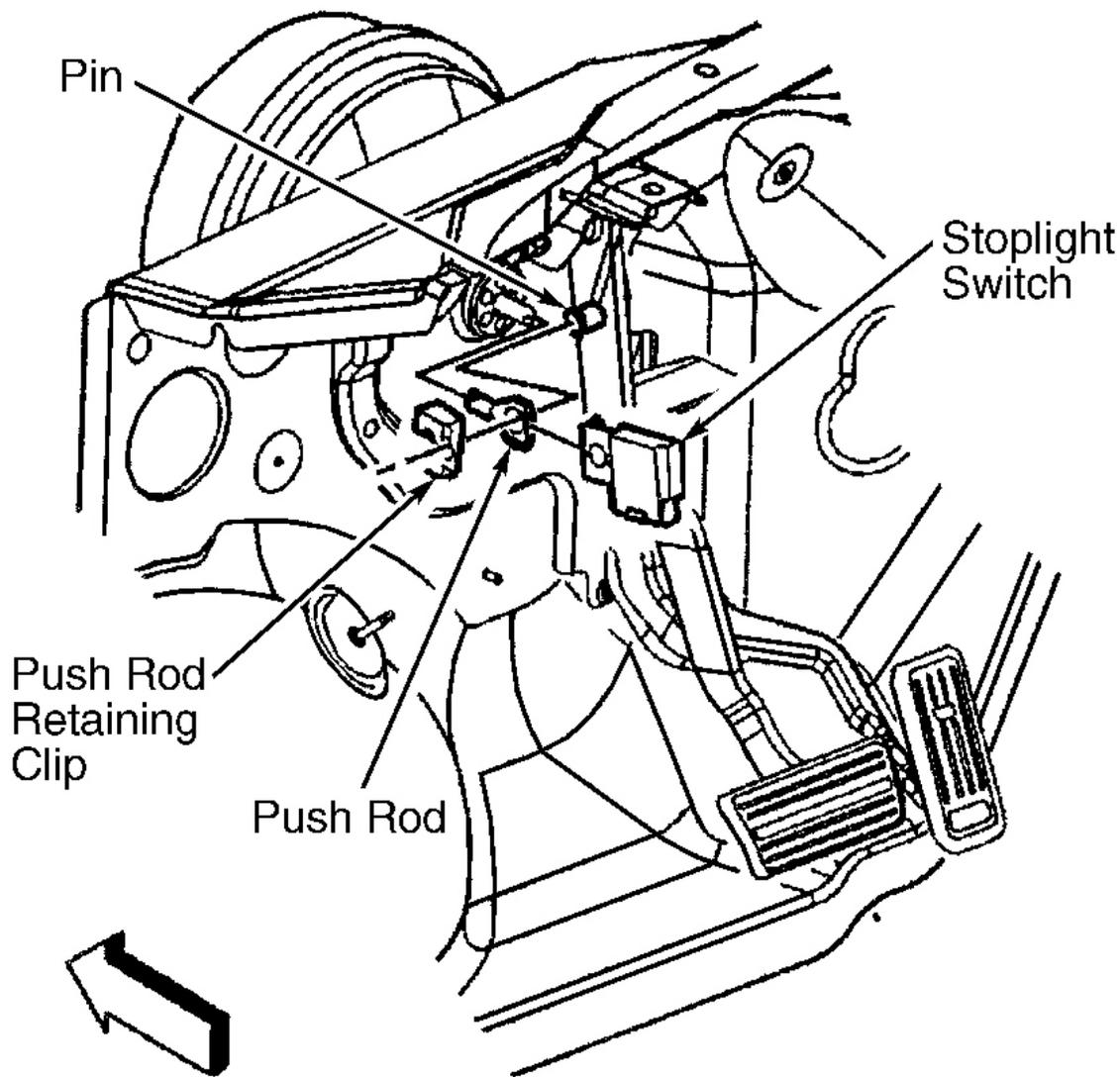
Installation

1. Inspect the reservoir for cracks or deformation. If found, replace the reservoir. Clean the reservoir with denatured alcohol, or equivalent. Dry the reservoir with non-lubricated, filtered air.
2. Lubricate the NEW seals and the outer surface area of the reservoir-to-housing barrels with Delco Supreme 11(R) (GM P/N 12377967) or equivalent DOT-3 brake fluid, from a clean, sealed brake fluid container. Install the lubricated seals, make sure they are fully seated.
3. Install the reservoir to the master cylinder by pressing the reservoir straight down on the master cylinder until the pin holes are aligned. See **Fig. 38** . Carefully install the reservoir retaining pins to secure the reservoir. Place the brake fluid level sensor into the reservoir, press into place to secure the sensor retaining tabs. Remove the master cylinder from the vice.
4. Install the master cylinder. See **MASTER CYLINDER** . Release the park brake. Bleed the hydraulic brake system. See **BLEEDING BRAKE SYSTEM** .

STOP LIGHT SWITCH

Removal & Installation

Disconnect the electrical connector from the stop light switch. Remove the pushrod retaining clip. Remove the stop light switch. Install the stop light switch. Install the pushrod retaining clip. Connect the electrical connector to the stop light switch. See **Fig. 39** .



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Fig. 39: Removing & Installing Stoplight Light Switch
 Courtesy of GENERAL MOTORS CORP.

PARK BRAKE ACTUATOR

Removal & Installation

1. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the full upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
2. Raise and support the vehicle. Remove the tire and wheel assembly. Remove appropriate rotor. See **BRAKE ROTOR** . Remove the axle shaft. See AXLE SHAFTS article in DRIVELINE/AXLES. Remove appropriate park brake shoe. See **PARK BRAKE SHOES** .

3. Remove the actuator and rubber boot. See **Fig. 40** .
4. Install the rubber boot and the actuator. Install the park brake shoe. See **PARK BRAKE SHOES** .
5. Install the axle shaft. See appropriate AXLE SHAFTS article in DRIVELINE/AXLES. Adjust the park brake shoe. See **PARK BRAKE SHOE ADJUSTMENT** under PARK BRAKE ADJUSTMENT in ADJUSTMENTS & INSPECTION.
6. Install the rotor. See **BRAKE ROTOR** . Install the tire and wheel assembly. Remove the safety stands. Lower vehicle.
7. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53** . Remove the scribe or screwdriver. Slowly release the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

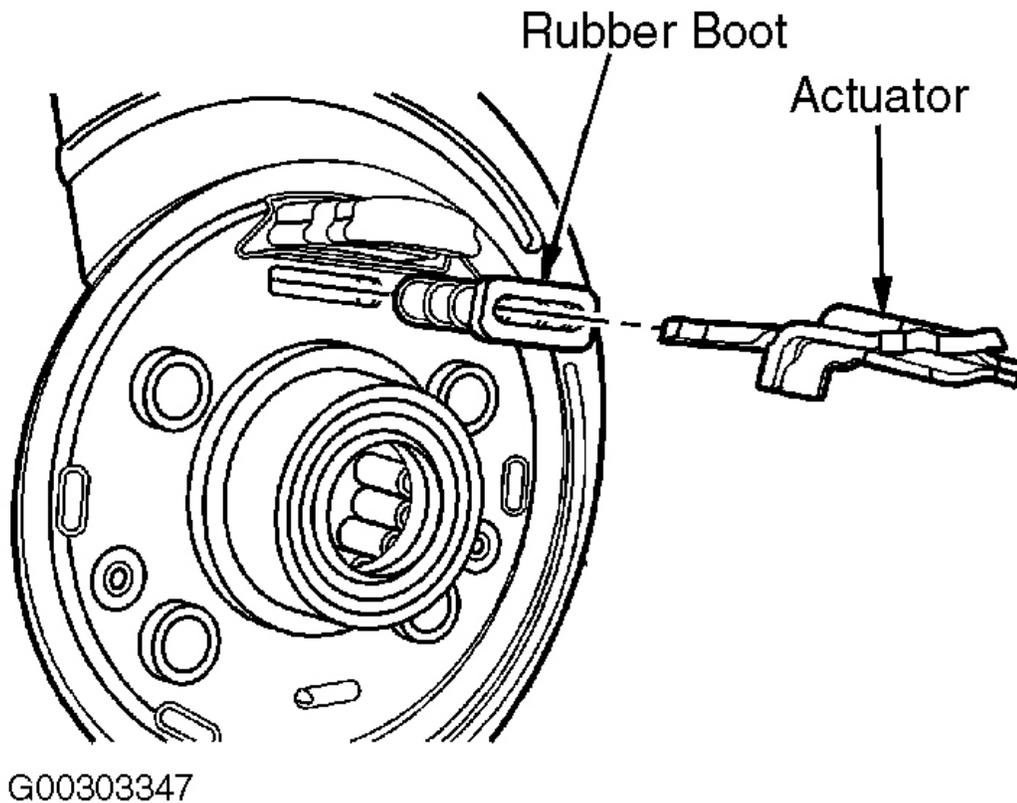
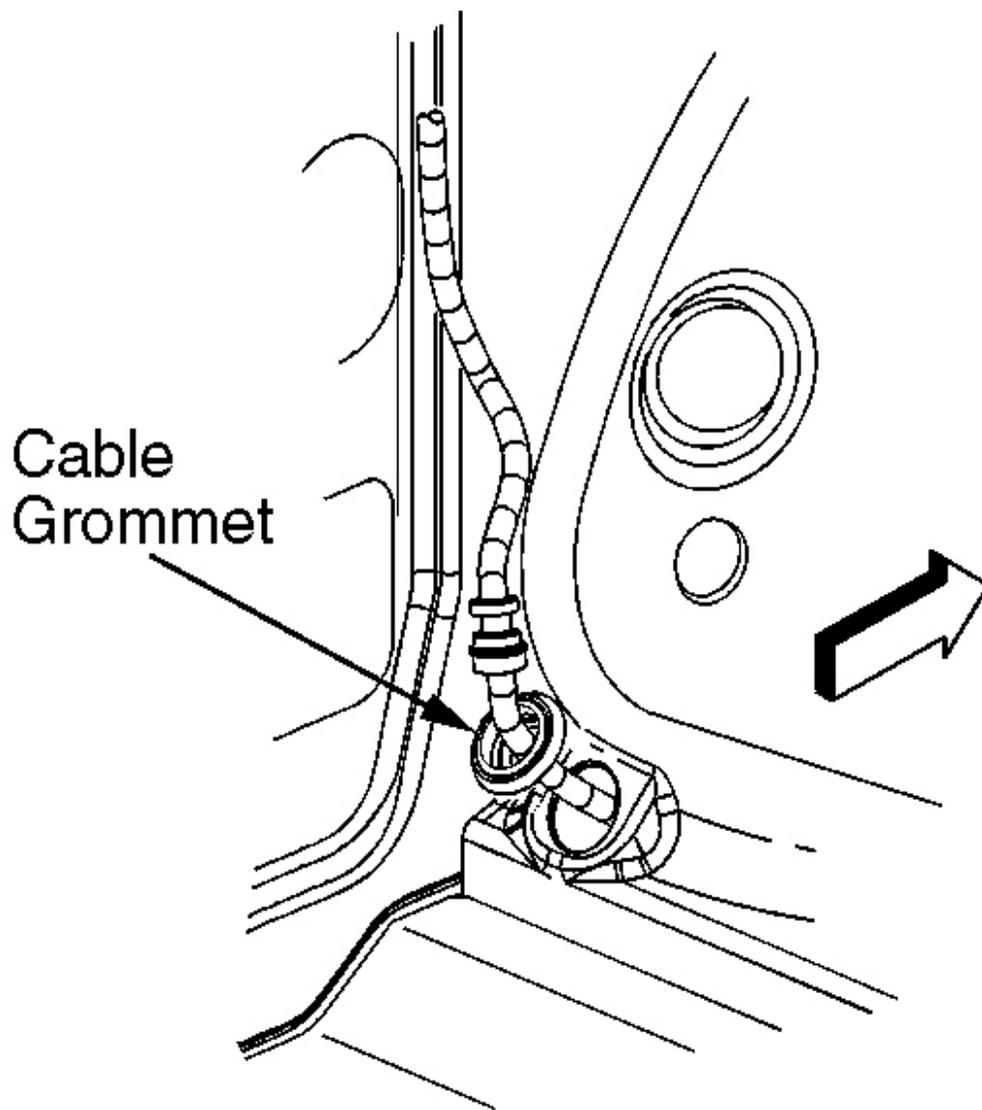


Fig. 40: Removing/Installing Park Brake Actuator
Courtesy of GENERAL MOTORS CORP.

PARK BRAKE CABLE

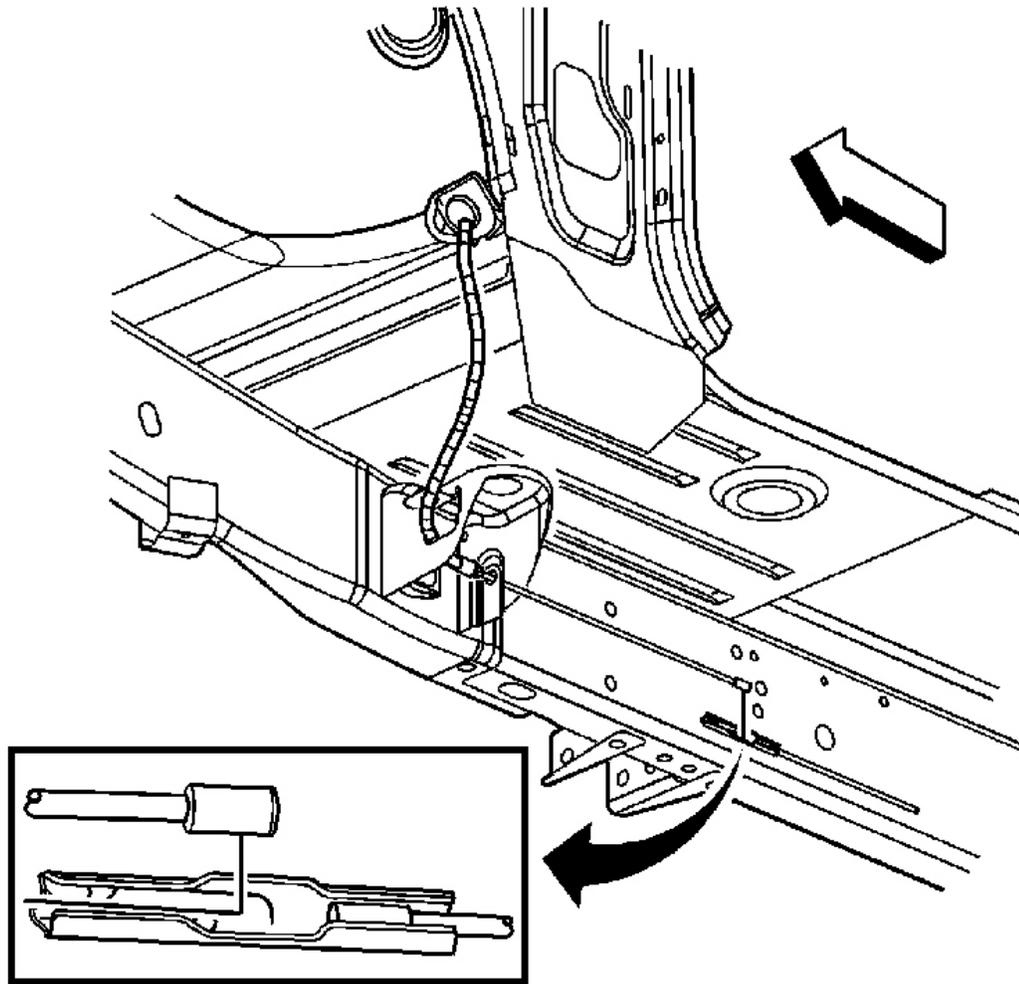
Removal (Front)

1. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the full upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
2. Remove the park brake pedal. See **PARK BRAKE PEDAL ASSEMBLY** . Roll the carpet back to access cable grommet. See **Fig. 41** .
3. Raise and support the vehicle. Disengage the grommet and the cable from the floor pan. See **Fig. 42** . Disconnect the front cable from the rear cable. Remove the cable from the body mount by depressing the retaining tabs. Remove the cable.



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Fig. 41: Locating Cable Grommet (Front)
Courtesy of GENERAL MOTORS CORP.



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Fig. 42: Disengaging/Engaging Grommet & Cable (Front)
 Courtesy of GENERAL MOTORS CORP.

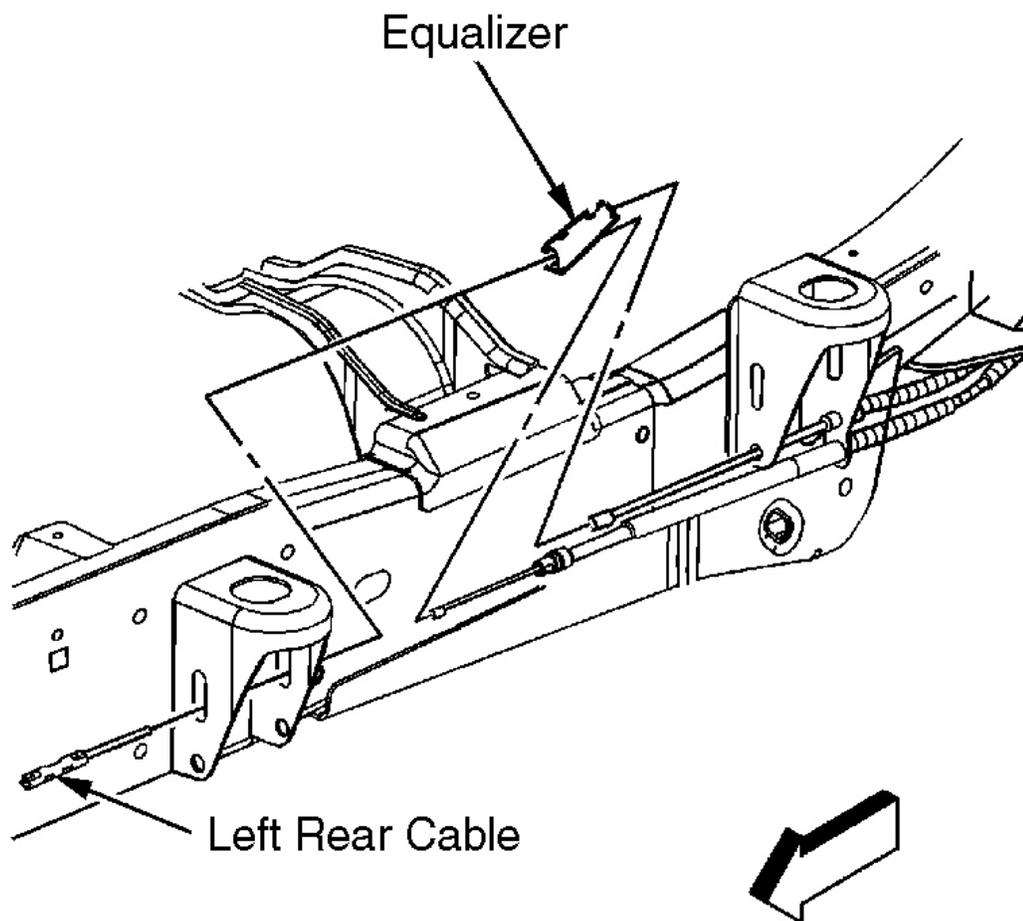
Installation

1. Install the cable. Snap the retainer tabs into the body mount. Connect the front cable to the rear cable. Route the cable in through the floor pan and engage the grommet. Remove the safety stands. Lower the vehicle.
2. Roll the carpet into place. Install the park brake pedal. See **PARK BRAKE PEDAL ASSEMBLY**.
3. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53**. Remove the scribe or screwdriver. Slowly release

the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

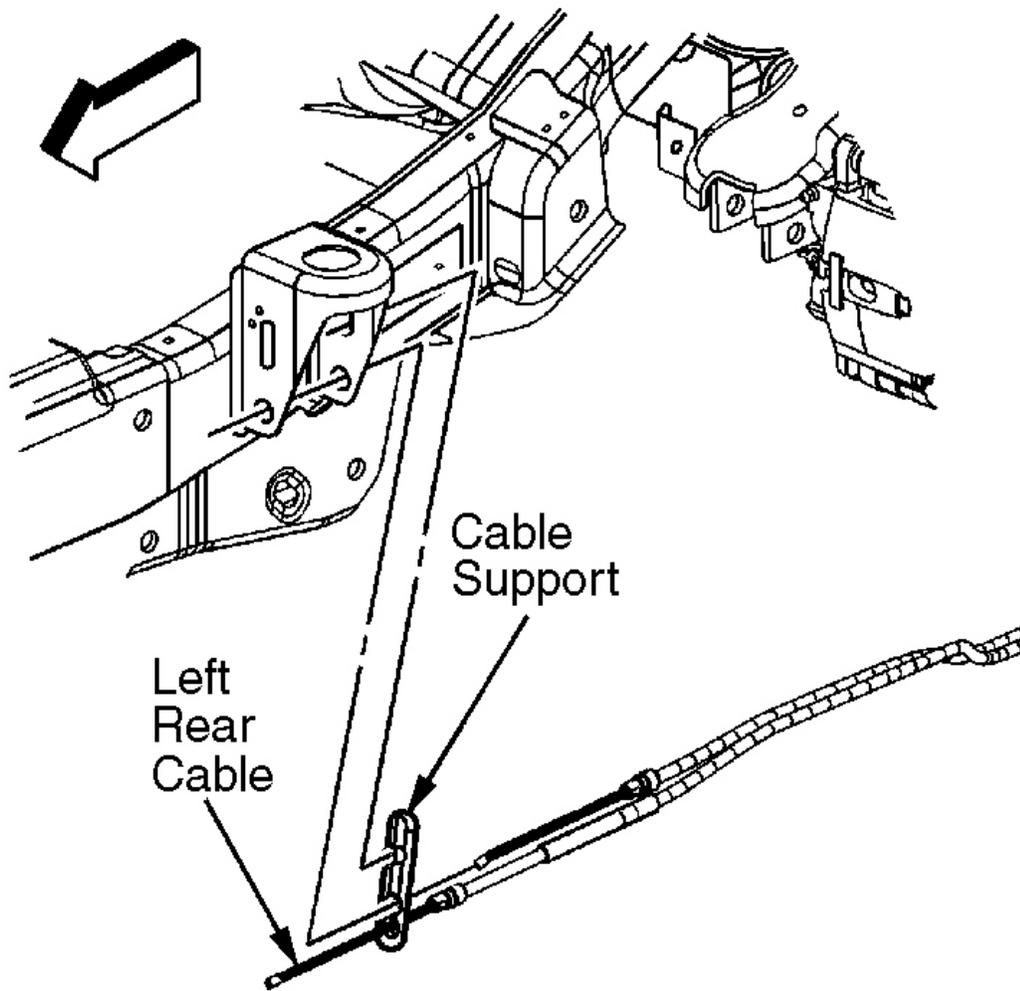
Removal (Left Rear)

1. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the full upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
2. Raise and support the vehicle. Disconnect the left rear cable from the front cable. See **Fig. 42** . Remove the left rear cable from the equalizer by depressing the locking tabs.
3. Remove the left rear cable from the cable support. See **Fig. 44** . Remove the cable from the backing plate by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate. See **Fig. 54** .
4. Remove the cable from the lever. Remove the left rear cable from the cable guide. See **Fig. 45** . Remove the cable from the vehicle.



G00303341

Fig. 43: Removing/Installing Cable From Equalizer (Left Rear)
Courtesy of GENERAL MOTORS CORP.



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Fig. 44: Removing Cable From Cable Support (Left Rear)
Courtesy of GENERAL MOTORS CORP.

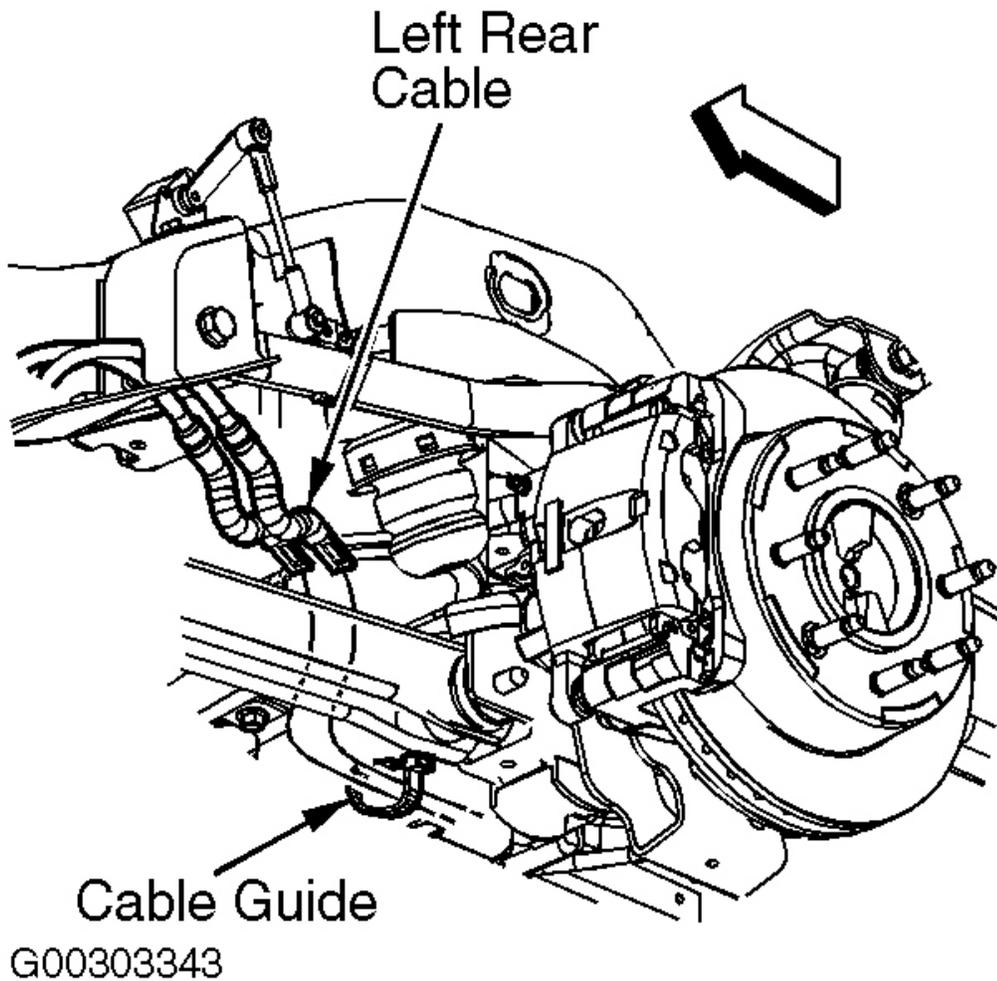


Fig. 45: Removing Cable From Cable Guide
Courtesy of GENERAL MOTORS CORP.

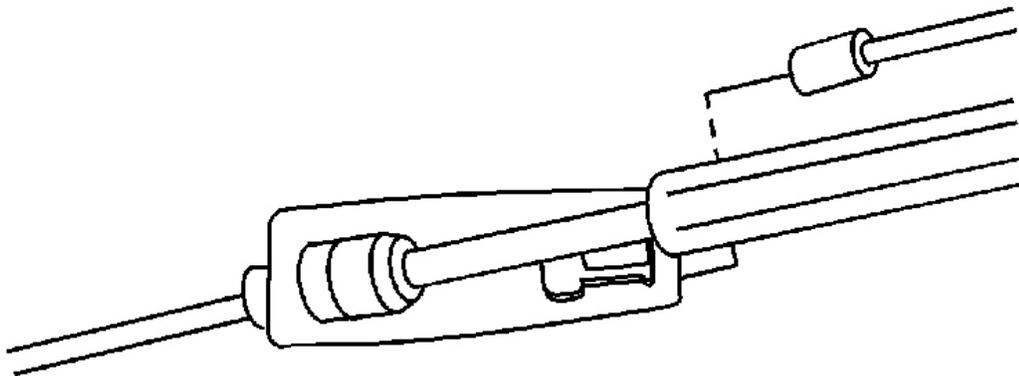
Installation

1. Install the left rear cable taking care to correctly route the cable through the cable guide. Install the cable to the lever.
2. Install the cable to the backing plate by compressing the spring, routing the cable through the slot in the backing plate and pressing the cable into the backing plate until the locking tabs snap into place.
3. Install the left rear cable to the cable support. Install the left rear cable to the equalizer until the locking tabs snap into place. Connect the left rear cable to the front cable. Remove the safety stands. Lower the vehicle.

4. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53** . Remove the scribe or screwdriver. Slowly release the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

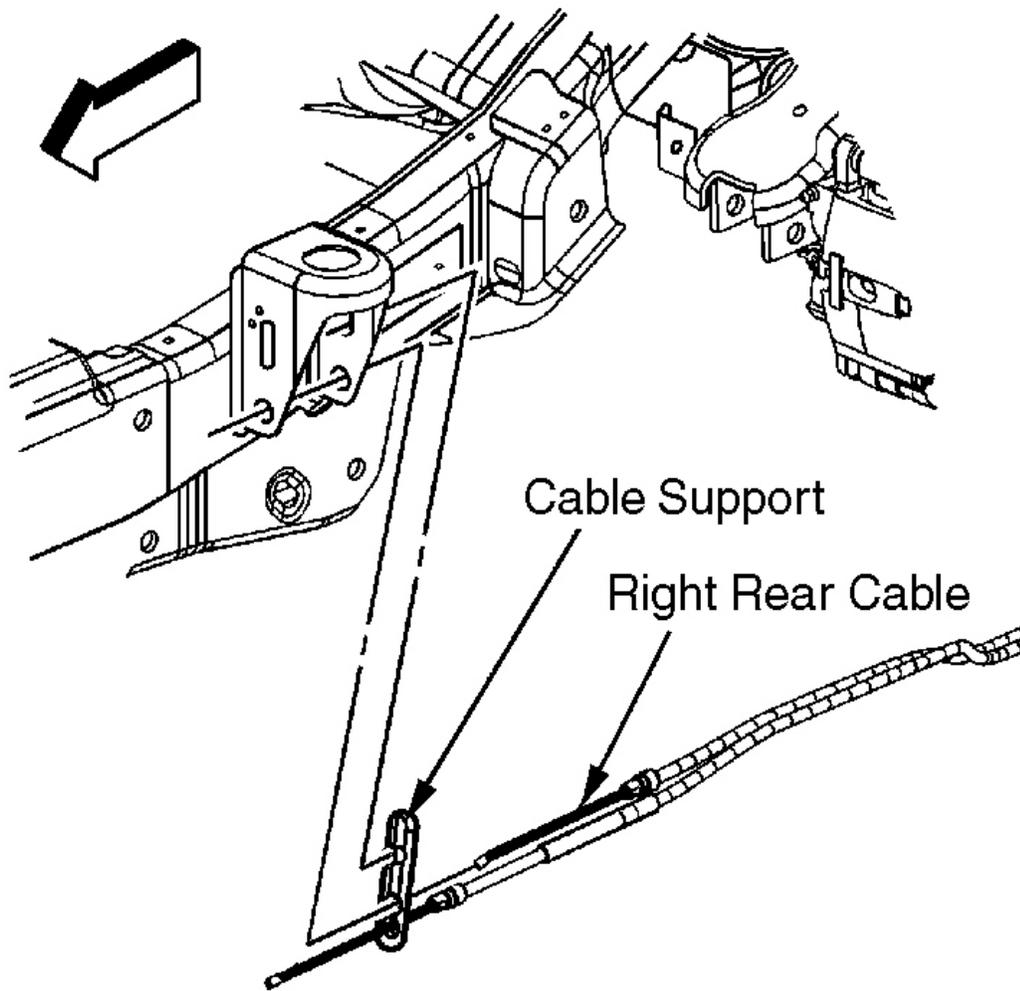
Removal (Right Rear)

1. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the full upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
2. Raise and support the vehicle. Disconnect the right rear cable from the equalizer. See **Fig. 46** . Remove the right rear cable from the cable support. See **Fig. 47** .
3. Remove the track bar clips from the track bar. See **Fig. 48** . Remove the cable from the backing plate by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate. See **Fig. 54** .
4. Remove the cable from the lever. Remove the right rear cable from the cable guide. See **Fig. 45** . Remove the cable from the vehicle.



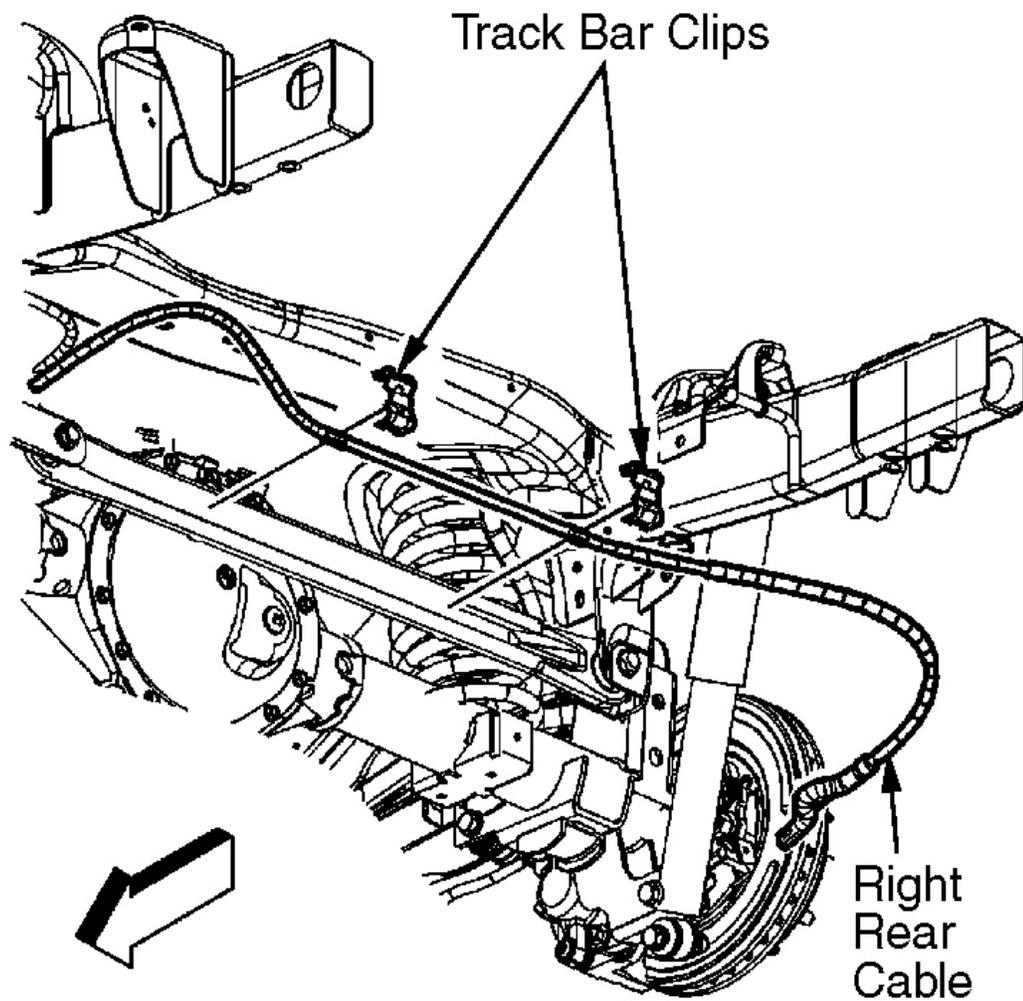
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Fig. 46: Disconnecting & Connecting Cable From Equalizer (Right Rear)
Courtesy of GENERAL MOTORS CORP.



G00303345

Fig. 47: Removing Cable From Cable Support (Right Rear)
Courtesy of GENERAL MOTORS CORP.



G00303346

Fig. 48: Removing/Installing Track Bar Clips
Courtesy of GENERAL MOTORS CORP.

Installation

1. Install the right rear cable taking care to correctly route the cable through the cable guide. Install the cable to the lever. Install the cable to the backing plate by compressing the spring, routing the cable through the slot in the backing plate and pressing the cable into the backing plate until the locking tabs snap into place.
2. Position the right rear cable and the clips on the track bar. Install the track bar clips to the locating tabs on the track bar. Install the right rear cable to the cable support.
3. Install the right rear cable to the equalizer. Remove the safety stands. Lower the vehicle.

4. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53** . Remove the scribe or screwdriver. Slowly release the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

PARK BRAKE CABLE GUIDE

Removal & Installation

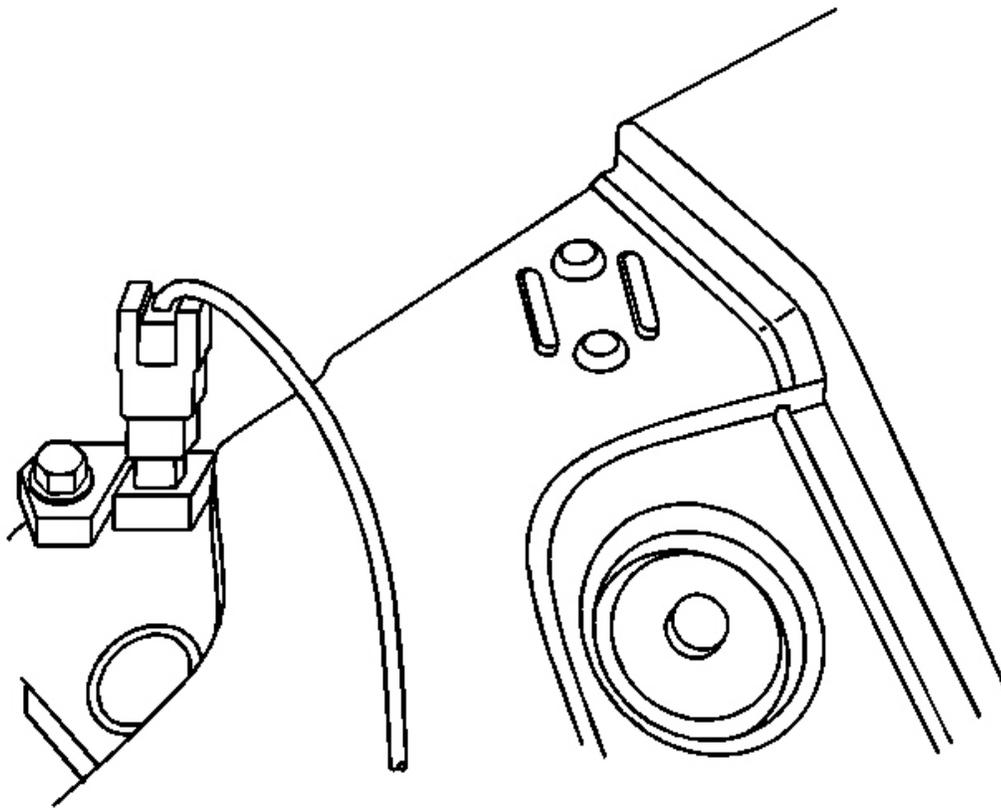
1. Release the parking brake. Raise and support the vehicle. Remove the park brake cable guide bolt. Remove the park brake cable guide. Remove the park brake guide from the park brake cable.
2. Install the park brake cable guide to the park brake cable. Install the park brake cable guide.
3. Install the park brake cable guide bolt. Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** . Remove the safety stands. Lower the vehicle.

PARK BRAKE PEDAL ASSEMBLY

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

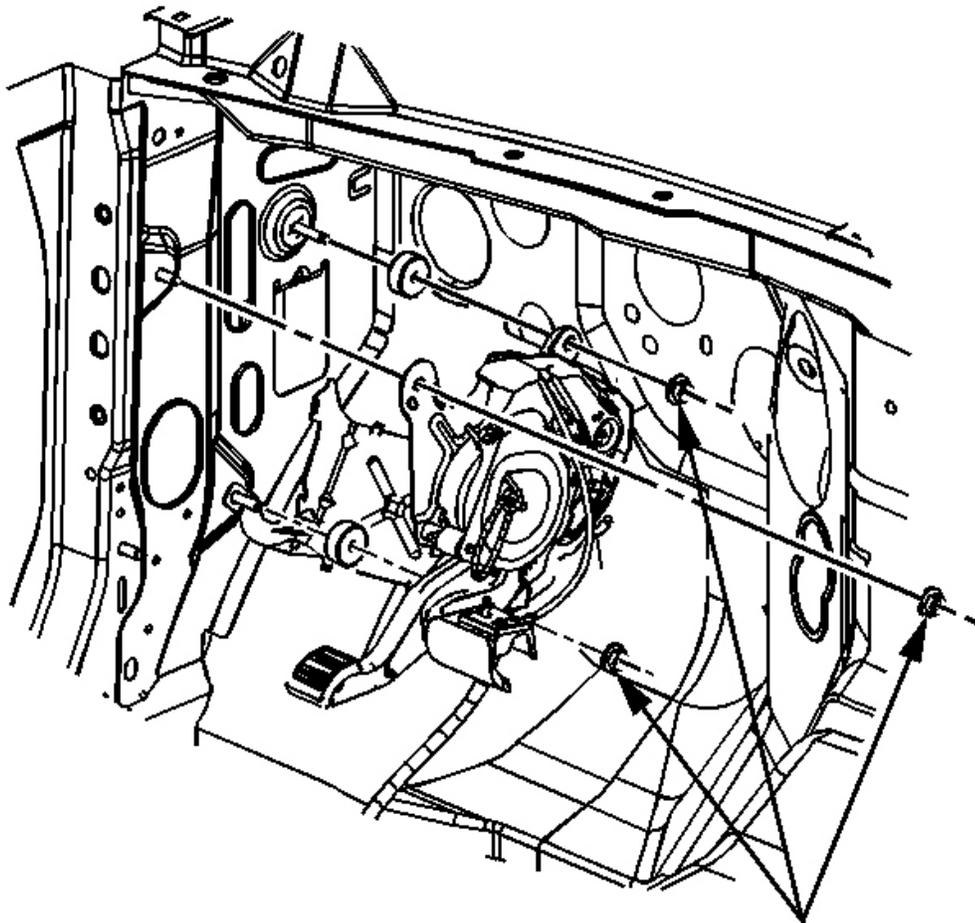
Removal

1. Disconnect the negative battery cable
2. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the full upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
3. Remove the left side hinge pillar panel. Remove the MID-Bussed Electrical Center bracket. Disconnect the park brake warning light connection. See **Fig. 49** . Disconnect the park brake release cable from the park brake lever.
4. Remove the park brake lever mounting nuts. See **Fig. 50** . Disconnect the front park brake cable from the park brake lever. See **Fig. 51** . Remove the park brake lever.



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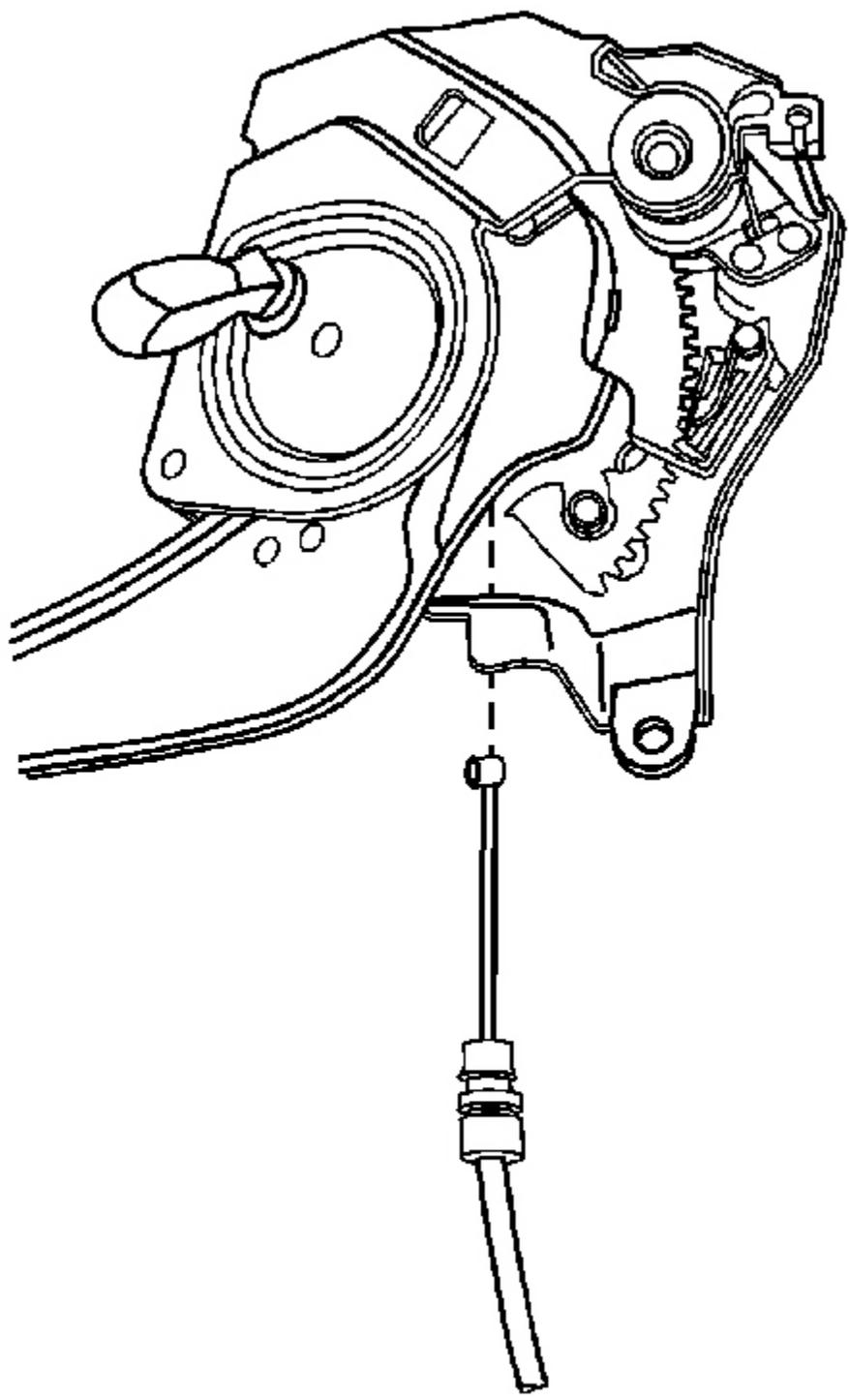
Fig. 49: Disconnecting/Connecting Park Brake Warning Light Connector
Courtesy of GENERAL MOTORS CORP.



Park Brake Lever
Mounting Nuts

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Fig. 50: Removing/Installing Park Brake Lever Mounting Nuts
Courtesy of GENERAL MOTORS CORP.



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Fig. 51: Disconnecting/Connecting Front Park Brake Cable From Park Brake Lever
Courtesy of GENERAL MOTORS CORP.

Installation

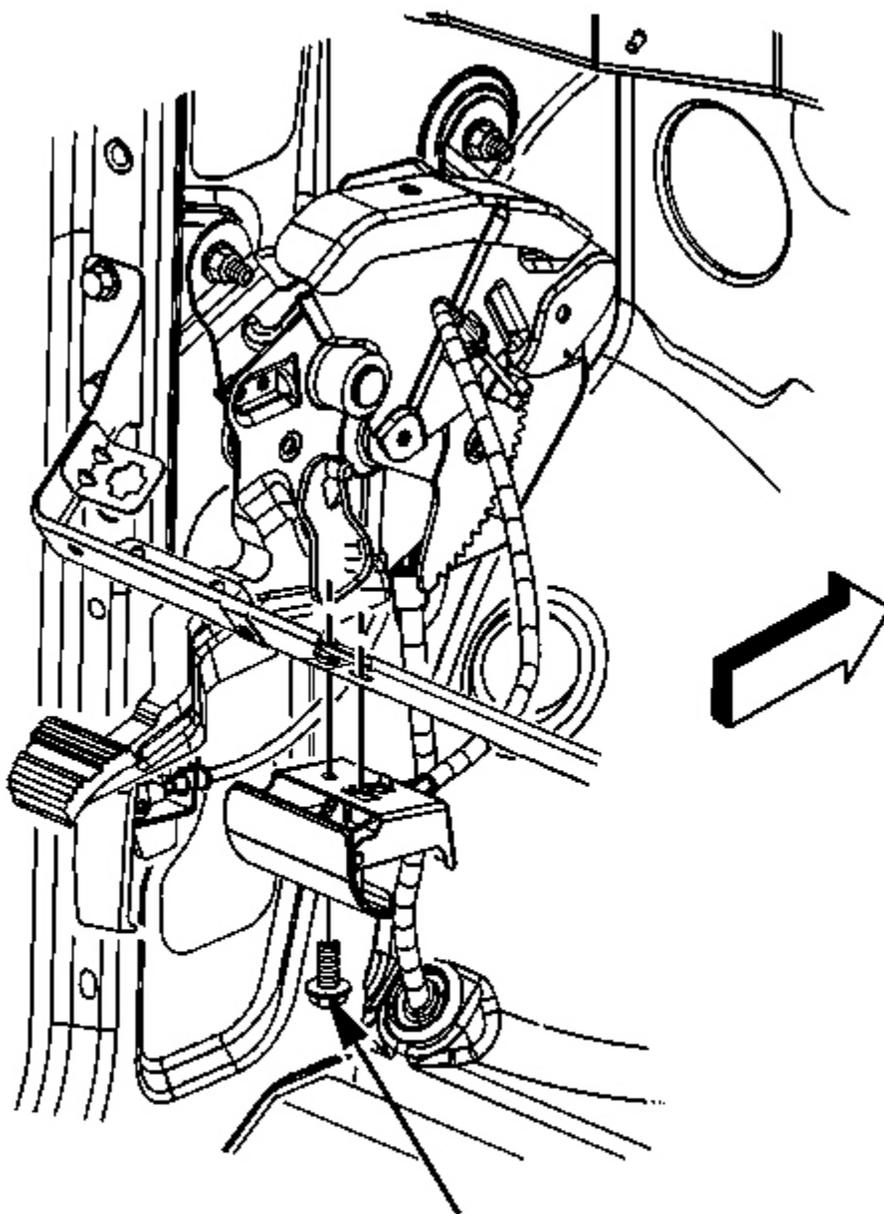
1. Connect the front park brake cable to the park brake lever. See **Fig. 51** . Install the park brake lever. Install the park brake lever mounting nuts. See **Fig. 50** . Tighten the nuts to specification. See **TORQUE SPECIFICATIONS** .
2. Connect the park brake release cable to the park brake lever. Connect the park brake warning lamp connector. See **Fig. 49** . Install the MID-Bussed Electrical Center bracket. Install the left side hinge pillar panel. Connect the negative battery cable.
3. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53** . Remove the scribe or screwdriver. Slowly release the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

PARK BRAKE RELEASE HANDLE ASSEMBLY

Removal & Installation

CAUTION: Before servicing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF, unless instructed otherwise in these procedures. If a tool or equipment could easily come in contact with a live exposed electrical terminal, also disconnect the negative battery cable. Failure to follow these precautions may cause personal injury and/or damage to the vehicle or its components.

1. Disconnect the negative battery cable. Remove the park brake release lever mounting bolt. See **Fig. 52** . Remove the park brake release lever handle from the knee bolster.
2. Remove the MID-Bussed Electrical Center from the bracket. Remove the park brake release cable housing from the pedal assembly. Remove the park brake release cable from the pedal assembly.
3. Note the routing of the cable as you remove the park brake release handle assembly from the vehicle.
4. To install, install park brake release handle assembly to the vehicle. Install the cable using the same routing as the original cable. Install the park brake release cable to the pedal assembly.
5. Install the park brake release cable housing to the pedal assembly. Install the MID-Bussed Electrical Center to the bracket. Install the park brake release lever handle to the knee bolster.
6. Install the park brake release lever mounting bolt. Tighten the bolt to specification. See **TORQUE SPECIFICATIONS** . Connect the negative battery cable.



Park Brake Release
Lever Mounting Bolt

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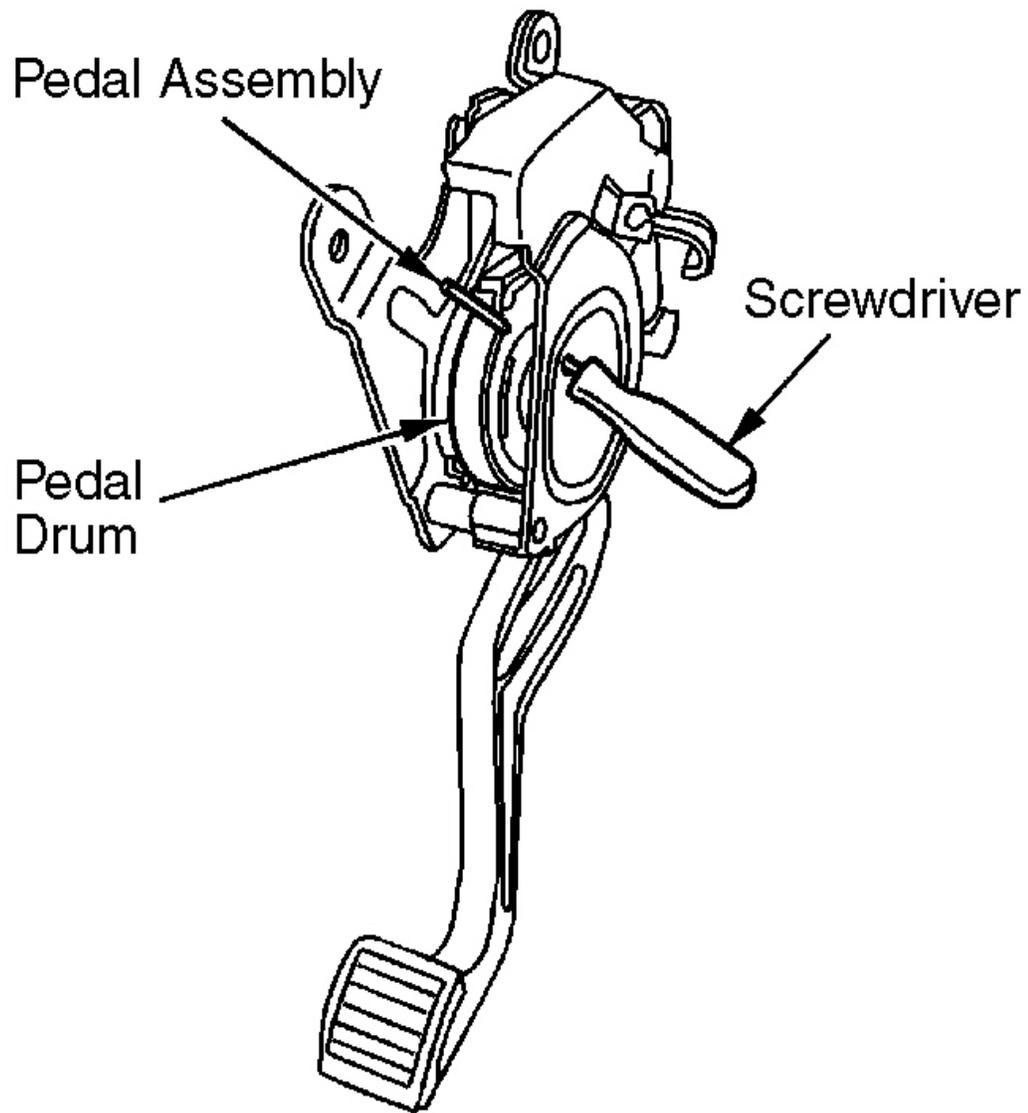
Fig. 52: Removing/Installing Park Brake Release Lever Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

PARK BRAKE SHOES

CAUTION: Avoid taking the following actions when you service wheel brake parts: **DO NOT** grind brake linings. **DO NOT** sand brake linings. **DO NOT** clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

Removal

1. Disable the park brake cable automatic adjuster. Raise and support the vehicle. Hold the pedal in the FULL upward position. Pull rearward on the front park brake cable until the pedal drum reaches its full reset position. Insert a scribe or the shaft of a thin screwdriver on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly. See **Fig. 53** . Slowly release the cable.
2. Raise and support the vehicle. Remove the tire and the wheel. Remove the caliper and mounting bracket as an assembly. See **BRAKE PADS** .
3. Remove the rotor. See **BRAKE ROTOR** . Remove the cable from the backing plate by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate. See **Fig. 54** .
4. Remove the cable from the lever. Remove the axle shaft. See AXLE SHAFTS article in DRIVELINE/AXLES. Remove the park brake shoe return springs. See **Fig. 55** . Remove the park brake shoe anchor springs and pins. See **Fig. 56** . Remove the park brake shoes.



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Fig. 53: Disabling Park Brake Cable Automatic Adjuster
Courtesy of GENERAL MOTORS CORP.

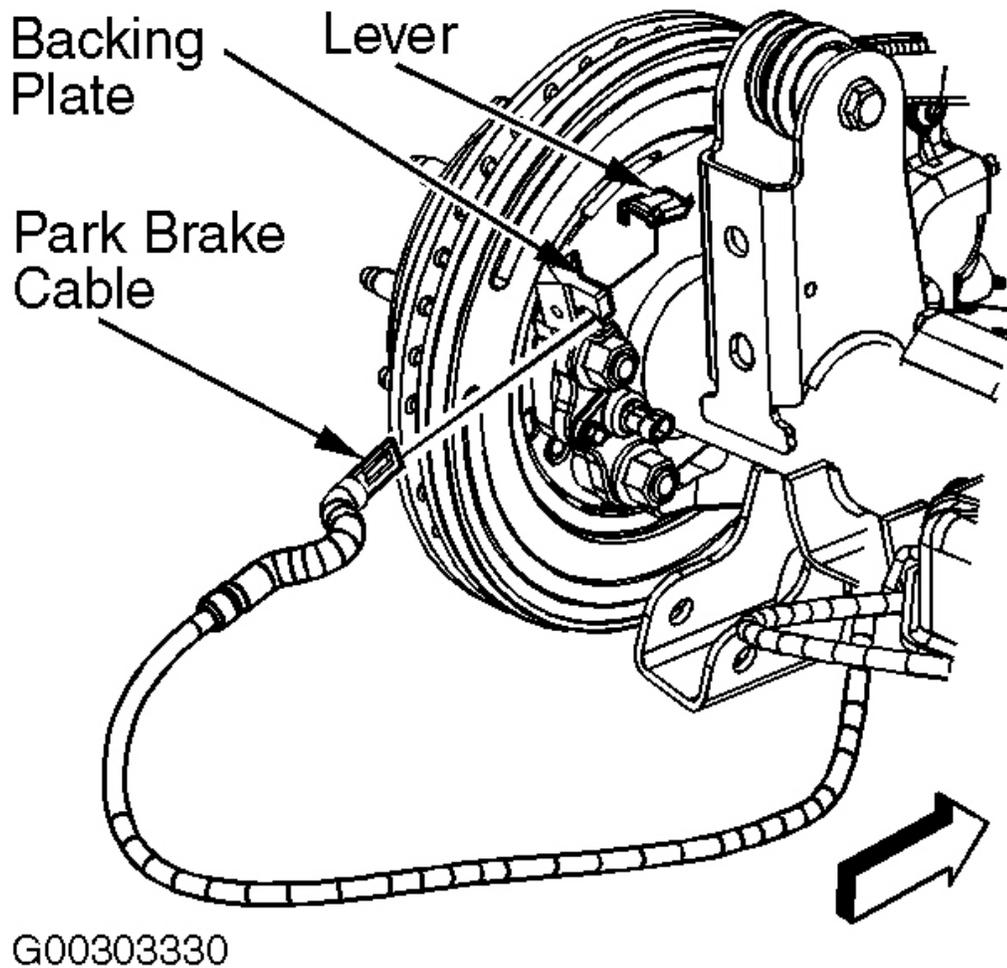
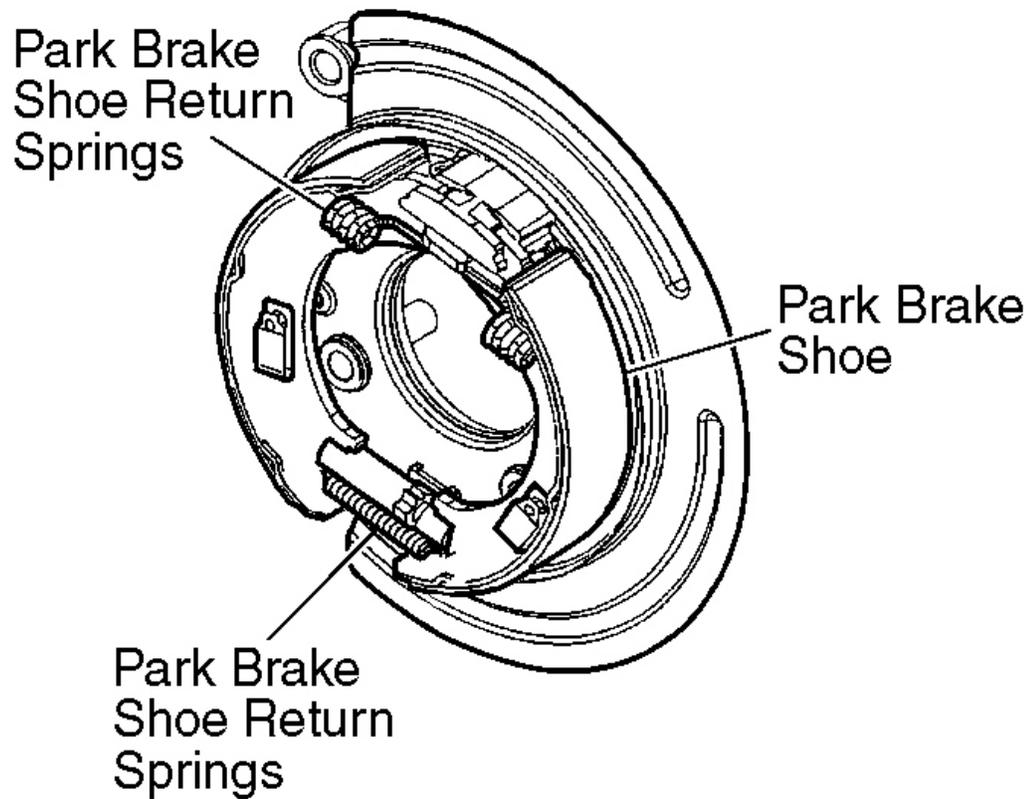
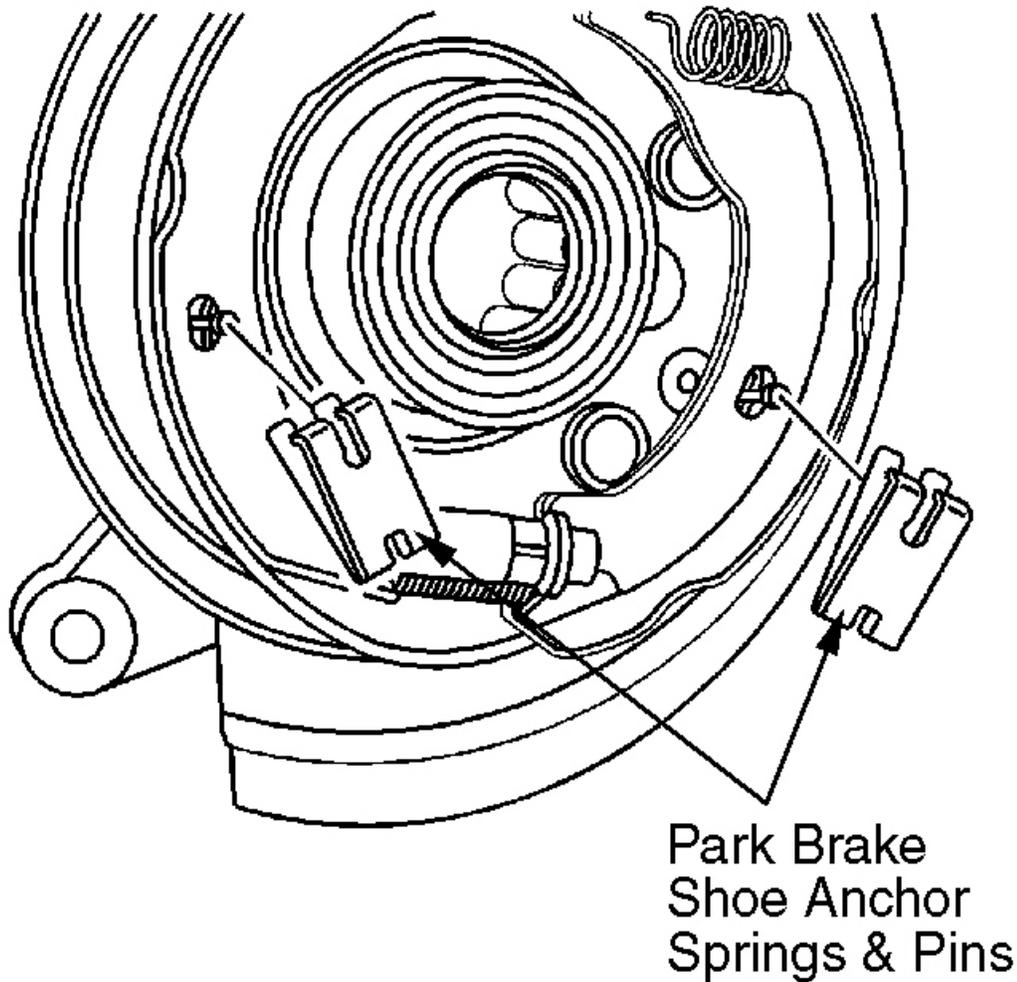


Fig. 54: Removing/Installing Park Brake Shoe Cable
Courtesy of GENERAL MOTORS CORP.



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Fig. 55: Removing/Installing Park Brake Shoe Return Springs
Courtesy of GENERAL MOTORS CORP.



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Fig. 56: Removing/Installing Park Brake Shoe Anchor Springs & Pins
Courtesy of GENERAL MOTORS CORP.

Installation

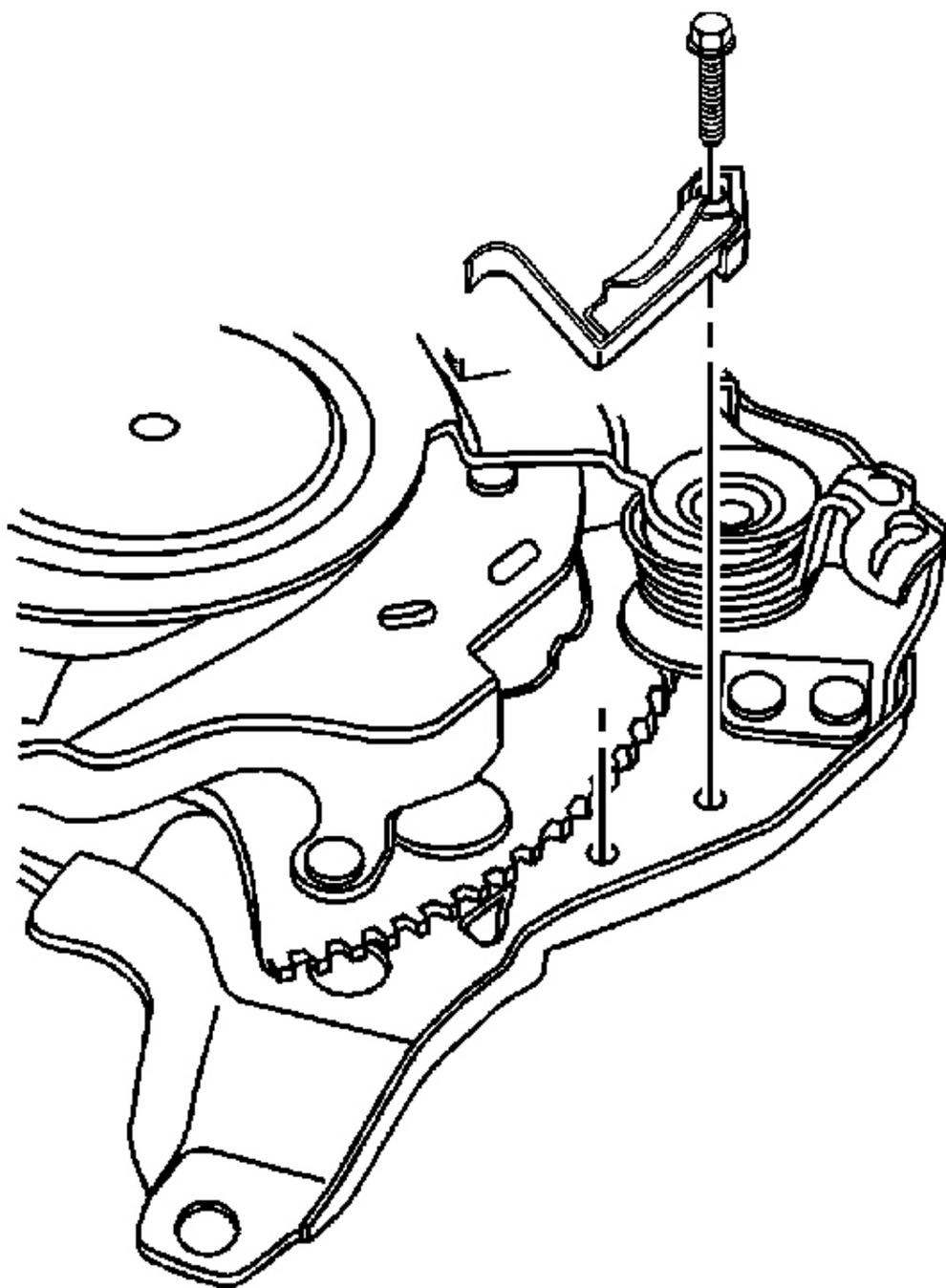
1. Clean the debris and the dust from the park brake components using a clean shop cloth. Align the slots in both the adjusting screw and tappet to be parallel with the backing plate face. Install the park brake shoe assembly to the vehicle by placing one of the open ends of the shoe over the axle flange and rotating the shoe until it is behind the flange.
2. Position the park brake shoe on the inboard side of the actuator. Slide the park brake shoe into position and seat into the retaining spring. Inspect the shoe assembly position. The shoe must be central on the backing plate with both tips located in the slots.

3. Adjust the park brake shoe. See **PARK BRAKE ADJUSTMENT** under ADJUSTMENTS & INSPECTION. Install the rotor. Install the park brake cable to the park brake actuator lever.
4. Tighten the nut to the intermediate cable at the equalizer. Tighten the nut specification. See **TORQUE SPECIFICATIONS** . Install the tire and wheel. Remove the safety stands. Lower the vehicle. Adjust park brake cable. See **PARK BRAKE ADJUSTMENT** under REMOVAL & INSTALLATION.
5. Enable the park brake cable automatic adjuster. Hold the park brake pedal in the FULL upward position. Pull rearward on the front park brake cable until the tension is released from the scribe or nail installed through the holes in the pedal assembly. See **Fig. 53** . Remove the scribe or screwdriver. Slowly release the park brake cable until it returns to its original position. Release the park brake pedal. Lower the vehicle. Apply and release the park brake pedal to ensure that there is no binding or sticking.

PARK BRAKE WARNING LIGHT SWITCH

Removal & Installation

1. Disconnect the negative battery cable. Remove the MID-Bussed Electrical Center from the bracket.
2. Disconnect the park brake warning lamp switch connector. See **Fig. 49** . Remove the park brake warning lamp switch mounting bolt. See **Fig. 57** . Remove the park brake warning lamp switch.
3. Install the park brake warning lamp switch. Install the park brake warning lamp switch mounting bolt and tighten to specification. See **TORQUE SPECIFICATIONS** .
4. Connect the park brake warning lamp switch connector. Install the MID-Bussed Electrical Center bracket. Connect the negative battery cable.



G00303338

OVERHAUL

BRAKE ROTOR REFINISHING

CAUTION: Avoid taking the following actions when you service wheel brake parts: **DO NOT** grind brake linings. **DO NOT** sand brake linings. **DO NOT** clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

CAUTION: The disc brake rotors **DO NOT** require refinishing as part of routine brake system service. New disc brake rotors **DO NOT** require refinishing. **DO NOT** refinish disc brake rotors in an attempt to correct the following conditions:

- Brake system noise - squeal, growl, groan.
- Uneven and/or premature disc brake pad wear.
- Superficial or cosmetic corrosion/rust of the disc brake rotor friction surface.
- Scoring of the disc brake rotor friction surface less than the maximum allowable specification.

Before refinishing a brake rotor, the rotor **MUST** first be checked for adequate thickness to allow the rotor to be refinished and remain above the minimum allowable thickness after refinish specification. See **BRAKE ROTOR THICKNESS MEASUREMENT** under **ADJUSTMENTS & INSPECTION**. Disc brake rotors should only be refinished if they have adequate thickness to be refinished and if one or more of the following conditions exist:

- Thickness variation in excess of the maximum allowable specification.
- Excessive corrosion/rust and/or pitting.
- Cracks and/or heat spots.
- Excessive blueing discoloration.
- Scoring of the disc brake rotor surface in excess of the maximum allowable specification.

Disc brake rotors may need to be refinished as part of the process for correcting brake rotor assembled lateral runout (LRO) that exceeds the maximum allowable specification.

CAUTION: Whenever the brake rotor has been separated from the hub/axle flange, clean any rust or contaminants from the hub/axle flange and the brake rotor mating surfaces. Failure to do this may result in increased assembled lateral runout (LRO) of the brake rotor, which could lead to brake pulsation.

1. Using the Wheel Hub Resurfacing Kit (J 42450-A), thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange.
2. Using the Rotor Resurfacing Kit (J 41013), thoroughly clean any rust or corrosion from the mating surface and mounting surface of the brake rotor.
3. Inspect the mating surfaces of the hub/axle flange and the rotor to ensure that there are no foreign particles or debris remaining.
4. Mount the brake rotor to the brake lathe according to the lathe manufacturer's instructions, ensuring that all mounting attachments and adapters are clean and free of debris.
5. Ensure that any vibration dampening attachments are securely in place.
6. With the brake lathe running, slowly bring in the cutting tools until they just contact the brake rotor friction surfaces.
7. Observe the witness mark on the brake rotor. If the witness mark extends approximately three-quarters or more of the way around the brake rotor friction surface on each side, the brake rotor is properly mounted to the lathe.
8. If the witness mark does not extend three-quarters or more of the way around the brake rotor, re-mount the rotor to the lathe.
9. Following the brake lathe manufacturer's instructions, refinish the brake rotor.
10. After each successive cut, inspect the brake rotor thickness. See **BRAKE ROTOR THICKNESS MEASUREMENT** under ADJUSTMENTS & INSPECTION.
11. If at any time the brake rotor exceeds the minimum allowable thickness after refinish specification, the brake rotor must be replaced.
12. After refinishing the brake rotor, use the following procedure in order to obtain the desired non-directional finish:
 - A. Follow the brake lathe manufacturer's recommended speed setting for applying a non-directional finish.
 - B. Using moderate pressure, apply the non-directional finish:
 - If the lathe is equipped with a non-directional finishing tool, apply the finish with 120 grit aluminum oxide sandpaper.
 - If the lathe is not equipped with a non-directional finishing tool, apply the finish with a sanding block and 150 grit aluminum oxide sandpaper.
 - C. After applying a non-directional finish, clean each friction surface of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.

13. Remove the brake rotor from the brake lathe.
14. Measure the assembled Lateral Runout (LRO) of the brake rotor to ensure optimum performance of the disc brakes. See **BRAKE ROTOR SURFACE & WEAR INSPECTION** under ADJUSTMENTS & INSPECTION.
15. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications.
16. Inspect each of the disc brake rotors and determine if the rotors can be refinished and remain above the minimum allowable thickness after refinish specification: Inspect the thickness of each of the disc brake rotors. Inspect each of the disc brake rotors for excessive surface wear and/or lateral runout.

BRAKE CALIPER

CAUTION: DO NOT place your fingers in front of the piston in order to catch or protect the piston while applying compressed air. This could result in serious injury.

CAUTION: Avoid taking the following actions when you service wheel brake parts: DO NOT grind brake linings. DO NOT sand brake linings. DO NOT clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the following actions: Eye contact; rinse thoroughly with water. Skin contact; wash with soap and water. If ingested, consult a physician immediately.

NOTE: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

Disassembly (Front)

1. Replace all the components included in the repair kits used to service this brake caliper. Lubricate the rubber parts with NEW Delco Supreme 11(R) (GM P/N 12377967) or equivalent DOT-3 brake fluid to make assembly easier.
2. If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. The torque values specified are for dry, non-lubricated fasteners. Perform the service

operations on a clean bench, free from all mineral oil materials. Remove the brake caliper from vehicle. See **BRAKE CALIPER** under REMOVAL & INSTALLATION. Drain the brake fluid from the brake caliper.

3.

CAUTION: DO NOT place your fingers in front of the piston in order to catch or protect the piston while applying compressed air. This could result in serious injury.

NOTE: Use clean cloths to pad interior of caliper housing during piston removal. Use just enough air to ease the pistons out of the bores. If the pistons are blown out, even with the padding provided, it may be damaged.

Place a 1" (25 mm) block of wood between the caliper and the piston. Install a large C-clamp over the body of the brake caliper with the C-clamp ends against the rear of the caliper body and against the block of wood. Carefully remove the brake caliper piston by directing low pressure compressed air into the brake caliper inlet hole.

4. Remove the C-clamp from the caliper. Remove the block of wood from the caliper. Install clean cloths to pad the interior of the caliper housing between the remaining caliper piston and the caliper body. To cover the open caliper bore place a 1" (25 mm) block of wood between the caliper body and the brake caliper dust boot seal.

5. Install a large C-clamp over the body of the brake caliper with the C-clamp ends against the rear of the caliper body and against the block of wood. Carefully remove the brake caliper piston by directing low pressure compressed air into the brake caliper inlet hole. Remove the C-clamp from the caliper. Remove the block of wood from the caliper.

6.

CAUTION: Care must be used when removing the piston boot and seal from the caliper. Use a small plastic or wood tool for removal. DO NOT use a metal tool because it may damage the caliper bore or seal groove.

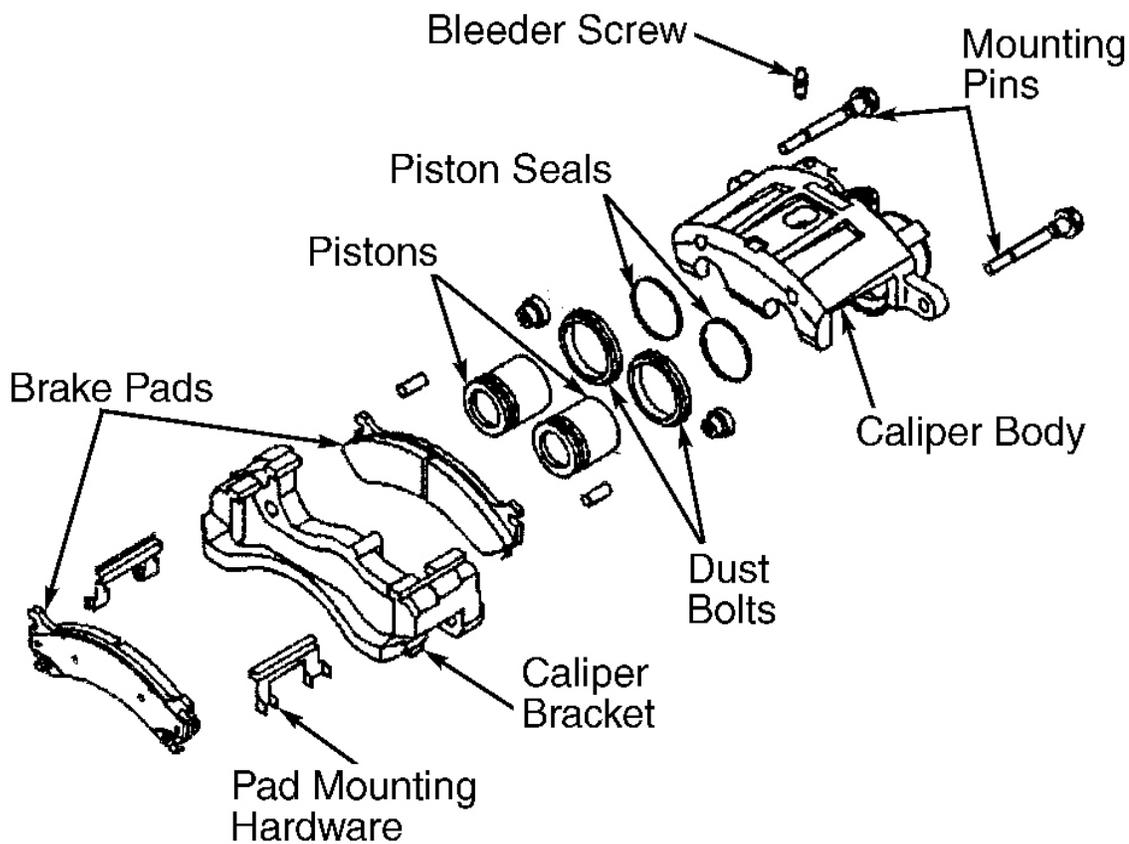
Remove the piston boots from the brake caliper. See **Fig. 58** . Remove the piston seals from the brake caliper. Remove the brake caliper bleeder valve and cap from the brake caliper.

7.

CAUTION: DO NOT use abrasives to clean the brake caliper piston. Clean the brake caliper piston bore, seal counterbore and the caliper piston with denatured alcohol, or equivalent.

Dry the caliper piston bores and counterbores, and the piston with non-lubricated, filtered air. Inspect all of the brake caliper parts as follows. Inspect piston for scoring, nicks, cracks, wear or corrosion.

8. Replace the pistons if any damage is found. Inspect caliper bore for scoring, nicks, cracks, wear, or corrosion. Use crocus cloth to polish out light corrosion. Otherwise, replace the caliper. DO NOT hone the caliper bore. Seal groove in the caliper bore for nicks or burrs. If found, replace the caliper.



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Fig. 58: Exploded View Of Dual Piston Caliper Assembly
 Courtesy of GENERAL MOTORS CORP.

Reassembly

1. Install the brake caliper bleeder valve and bleeder valve cap into the brake caliper. Lubricate the NEW piston seal with Delco Supreme 11(R), (GM P/N 12377967) or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
2. Install the lubricated, NEW piston seals into the caliper bores. Install the caliper piston into the caliper bore. Install the NEW piston dust boot seal over the piston.
3. Using the Brake Caliper Piston Boot Seal Installer (J-45515), fully seat the piston dust boot seal in the caliper. Install the brake caliper to the vehicle. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.

Disassembly (Rear)

CAUTION: DO NOT place your fingers in front of the piston in order to catch or protect the piston while applying compressed air. This could result in serious injury.

CAUTION: Avoid taking the following actions when you service wheel brake parts:

DO NOT grind brake linings. DO NOT sand brake linings. DO NOT clean wheel brake parts with a dry brush or with compressed air. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts. Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne.

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the following actions: Eye contact; rinse thoroughly with water. Skin contact; wash with soap and water. If ingested, consult a physician immediately.

1. Remove the brake caliper from the vehicle. See **BRAKE CALIPER** under REMOVAL & INSTALLATION. Place a thin piece of wood in front of the piston in order to prevent damage. Remove the piston by directing compressed air into the brake hose inlet fitting port of the brake caliper housing.
2. Remove the piston boot. Remove the piston seal. Remove the brake caliper bleed screw cap. Remove the brake caliper bleed screw. See **Fig. 58** . Inspect the brake caliper bore and the piston seal groove for scoring and corrosion. If you find excessive scoring or corrosion around the piston seal area, replace the brake caliper housing.
3. Inspect the brake caliper mounting bracket guide surfaces for corrosion and wear. Remove and replace the brake caliper mounting bracket if needed. Clean all the residue from the brake pad guiding surfaces on the brake caliper housing and the brake caliper mounting bracket.
4. Clean all the parts not included in the repair kit with denatured alcohol. Dry all the parts with filtered unlubricated compressed air. Blow out all passages in the brake caliper housing and the brake caliper bleeder valve.

Reassembly

1. Install the brake caliper bleed screw. Tighten the brake caliper bleed screw to specification. See **TORQUE SPECIFICATIONS** . Install the brake caliper bleed screw cap. Lubricate the NEW piston seal and the brake caliper bore seal groove with brake fluid, GM P/N 12388967.
2. Install NEW the seal into the brake caliper bore seal groove. Ensure that the seal is not twisted. Lubricate the brake caliper bore and the piston with brake fluid, GM P/N 12388967. See **Fig. 58** .
3. Install the boot and the piston. Install the boot over the end of the piston so that the fold will face toward the brake caliper housing piston bore opening. Seat the boot into the brake caliper bore groove. Slide the piston into the brake caliper bore. Push down the piston to the bottom of the brake caliper bore.
4. Ensure that the boot properly seats into the piston groove and into the groove in the brake caliper bore. Repeat previous step for the remaining piston. Install the brake caliper to the vehicle. See **BRAKE CALIPER** under REMOVAL & INSTALLATION.

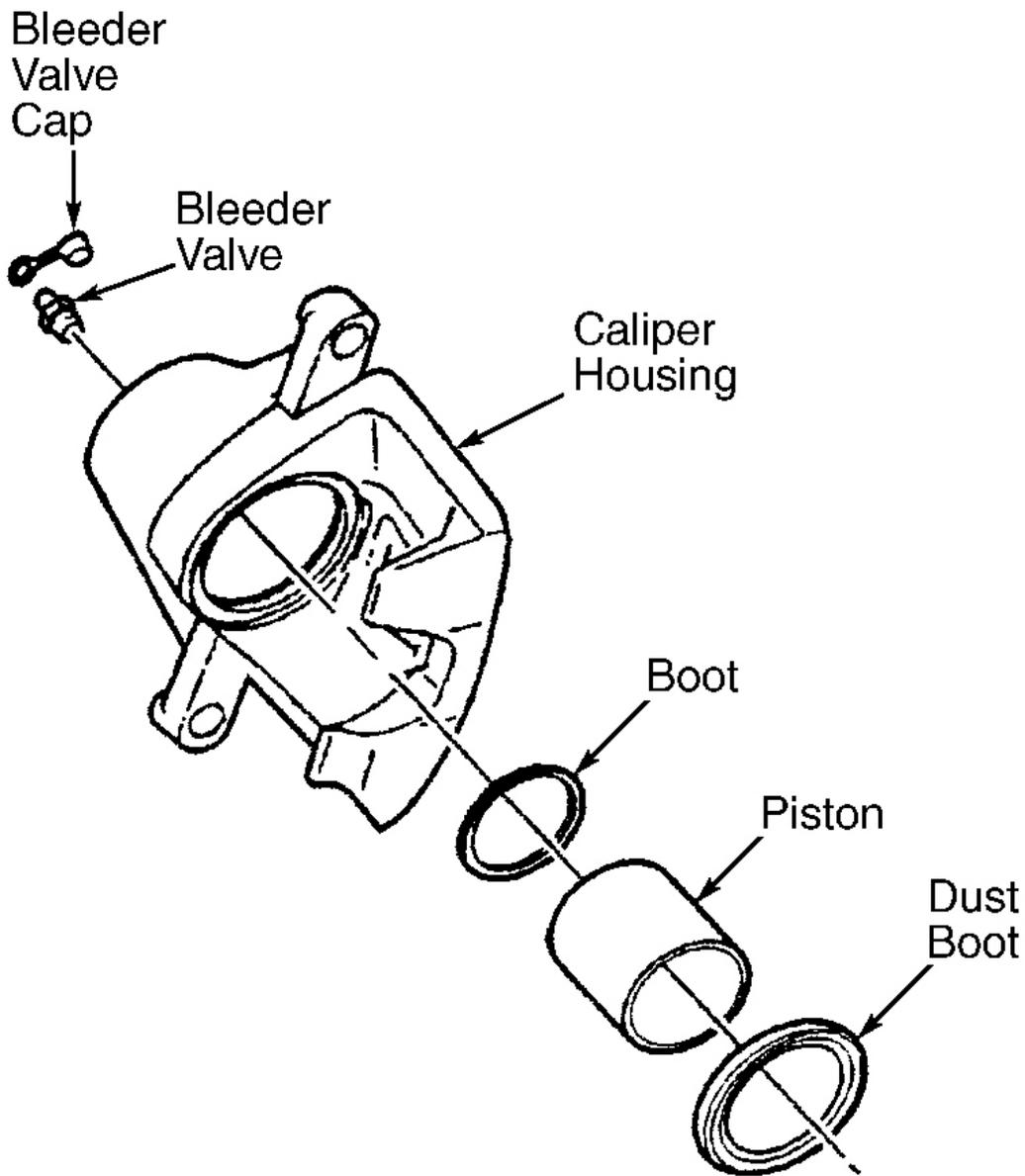
MASTER CYLINDER

Disassembly

1. Remove the brake master cylinder from the vehicle. See **MASTER CYLINDER** under REMOVAL & INSTALLATION. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible.
2. Clean the outside of the master cylinder reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Remove the reservoir cap and diaphragm from the reservoir. Inspect the reservoir cap and diaphragm for the following conditions. If any of these conditions are present, replace the affected components. Cuts or cracks, nicks or deformation.
3. Remove the master cylinder reservoir from the master cylinder. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION. Using a smooth, round-ended tool, depress the primary piston and remove the piston retainer. Remove the primary piston assembly from the cylinder bore.
4. Plug the cylinder inlet ports and the rear outlet port. Apply low pressure, non-lubricated, filtered air into the front outlet port, in order to remove the secondary piston with the primary and secondary seals, and the return spring. Discard the primary piston assembly, the piston retainer, and the seals and seal retainer from the secondary piston.

Reassembly

1. DO NOT use abrasives to clean the brake master cylinder bore. Clean the interior and exterior of the master cylinder, the secondary piston, and the return spring in denatured alcohol, or equivalent.
2. Inspect the master cylinder bore, inlet and outlet ports, the secondary piston, and the return spring for cracks, scoring, pitting, and/or corrosion. Replace the master cylinder if any of these conditions exist. Dry the master cylinder and the individual components with non-lubricated, filtered air.
3. Lubricate the master cylinder bore, the secondary piston, the return spring, and all of the individual overhaul components with Delco Supreme 11(R) (GM P/N 12377967) or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. Assemble the lubricated, NEW primary seal and retainer, and NEW secondary seal onto the secondary piston.
4. Install the lubricated return spring and secondary piston assembly into the cylinder bore. Install the lubricated, NEW primary piston assembly into the cylinder bore. Using a smooth, round-ended tool, depress the primary piston and install the NEW piston retainer.
5. Install the master cylinder reservoir to the master cylinder. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION. Install the reservoir cap and diaphragm to the reservoir. Install the master cylinder to the vehicle. See **MASTER CYLINDER** under REMOVAL & INSTALLATION.



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Fig. 59: Exploded View Of Single Piston Caliper Assembly
Courtesy of GENERAL MOTORS CORP.

DISC BRAKE SPECIFICATIONS

- For 2003 disc brake specifications, see **SERVICE SPECIFICATIONS** under DISC BRAKES in SPECIFICATIONS INDEX article in SPECIFICATIONS.

- For 2004 disc brake specifications, see **SERVICE SPECIFICATIONS** under DISC BRAKES in SPECIFICATIONS INDEX article in SPECIFICATIONS.

TORQUE SPECIFICATIONS

- For 2003 torque specifications, see **TORQUE SPECIFICATIONS** under DISC BRAKES in SPECIFICATIONS INDEX article in SPECIFICATIONS.
- For 2004 torque specifications, see **TORQUE SPECIFICATIONS** under DISC BRAKES in SPECIFICATIONS INDEX article in SPECIFICATIONS.

2004 BRAKES

Park Brake - Hummer H2

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Caliper Mounting Bracket to Axle Flange Nuts	135 N.m	100 lb ft
Cable Support Bracket Bolts	85 N.m	64 lb ft
Park Brake Cable Guide to Frame Bolt	12 N.m	106 lb in
Park Brake Cable to Rear Axle Clip Bolt	25 N.m	18 lb ft
Park Brake Cable to Shock Absorber Bracket Bolt	25 N.m	18 lb ft
Park Brake Lever Mounting Bolts	25 N.m	18 lb ft
Park Brake Warning Lamp Switch Bolt	3 N.m	25 lb in

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - PARK BRAKE

Begin the system diagnosis by reviewing the system description and operation. Reviewing the description and operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the description and operation information will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Park Brake** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - PARK BRAKE

IMPORTANT: Review the system operation in order to familiarize yourself with the system functions.

Refer to **Park Brake System Description and Operation** .

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the park brake system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

Park Brake Will Not Hold or Release

PARK BRAKE WILL NOT HOLD OR RELEASE

Park Brake Will Not Hold or Release

Step	Action	Yes	No
1	Were you sent here from the Park Brake Symptom table?	Go to Step 2	Go to Diagnostic Starting Point - Park Brake
2	Inspect the park brake system for proper operation. Refer to Park Brake System Diagnosis . Did you find and correct a condition?	Go to Step 5	Go to Step 3
3	Inspect the disc brake system for proper operation. Refer to Disc Brake System Diagnosis in Hydraulic Brakes. Did you find and correct a condition?	Go to Step 5	Go to Step 4
4	Inspect the hydraulic brake system for proper operation. Refer to Hydraulic Brake System Diagnosis in Hydraulic Brakes. Did you find and correct a condition?	Go to Step 5	Go to Diagnostic Starting Point - Park Brake
5	Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test in Hydraulic Brakes. Is the condition still present?	Go to Step 2	System OK

PARK BRAKE SYSTEM DIAGNOSIS

Park Brake System Diagnosis

Step	Action	Yes	No
DEFINITION: This diagnostic table is designed to diagnose ONLY the components of the PARK brake system in order to determine if the PARK brake system is operating properly. You will be directed by the appropriate Symptom Table to go to other brake system diagnostic tables as appropriate.			
1	Were you sent here from a Hydraulic Brake Symptom Table?	Go to Step 4	Go to Step 2
2	Were you sent here from a Park Brake Symptom Table?	Go to Step 4	Go to Step 3
3	Is the symptom related to the ability of the park brake system to hold and/or release?	Go to Diagnostic Starting Point - Park Brake	Go to Diagnostic Starting Point - Hydraulic Brakes in Hydraulic Brakes
4	<ol style="list-style-type: none"> 1. Raise and support the vehicle with the rear axle supported by jack stands. Refer to Lifting and Jacking the Vehicle in General Information. 2. Shift the transmission into NEUTRAL. 3. With the park brake RELEASED, attempt to rotate the rear wheels to check the rear brakes for 		

	a significant amount of drag.		
	Do the rear brakes have a significant amount of drag?	Go to Step 11	Go to Step 5
5	<ol style="list-style-type: none"> Shift the transmission into NEUTRAL. Apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. 		
	Do the rear brakes have a significant amount of drag?	Go to Step 6	Go to Step 7
6	<ol style="list-style-type: none"> Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction in the amount of drag. 		
	Did the rear brakes exhibit a significant reduction in the amount of drag?	Go to Step 22	Go to Step 11
7	<p>Visually check the park brake cable connections and the cables that are accessible on the UNDERSIDE of the vehicle for disconnections and/or damage.</p> <p>Were any of the park brake cables disconnected and/or damaged?</p>	Go to Step 8	Go to Step 9
8	<p>Reconnect or replace the park brake cables as necessary. Refer to the following procedures as necessary:</p> <ul style="list-style-type: none"> • <u>Park Brake Cable Replacement - Front</u> • <u>Park Brake Cable Replacement - Left Rear</u> • <u>Park Brake Cable Replacement - Right Rear</u> 		-
	Did you complete the repair and/or replacement?	Go to Step 9	
9	<p>Check the adjustment of the park brake. Refer to <u>Park Brake Adjustment</u>.</p> <p>Was the park brake adjusted properly?</p>	Go to Step 11	Go to Step 10
10	<p>Adjust the park brake. Refer to <u>Park Brake Adjustment</u>.</p> <p>Were you able to attain adjustment of the park brake?</p>	Go to Step 16	Go to Step 11
11	<p>NOTE:</p> <p>Do not depress the brake pedal with the brake rotors and/or the brake drums removed, or with the brake calipers repositioned away from the brake rotors, or damage to the brake system may result.</p> <ol style="list-style-type: none"> Remove the rear brake rotors. Refer to <u>Brake Rotor Replacement - Rear</u> in Disc Brakes. 		

	<ol style="list-style-type: none"> 2. Inspect the park brake shoe hardware for looseness, damaged, broken or missing components. 3. Check the park brake actuators for a seized condition. <p>Does the park brake hardware and/or the park brake actuators require replacement?</p>	Go to Step 12	Go to Step 13
12	<ol style="list-style-type: none"> 1. Replace park brake hardware components as necessary. Refer to <u>Park Brake Shoe Replacement</u> . 2. Replace the park brake actuators as necessary. Refer to <u>Park Brake Actuator Replacement</u> . <p>Did you complete the replacement?</p>	Go to Step 13	-
13	<p>Have an assistant apply and release the park brake, while you observe the park brake cables for free movement.</p> <p>Did the park brake cables move freely?</p>	Go to Step 14	Go to Step 17
14	<p>Check the adjustment of the park brake. Refer to <u>Park Brake Adjustment</u> .</p> <p>Was the park brake adjusted properly?</p>	Go to Step 16	Go to Step 15
15	<p>Adjust the park brake. Refer to <u>Park Brake Adjustment</u> .</p> <p>Were you able to attain adjustment of the park brake?</p>	Go to Step 16	Go to Step 25
16	<ol style="list-style-type: none"> 1. With the transmission still in NEUTRAL, apply the park brake. 2. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. 3. Release the park brake. 4. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. <p>Did the park brake apply and release properly?</p>	Go to Step 27	Return to Symptom Table
17	<p>Disconnect the park brake cable connections that are accessible on the UNDERSIDE of the vehicle one at a time and check each cable for free movement.</p> <p>Do any of the park brake cables accessible on the underside of the vehicle require replacement?</p>	Go to Step 18	Go to Step 19
	<p>Replace any of the park brake cables that do not have free movement and/or are not releasing properly. Refer to the following procedures as necessary:</p> <ul style="list-style-type: none"> • <u>Park Brake Cable Replacement - Front</u> 		

18	<ul style="list-style-type: none"> • <u>Park Brake Cable Replacement - Left Rear</u> • <u>Park Brake Cable Replacement - Right Rear</u> <p>Did you complete the replacement?</p>	Go to Step 19	-
19	<ol style="list-style-type: none"> 1. Disconnect the front park brake cable connection accessible INSIDE the vehicle at the park brake pedal assembly and check for free movement. 2. Replace the front park brake cable if it does not have free movement. Refer to <u>Park Brake Cable Replacement - Front</u> . <p>Did you find and correct a condition?</p>	Go to Step 25	Go to Step 20
20	<ol style="list-style-type: none"> 1. Disconnect the park brake release handle assembly cable connection from the park brake pedal assembly and check for free movement. 2. Replace the park brake release handle assembly if the release cable does not have free movement. Refer to <u>Park Brake Release Handle Assembly Replacement</u> . <p>Did you find and correct a condition?</p>	Go to Step 25	Go to Step 21
21	<p>Replace the park brake pedal assembly that is not releasing properly. Refer to <u>Park Brake Pedal Assembly Replacement</u> .</p> <p>Did you complete the replacement?</p>	Go to Step 25	-
22	<p>Check the adjustment of the park brake. Refer to <u>Park Brake Adjustment</u> .</p> <p>Is the park brake adjusted properly?</p>	Go to Step 27	Go to Step 23
23	<p>Adjust the park brake. Refer to <u>Park Brake Adjustment</u> .</p> <p>Were you able to attain adjustment of the park brake system?</p>	Go to Step 26	Go to Step 24
24	<ol style="list-style-type: none"> 1. Remove the rear brake rotors, if they have not yet been removed. Refer to <u>Brake Rotor Replacement - Rear</u> in Disc Brakes. 2. Check the park brake actuators for a seized condition. 3. Replace the park brake actuators as necessary. Refer to <u>Park Brake Actuator Replacement</u> . <p>Did you find and correct a condition?</p>	Go to Step 25	Return to Symptom Table
	Adjust the park brake. Refer to <u>Park Brake</u>		

25	Adjustment . Were you able to attain adjustment of the park brake system?	Go to Step 26	Return to Symptom Table
26	<ol style="list-style-type: none"> 1. With the transmission still in NEUTRAL, apply the park brake. 2. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. 3. Release the park brake. 4. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. <p>Did the park brake apply and release properly?</p>	Go to Step 27	Return to Symptom Table
27	Install or connect any components that were removed or disconnected during diagnosis. Did you complete the operation?	Park Brake System OK Return to Symptom Table	-

PARK BRAKE SHOE INSPECTION

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
 2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
 3. Remove the rear brake caliper bracket with the rear brake caliper. Refer to **Brake Caliper Bracket Replacement - Rear** in Disc Brakes.
 4. Remove the rear brake rotor. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
- or
5. Inspect and replace the park brake shoe and lining if any of the following conditions are found:
 - Excessive wear indicated by the park brake lining being worn down to the shoe
 - Brake lining cracking
 - Oil or fluid contamination of the brake lining
 6. Adjust the park brake shoe. Refer to **Park Brake Adjustment** in Park Brake.
 7. Install the rear brake rotor. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
 8. Install the rear brake caliper with the rear brake caliper bracket. Refer to **Brake Caliper Bracket Replacement - Rear** in Disc Brakes.
 9. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
 10. Lower the vehicle.

REPAIR INSTRUCTIONS

PARK BRAKE SHOE REPLACEMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

Removal Procedure

1. Disable the park brake cable automatic adjuster. Refer to Disabling the Park Brake Cable Automatic Adjuster.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
3. Remove the tire and the wheel. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
4. Remove the caliper and mounting bracket as an assembly. Refer to Brake Pads Replacement - Rear in Disc Brakes.
5. Remove the rotor. Refer to Brake Rotor Replacement - Rear in Disc Brakes.

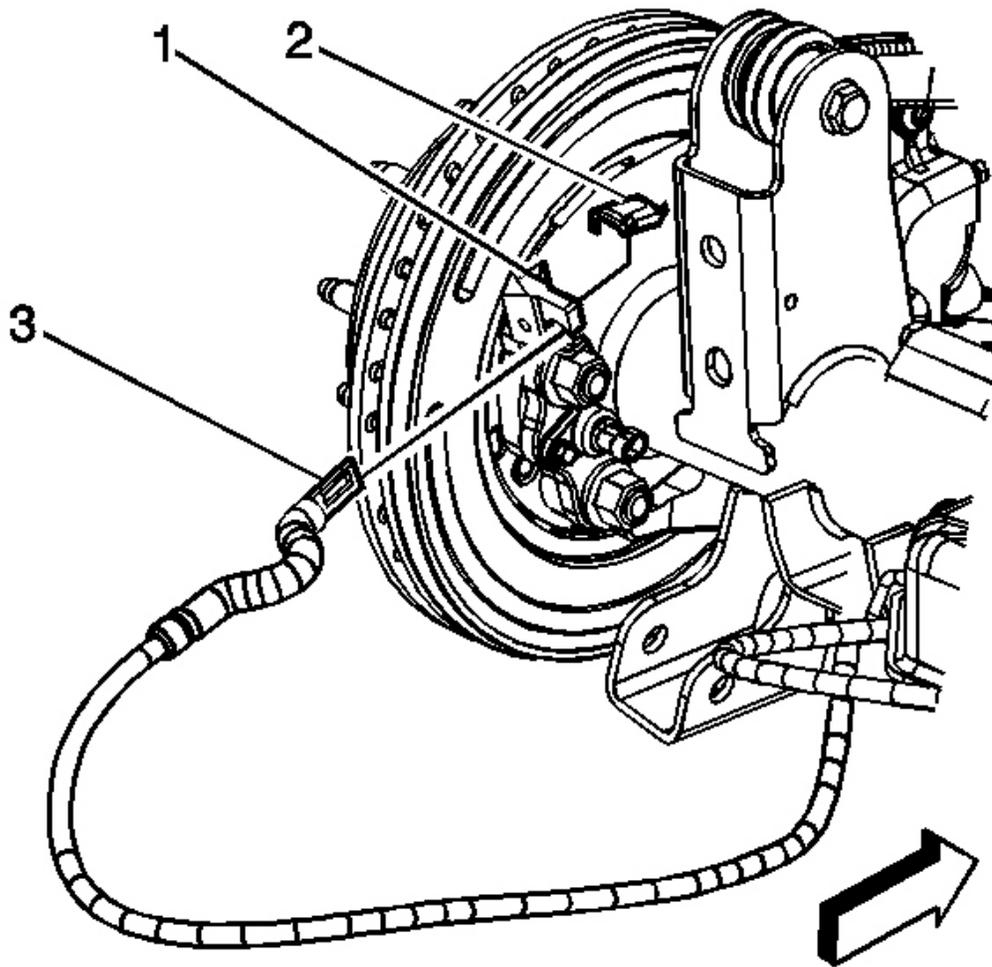


Fig. 1: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

6. Remove the cable (3) from the backing plate (1) by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate.
7. Remove the cable (3) from the lever (2).
8. Remove the axle shaft. Refer to **Rear Axle Shaft Replacement** in Rear Drive Axle.

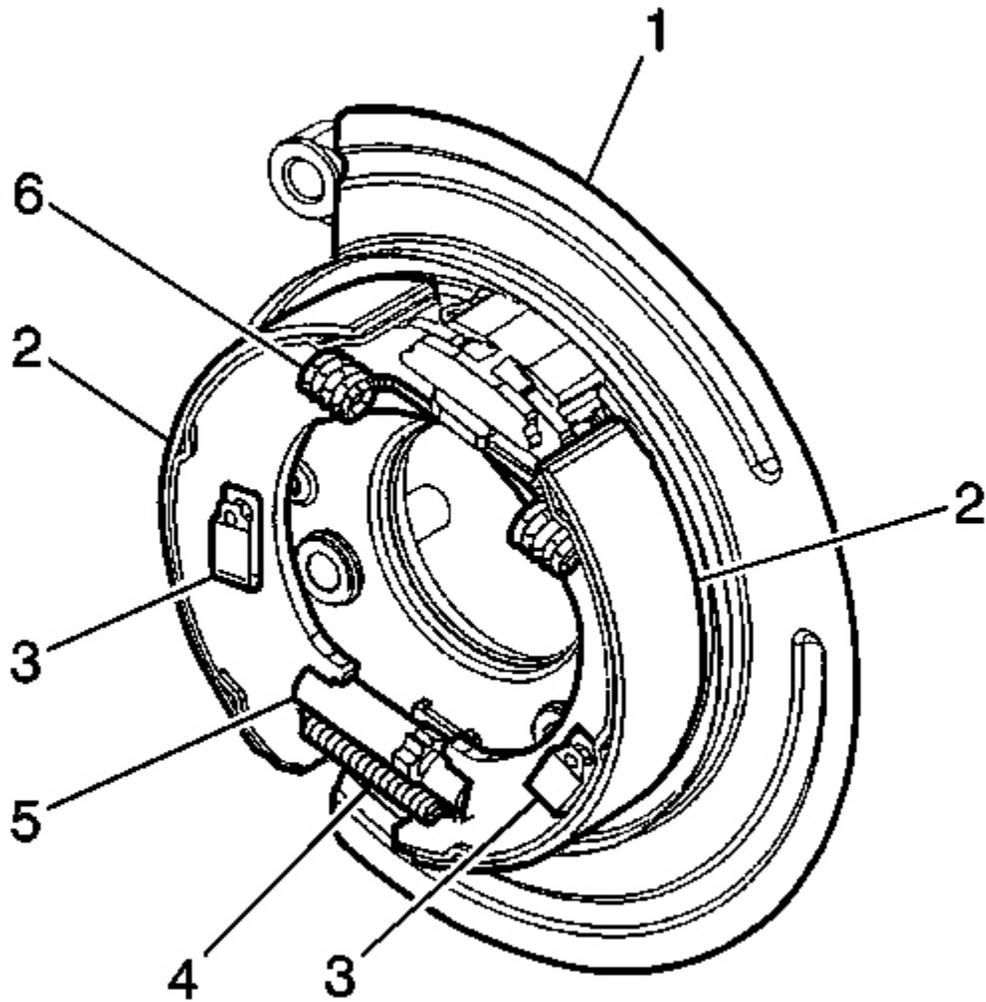


Fig. 2: Park Brake Shoe Return Springs
Courtesy of GENERAL MOTORS CORP.

9. Remove the park brake shoe return springs (4, 6).

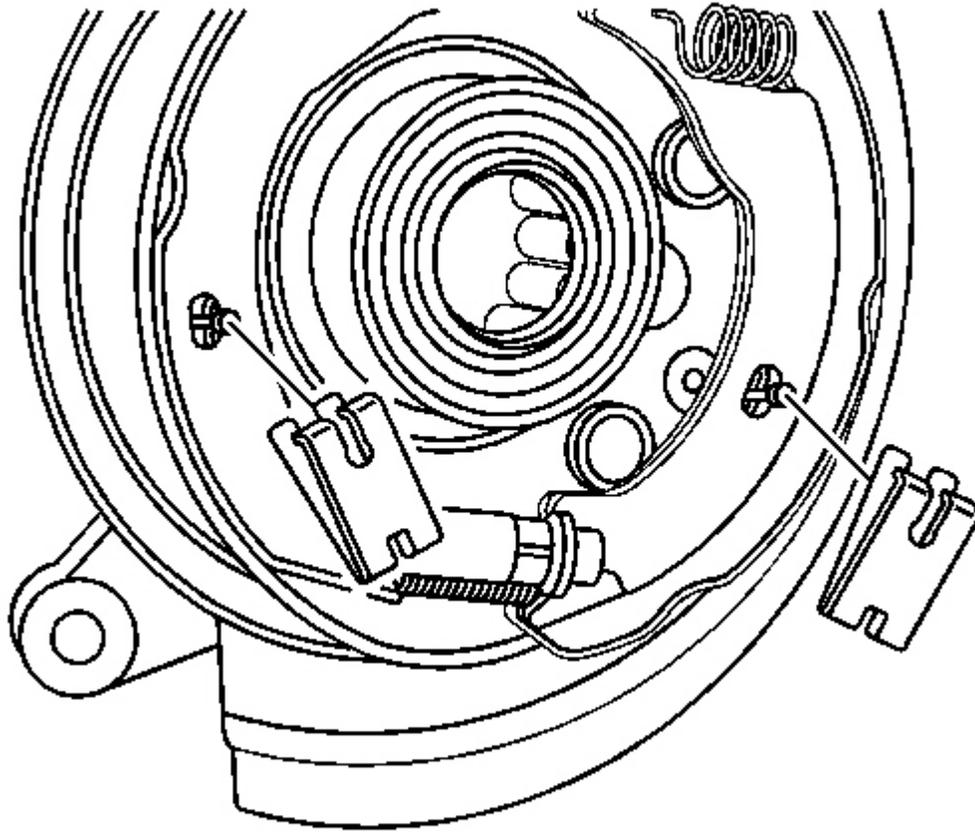


Fig. 3: Park Brake Shoes
Courtesy of GENERAL MOTORS CORP.

10. Remove the park brake shoe anchor springs and pins.
11. Remove the park brake shoes.

Installation Procedure

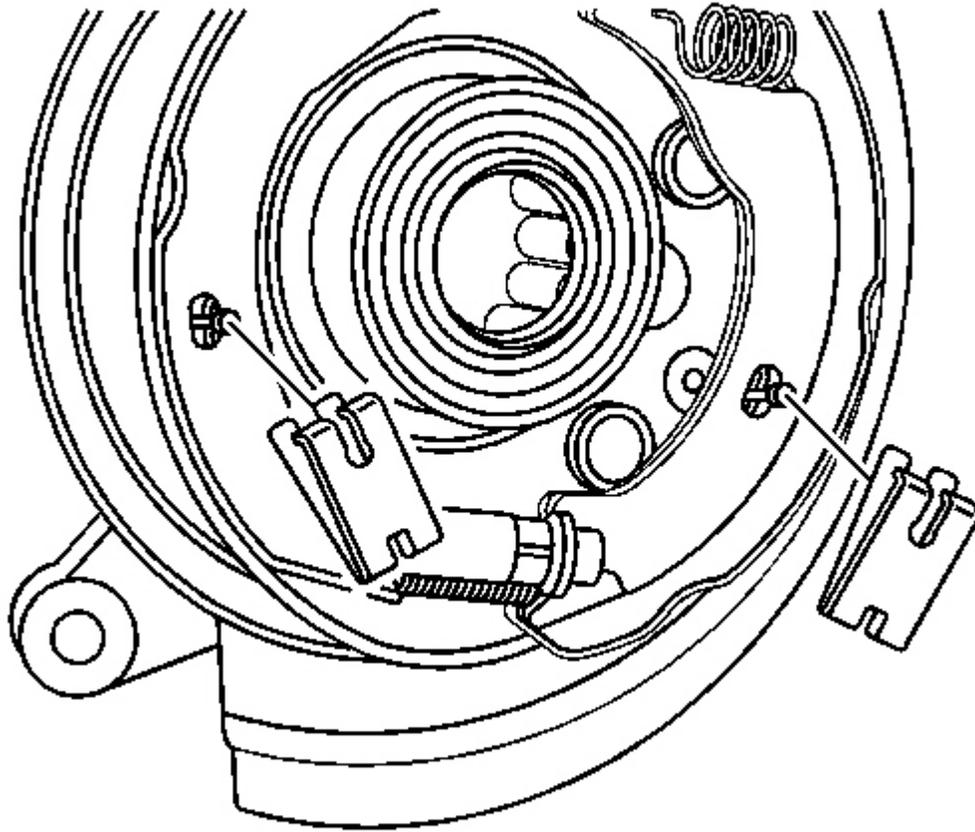


Fig. 4: Park Brake Shoes
Courtesy of GENERAL MOTORS CORP.

1. Clean the debris and the dust from the park brake components using a clean towel.
2. Install the park brake shoes.
3. Install the park brake shoe anchor springs and pins.

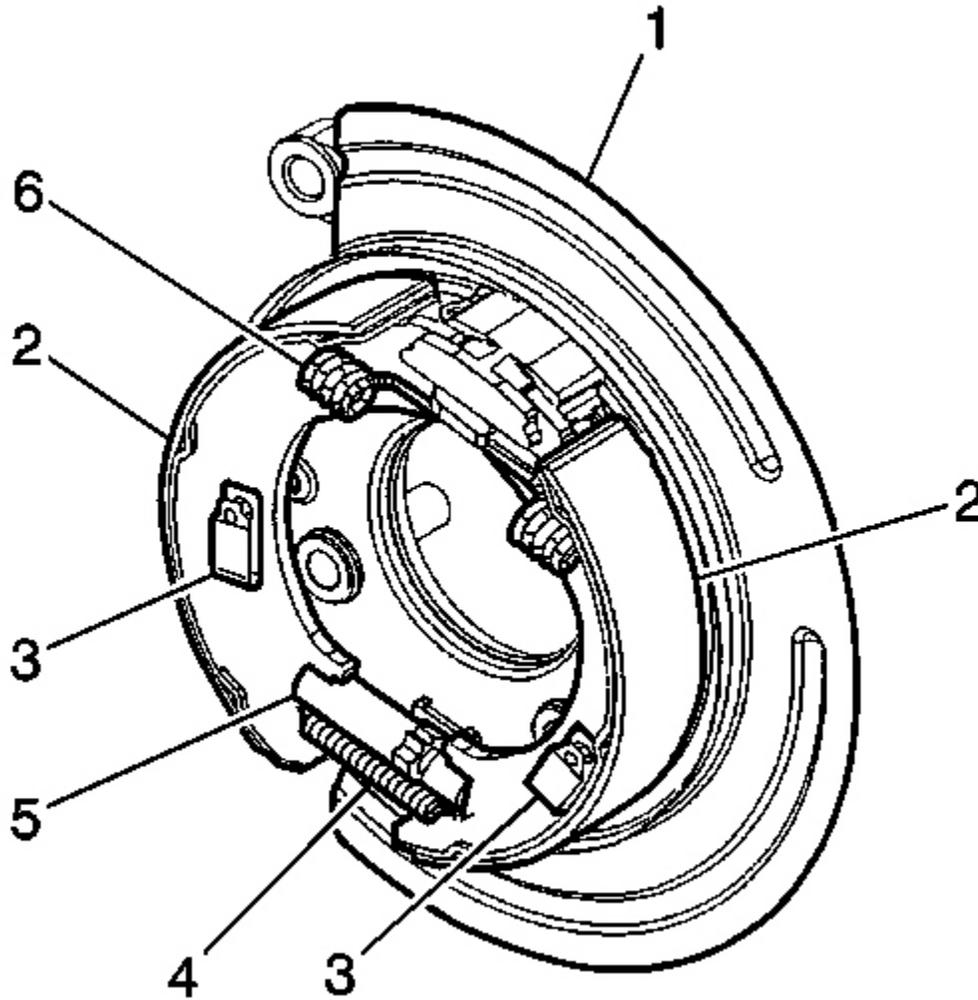


Fig. 5: Park Brake Shoe Return Springs
Courtesy of GENERAL MOTORS CORP.

4. Install the park brake shoe return springs (4, 6).
5. Adjust the park brake shoe. Refer to **Park Brake Adjustment** .
6. Install the axle shaft. Refer to **Rear Axle Shaft Replacement** in Rear Drive Axle.
7. Install the rotor. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.

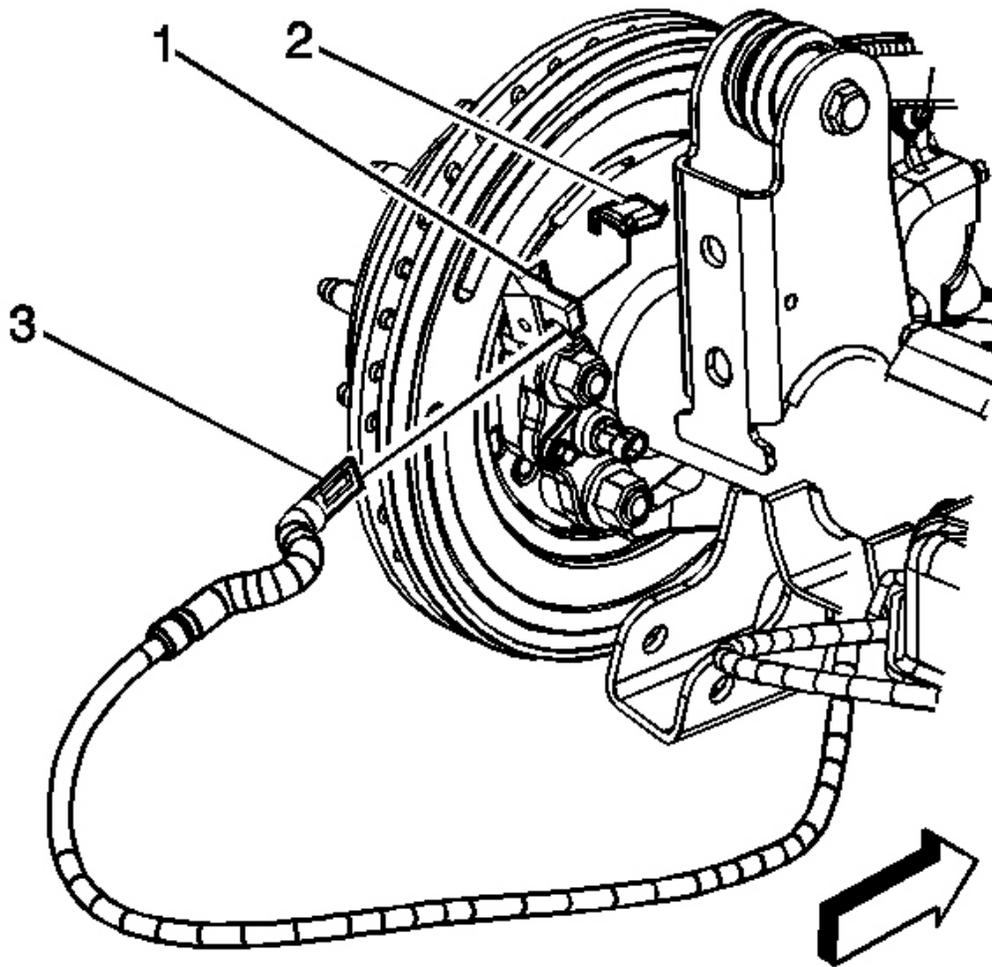


Fig. 6: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

8. Install the cable (3) to the lever (2).
9. install the cable (3) to the backing plate (1) by compressing the spring, routing the cable through the slot in the backing plate and pressing the cable into the backing plate until the locking tabs snap into place.
10. Install the caliper and mounting bracket as an assembly. Refer to **Brake Pads Replacement - Rear** in Disc Brakes.
11. Install the tire and wheel. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
12. Remove the safety stands.
13. Lower the vehicle.

14. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** .

PARK BRAKE RELEASE HANDLE ASSEMBLY REPLACEMENT

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.

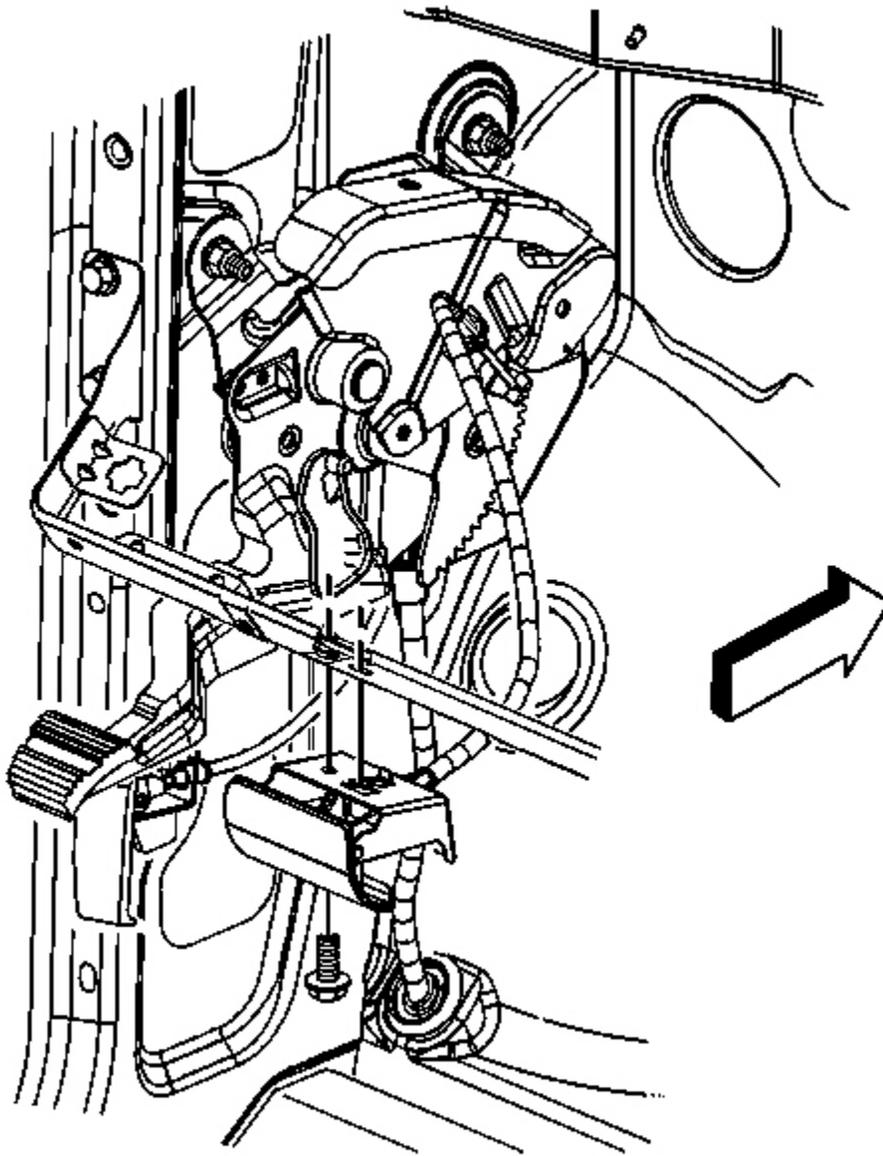


Fig. 7: Park Brake Release Lever Handle & Bolt
Courtesy of GENERAL MOTORS CORP.

2. Remove the park brake release lever mounting bolt.
3. Remove the park brake release lever handle from the knee bolster.
4. Remove the MID-Bussed Electrical Center from the bracket.

5. Remove the park brake release cable housing from the pedal assembly.
6. Remove the park brake release cable from the pedal assembly.
7. Note the routing of the cable as you remove the park brake release handle assembly from the vehicle.

Installation Procedure

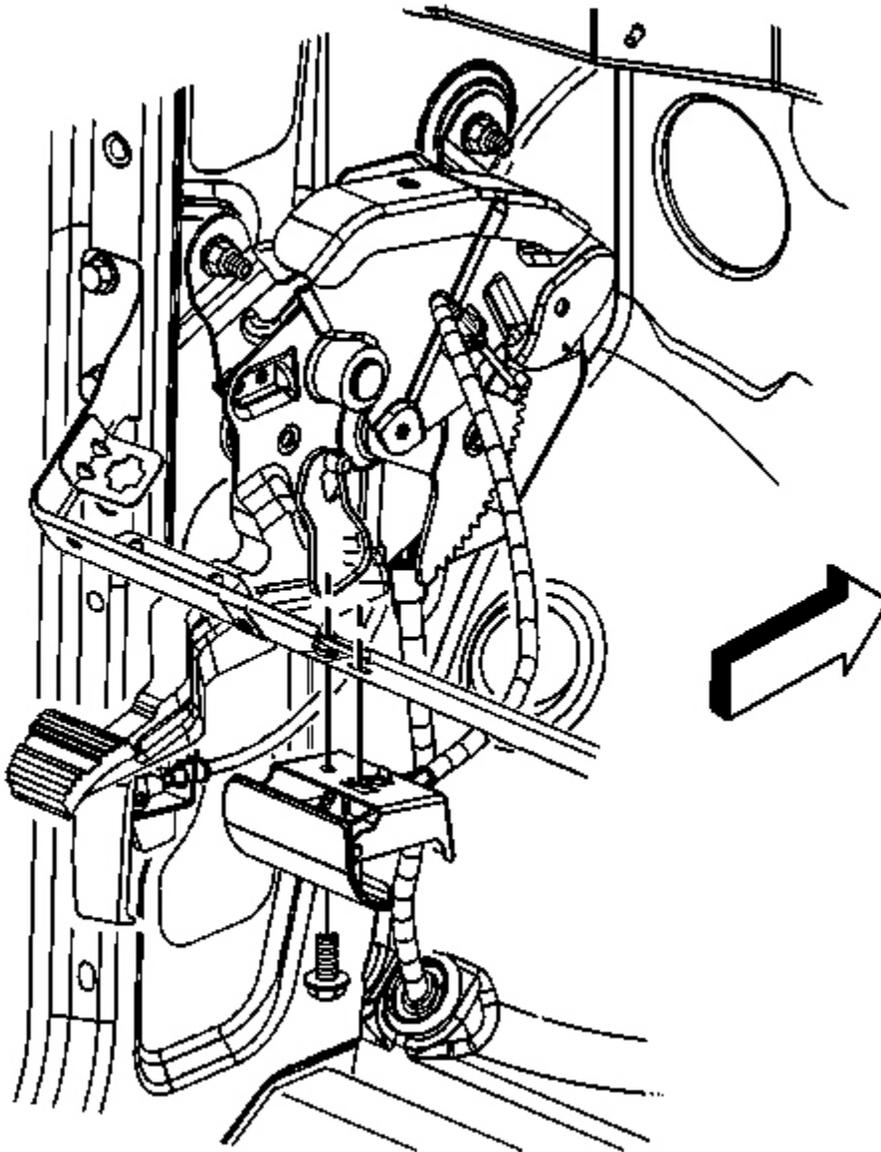


Fig. 8: Park Brake Release Lever Handle & Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the park brake release handle assembly to the vehicle. Install the cable using the same routing as the original cable.
2. Install the park brake release cable to the pedal assembly.
3. Install the park brake release cable housing to the pedal assembly.
4. Install the MID-Bussed Electrical Center to the bracket.
5. Install the park brake release lever handle to the knee bolster.

NOTE: Refer to Fastener Notice in Cautions and Notices.

6. Install the park brake release lever mounting bolt.

Tighten: Tighten the bolt to 25 N.m (18 lb ft).

7. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.

PARK BRAKE PEDAL ASSEMBLY REPLACEMENT

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.
2. Disable the park brake cable automatic adjuster. Refer to **Disabling the Park Brake Cable Automatic Adjuster**.
3. Remove the left side hinge pillar panel. Refer to **Trim Replacement - Hinge Pillar** in Interior Trim.
4. Remove the MID-Bussed Electrical Center from the bracket.

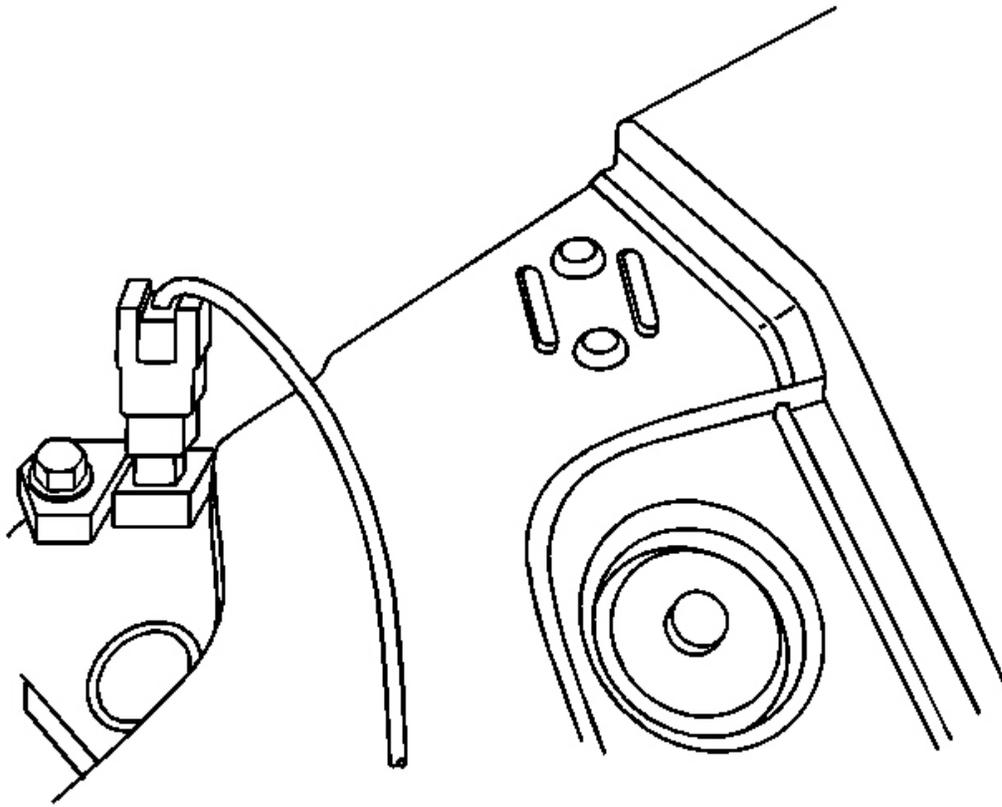


Fig. 9: Park Brake Warning Lamp Connection
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the park brake warning lamp connection.

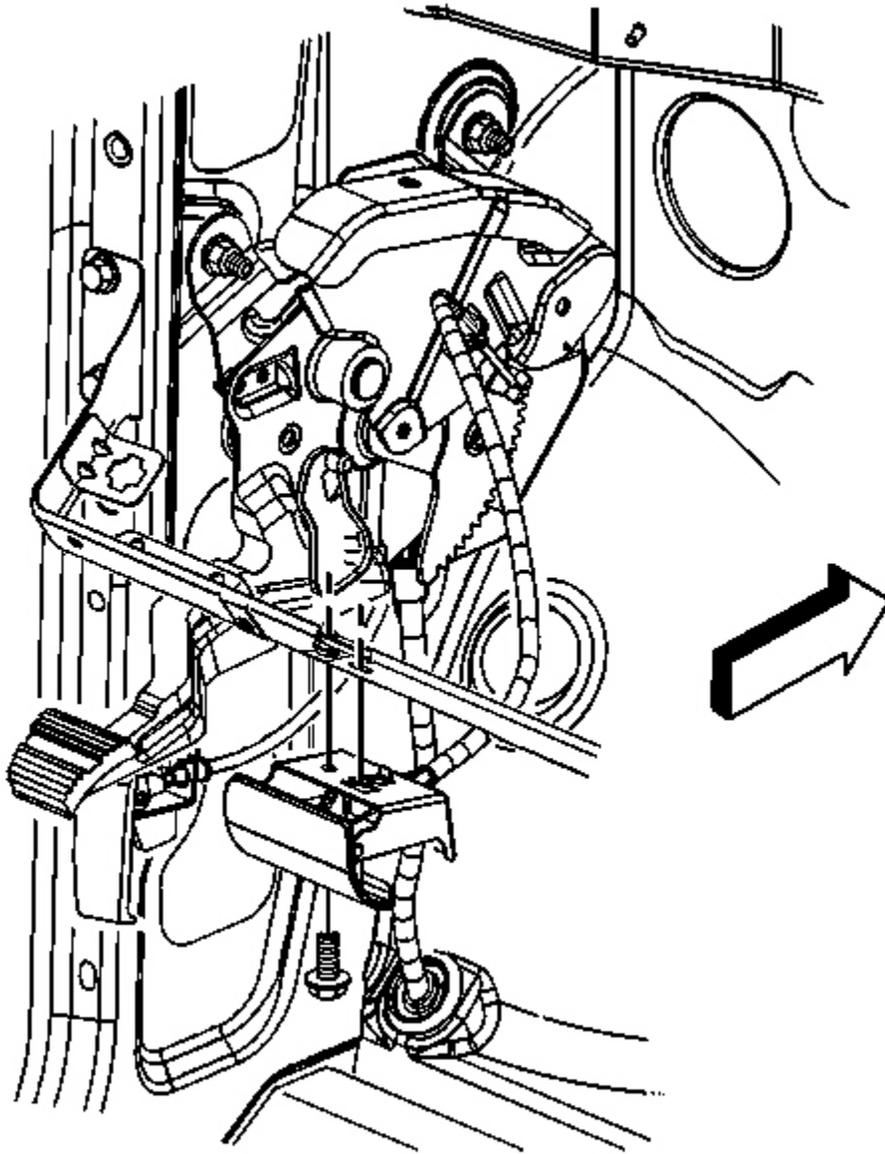


Fig. 10: Park Brake Release Lever Handle & Bolt
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the park brake release cable from the park brake lever.

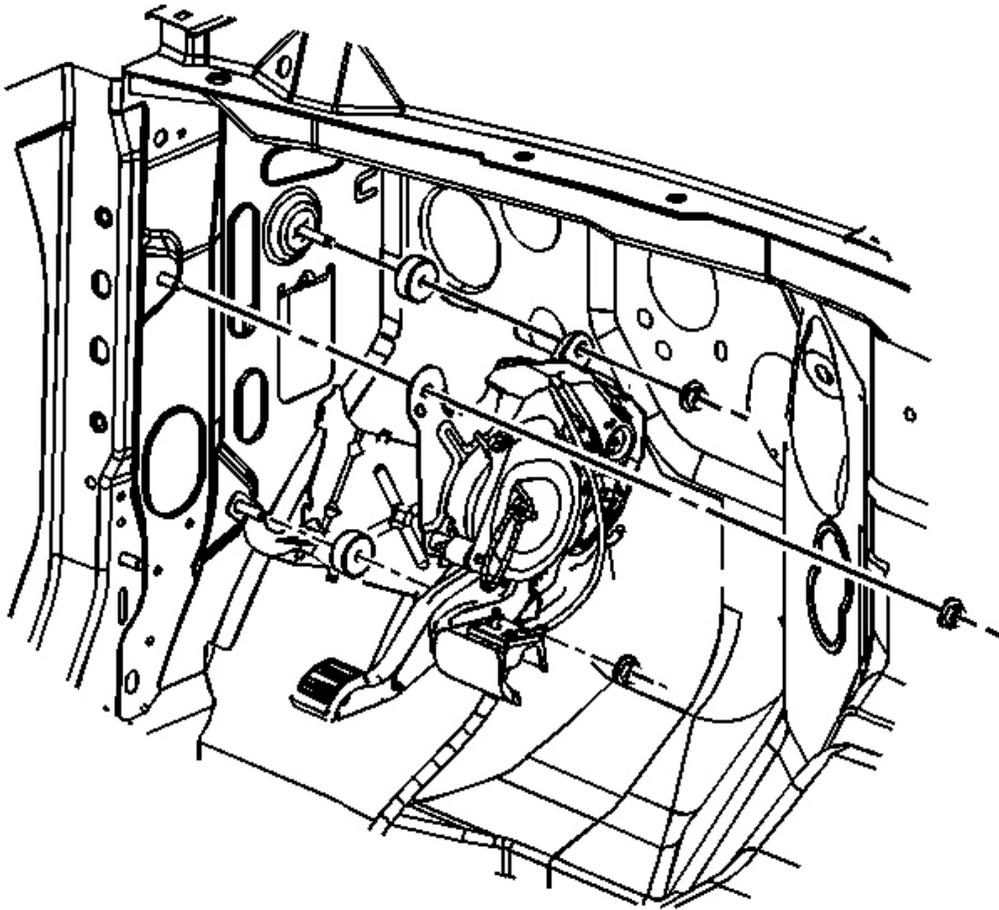


Fig. 11: Park Brake Lever Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

7. Remove the park brake lever mounting nuts.

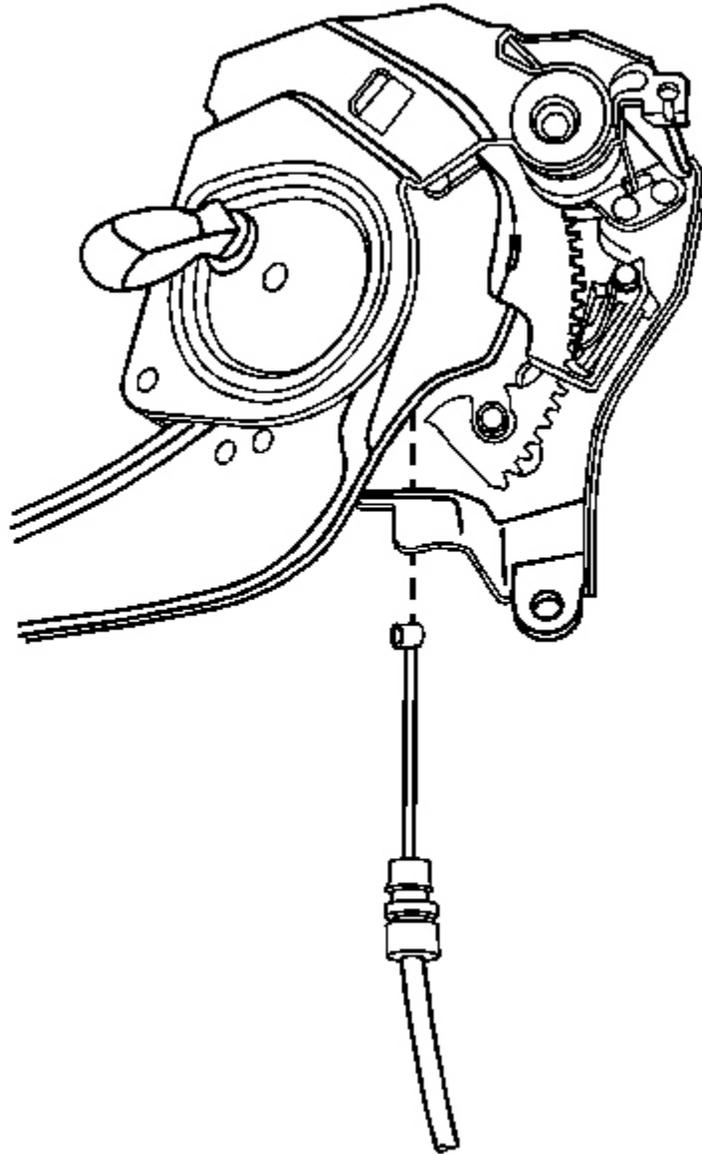


Fig. 12: Front Park Brake Cable & Park Brake Lever
Courtesy of GENERAL MOTORS CORP.

8. Disconnect the front park brake cable from the park brake lever.
9. Remove the park brake lever.

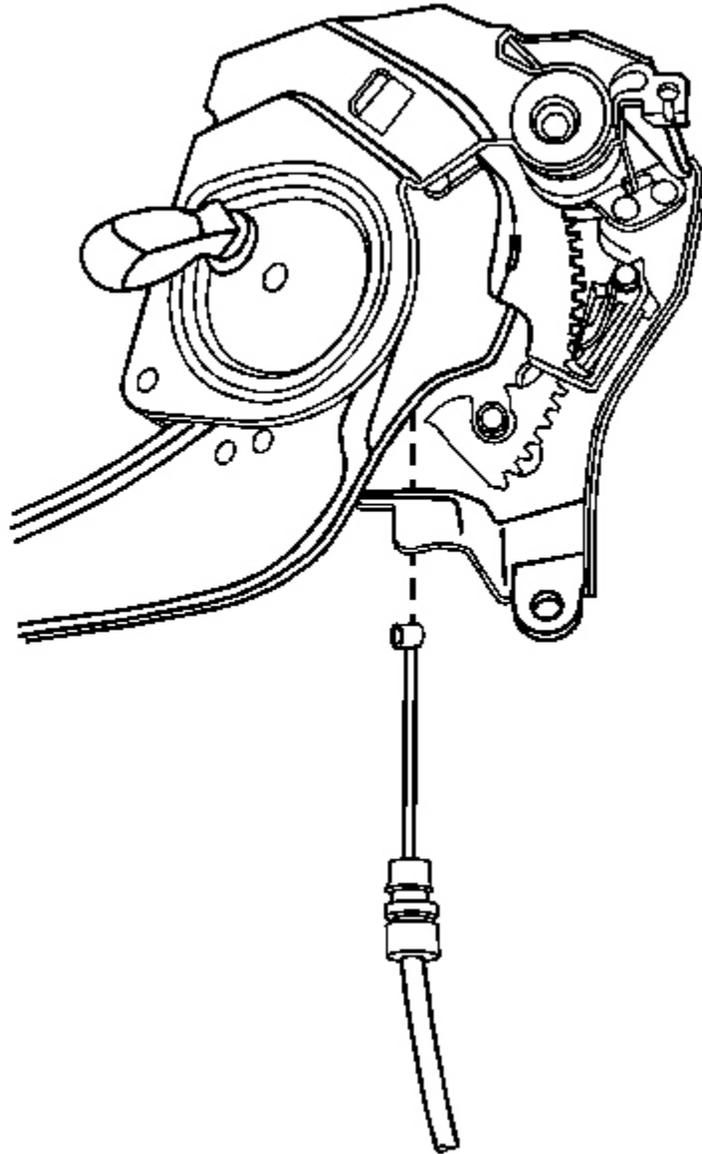


Fig. 13: Front Park Brake Cable & Park Brake Lever
Courtesy of GENERAL MOTORS CORP.

1. Connect the front park brake cable to the park brake lever.

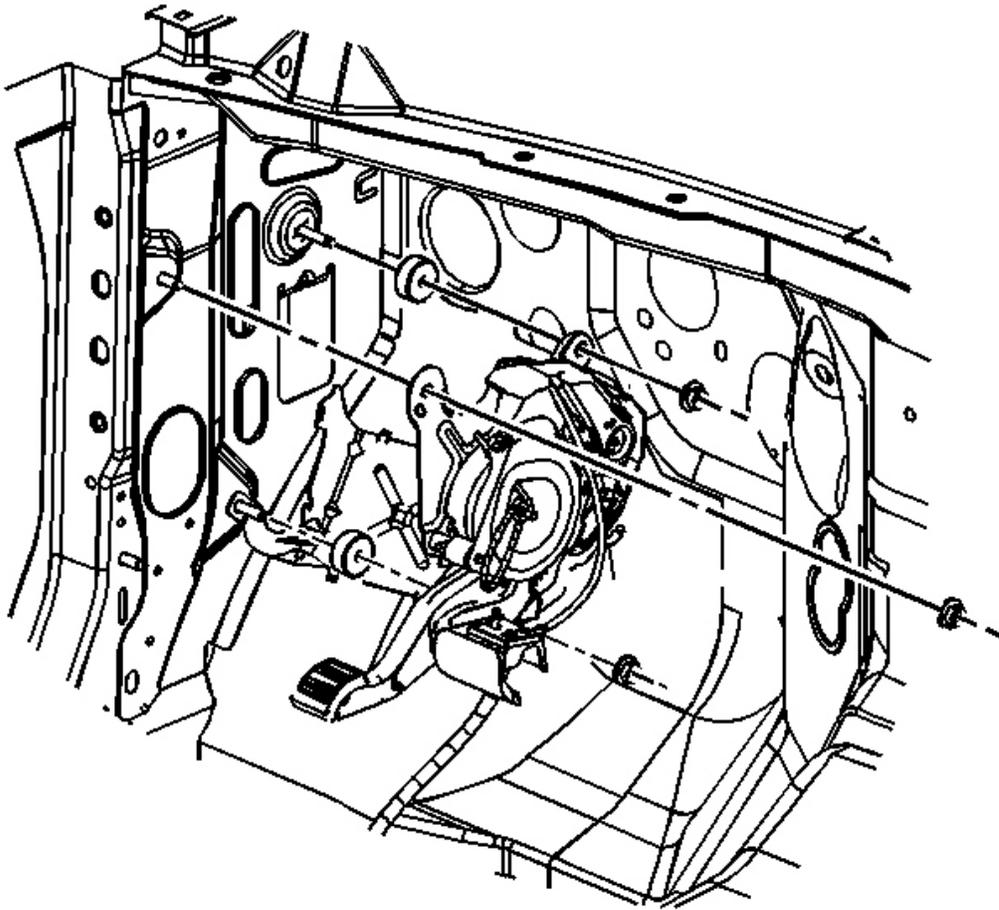


Fig. 14: Park Brake Lever Mounting Nuts
Courtesy of GENERAL MOTORS CORP.

2. Install the park brake lever.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the park brake lever mounting nuts.

Tighten: Tighten the nuts to 25 N.m (18 lb ft).

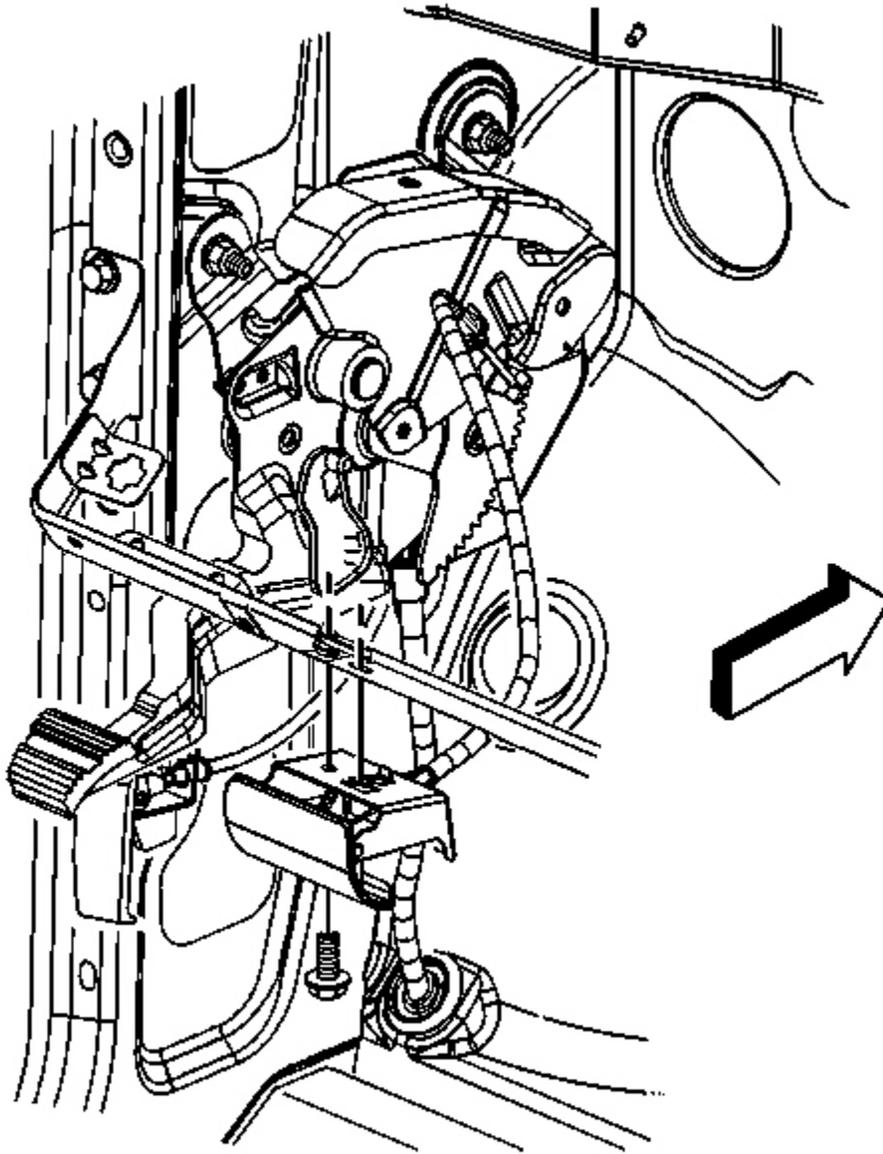


Fig. 15: Park Brake Release Lever Handle & Bolt
Courtesy of GENERAL MOTORS CORP.

4. Connect the park brake release cable to the park brake lever.

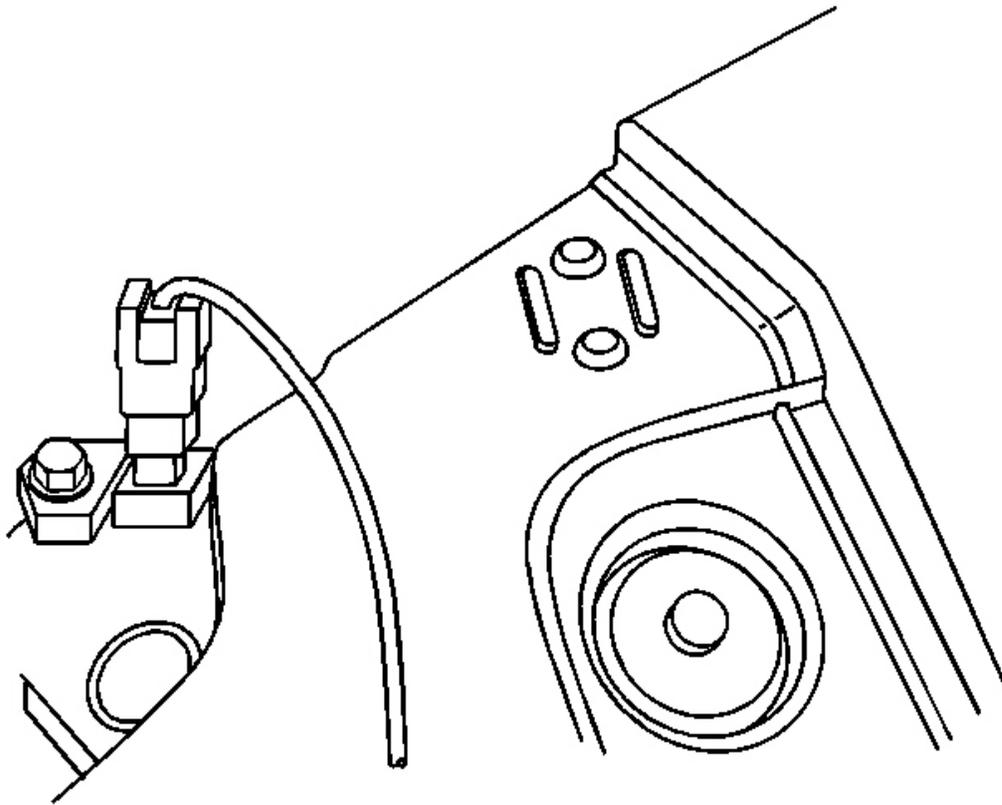


Fig. 16: Park Brake Warning Lamp Connection
Courtesy of GENERAL MOTORS CORP.

5. Connect the park brake warning lamp connector.
6. Install the MID-Bussed Electrical Center bracket.
7. Install the left side hinge pillar panel. Refer to **Trim Replacement - Hinge Pillar** in Interior Trim.
8. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.
9. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** .

PARK BRAKE WARNING LAMP SWITCH REPLACEMENT

Removal Procedure

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.
2. Remove the MID-Bussed Electrical Center from the bracket.

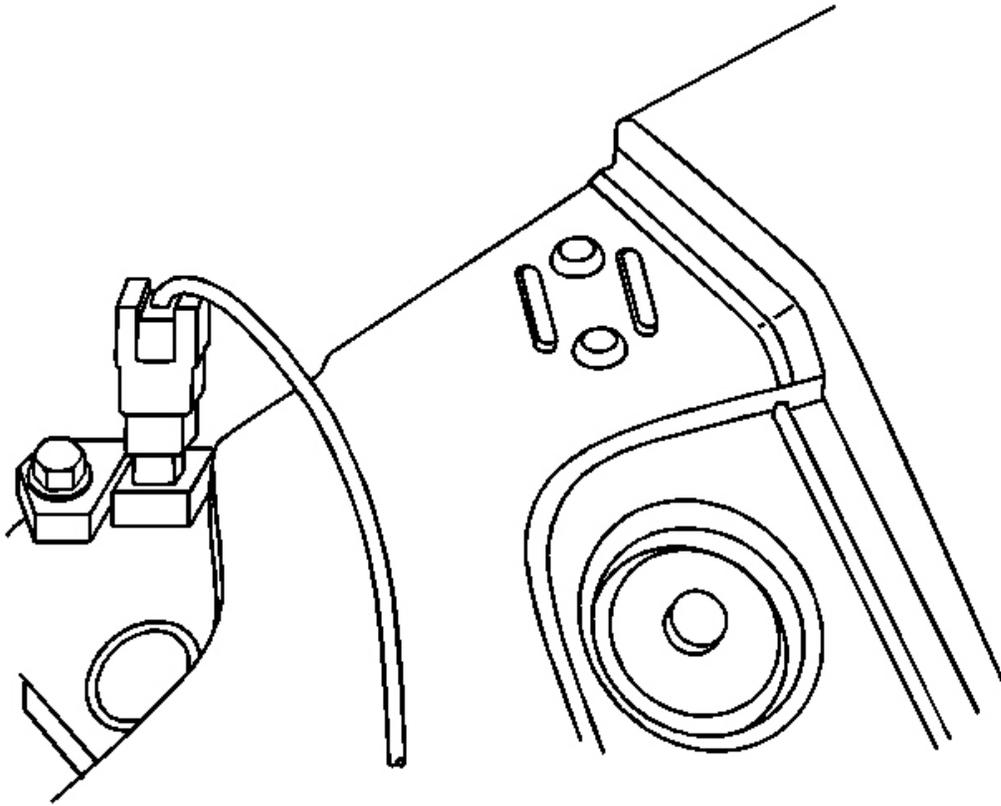


Fig. 17: Park Brake Warning Lamp Connection
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the park brake warning lamp switch connector.

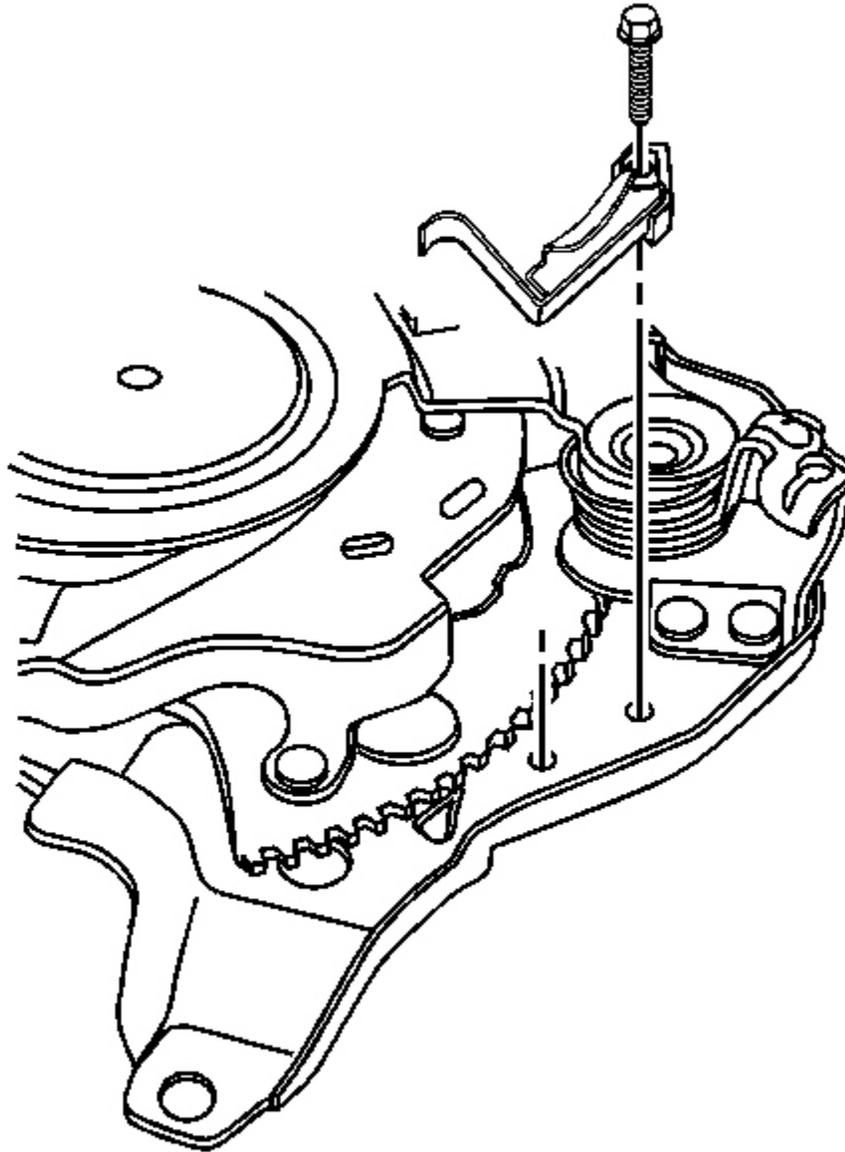


Fig. 18: Park Brake Warning Lamp Switch
Courtesy of GENERAL MOTORS CORP.

4. Remove the park brake warning lamp switch mounting bolt.
5. Remove the park brake warning lamp switch.

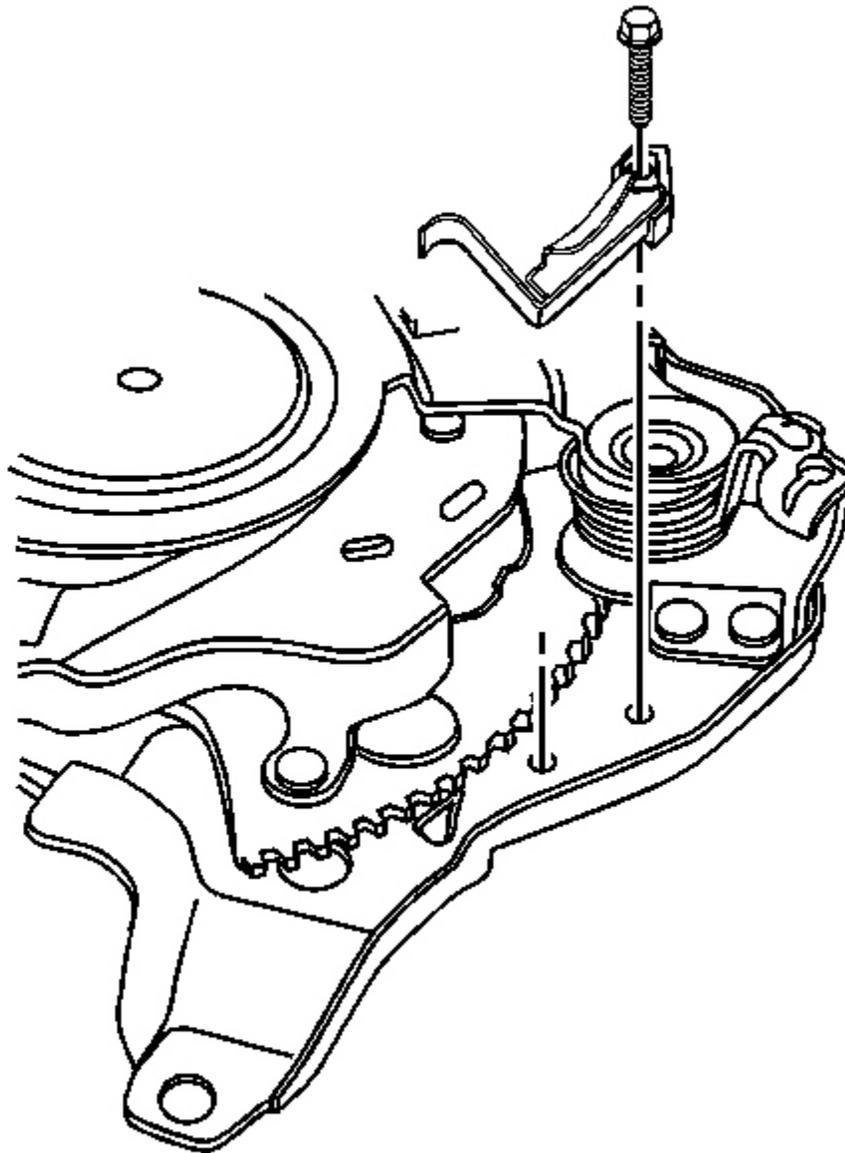


Fig. 19: Park Brake Warning Lamp Switch
Courtesy of GENERAL MOTORS CORP.

1. Install the park brake warning lamp switch.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the park brake warning lamp switch mounting bolt.

Tighten: Tighten the bolt to 3 N.m (25 lb in).

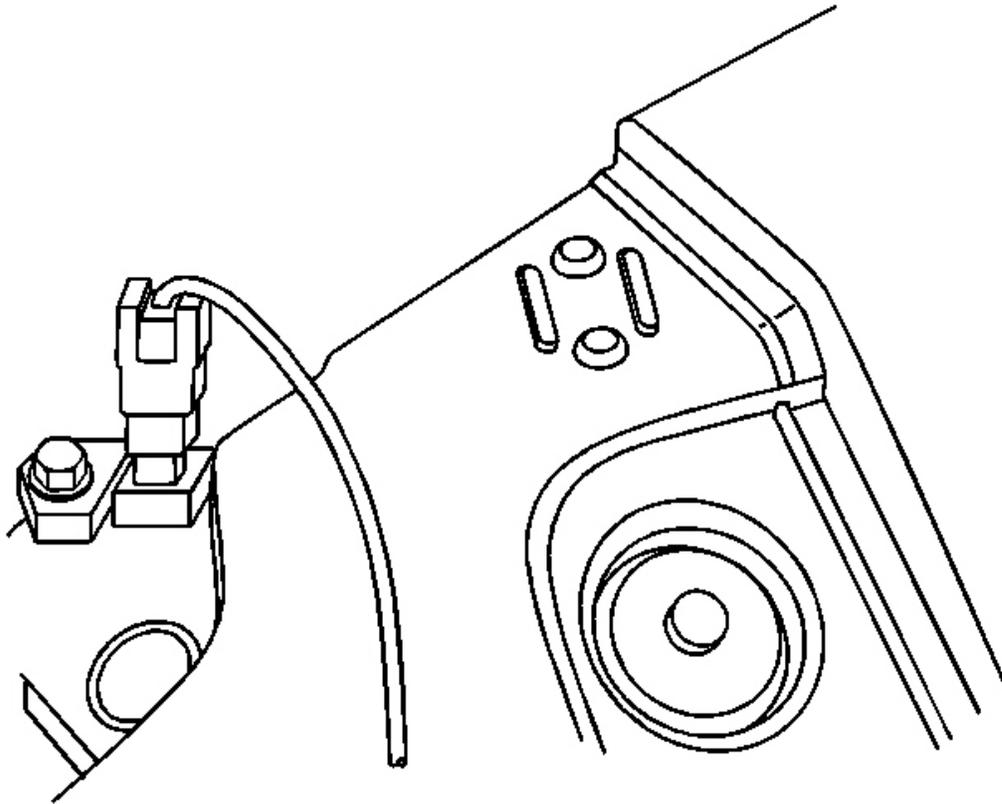


Fig. 20: Park Brake Warning Lamp Connection
Courtesy of GENERAL MOTORS CORP.

3. Connect the park brake warning lamp switch connector.
4. Install the MID-Bussed Electrical Center bracket.
5. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnect/Connect Procedure (Single Battery)** in Engine Electrical.

PARK BRAKE CABLE REPLACEMENT - FRONT

Removal Procedure

1. Disable the park brake cable automatic adjuster. Refer to **Disabling the Park Brake Cable Automatic Adjuster** In Park Brake.
2. Remove the park brake pedal. Refer to **Park Brake Pedal Assembly Replacement** .

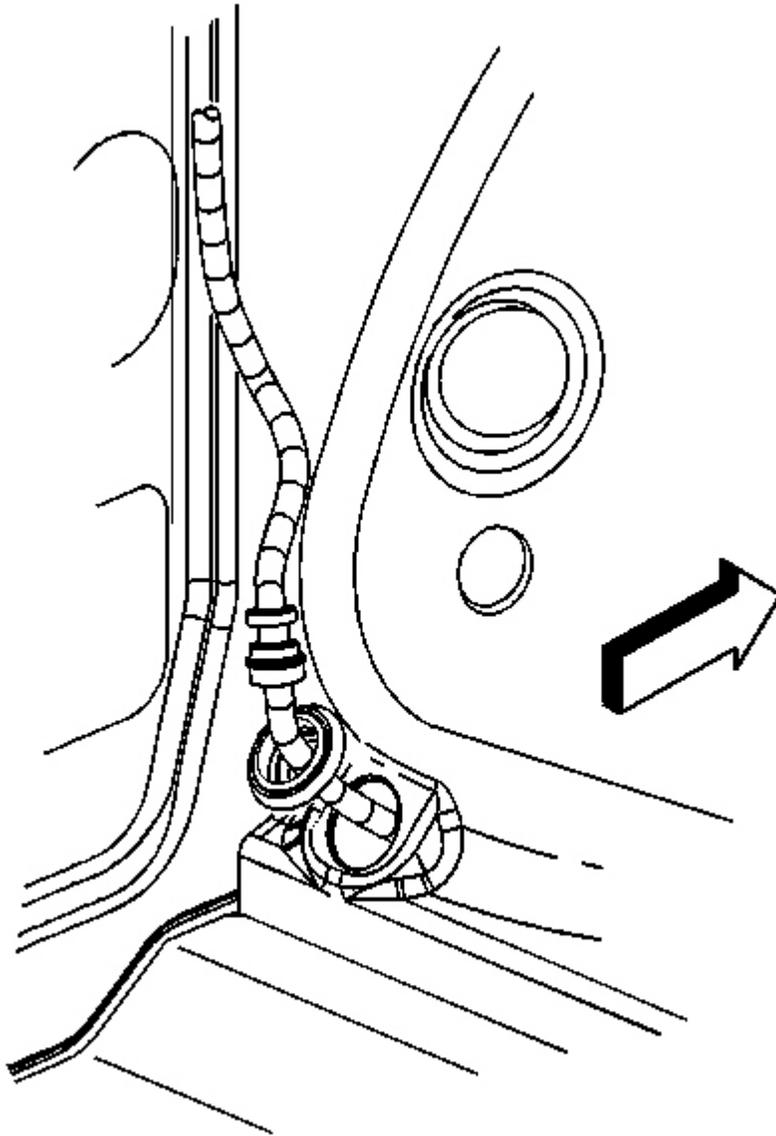


Fig. 21: Access Cable Grommet
Courtesy of GENERAL MOTORS CORP.

3. Roll the carpet back to access cable grommet.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

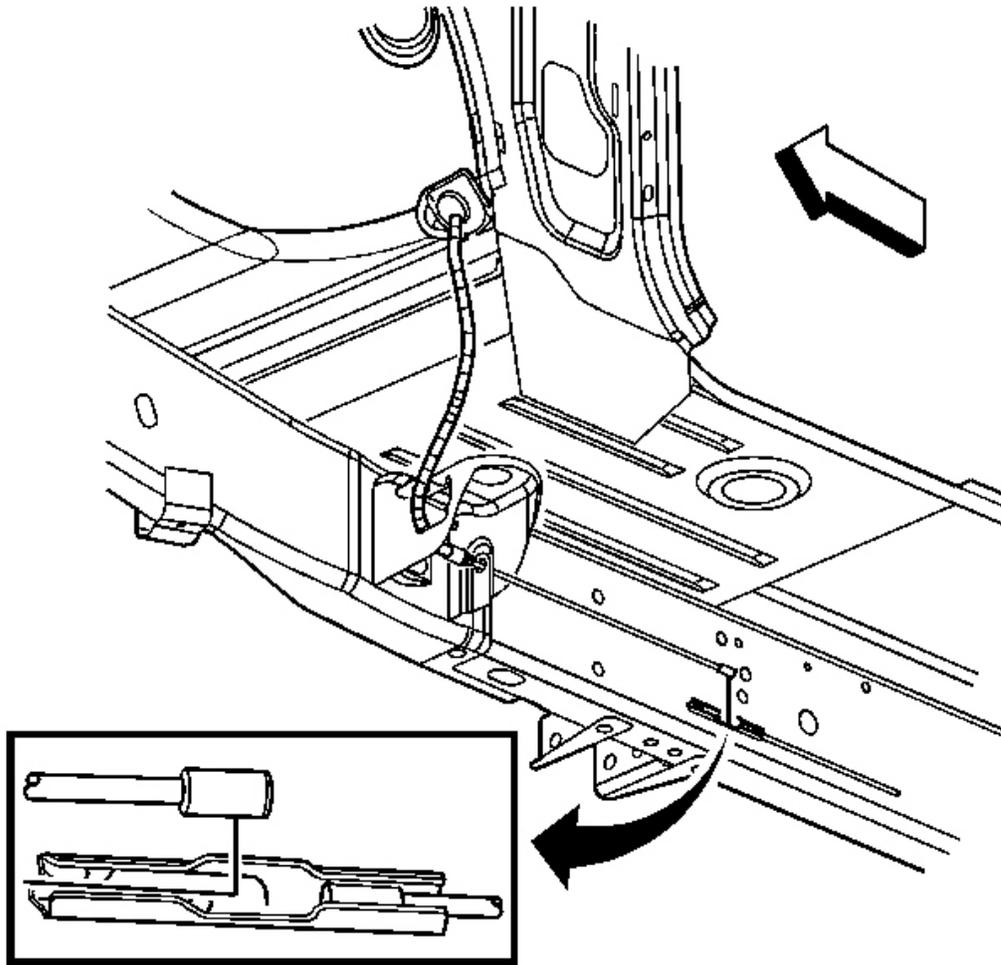


Fig. 22: Front/Intermediate Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

5. Disengage the grommet and the cable from the floor pan.
6. Disconnect the front cable from the rear cable.
7. Remove the cable from the body mount by depressing the retaining tabs.
8. Remove the cable.

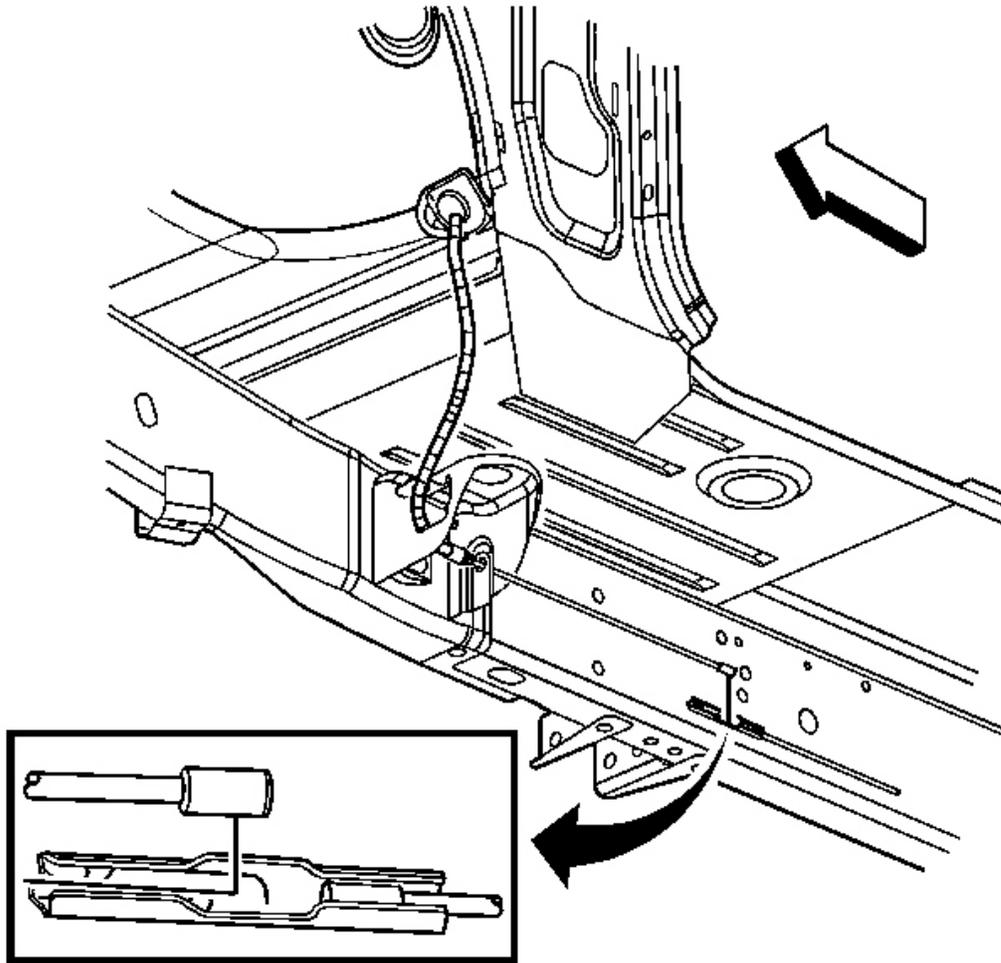


Fig. 23: Front/Intermediate Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the cable.
2. Snap the retainer tabs into the body mount.
3. Connect the front cable to the rear cable.
4. Route the cable in through the floor pan and engage the grommet.
5. Remove the safety stands.
6. Lower the vehicle.

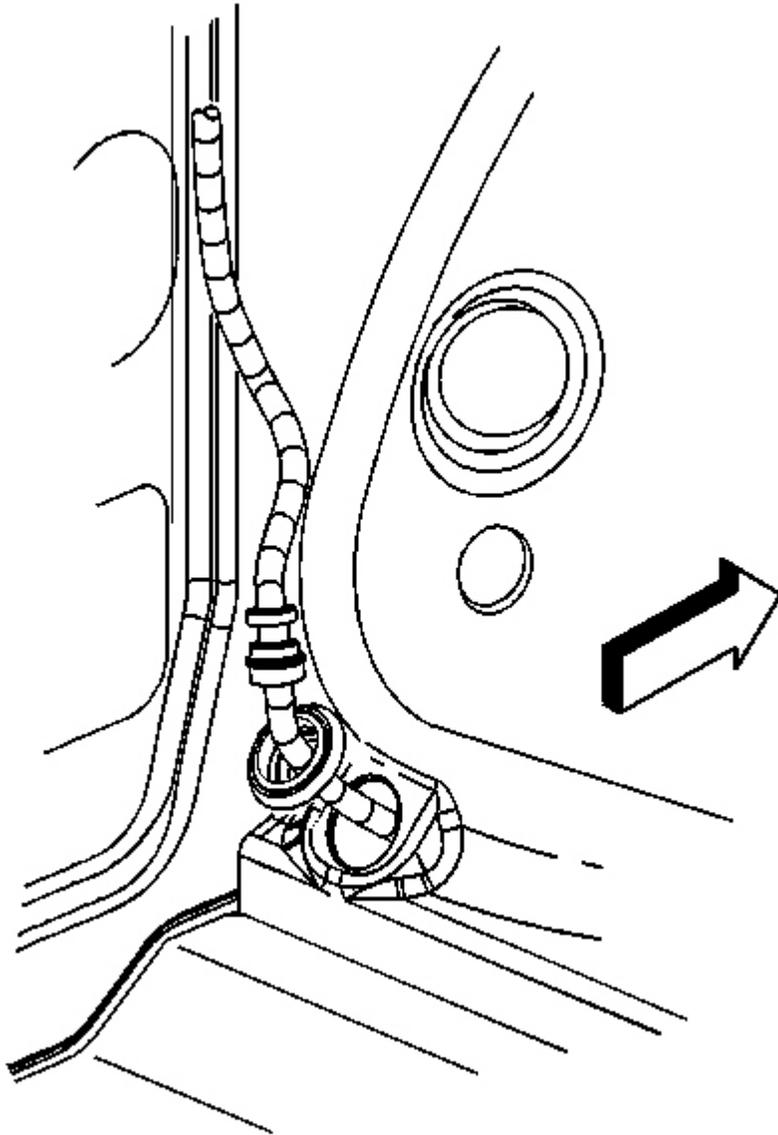


Fig. 24: Access Cable Grommet
Courtesy of GENERAL MOTORS CORP.

7. Roll the carpet into place.
8. Install the park brake pedal. Refer to **Park Brake Pedal Assembly Replacement** .
9. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** in Park Brake.

PARK BRAKE CABLE REPLACEMENT - LEFT REAR

Removal Procedure

1. Disable the park brake cable automatic adjuster. Refer to **Disabling the Park Brake Cable Automatic Adjuster**.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

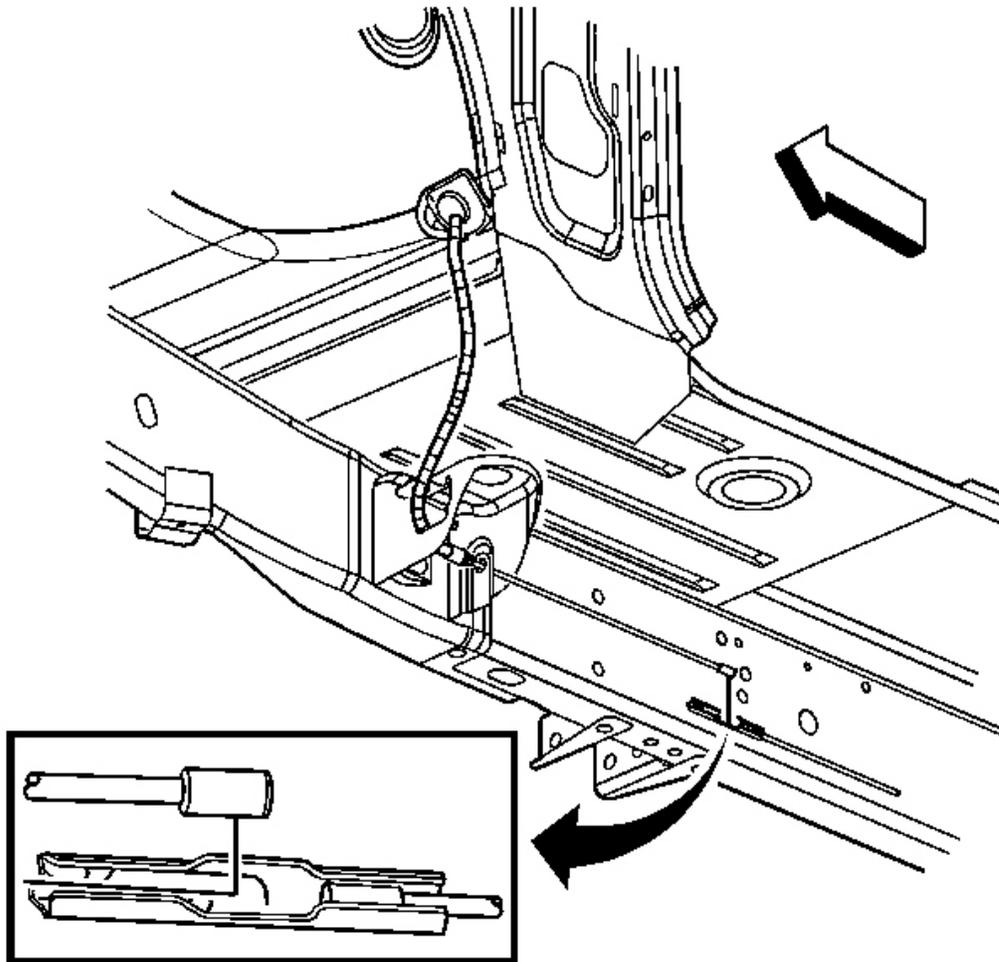


Fig. 25: Front/Intermediate Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the left rear cable from the front cable.

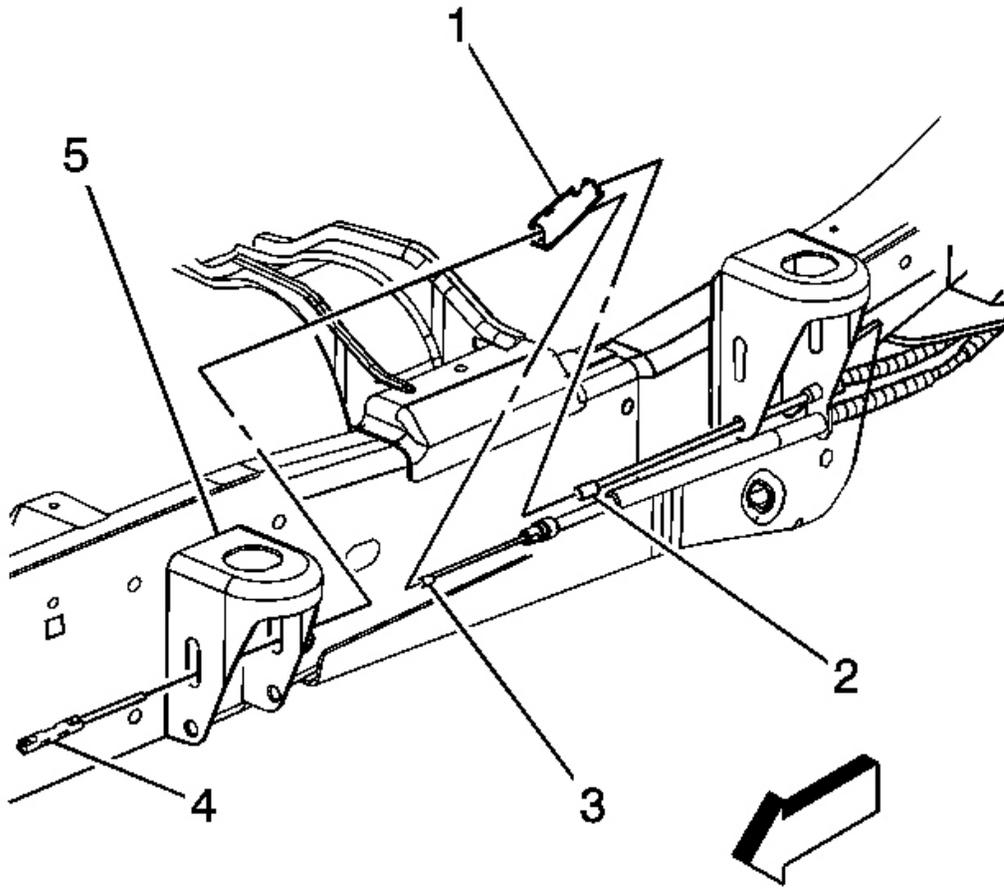


Fig. 26: Left Rear Cable & Equalizer
Courtesy of GENERAL MOTORS CORP.

4. Remove the left rear cable (4) from the equalizer (1) by depressing the locking tabs.

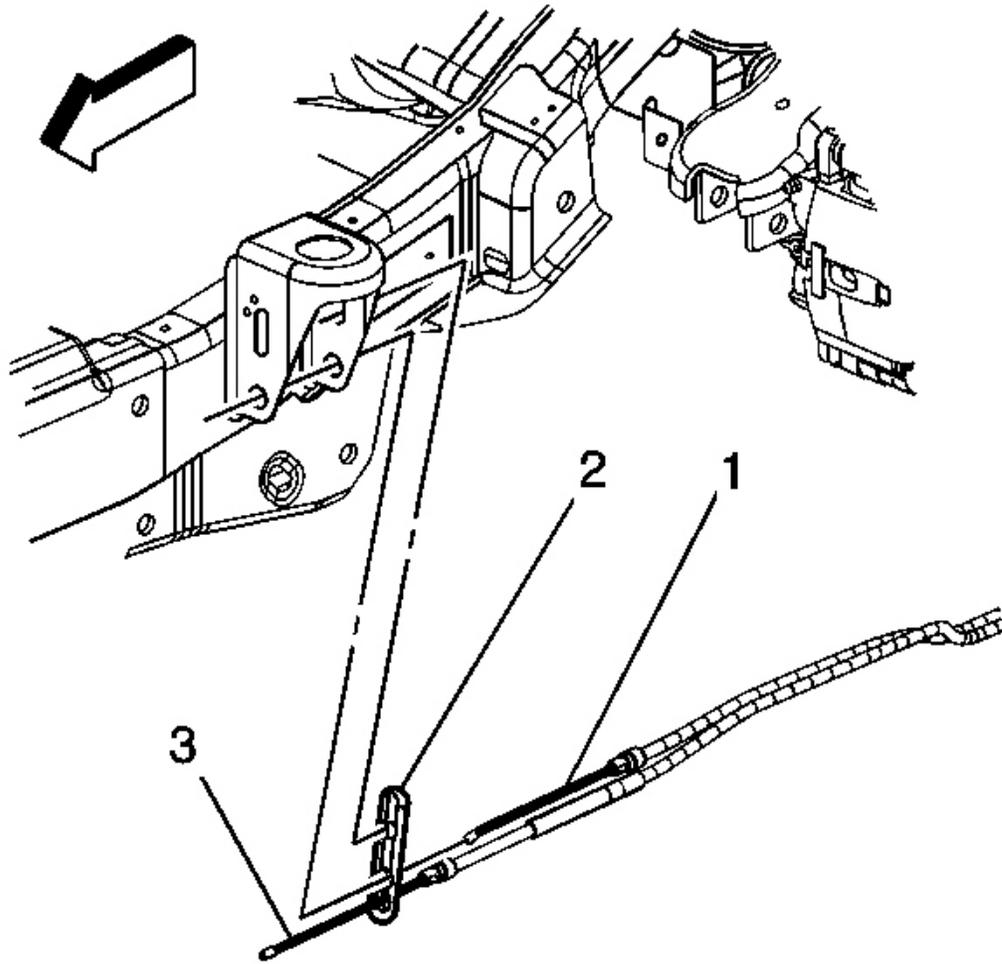


Fig. 27: Left Rear Cable & Cable Support
Courtesy of GENERAL MOTORS CORP.

5. Remove the left rear cable (3) from the cable support (2).

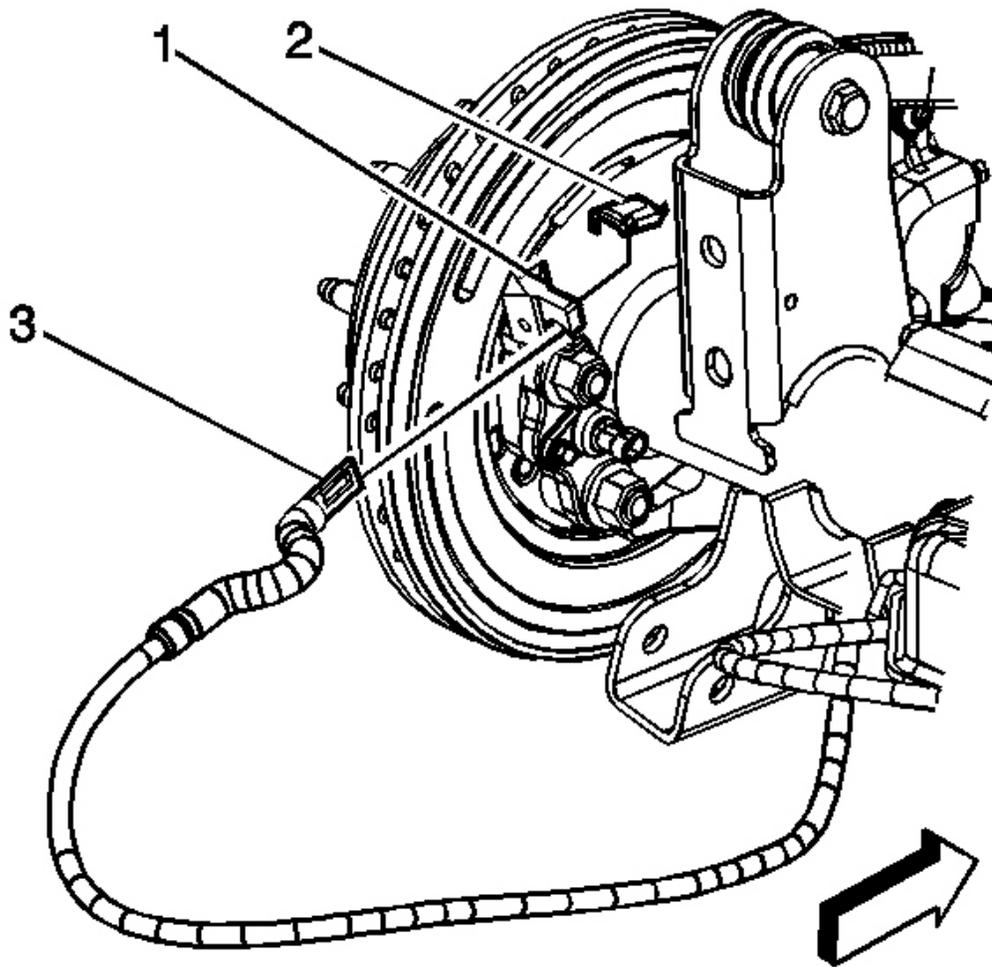


Fig. 28: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

6. Remove the cable (3) from the backing plate (1) by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate.
7. Remove the cable (3) from the lever (2).

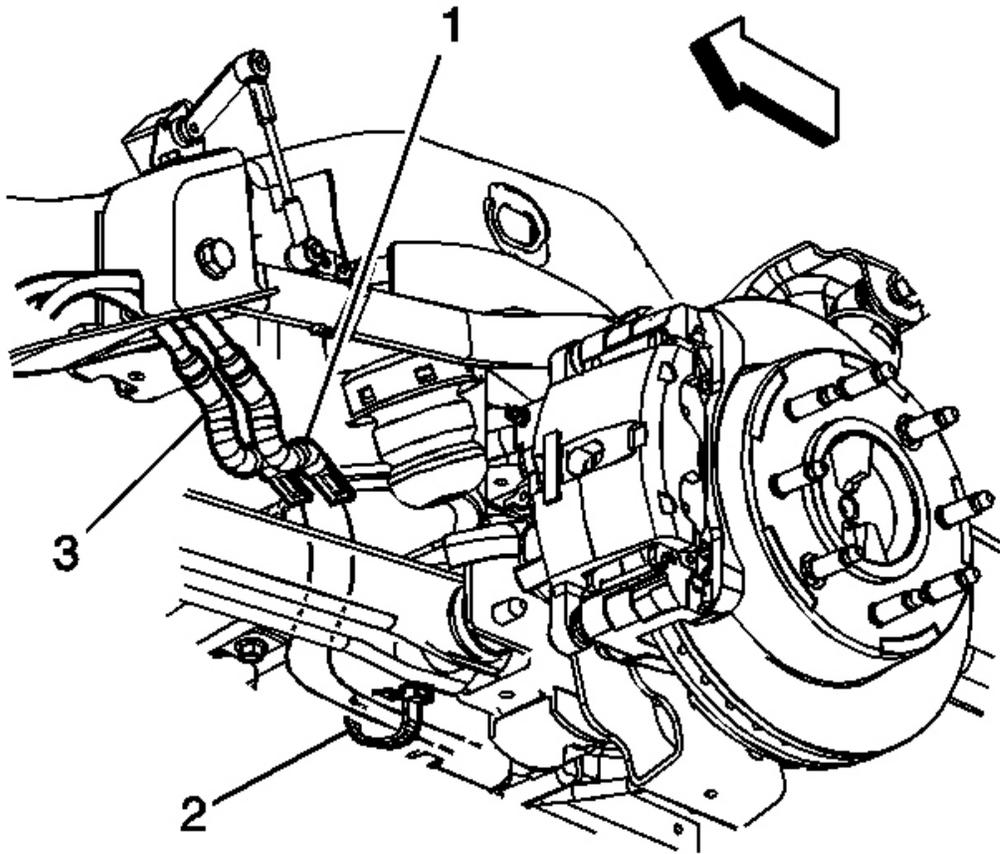


Fig. 29: Left Rear Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

8. Remove the left rear cable (1) from the cable guide (2).
9. Remove the cable from the vehicle.

Installation Procedure

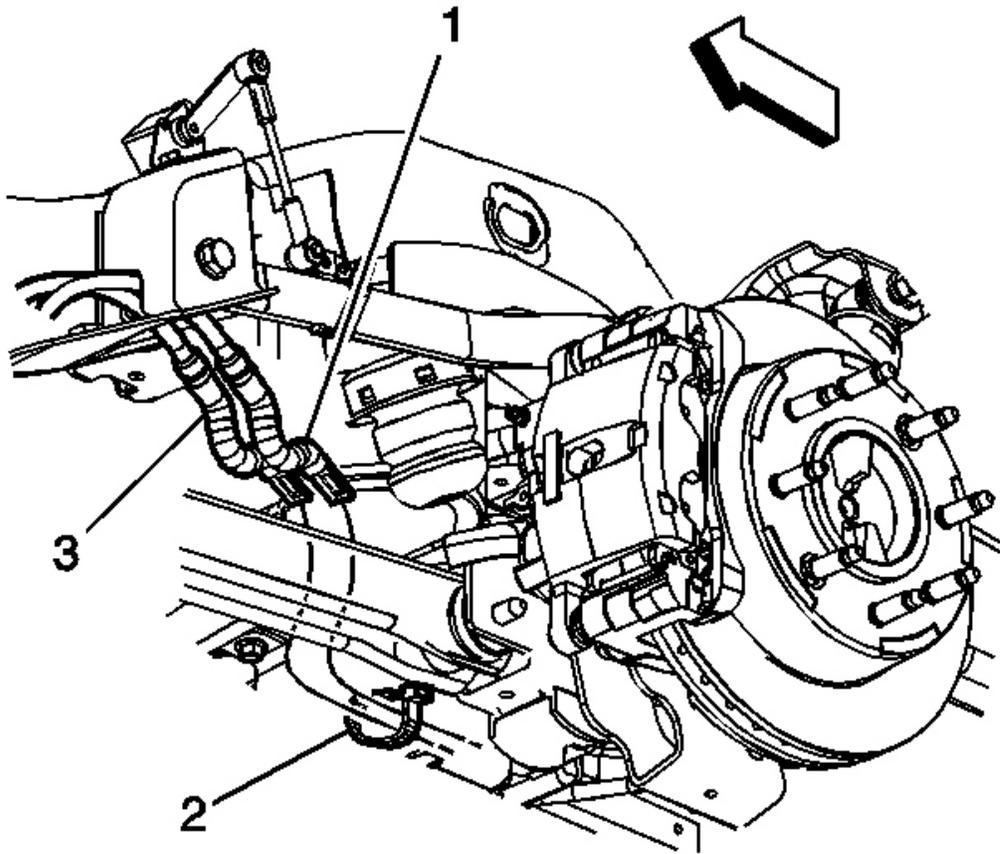


Fig. 30: Left Rear Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the left rear cable taking care to correctly route the cable (1) through the cable guide (2).

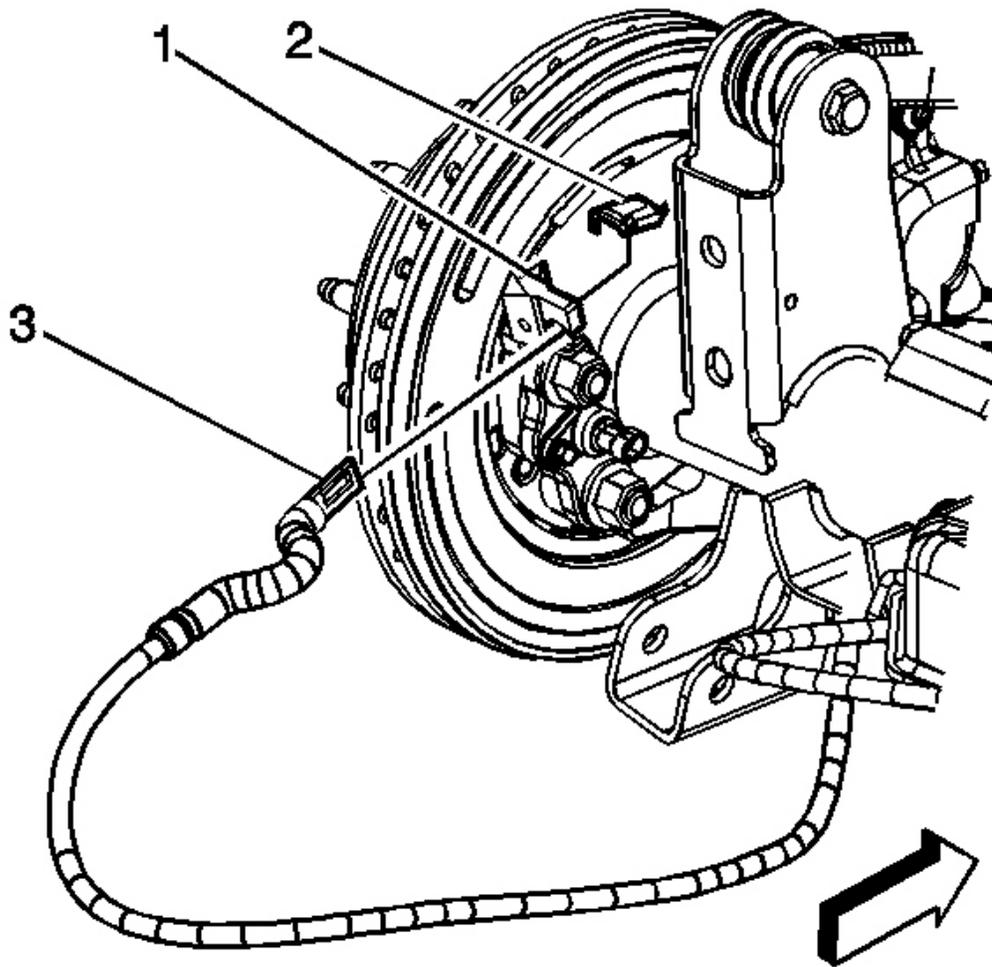


Fig. 31: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

2. Install the cable (3) to the lever (2).
3. install the cable (3) to the backing plate (1) by compressing the spring, routing the cable through the slot in the backing plate and pressing the cable into the backing plate until the locking tabs snap into place.

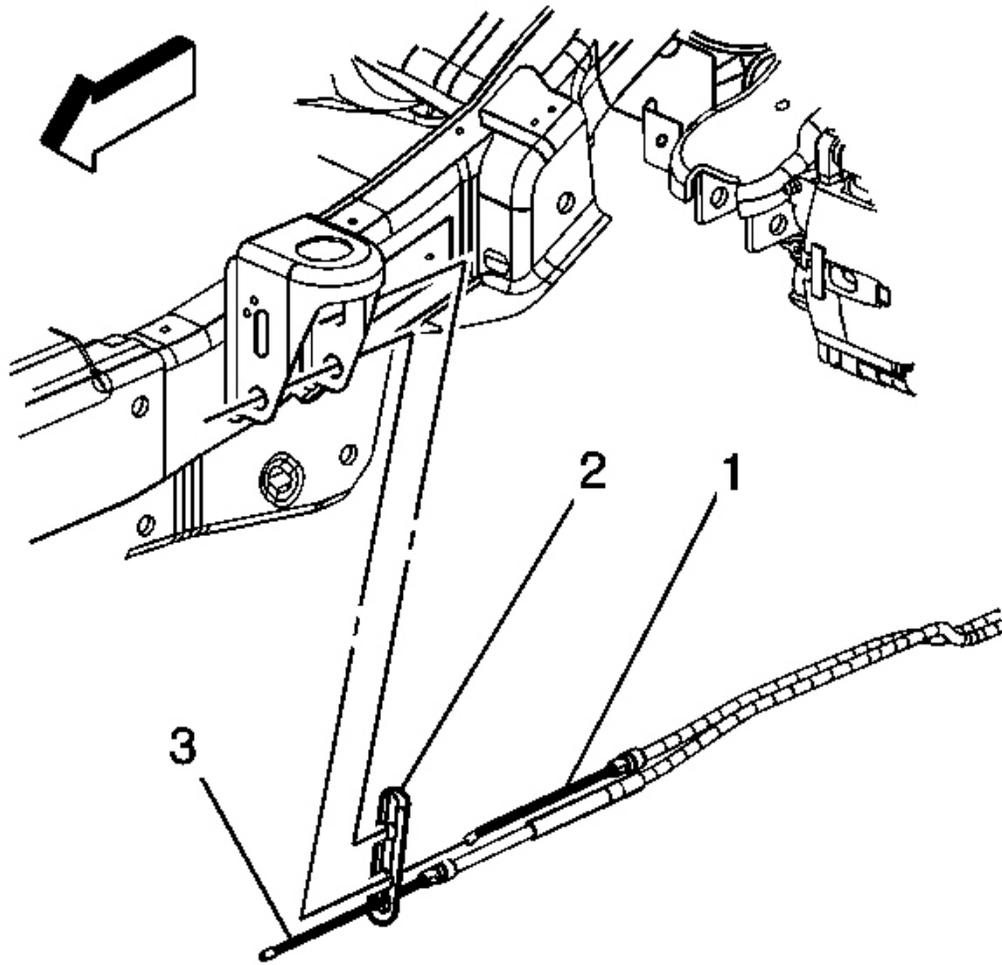


Fig. 32: Left Rear Cable & Cable Support
Courtesy of GENERAL MOTORS CORP.

4. Install the left rear cable (3) to the cable support (2).

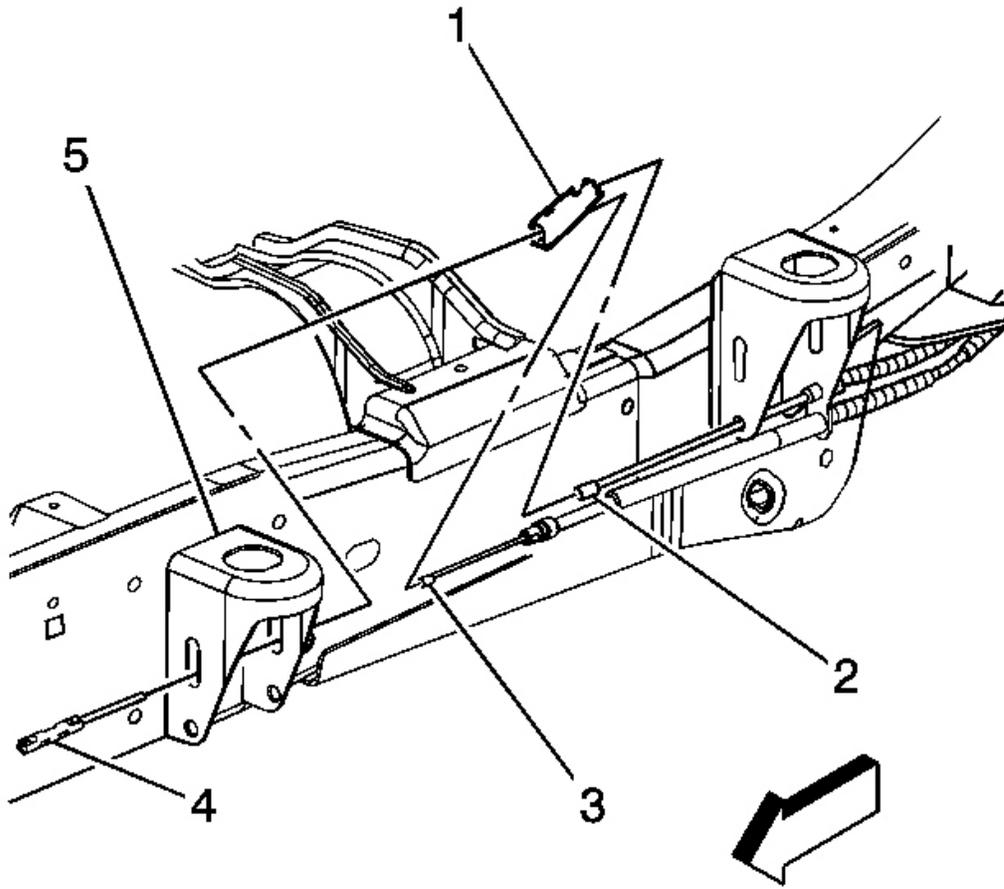


Fig. 33: Left Rear Cable & Equalizer
Courtesy of GENERAL MOTORS CORP.

5. Install the left rear cable (4) to the equalizer (1) until the locking tabs snap into place.

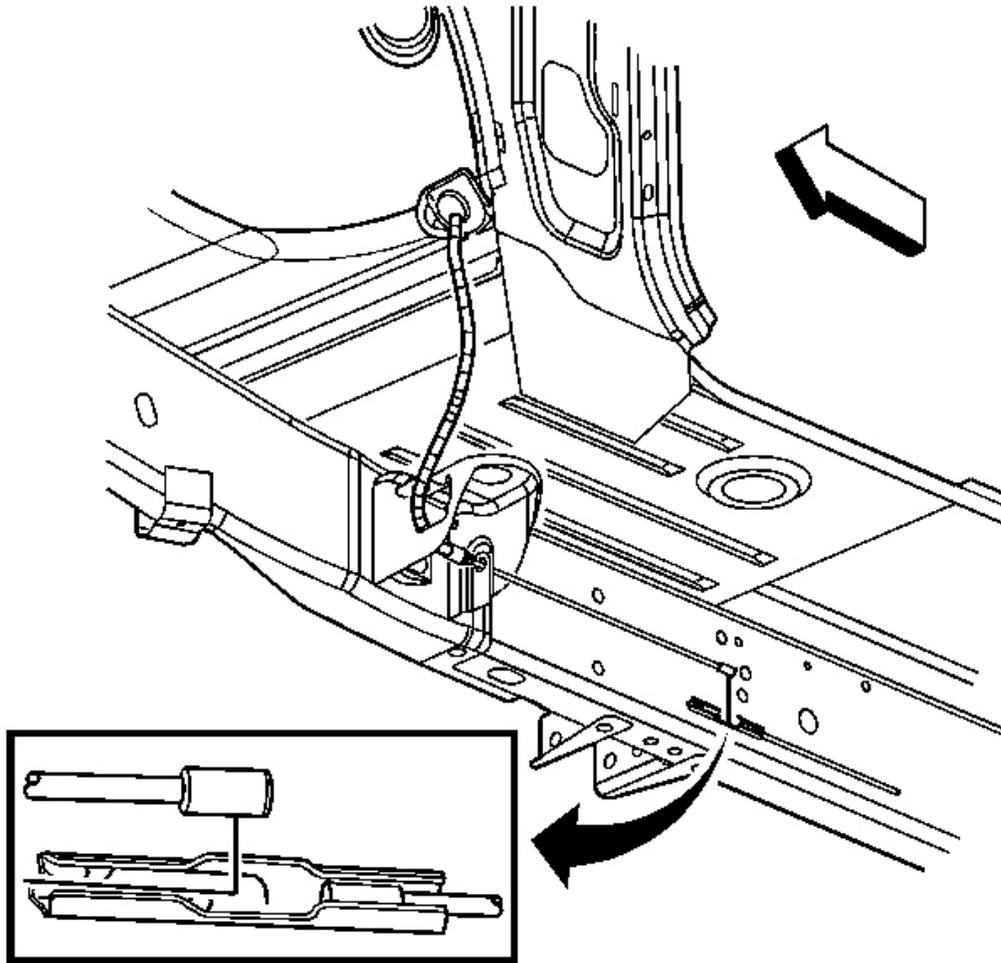


Fig. 34: Front/Intermediate Park Brake Cable
Courtesy of GENERAL MOTORS CORP.

6. Connect the left rear cable to the front cable.
7. Remove the safety stands.
8. Lower the vehicle.
9. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** .

PARK BRAKE CABLE REPLACEMENT - RIGHT REAR

Removal Procedure

1. Disable the park brake cable automatic adjuster. Refer to **Disabling the Park Brake Cable Automatic Adjuster** .
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

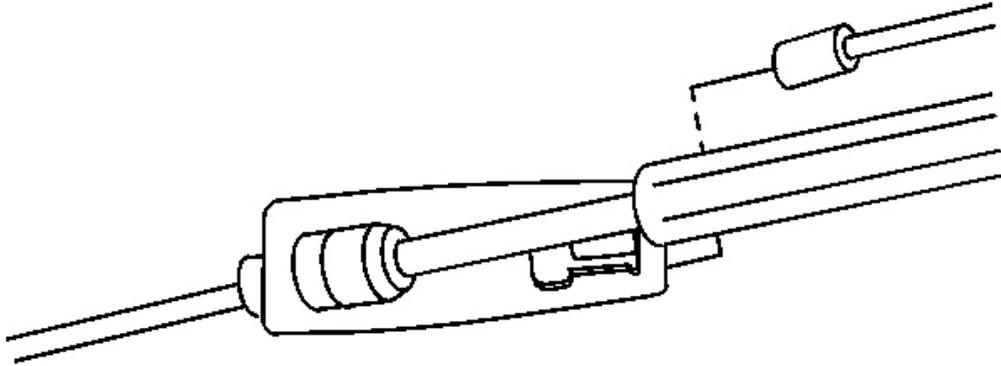


Fig. 35: Right Rear Park Brake Cable & Equalizer
Courtesy of GENERAL MOTORS CORP.

3. Disconnect the right rear cable from the equalizer.

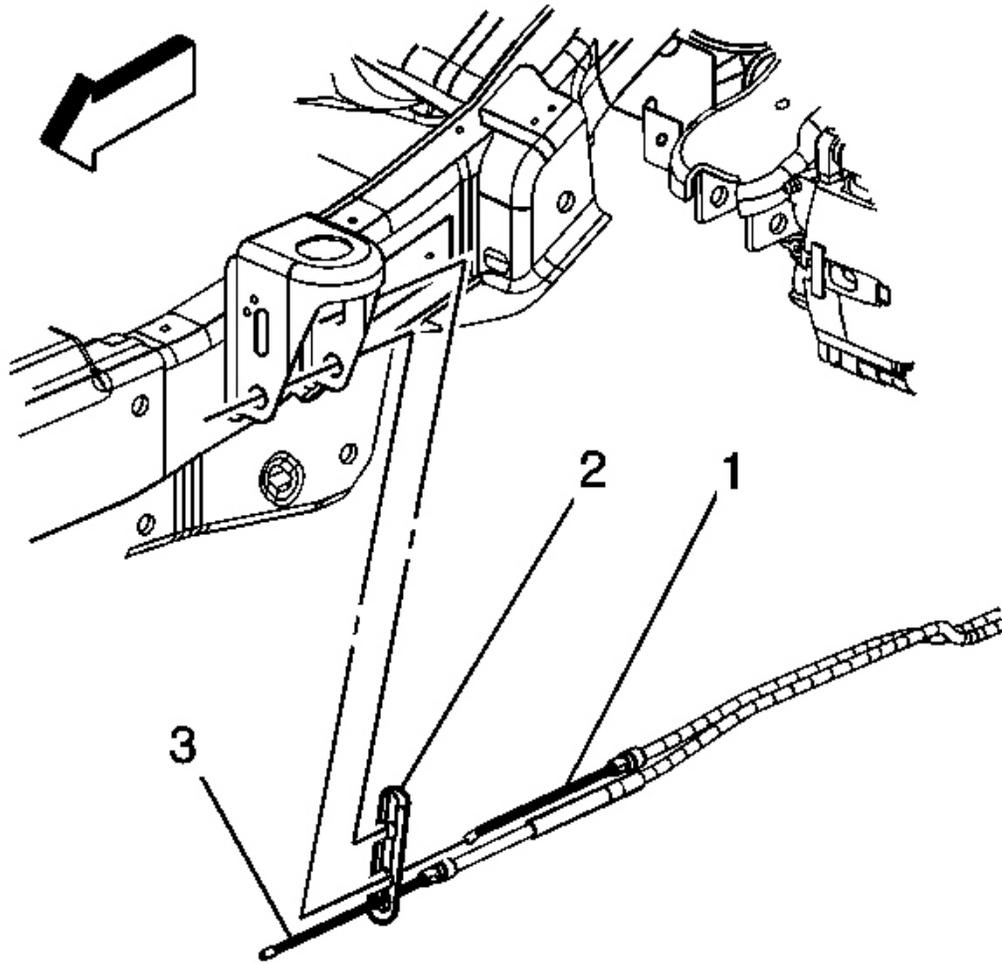


Fig. 36: Right Rear Cable & Cable Support
Courtesy of GENERAL MOTORS CORP.

4. Remove the right rear cable (1) from the cable support (2).

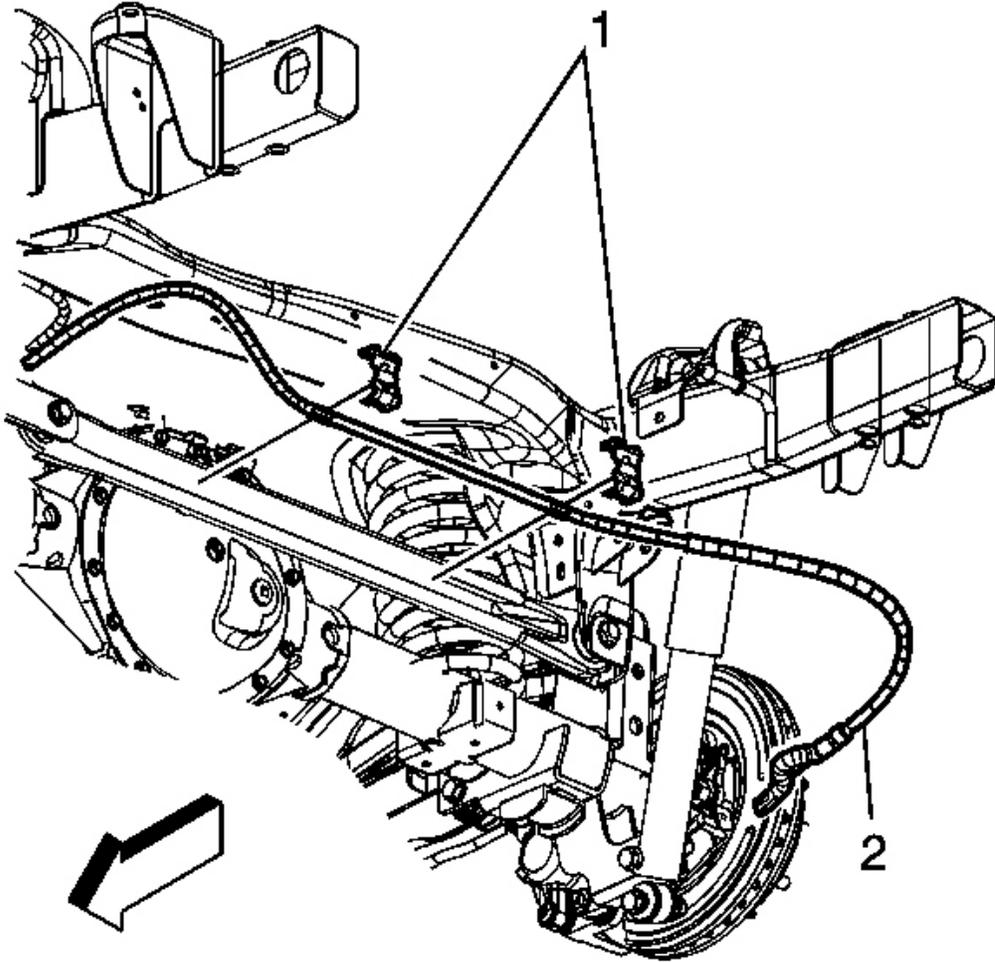


Fig. 37: Track Bar & Clips
Courtesy of GENERAL MOTORS CORP.

5. Remove the track bar clips (1) from the track bar.

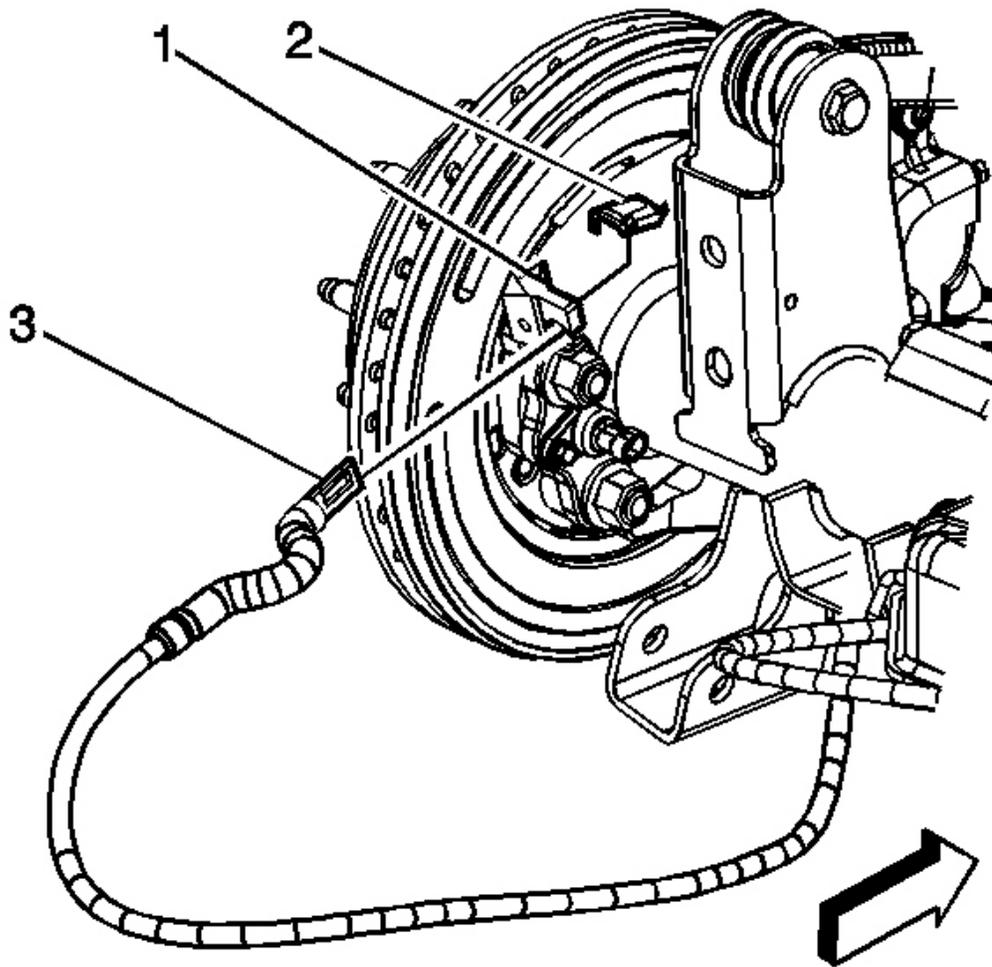


Fig. 38: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

6. Remove the cable (3) from the backing plate (1) by compressing the spring to access and depress the locking tabs, pull the cable out of the backing plate, and routing the cable through the slot in the backing plate.
7. Remove the cable (3) from the lever (2).

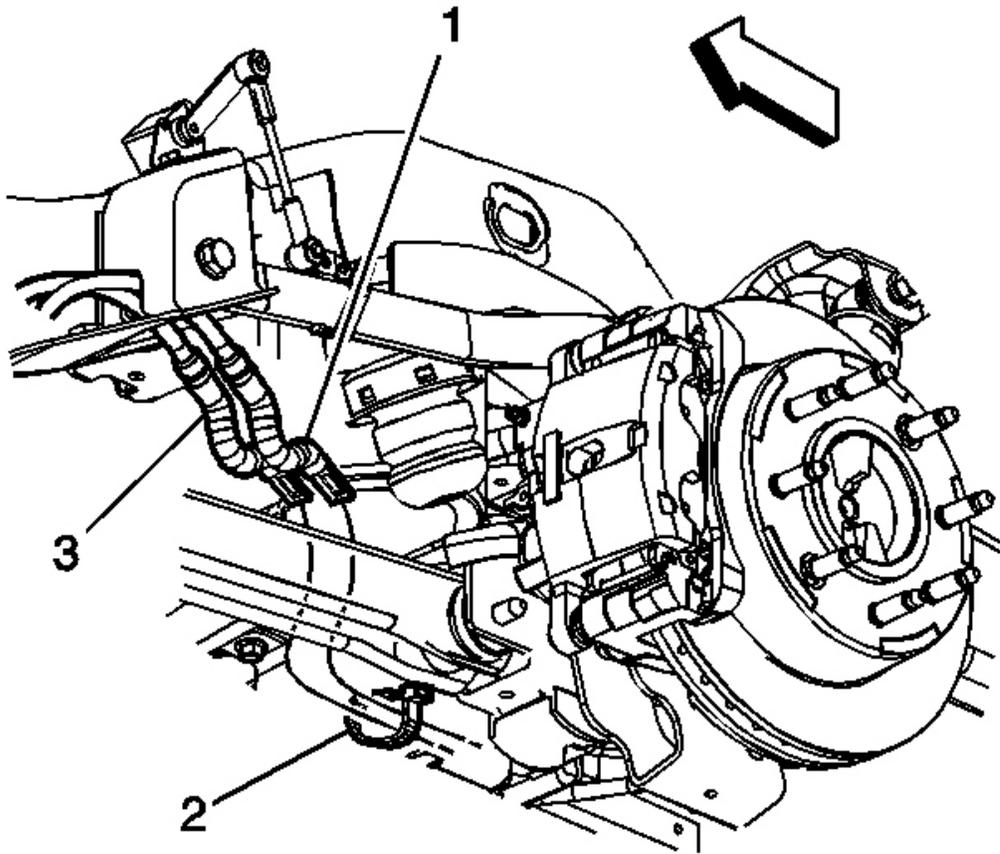


Fig. 39: Right Rear Cable & Cable Guide
Courtesy of GENERAL MOTORS CORP.

8. Remove the right rear cable (3) from the cable guide (2).
9. Remove the cable from the vehicle.

Installation Procedure

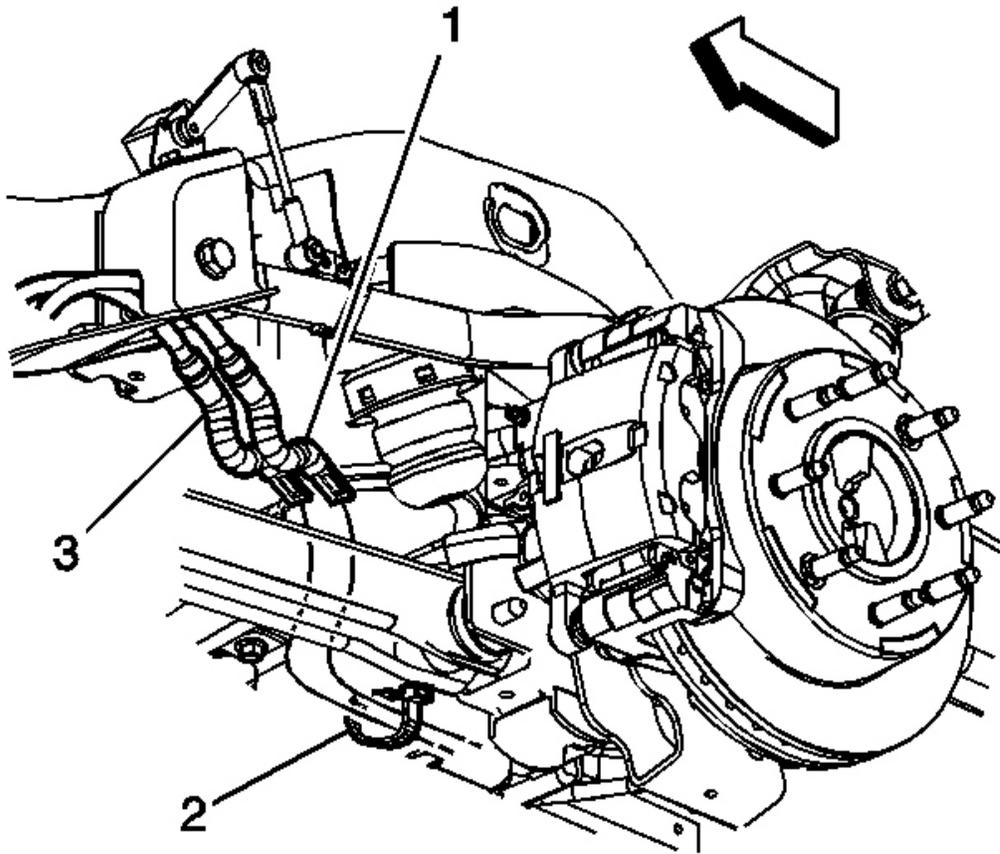


Fig. 40: Right Rear Cable & Cable Guide
Courtesy of GENERAL MOTORS CORP.

1. Install the right rear cable taking care to correctly route the cable (3) through the cable guide (2).

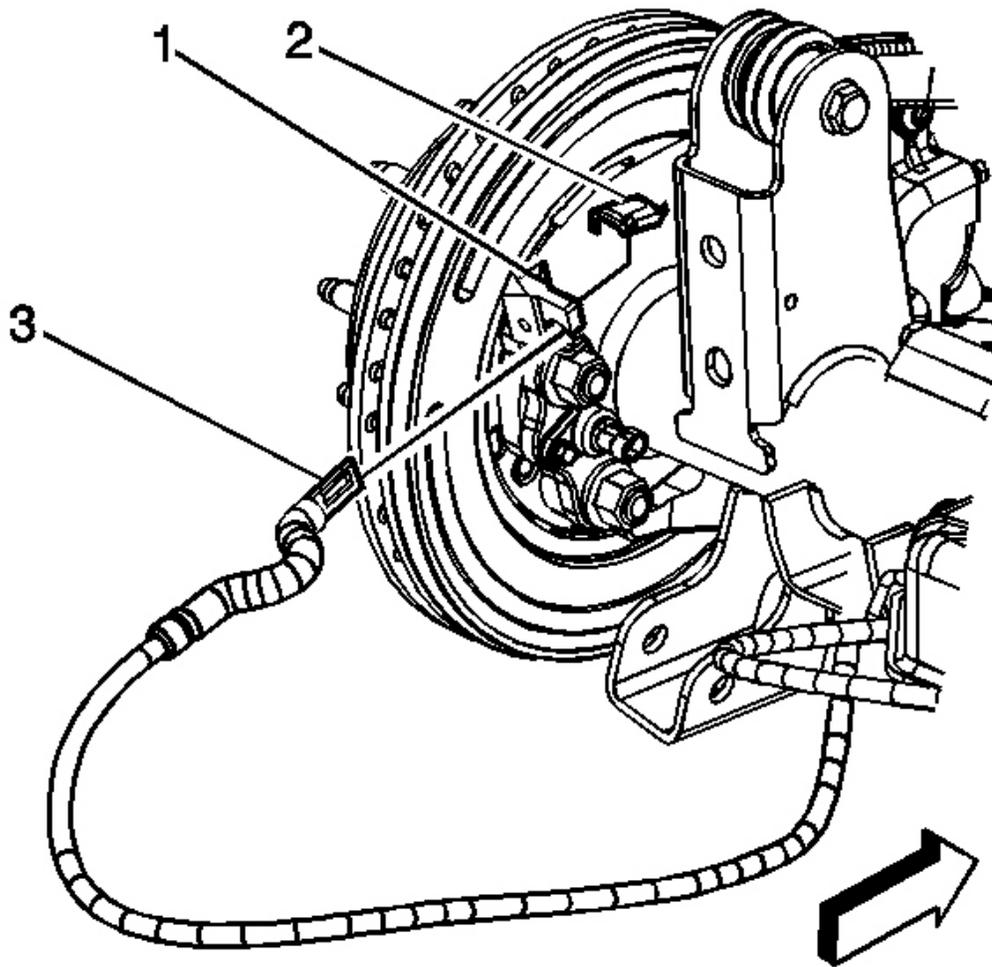


Fig. 41: Cable, Lever & Backing Plate
Courtesy of GENERAL MOTORS CORP.

2. Install the cable (3) to the lever (2).
3. install the cable (3) to the backing plate (1) by compressing the spring, routing the cable through the slot in the backing plate and pressing the cable into the backing plate until the locking tabs snap into place.

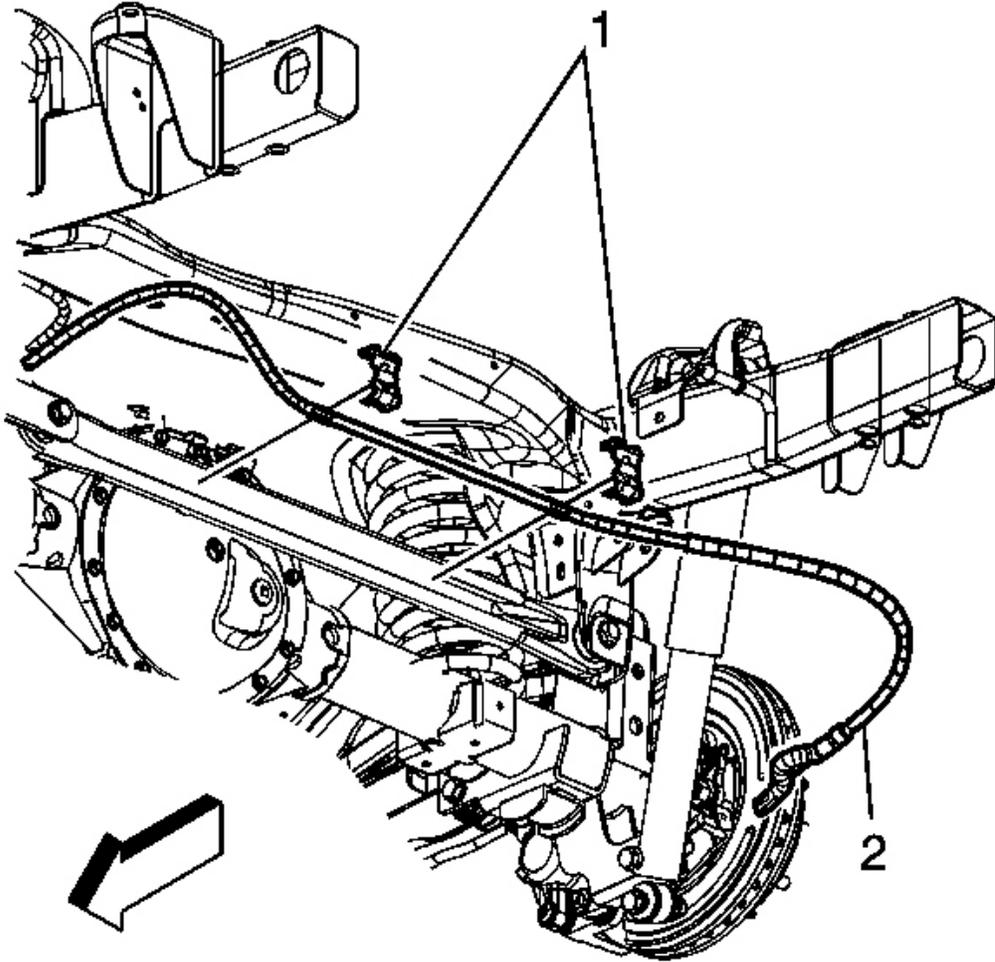


Fig. 42: Track Bar & Clips
Courtesy of GENERAL MOTORS CORP.

4. Position the right rear cable (2) and the clips (1) on the track bar.

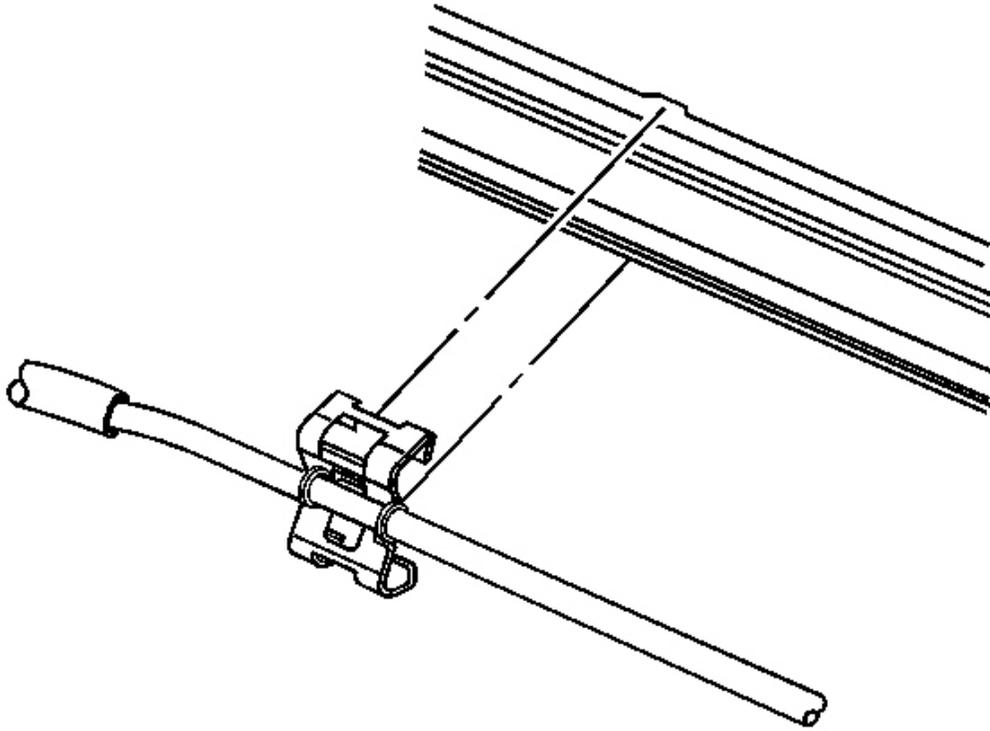


Fig. 43: Installing Track Bar Clips
Courtesy of GENERAL MOTORS CORP.

5. Install the track bar clips to the locating tabs on the track bar.

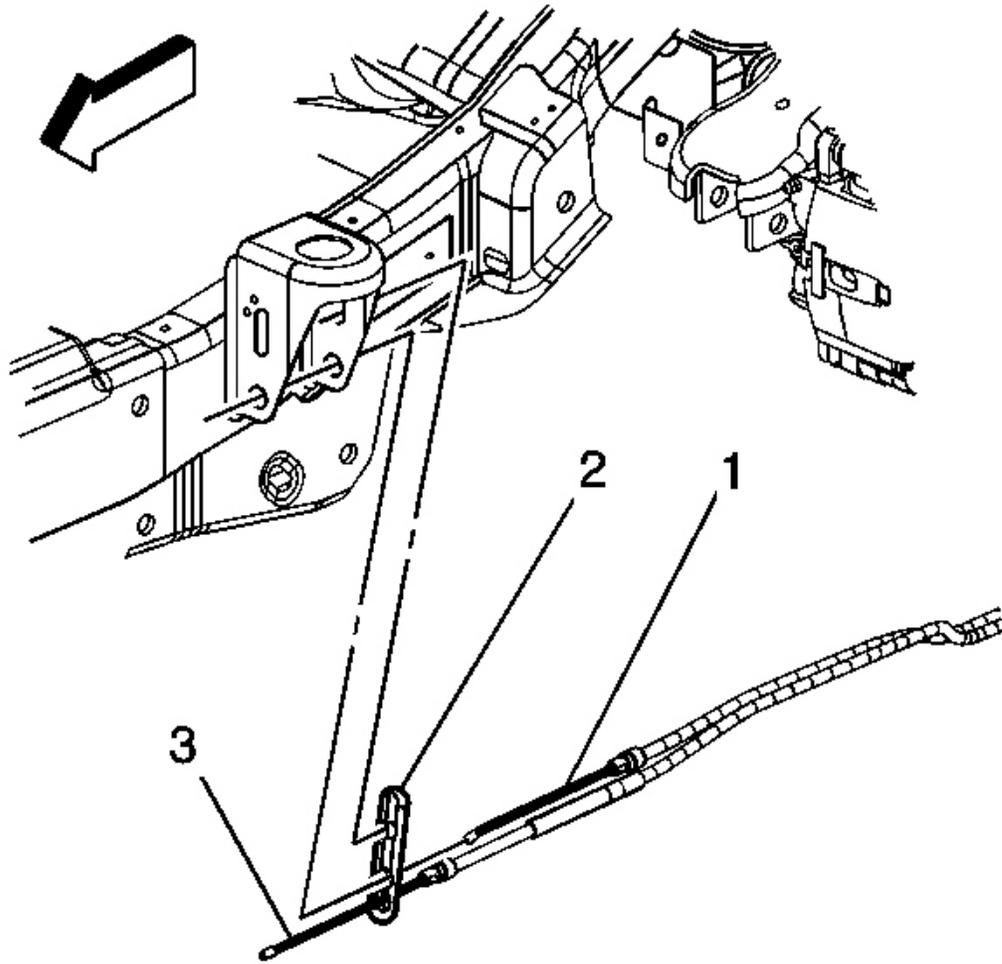


Fig. 44: Right Rear Cable & Cable Support
Courtesy of GENERAL MOTORS CORP.

6. Install the right rear cable (1) to the cable support (2).

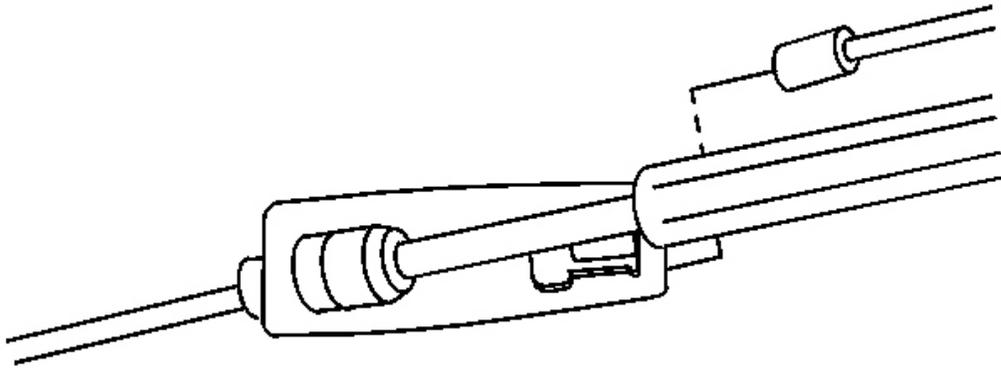


Fig. 45: Right Rear Park Brake Cable & Equalizer
Courtesy of GENERAL MOTORS CORP.

7. Install the right rear cable to the equalizer.
8. Remove the safety stands.
9. Lower the vehicle.
10. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** .

PARK BRAKE CABLE GUIDE REPLACEMENT

Removal Procedure

1. Release the parking brake.
2. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.

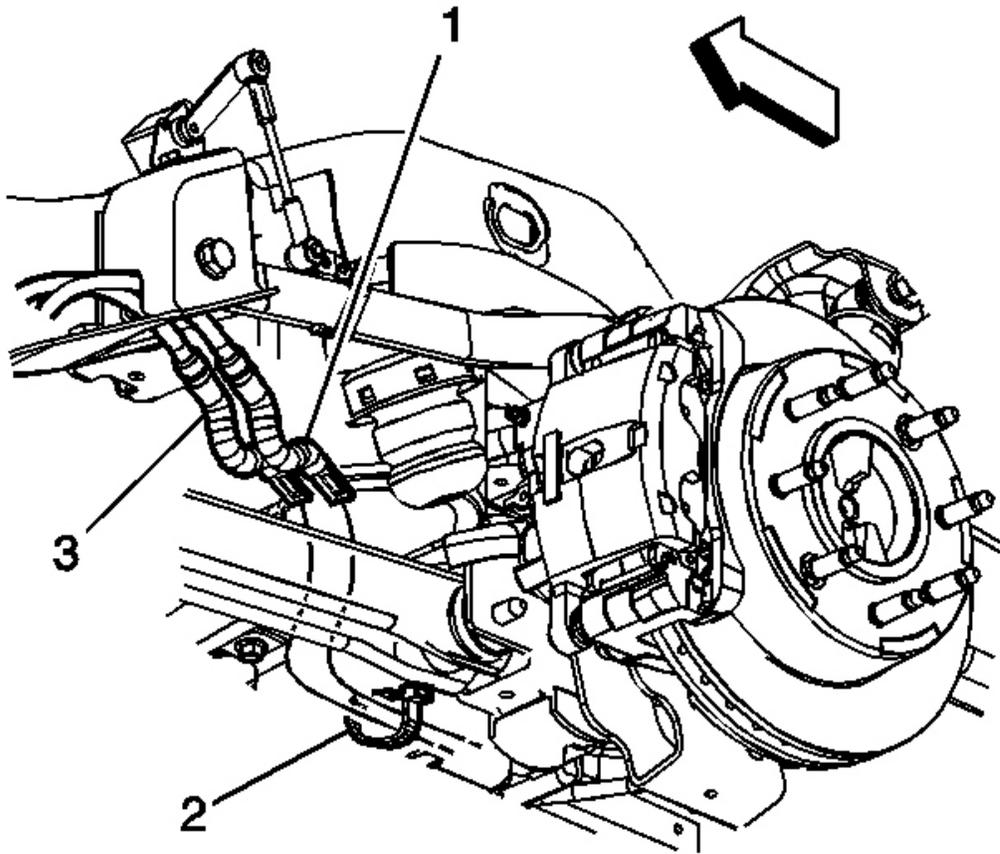


Fig. 46: Park Brake Cable Guide
Courtesy of GENERAL MOTORS CORP.

3. Remove the park brake cable guide bolt.
4. Remove the park brake cable guide (2).
5. Remove the park brake guide from the park brake cable.

Installation Procedure

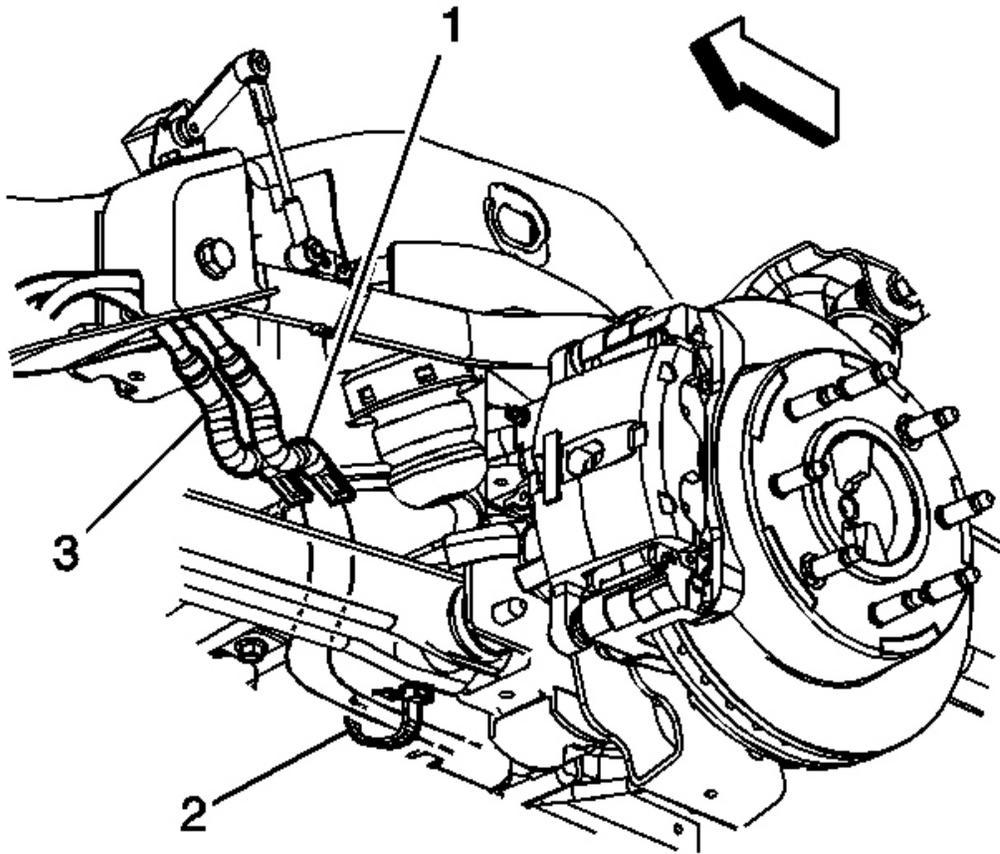


Fig. 47: Park Brake Cable Guide
Courtesy of GENERAL MOTORS CORP.

1. Install the park brake cable guide to the park brake cable.
2. Install the park brake cable guide (2).

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Install the park brake cable guide bolt.

Tighten: Tighten the bolt to 12 N.m (106 lb in).

4. Remove the safety stands.
5. Lower the vehicle.

DISABLING THE PARK BRAKE CABLE AUTOMATIC ADJUSTER

Before any components of the parking brake system are serviced, the following procedure must be followed. Two technicians are required to perform this procedure: one inside the vehicle and one outside the vehicle.

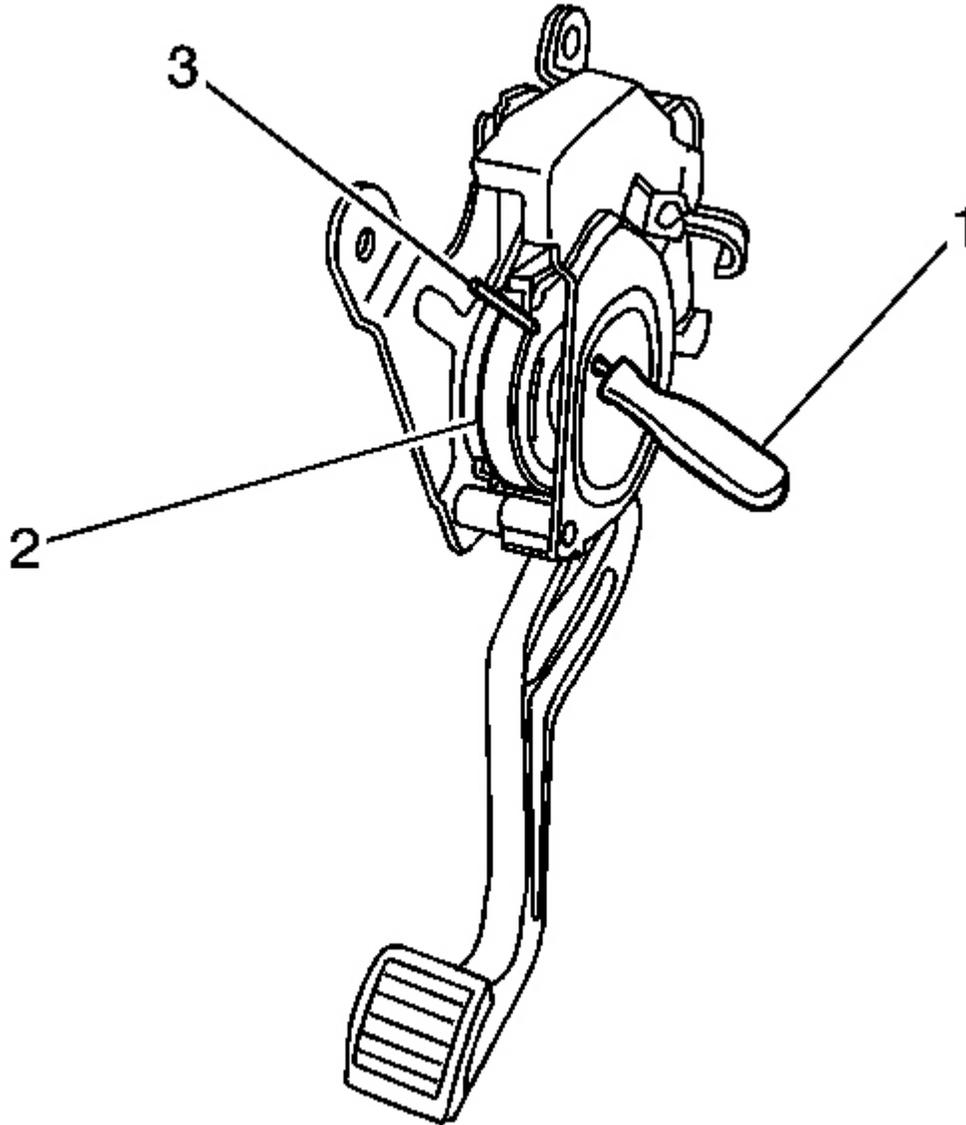


Fig. 48: Park Brake Cable Automatic Adjuster
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
2. Hold the pedal in the FULL upward position.
3. Pull rearward on the front park brake cable until the pedal drum (2) reaches its full reset position.
4. Insert a scribe or the shaft of a thin screwdriver (1) on an upward angle through the hole in the front of the pedal assembly, past the retracted pedal drum, and into the hole in the back of the pedal assembly (3).
5. Slowly release the cable.
6. Remove the component that requires service.

ENABLING THE PARK BRAKE CABLE AUTOMATIC ADJUSTER

If the park brake automatic adjuster has been disabled, the following two person procedure must be performed.

1. Hold the park brake pedal in the FULL upward position.

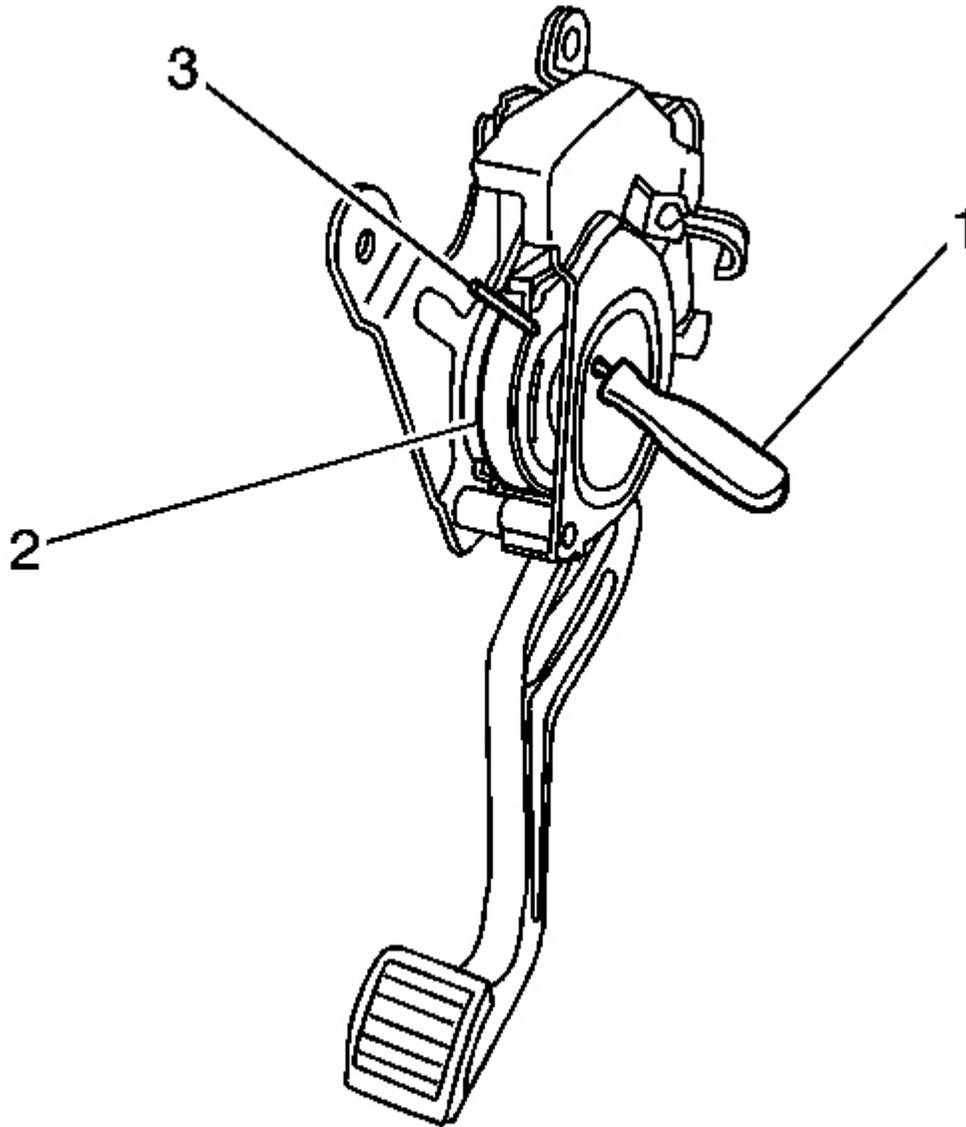


Fig. 49: Park Brake Cable Automatic Adjuster
Courtesy of GENERAL MOTORS CORP.

2. Pull rearward on the front park brake cable until the tension is released from the scribe or nail (1) installed through the holes in the pedal assembly.
3. Remove the scribe or screwdriver (1).
4. Slowly release the park brake cable until it returns to its original position.

5. Release the park brake pedal.
6. Lower the vehicle.
7. Apply and release the park brake pedal to ensure that there is no binding or sticking.

PARK BRAKE ACTUATOR REPLACEMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

Removal Procedure

1. Disable the park brake cable automatic adjuster. Refer to Disabling the Park Brake Cable Automatic Adjuster
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
3. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation in Tires and Wheels.
4. Remove the rotor. Refer to Brake Rotor Replacement - Rear in Disc Brakes.
5. Remove the axle shaft. Refer to Rear Axle Shaft Replacement in Rear Drive Axle.
6. Remove the park brake shoe. Refer to Park Brake Shoe Replacement .

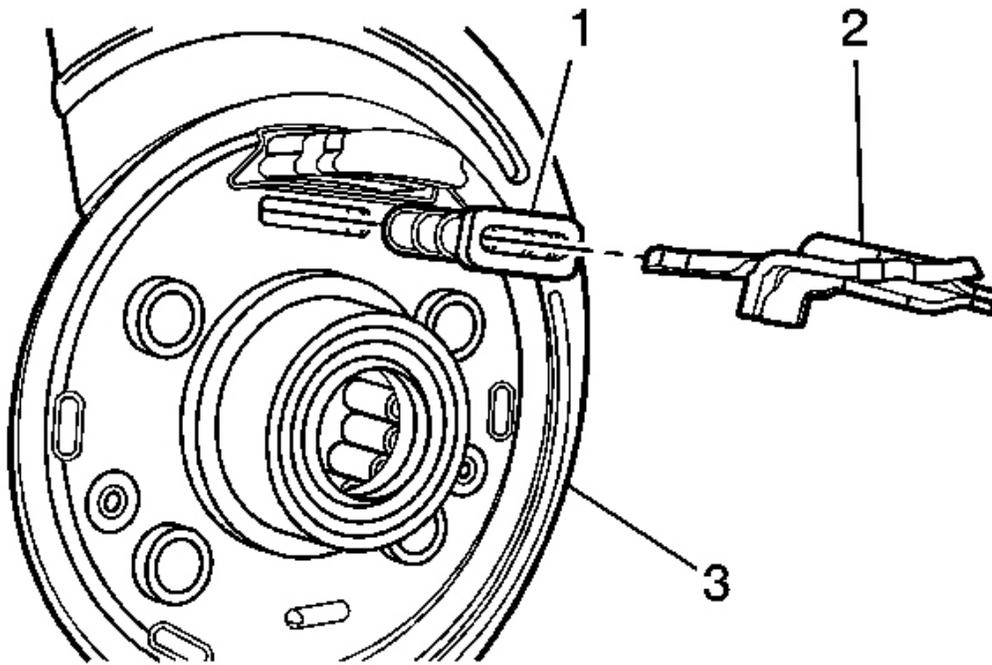


Fig. 50: Park Brake Actuator & Rubber Boot
Courtesy of GENERAL MOTORS CORP.

7. Remove the actuator (2) and rubber boot (1).

Installation Procedure

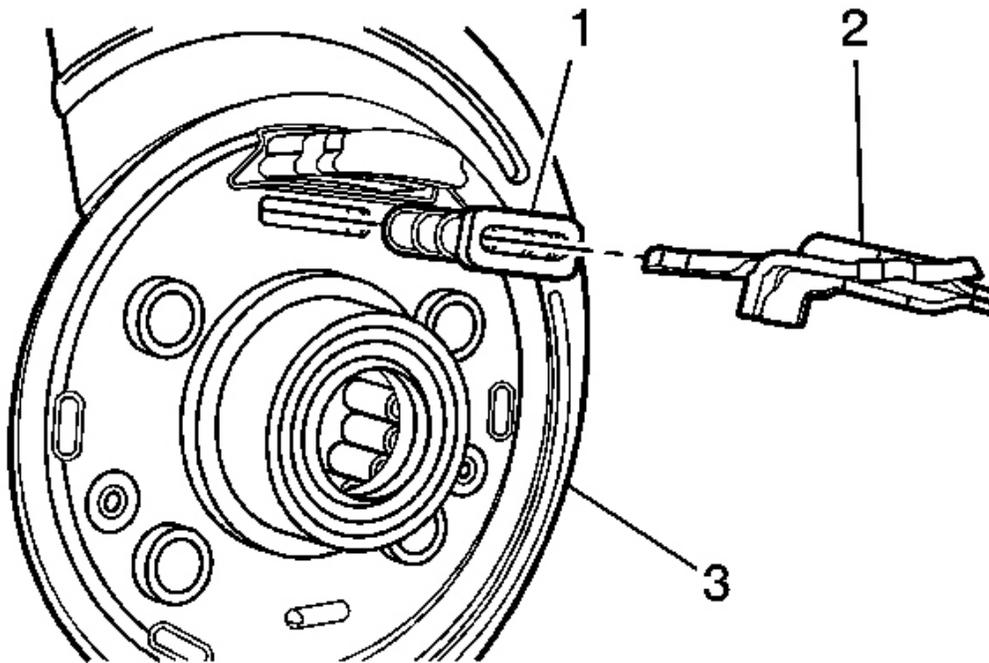


Fig. 51: Park Brake Actuator & Rubber Boot
 Courtesy of GENERAL MOTORS CORP.

1. Install the rubber boot (1) and the actuator (2).
2. Install the park brake shoe. Refer to **Park Brake Shoe Replacement** .
3. Install the axle shaft. Refer to **Rear Axle Shaft Replacement** in Rear Drive Axle.
4. Adjust the park brake shoe. Refer to **Park Brake Adjustment** .
5. Install the rotor. Refer to **Brake Rotor Replacement - Rear** in Disc Brakes.
6. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
7. Remove the safety stands.
8. Lower vehicle.
9. Enable the park brake cable automatic adjuster. Refer to **Enabling the Park Brake Cable Automatic Adjuster** in Park Brake.

PARK BRAKE ADJUSTMENT

CAUTION: Refer to Brake Dust Caution in Cautions and Notices.

Tools Required

J 21177-A Drum-to-Brake Shoe Clearance Gauge. See Special Tools and Equipment .

Park Brake Shoe Adjustment

IMPORTANT: The park brake shoes must be adjusted before the park brake pedal is adjusted.

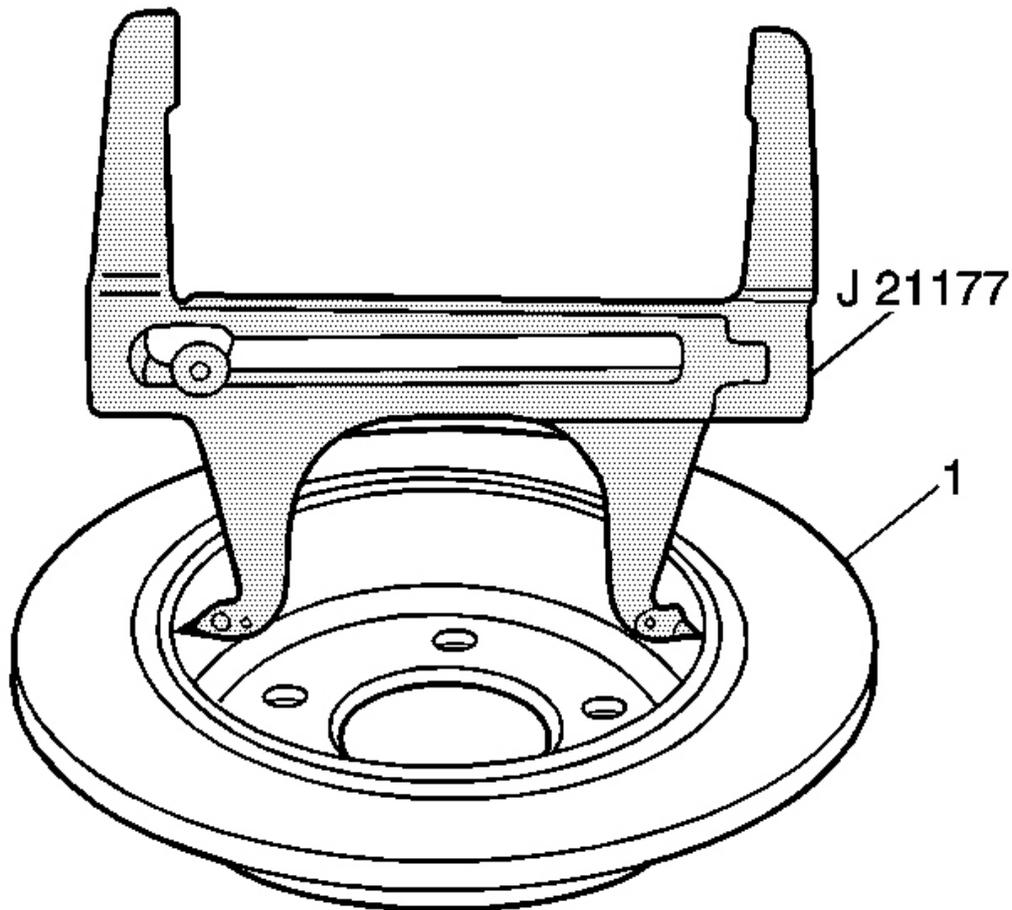


Fig. 52: Applying J 21177-A To Inside Of Brake Drum
Courtesy of GENERAL MOTORS CORP.

1. Set the **J 21177-A** so that it contacts the inside diameter of the rotor (1). See Special Tools and

Equipment .

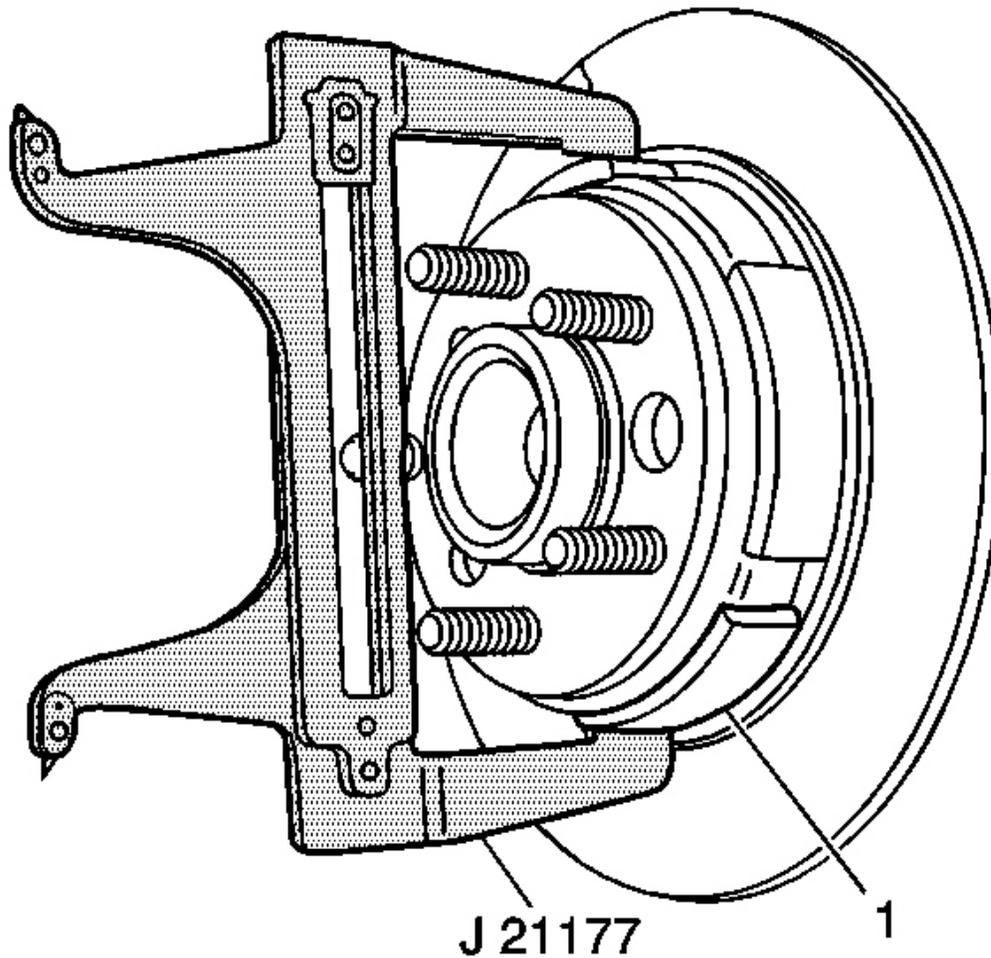


Fig. 53: Adjusting Parking Brake Shoes Using J 21177-A
Courtesy of GENERAL MOTORS CORP.

2. Position the **J 21177-A** over the shoe (1) and the lining at the widest point. See **Special Tools and Equipment .**
3. Turn the adjuster nut until the lining just contacts the **J 21177-A** . See **Special Tools and Equipment .**
4. Repeat steps 1-3 for the opposite side.
5. The clearance between the park brake shoe and the rotor is 0.6604 mm (0.026 in).

IMPORTANT: Before you adjust the park brake, verify that the park brake shoes are adjusted to provide a clearance of 0.6604 mm (0.026 in).

1. Verify that the automatic adjuster lock-out pin has been removed.
2. Fully apply and release the park brake pedal 3 times.

DESCRIPTION AND OPERATION

PARK BRAKE SYSTEM DESCRIPTION AND OPERATION

System Component Description

The park brake system consists of the following:

Park Brake Pedal Assembly

Receives and transfers park brake system apply input force from driver to park brake cable system.

Park Brake Release Handle Assembly

Releases applied park brake system when pulled.

Park Brake Cables

Transfers input force received from park brake pedal, through park brake cable equalizer, to park brake apply lever.

Park Brake Cable Equalizer

Evenly distributes input force to both the left and right park brake units.
Threaded park brake cable equalizers are also used to remove slack in park brake cables.

Park Brake Apply Lever

Multiplies and transfers input force to park brake actuator.

Park Brake Actuator/Adjuster

Uses multiplied input force from apply lever to expand park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor.
Threaded park brake actuators are also used to control clearance between the park brake shoe and the friction surface of the drum-in-hat portion of the rear brake rotor.

Park Brake Shoe

Applies mechanical output force from park brake actuator to friction surface of the drum-in-hat portion of

the rear brake rotor.

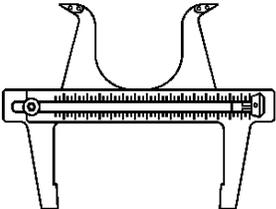
System Operation

Park brake apply input force is received by the park brake pedal assembly being depressed, transferred and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators which expand the park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor in order to prevent the rotation of the rear tire and wheel assemblies. The park brake release handle assembly releases an applied park brake system when it is pulled rearward.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description
	<p data-bbox="808 803 1300 869">J 21177-A Drum-to-Brake Shoe Clearance Gauge</p>