

2017 BRAKES

Disc Brakes - Impala

SPECIFICATIONS

FASTENER SPECIFICATIONS

Single Use Non-Threaded Fasteners/Components

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>
Application
Brake Caliper Piston Dust Boot Seal
Brake Caliper Piston Seal
Brake Hose Fitting Gasket

Reusable Threaded Fastener Tightening Specifications

NOTE:
All fasteners listed in this table can be reused after removal.

Application	Specification
	Metric (English)
Brake Caliper Bleeder Valve	10 N.m (89 lb in)
Brake Caliper Bracket Bolt - Front	
First Pass:	150 N.m (111 lb ft)
Final Pass:	45 Degrees
Brake Caliper Bracket Bolt - Rear	
First Pass:	100 N.m (74 lb ft)
Final Pass:	45 Degrees
Brake Caliper Guide Pin Bolt	27 N.m (20 lb ft)
Brake Hose Fitting Bolt	40 N.m (30 lb ft)
Brake Rotor Bolt	7 N.m (62 lb in)

DISC BRAKE COMPONENT SPECIFICATIONS

Application	Specification	
	Metric	English
Front Brakes		
Brake Rotor Diameter	321.0 mm	12.63 in
Brake Rotor Discard Thickness*	27.0 mm	1.07 in

Application	Specification	
	Metric	English
Brake Rotor Maximum Allowable Assembled Lateral Runout	0.05 mm	0.002 in
Brake Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
Brake Rotor Maximum Allowable Thickness Variation	0.006 mm	0.00024 in
Brake Rotor Thickness New	30.0 mm	1.18 in
Rear Brakes		
Brake Rotor Diameter	315.0 mm	12.40 in
Brake Rotor Discard Thickness*	21.5 mm	0.846 in
Brake Rotor Maximum Allowable Assembled Lateral Runout	0.05 mm	0.002 in
Brake Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
Brake Rotor Maximum Allowable Thickness Variation	0.006 mm	0.00024 in
Brake Rotor Thickness- New	23.0 mm	0.905 in
*All brake rotors have a discard dimension cast into them. Replace any rotor that does not meet this specification. After refinishing the rotor, replace any rotor that does not meet the discard thickness specification.		

ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Brake Caliper Bracket Bolt	Threadlocker	89021297	10953488

DIAGNOSTIC INFORMATION AND PROCEDURES

BRAKE ROTOR THICKNESS MEASUREMENT

WARNING: Two different designs of the front brake rotors and front brake pads are used on this vehicle. Do NOT interchange first design and second design parts, or a loss of braking and personal injury could occur.

WARNING: Refer to [Brake Dust Warning](#) .

- If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to [Front Disc Brake Pads Replacement](#), and/or [Rear Disc Brake Pads Replacement](#).

2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
3. Using a micrometer calibrated in thousandths-of-a-millimeter, or ten-thousandths-of-an-inch, measure and record the thickness of the brake rotor at four or more points, evenly spaced around the rotor.

Ensure that the measurements are only taken within the friction surfaces and that the micrometer is positioned the same distance from the outer edge of the rotor, about 13 mm (1/2 in), for each measurement.

4. Compare the lowest thickness measurement recorded to the following specifications:

Specification - Front Brake Rotor Discard Thickness

27.0 mm (1.063 in)

Specification - Rear Brake Rotor Discard Thickness (J60)

10.0 mm (0.394 in)

Specification - Rear Brake Rotor Discard Thickness (J61)

21.0 mm (0.827 in)

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.
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, the rotor requires replacement.

BRAKE ROTOR THICKNESS VARIATION MEASUREMENT

WARNING: Refer to **Brake Dust Warning**.

NOTE: Any disc brake rotor that exhibits thickness variation exceeding the maximum acceptable level must be refinished or replaced. Thickness variation exceeding the maximum acceptable level can cause brake pulsation.

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to **Front Disc Brake Pads Replacement**, and/or **Rear Disc Brake Pads Replacement**.
2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
3. Using a micrometer calibrated in thousandths-of-a-millimeter, or ten-thousandths-of-an-inch, measure and record the thickness of the brake rotor at 4 or more points, evenly spaced around the rotor.

Ensure that the measurements are only taken within the friction surfaces and that the micrometer is positioned the same distance from the outer edge of the rotor, about 13 mm (1/2 in), for each measurement.

4. Calculate the difference between the highest and lowest thickness measurements recorded to obtain the amount of thickness variation.
5. Compare the thickness variation measurement to the following specification:

Specification - Brake Rotor Maximum Allowable Thickness Variation

0.006 mm (0.00024 in)

NOTE:

Whenever a brake rotor is refinished or replaced, the assembled lateral runout (LRO) of the rotor must be measured to ensure optimum performance of the disc brakes.

6. If the brake rotor thickness variation measurement exceeds the specification, the rotor requires refinishing or replacement.

BRAKE ROTOR SURFACE AND WEAR INSPECTION

WARNING: Refer to [Brake Dust Warning](#) .

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to [Front Disc Brake Pads Replacement](#), and/or [Rear Disc Brake Pads Replacement](#).
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.

- 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.

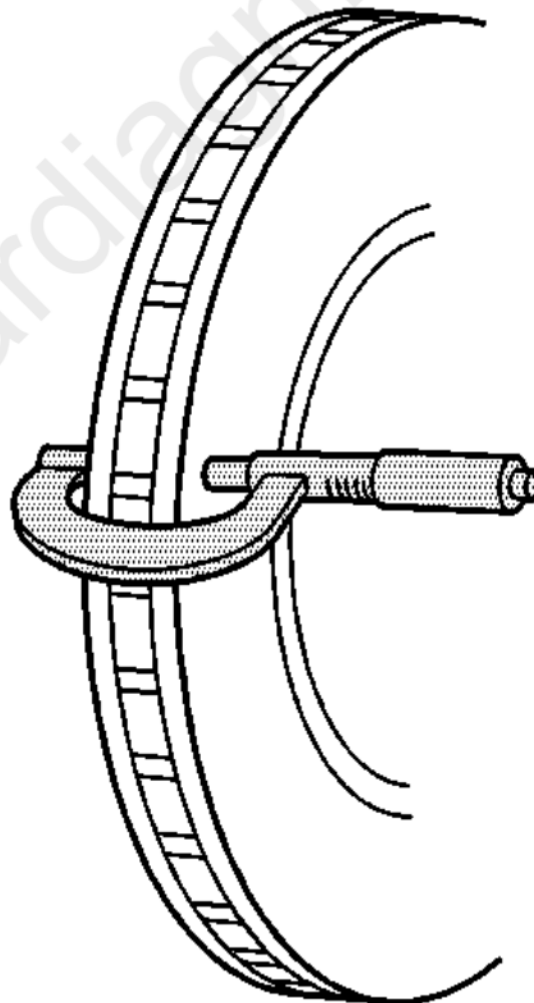


Fig. 1: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS COMPANY

5. Using a micrometer calibrated in thousandths-of-a-millimeter, or ten-thousandths-of-an-inch, measure and record the scoring depth of any grooves present on the rotor friction surfaces.
6. Compare the groove scoring depth recorded to the following specification:

Specification

Brake rotor maximum allowable scoring: 1.50 mm (0.059 in)

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.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT MEASUREMENT

Special Tools

- **CH-41013** Rotor Resurfacing Kit
- **CH-42450-A** Wheel Hub Resurfacing Kit
- **CH-45101** Hub and Wheel Runout Gauge
- **CH-45101-100** Conical Brake Rotor Washers

For equivalent regional tools, refer to [Special Tools](#).

WARNING: Refer to [Brake Dust Warning](#) .

NOTE:

- Brake rotor assembled lateral runout (LRO) exceeding the maximum allowable specification can cause thickness variation to develop in the brake rotor over time, usually between 4, 800 - 11, 300 km (3, 000 - 7, 000 mi).
- Brake rotor thickness variation **MUST** be checked **BEFORE** checking for assembled lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. Refer to [Brake Rotor Thickness Variation Measurement](#).

1. Match-mark the position of the brake rotor to the wheel studs if this has not been done already.

NOTE: 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.

2. Inspect the mating surface of the hub/axle flange and the brake rotor to ensure that there are no foreign particles, corrosion, rust, or debris remaining. If the wheel hub/axle flange and/or if the brake rotor mating surfaces exhibit these conditions, perform the following steps:
 1. Remove the brake rotor from the vehicle. Refer to [Front Brake Rotor Replacement](#), and/or [Rear Brake Rotor Replacement](#).
 2. Using the **CH-42450-A** wheel hub resurfacing kit, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange.
 3. Using the **CH-41013** rotor resurfacing kit, thoroughly clean any rust or corrosion from the mating surface of the brake rotor.
 4. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
3. Install the rotor to the hub/axle flange using the match-mark made prior to removal.

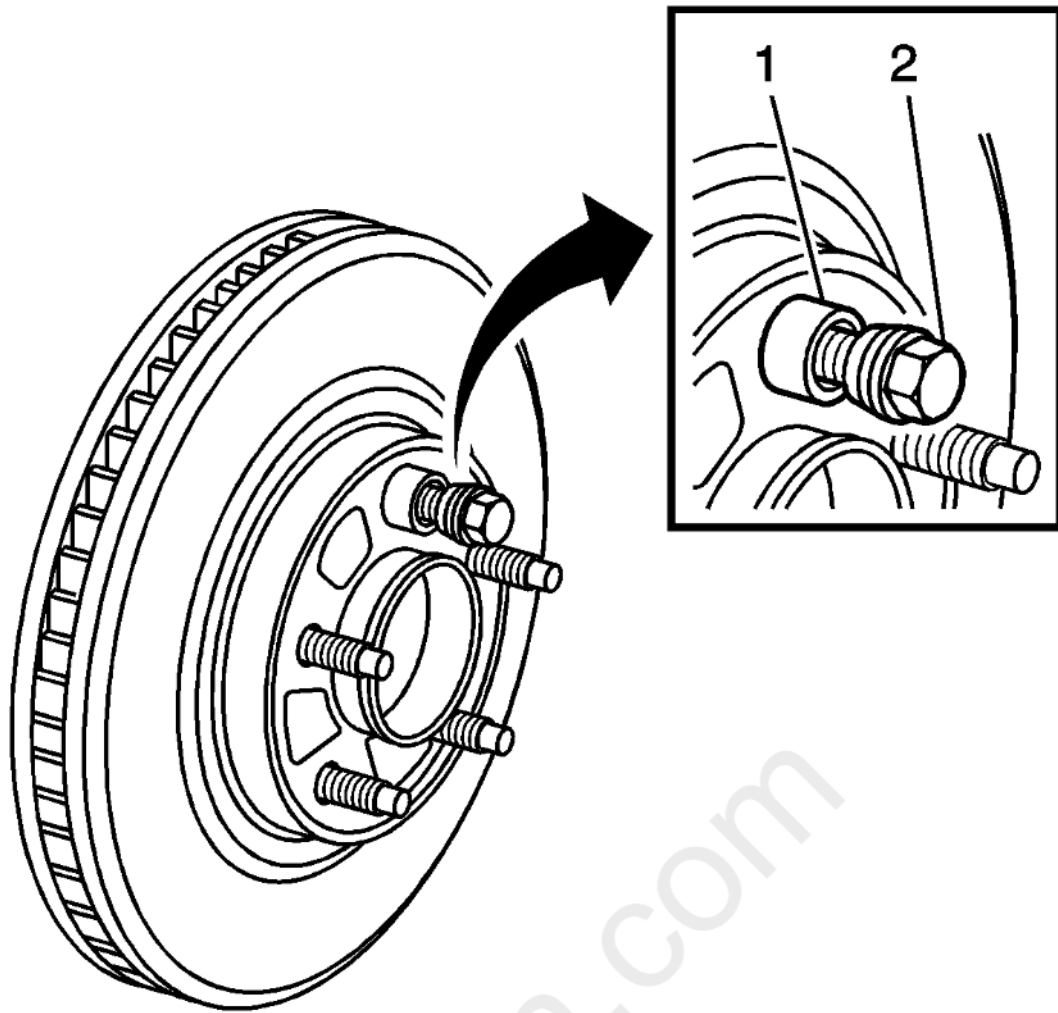


Fig. 2: Lug Nuts & Conical Washers

Courtesy of GENERAL MOTORS COMPANY

4. Hold the rotor firmly in place against the hub/axle flange and install one of the **CH-45101-100** conical brake rotor washers (1), and one lug nut (2) onto the upper-most wheel stud.
5. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

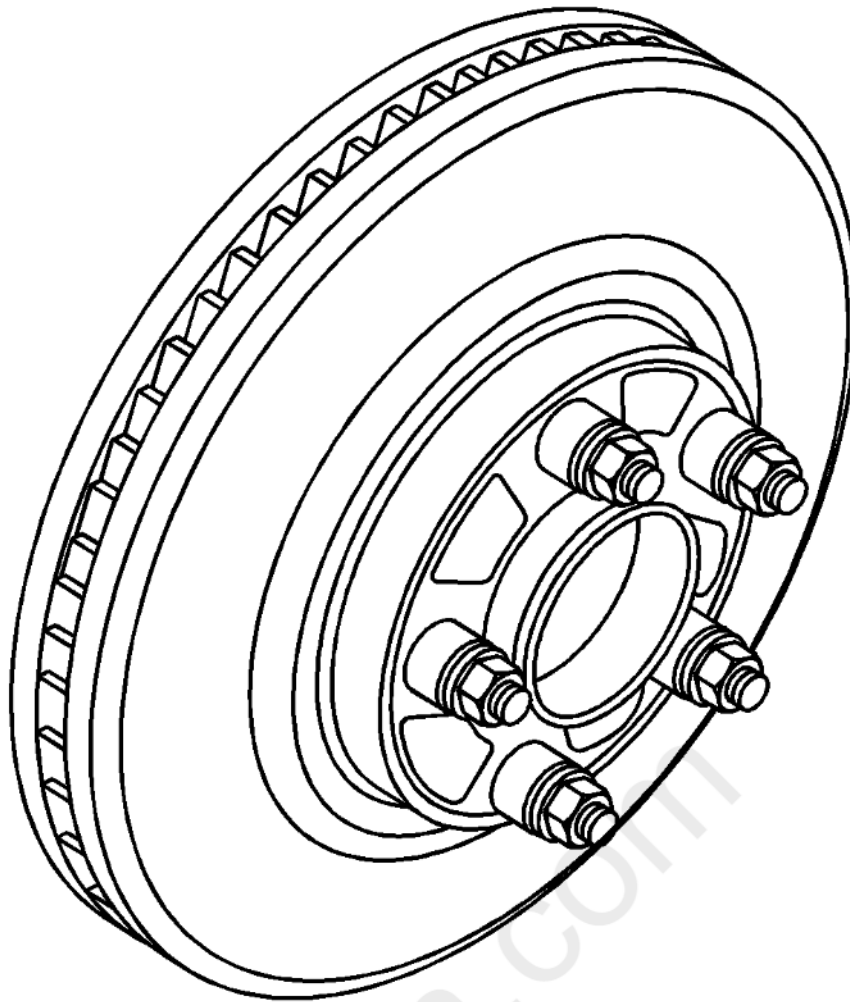


Fig. 3: Lug Nuts & Conical Washers

Courtesy of GENERAL MOTORS COMPANY

6. Install the remaining **CH-45101-100** conical brake rotor washers and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern.
7. Tighten the lug nuts in a star-pattern to specification. Refer to **Tire and Wheel Removal and Installation** .
8. If the brake rotor has been REFINISHED or REPLACED with a new rotor, proceed to step 14.
9. If the brake rotor meets the following criteria, proceed to step 10.
 - The rotor is within specifications and is being REUSED.
 - The rotor has NOT been refinished.
 - The rotor does NOT exhibit thickness variation exceeding the maximum allowable level.

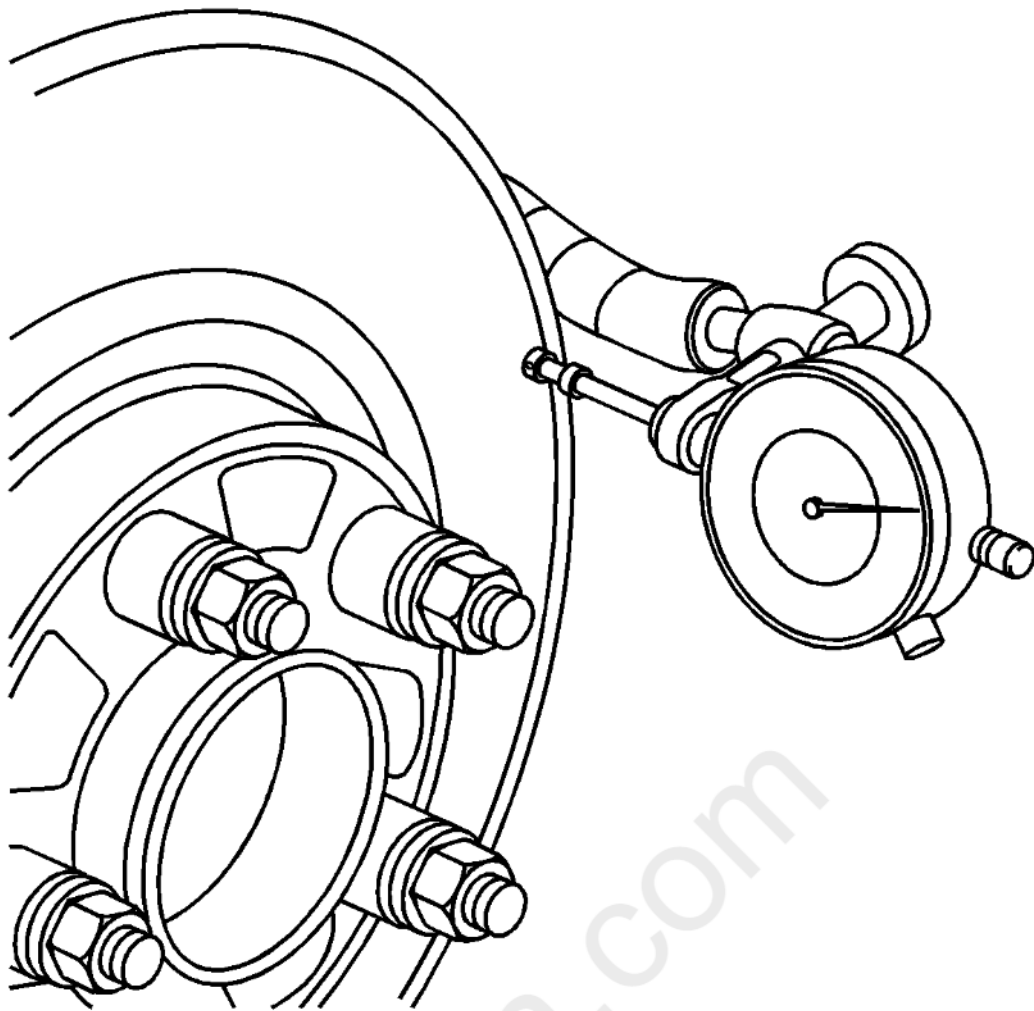


Fig. 4: Using Dial Indicator To Measure Lateral Runout

Courtesy of GENERAL MOTORS COMPANY

10. Mount a dial indicator, **CH-45101** hub and wheel runout gauge, or equivalent, to the steering knuckle and position the indicator button so it contacts the brake rotor friction surface at a 90 degree angle, approximately 13 mm (0.5 in) from the outer edge of the rotor.
11. Measure and record the assembled LRO of the brake rotor.
 1. Rotate the rotor until the lowest reading is displayed on the indicator dial, then set the dial to zero.
 2. Rotate the rotor until the highest reading is displayed on the dial.
 3. Mark the location of the high spot relative to the nearest wheel stud, or studs.
 4. Measure and record the amount of LRO.
12. Compare the brake rotor assembled LRO to the following specification:

Specification

- Front brake rotor maximum allowable assembled lateral runout: 0.05 mm (0.002 in)
- Rear brake rotor maximum allowable assembled lateral runout: 0.05 mm (0.002 in)

13. If the brake rotor assembled LRO is within specifications, proceed to step 18.

If the brake rotor assembled LRO exceeds the specification, refinish the rotor to ensure true parallelism. Refer to **Brake Rotor Refinishing**. After refinishing the rotor, proceed to step 14.

14. Mount a dial indicator, **CH-45101** hub and wheel runout gauge, or equivalent, to the steering knuckle and position the indicator button so it contacts the brake rotor friction surface at a 90 degree angle, approximately 13 mm (0.5 in) from the outer edge of the rotor.
15. Measure and record the assembled LRO of the brake rotor.
 1. Rotate the rotor until the lowest reading is displayed on the indicator dial, then set the dial to zero.

2. Rotate the rotor until the highest reading is displayed on the dial.
 3. Mark the location of the high spot relative to the nearest wheel stud, or studs.
 4. Measure and record the amount of LRO.
16. Compare the brake rotor assembled LRO to the following specification:

Specification

- Front brake rotor maximum allowable assembled lateral runout: 0.05 mm (0.002 in)
 - Rear brake rotor maximum allowable assembled lateral runout: 0.05 mm (0.002 in)
17. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. Refer to [Brake Rotor Assembled Lateral Runout Correction](#).
 18. If the brake rotor assembled LRO measurement is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **CH-45101-100** conical brake rotor washers and the lug nuts.

BRAKE PAD INSPECTION

WARNING: Refer to [Brake Dust Warning](#) .

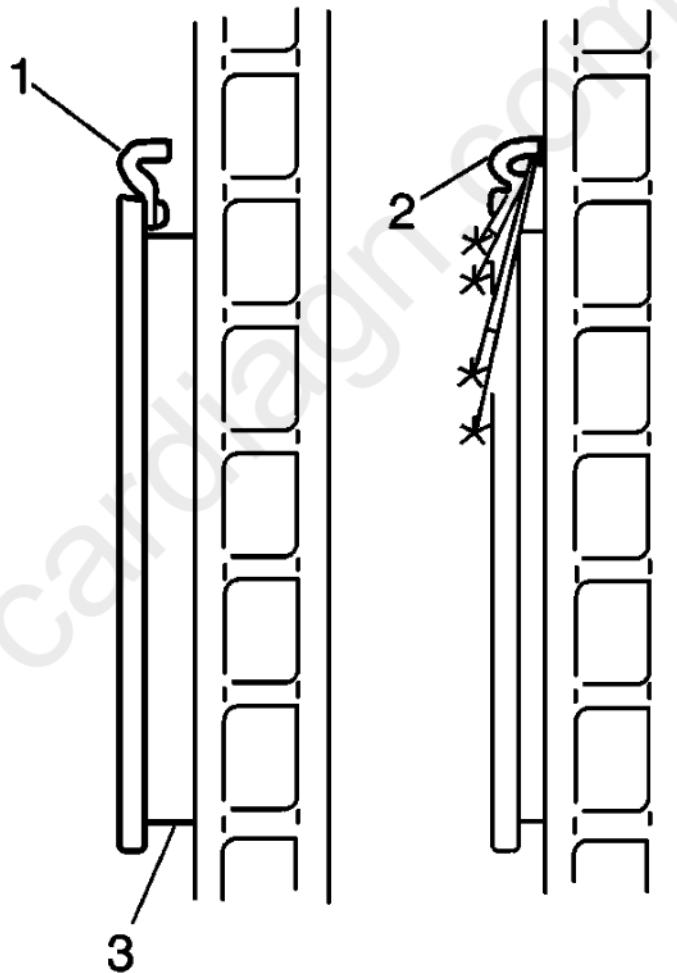


Fig. 5: View Of Brake Pads & Audible Wear Sensors
Courtesy of GENERAL MOTORS COMPANY

1. Inspect the disc brake pads at regular intervals, or whenever the tire and wheel assemblies are removed from the vehicle.
2. If replacement is necessary, always replace disc brake pads in axle sets.
3. Inspect both edges of the disc brake pad friction surfaces (3). The highest rate of wear normally occurs at the trailing edge of the disc brake pads.

4. Inspect the thickness of the disc brake pads (3) in order to ensure that they have not worn prematurely. The disc brake pad wear should be approximately even per axle set.
5. Both front and rear disc brake pads have integral, audible wear sensors (1). When the disc brake pad wear reaches the minimum allowable thickness, the wear sensor contacts the disc brake rotor (2). The wear indicator will then produce an audible, high-pitched warning noise during wheel rotation.
6. Replace the disc brake pads when the friction surface (3) is worn to within 2 mm (0.08 in) of the mounting plates.
7. 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 0.13 mm (0.005 in) gap exists midway between the length of the disc brake pads, replace the disc brake pads.
8. 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.
9. Replace the disc brake pads if any have separated from the mounting plates.
10. Inspect the disc brake pads friction surfaces for cracks, fractures, or damage which may cause noise or otherwise impair disc brake performance.

BRAKE CALIPER INSPECTION

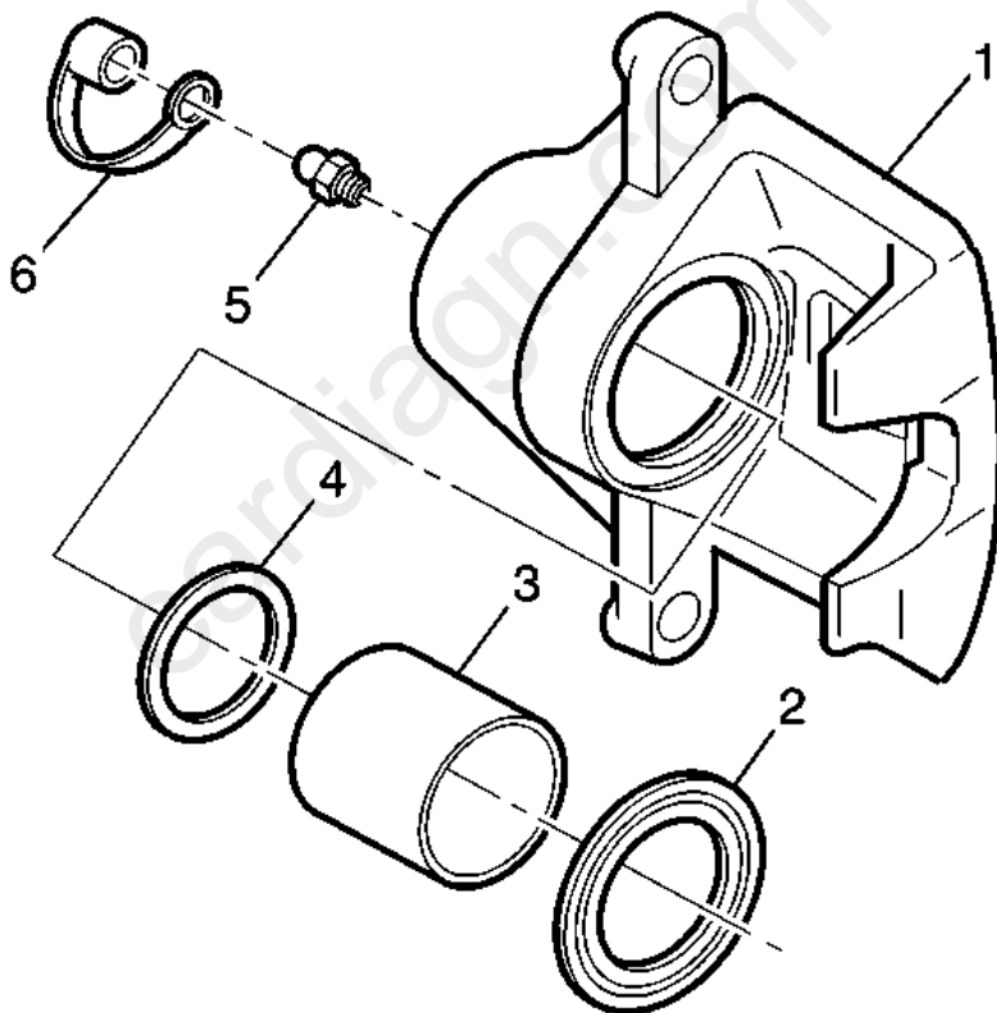


Fig. 6: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to [Brake Dust Warning](#) .

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

1. Inspect the brake caliper housing (1) for cracks, excess wear, and/or damage. If any of these conditions are present, the brake caliper requires replacement.
2. Inspect the caliper piston dust boot seal (2) for cracks, tears, cuts, deterioration and/or improper seating in the caliper body. If any of these conditions are present, the brake caliper requires overhaul or replacement.
3. Inspect for brake fluid leakage around the caliper piston dust boot seal (2) and on the disc brake pads. If there is any evidence of brake fluid leakage, the brake caliper requires overhaul or replacement.

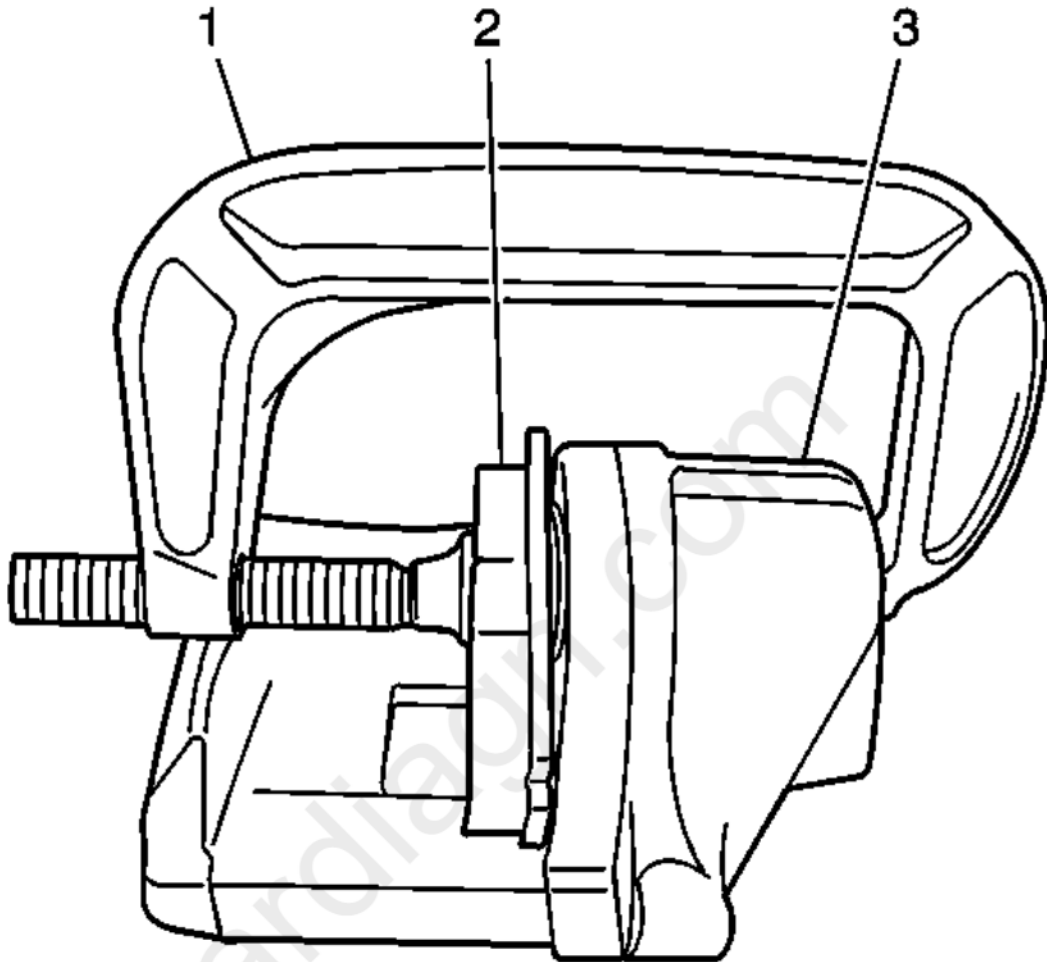


Fig. 7: Compressing Caliper Piston
Courtesy of GENERAL MOTORS COMPANY

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. If a caliper piston is frozen or difficult to bottom, the caliper requires overhaul or replacement.

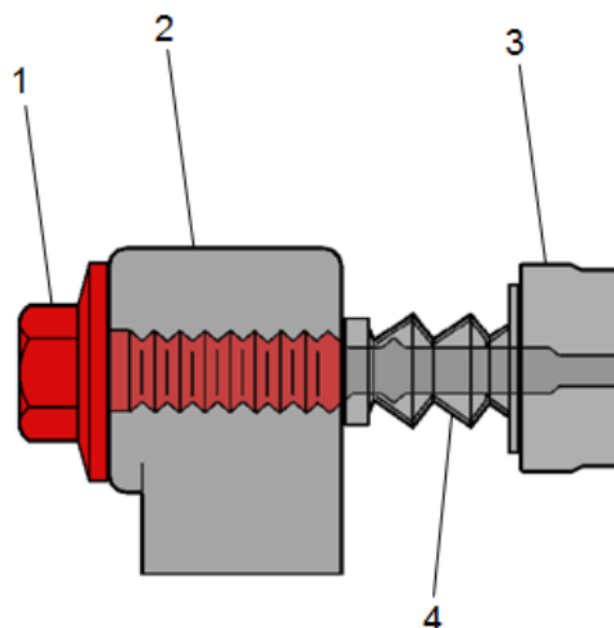
- For single piston caliper applications, insert a discarded inner brake pad (2) or block of wood in front of the piston. Using a large C-clamp (1) installed over the body of the caliper (3) and against the brake pad or block of wood, slowly bottom the piston in the bore.
- For dual piston caliper applications, insert a discarded inner brake pad (2) or block of wood in front of the pistons. Using 2 large C-clamps (1) installed over the body of the caliper (3) and against the brake pad or block of wood, slowly bottom the pistons evenly into the bores.

DISC BRAKE MOUNTING AND HARDWARE INSPECTION

WARNING: Refer to [Brake Dust Warning](#) .

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. Refer [Lifting and Jacking the Vehicle](#) .
5. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
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 bracket. If excessive looseness is observed, the brake caliper bracket bushings and/or the brake caliper guide pins may need to be replaced.
7. Compress the caliper piston(s).
 1. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad.
 2. Slowly tighten the C-clamp until the piston(s) are pushed completely into the caliper bores.
 3. Remove the C-clamp from the caliper.
8. With the piston(s) compressed into the caliper bore(s), grasp the brake caliper housing and slide it back and forth on the brake caliper pins. 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 guide pins and/or the brake caliper bracket bushings for wear or damage. If wear or damage conditions are found, replacement of the brake caliper guide pins and/or the brake caliper bracket bushings is necessary.
9. Without disconnecting the hydraulic brake flexible hose, remove the brake caliper from the caliper bracket and support with heavy mechanics wire. Refer to [Front Brake Caliper Replacement](#), and/or [Rear Brake Caliper Replacement](#).
10. Remove the disc brake pads from the brake caliper bracket.
11. Inspect the disc brake pad hardware for the following:
 - Missing hardware
 - Excessive corrosion
 - Bent mounting tabs
 - Looseness at the brake caliper bracket
 - Looseness at the disc brake pads
 - Excessive contaminants in the brake caliper bracket surface and threads.
12. If any of the conditions listed are found, the disc brake pad hardware requires replacement.
13. Ensure the disc brake pads are held firmly in place on the brake caliper bracket, yet slide easily on the mounting hardware without binding.



14. Inspect the caliper guide pins (1) for the following:
 - Binding
 - Seizing
 - Looseness in the brake caliper bracket (3)
 - Bent or damaged brake caliper bolts
 - Cracked or torn boots (4)
 - Missing boots
 - Bent or damaged brake caliper bracket (3)
15. If any of the conditions listed are found then the brake caliper hardware requires replacement.
16. Install the disc brake pads to the brake caliper bracket.
17. Install the disc brake caliper to the brake caliper bracket. Refer to **Front Brake Caliper Replacement**, and/or **Rear Brake Caliper Replacement**.

FRONT DISC BRAKE MOUNTING AND HARDWARE INSPECTION

WARNING: Refer to **Brake Dust Warning** .

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. Refer **Lifting and Jacking the Vehicle** .
5. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
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.
 1. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad.
 2. Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores.
 3. 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. Refer to **Front Brake Caliper Replacement**.

NOTE: When replacing the disc brake pads, maintain the same disc brake pad wear sensor orientation.

10. Remove the disc brake pads from the brake caliper mounting bracket.
11. Inspect the disc brake pad mounting hardware for the following:
 - Missing mounting hardware
 - Excessive corrosion
 - Bent mounting tabs
 - Looseness at the brake caliper mounting bracket

- Looseness at the disc brake pads
 - Excessive contaminants in the brake caliper mounting bracket surface and threads.
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.

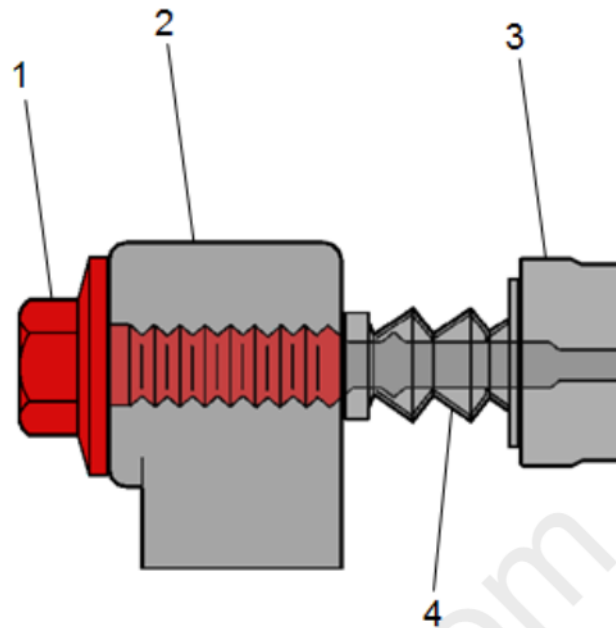


Fig. 9: View Of Caliper, Pin, Boots & Caliper Mounting Bracket
 Courtesy of GENERAL MOTORS COMPANY

14. Inspect the brake caliper guide pin bolt (1), brake caliper (2), caliper bracket (3), and the guide pin seal (4) for the following:
 - Binding
 - Seizing
 - Looseness in the brake caliper mounting bracket
 - Bent or damaged brake caliper mounting bolts
 - Cracked or torn boots
 - Missing boots
 - 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. Refer to **Front Brake Caliper Replacement**.

REAR DISC BRAKE MOUNTING AND HARDWARE INSPECTION

WARNING: Refer to **Brake Dust Warning** .

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.

WARNING: Do not use a service jack in locations other than those specified to lift this vehicle. Lifting the vehicle with a jack in those other locations

could cause the vehicle to slip off the jack and roll; this could cause injury or death.

4. Raise and support the vehicle. Refer [Lifting and Jacking the Vehicle](#) .
5. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
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 rear caliper piston.
 1. Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad.
 2. Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores.
 3. Remove the C-clamp from the caliper.
8. With the piston compressed into the caliper bore, 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 disconnect the hydraulic brake hose from the caliper. Refer to [Rear Brake Caliper Replacement](#).
10. Remove the disc brake pads from the brake caliper mounting bracket.
11. Inspect the disc brake pad mounting hardware for the following:
 - Missing mounting hardware
 - Excessive corrosion
 - Bent mounting tabs
 - Looseness at the brake caliper mounting bracket
 - Looseness at the disc brake pads
 - Excessive contaminants in the brake caliper mounting bracket surface and threads.
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.

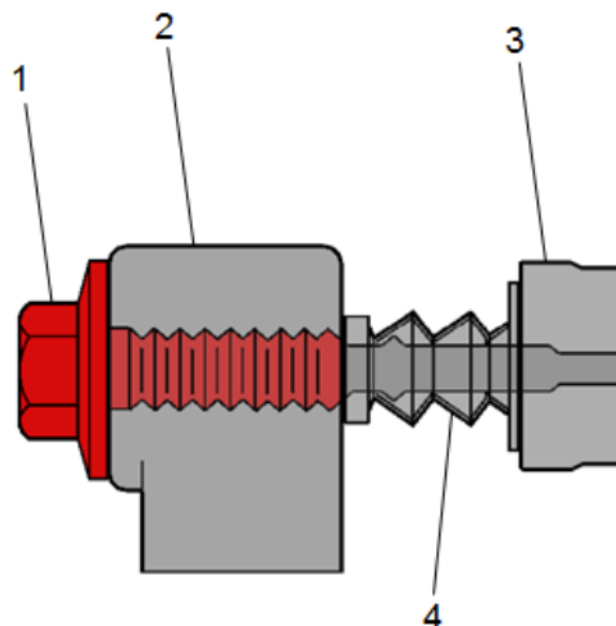


Fig. 10: View Of Caliper, Pin, Boots & Caliper Mounting Bracket
Courtesy of GENERAL MOTORS COMPANY

14. Inspect the caliper bolts (1) or guide pins for the following:
 - Binding
 - Seizing
 - Looseness in the brake caliper mounting bracket (3)
 - Bent or damaged brake caliper mounting bolts or guide pins
 - Cracked or torn boots (4)
 - Missing boots
 - Bent or damaged brake caliper mounting bracket (3)
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.



Fig. 11: Upper Guide Pin Seal And Guide Pin Seal
Courtesy of GENERAL MOTORS COMPANY

NOTE: Excess brake lubricant and trapped air must be expelled from the brake caliper guide pin bore to allow full caliper movement and prevent premature brake pad wear.

17. Gently pull the edge of the upper guide pin seal (1) away from the brake caliper guide pin (2) while simultaneously pushing the brake caliper guide pin into the brake caliper bracket to expel any trapped air and excess brake lubricant.
18. Repeat step 17 for the lower guide pin seal and brake caliper guide pin.
19. With a clean shop towel, clean any excess brake lubricant from the guide pin seal and brake caliper guide pin.
20. Install the disc brake caliper to the brake caliper mounting bracket. Refer to [Rear Brake Caliper Replacement](#).

REPAIR INSTRUCTIONS

FRONT DISC BRAKE PADS REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

NOTE: Always replace disc brake pads in axle sets.

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, no brake fluid needs to be removed before proceeding.

3. 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.
4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
5. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
6. Place a large C-clamp over the brake caliper body and against the outer brake pad.
7. Using the C-clamp, compress the brake caliper piston fully into the brake caliper bore.

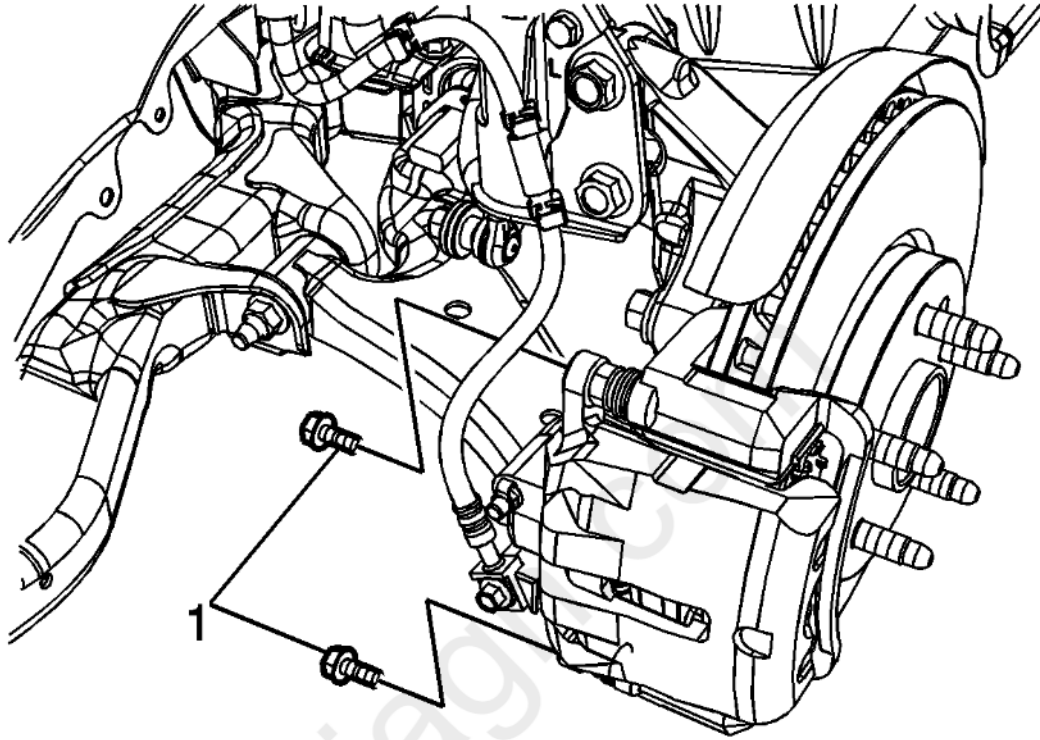


Fig. 12: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY.
- Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

8. Using a backup wrench to hold the brake caliper guide pins stationary, remove the brake caliper guide pin bolts (1).

CAUTION:

Support the brake caliper with heavy mechanic 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.

9. Remove the caliper and support the caliper with heavy mechanics wire.

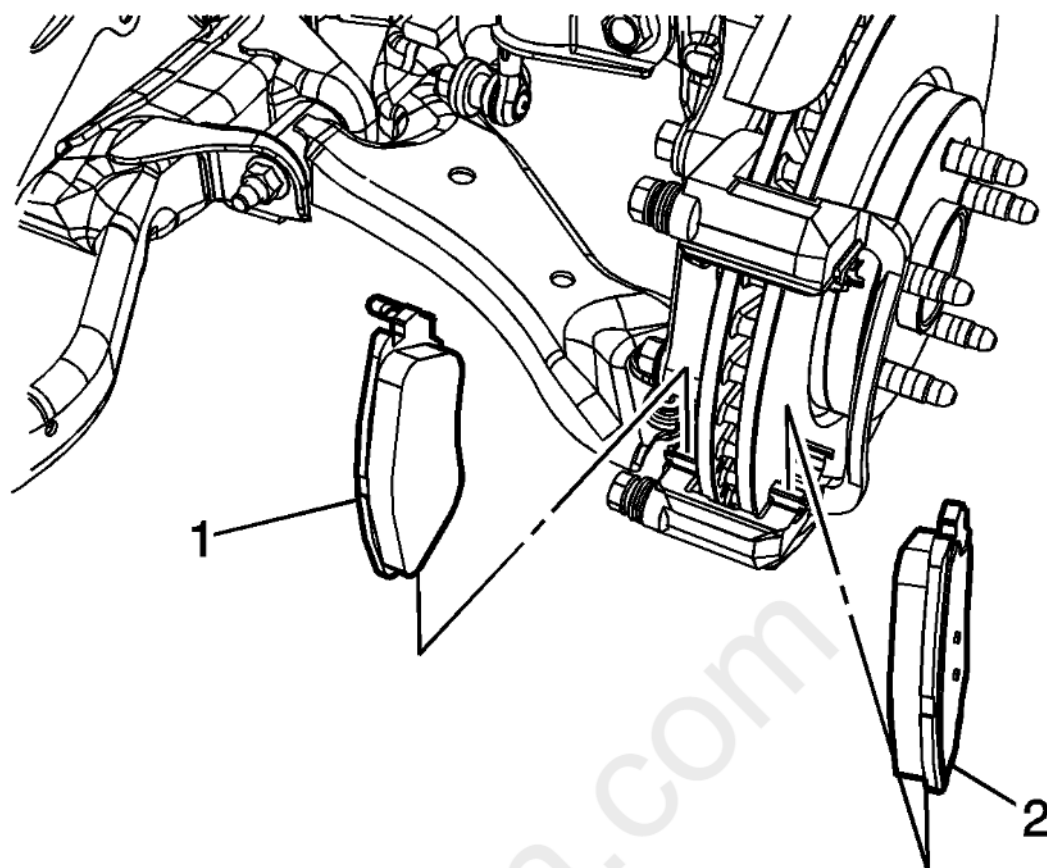


Fig. 13: Inner & Outer Brake Pads

Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pad wear sensor for correct installation.

10. Remove the inner brake pad (1) and the outer brake pad (2).

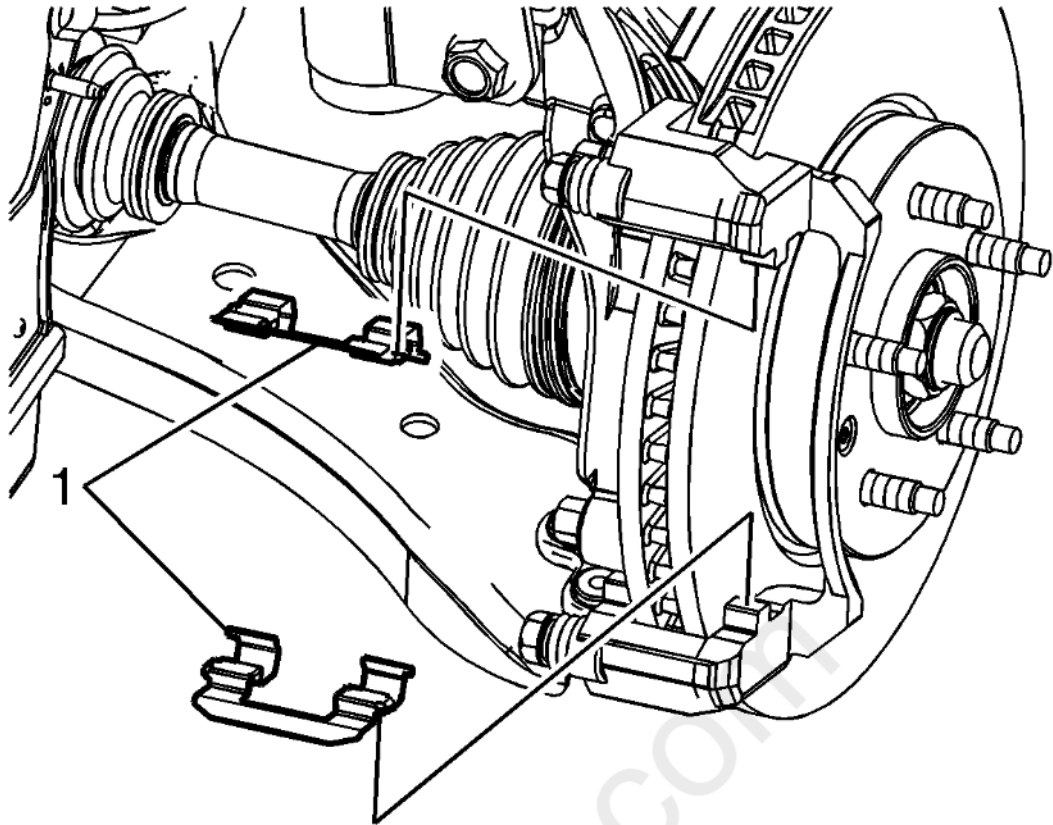


Fig. 14: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

11. Remove the upper and lower brake pad springs (1).
12. If installing new brake pads, discard the springs.

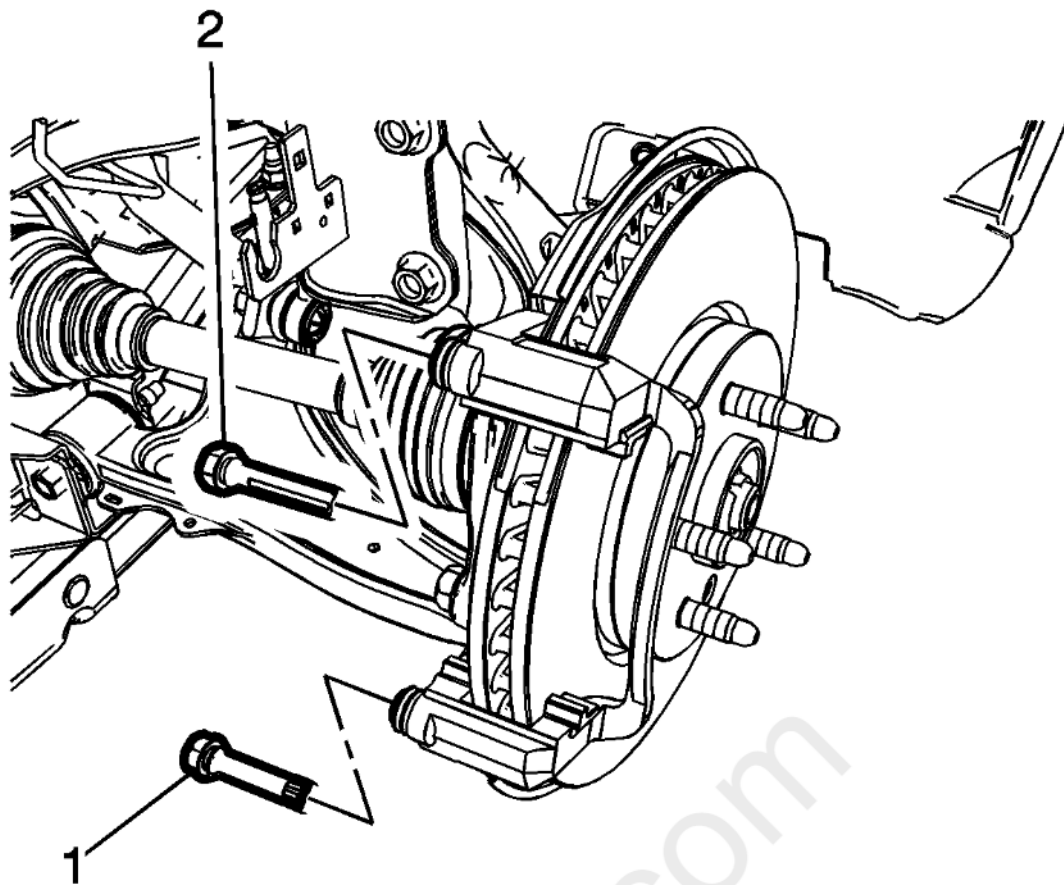


Fig. 15: Brake Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

NOTE: The lower brake caliper guide pin is equipped with a bushing and must be installed in the same location.

13. Remove the lower brake caliper guide pin (1).
14. Remove the upper brake caliper guide pin (2).

Installation Procedure

1. Inspect the brake caliper guide pins and guide pin seals for damage and replace, if necessary.
2. Remove any grease or debris from the brake caliper guide pins, guide pin seals, and guide pin bores in the brake caliper bracket with a clean shop cloth.
3. Apply a light coating of high temperature, silicone brake lubricant to the brake caliper bracket guide pin bores, the inner portion of the guide pin seals, and the brake caliper guide pins.

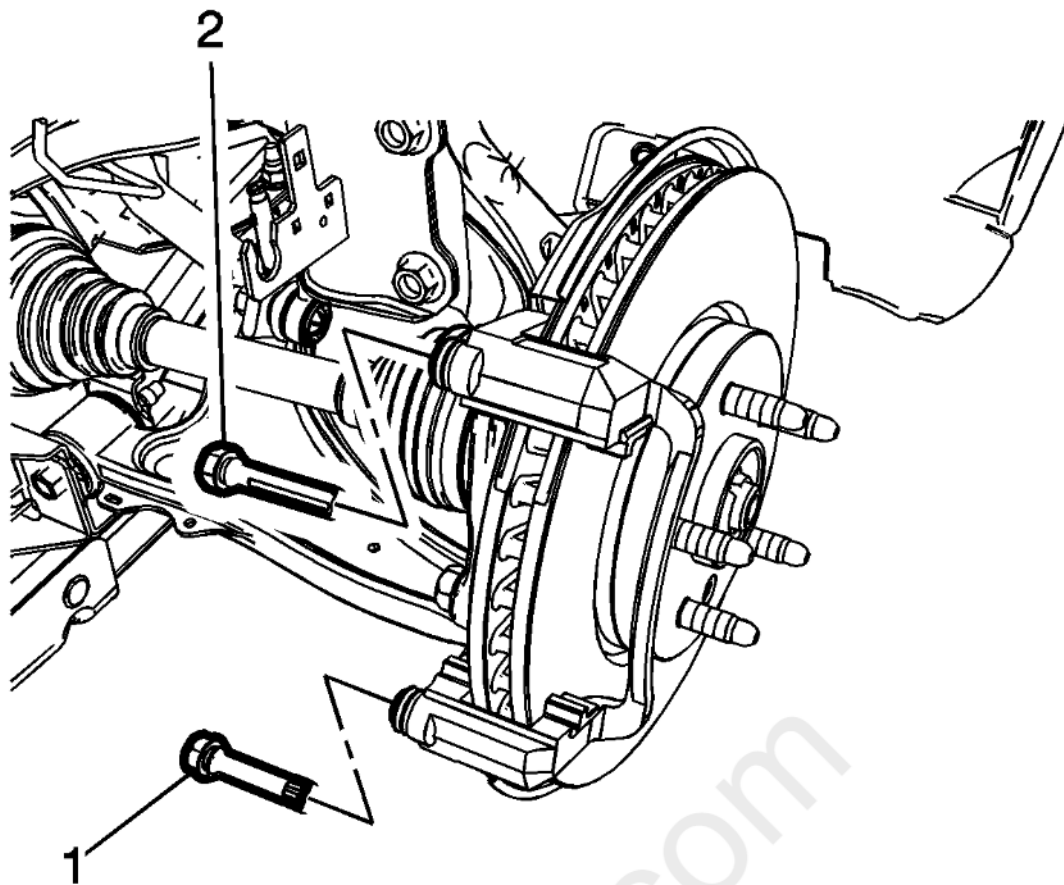


Fig. 16: Brake Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

NOTE: The lower brake caliper guide pin is equipped with a bushing and must be installed in the same location.

4. Install the lower brake caliper guide pin (1).
5. Seat the brake caliper guide pin seal in the groove of the brake caliper guide pin.
6. Install the upper brake caliper guide pin (2).
7. Seat the brake caliper guide pin seal in the groove of the brake caliper guide pin.

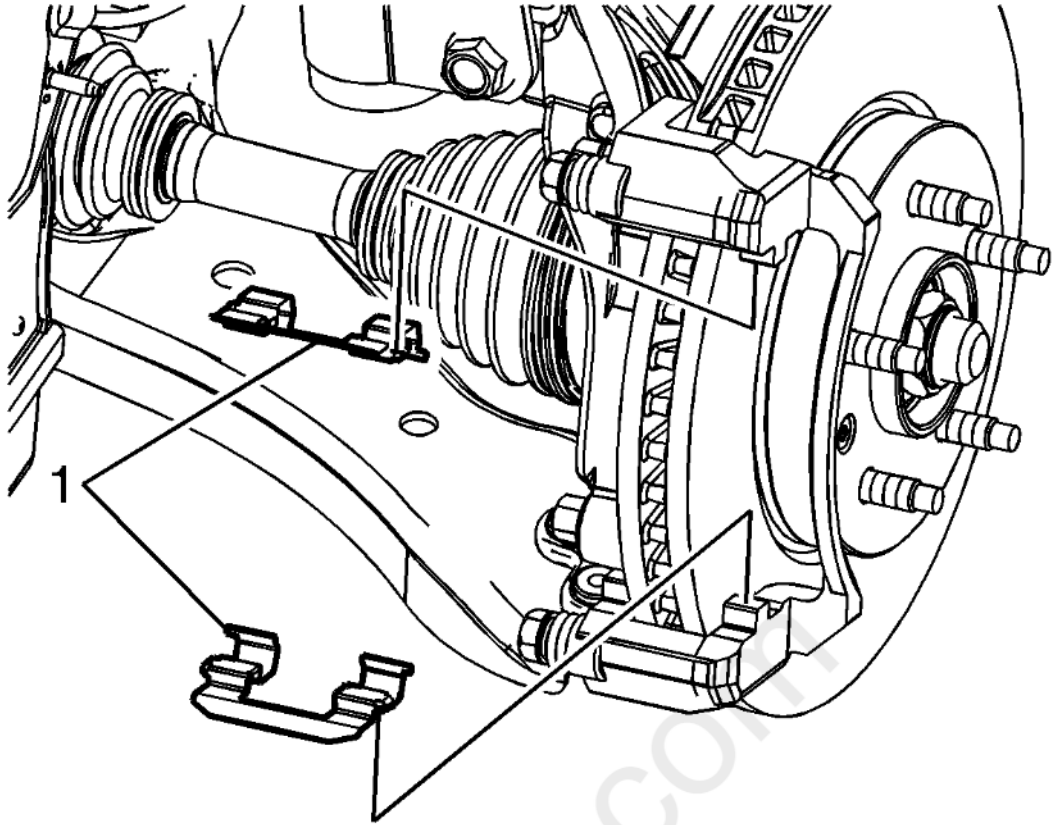


Fig. 17: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

NOTE: If installing new brake pads, install new springs.

8. Install the upper and lower brake pad springs (1).

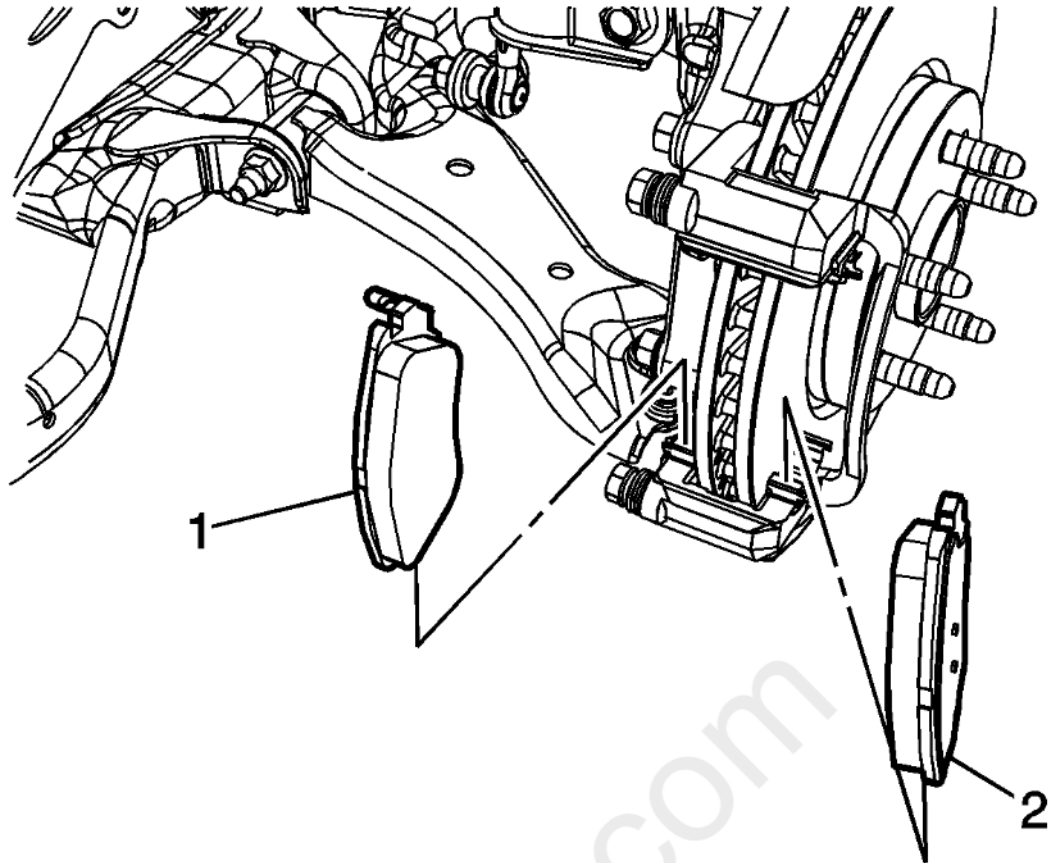


Fig. 18: Inner & Outer Brake Pads

Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the brake pad wear sensor for correct installation.

9. Install the inner brake pad (1) and the outer brake pad (2).
10. Position the brake caliper to the brake caliper bracket.

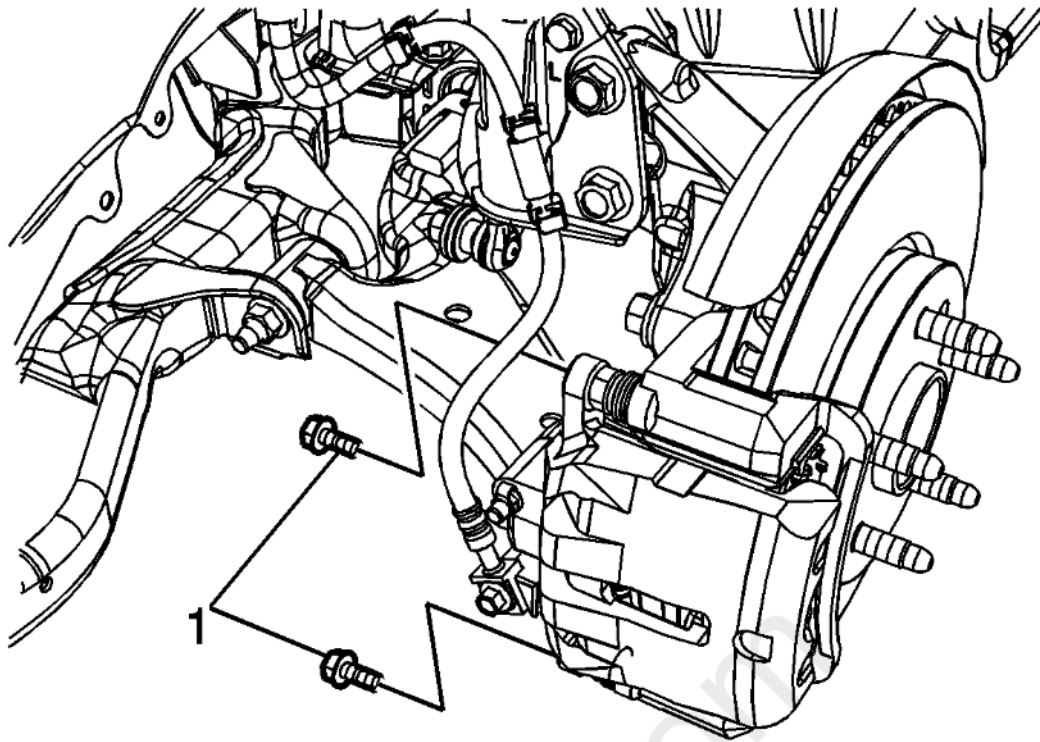


Fig. 19: Brake Caliper Guide Pin Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

11. Using a backup wrench to hold the brake caliper guide pins stationary, install the brake caliper guide pin bolts (1) and tighten to 27 N.m (20 lb ft).
12. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
13. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
14. Slowly release the brake pedal.
15. Wait 15 seconds, then repeat steps 13-14 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
16. Fill the master cylinder reservoir. Refer to [Master Cylinder Reservoir Filling](#) .
17. Burnish the brake pads and rotors. Refer to [Brake Pad and Rotor Burnishing](#).

REAR DISC BRAKE PADS REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

NOTE: Always replace disc brake pads in axle sets.

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, no brake fluid needs to be removed before proceeding.
3. 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.

4. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
5. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

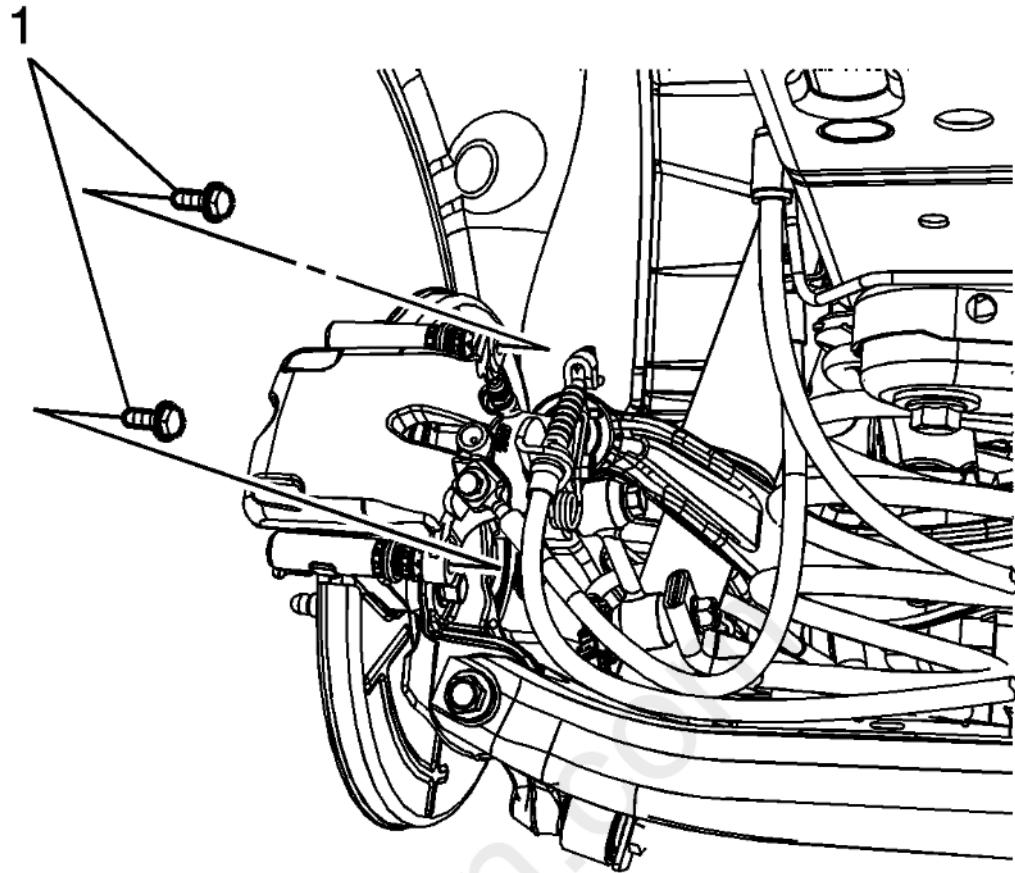


Fig. 20: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY.
- Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

6. Using a backup wrench to hold the brake caliper guide pin stationary, remove the brake caliper guide pin bolts (1).

CAUTION:

Support the brake caliper with heavy mechanic 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.

7. Remove the brake caliper from the brake caliper bracket and support with heavy mechanics wire or equivalent.

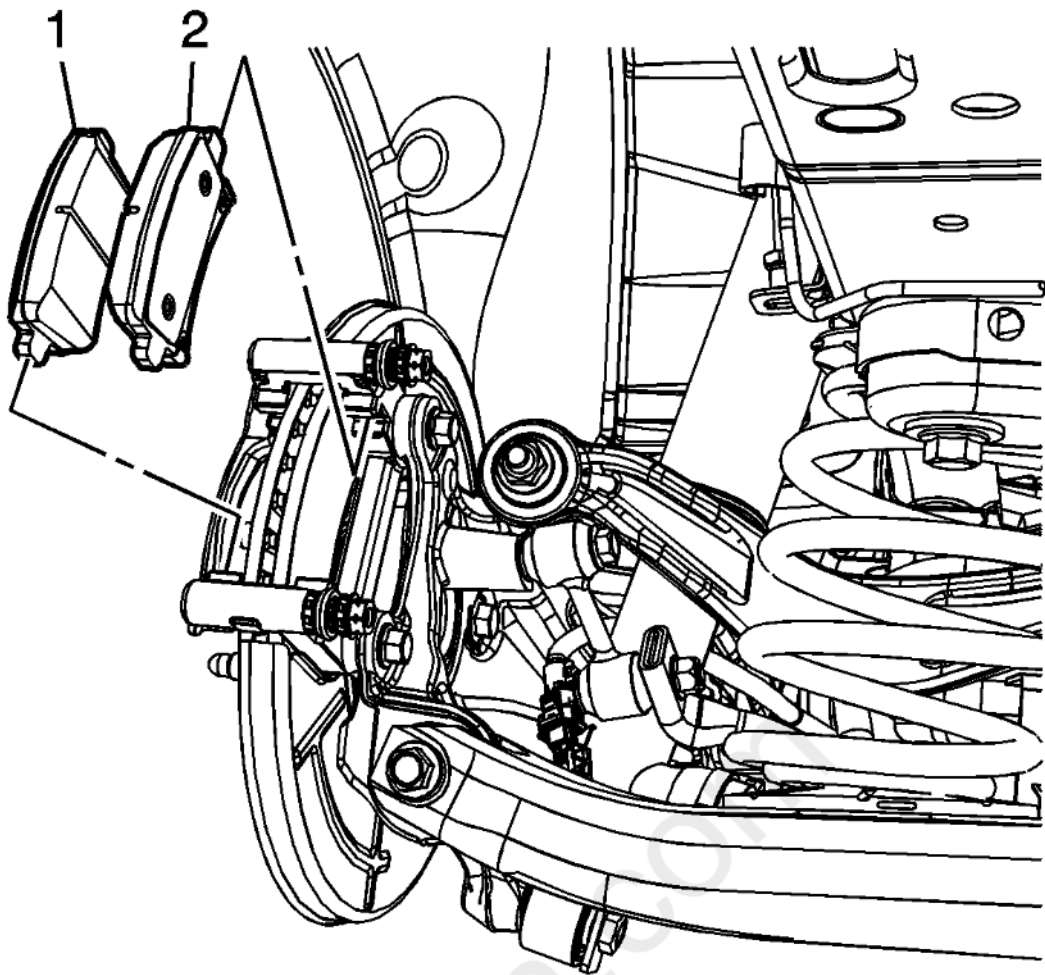


Fig. 21: Outer And Inner Brake Pads

Courtesy of GENERAL MOTORS COMPANY

8. Remove the outer brake pad (1).

NOTE: The inner brake pad is equipped with the wear sensor.

9. Remove the inner brake pad (2).

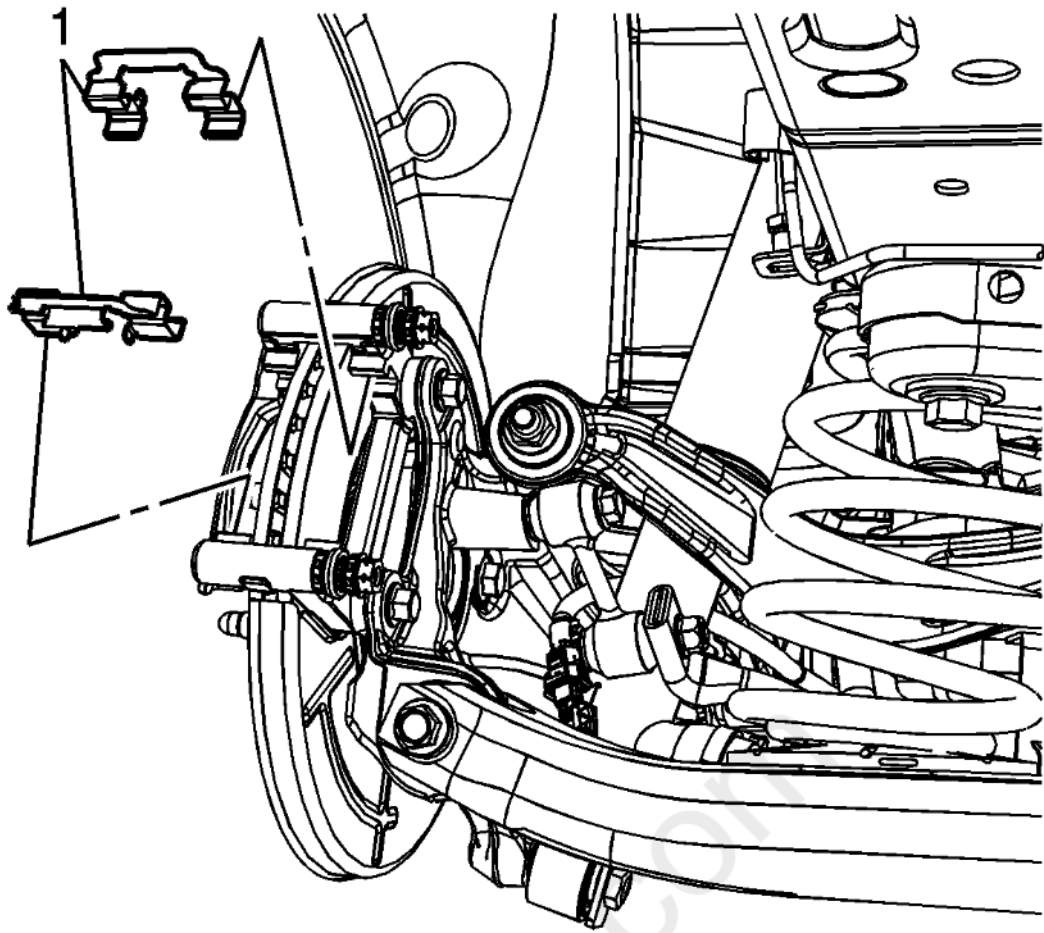


Fig. 22: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

10. Remove and discard the brake pad springs (1).
11. Thoroughly clean the brake caliper bracket contact areas of any corrosion.

Installation Procedure

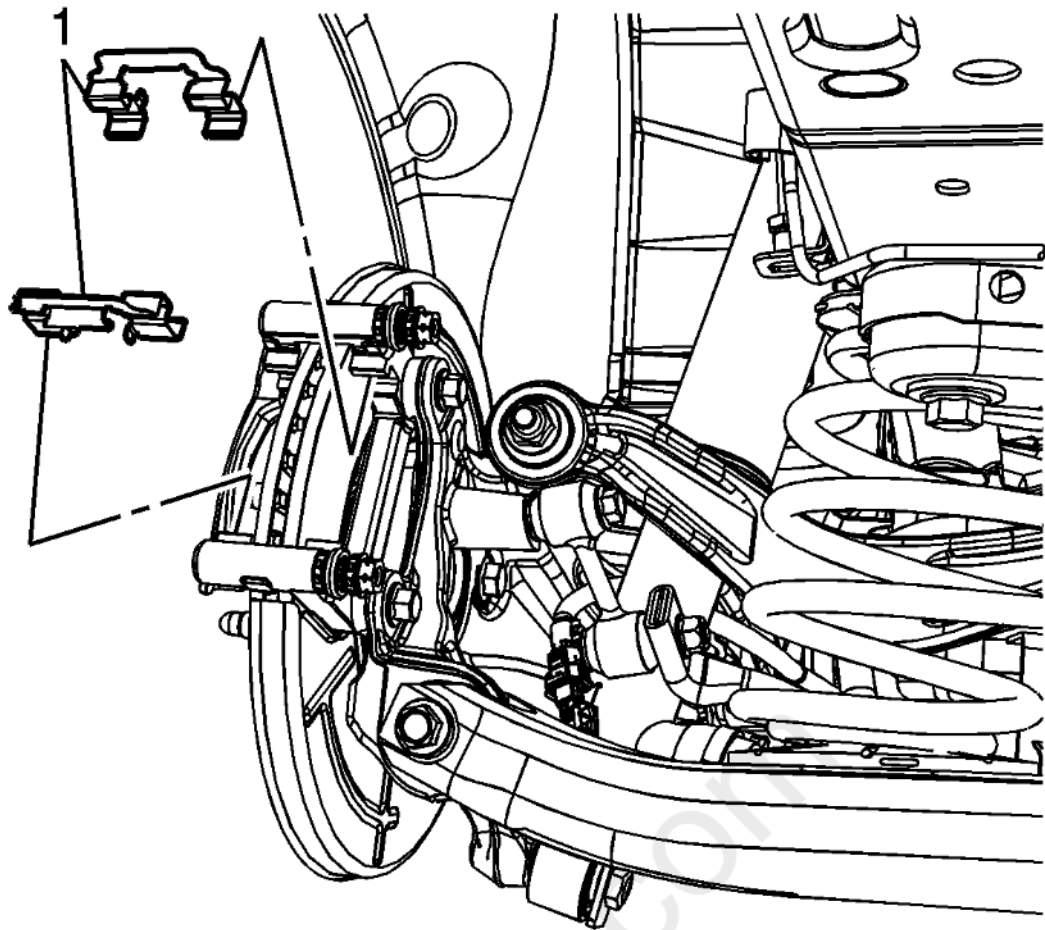


Fig. 23: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

1. Install new brake pad springs (1).

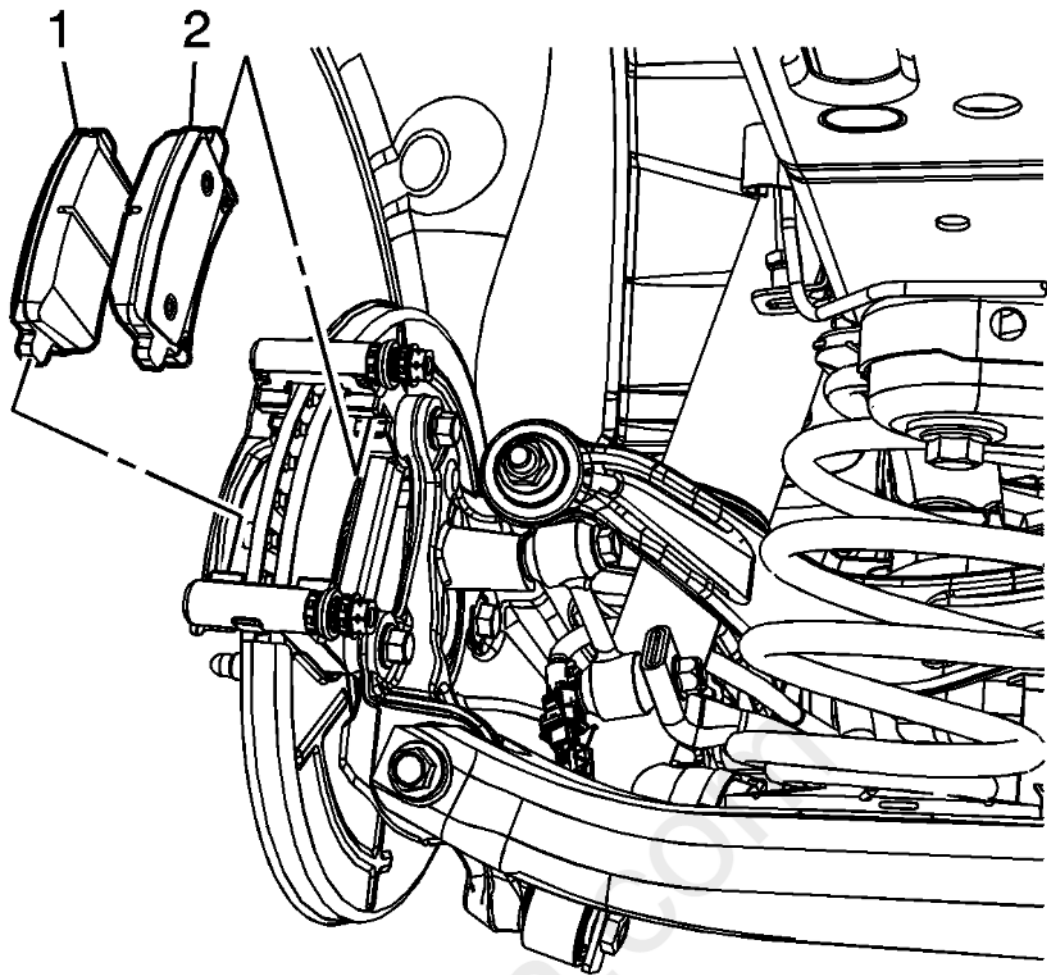


Fig. 24: Outer And Inner Brake Pads

Courtesy of GENERAL MOTORS COMPANY

2. Install the outer brake pad (1).

NOTE: The inner brake pad is equipped with the wear sensor.

3. Install the inner brake pad (2).
4. Using an appropriate brake caliper piston spanner tool, slowly rotate the brake caliper piston clockwise while applying inward pressure to the brake caliper piston until the piston is fully seated in the brake caliper housing.
5. Ensure the notches in the brake caliper piston align correctly with the pins on the inner disc brake pad.

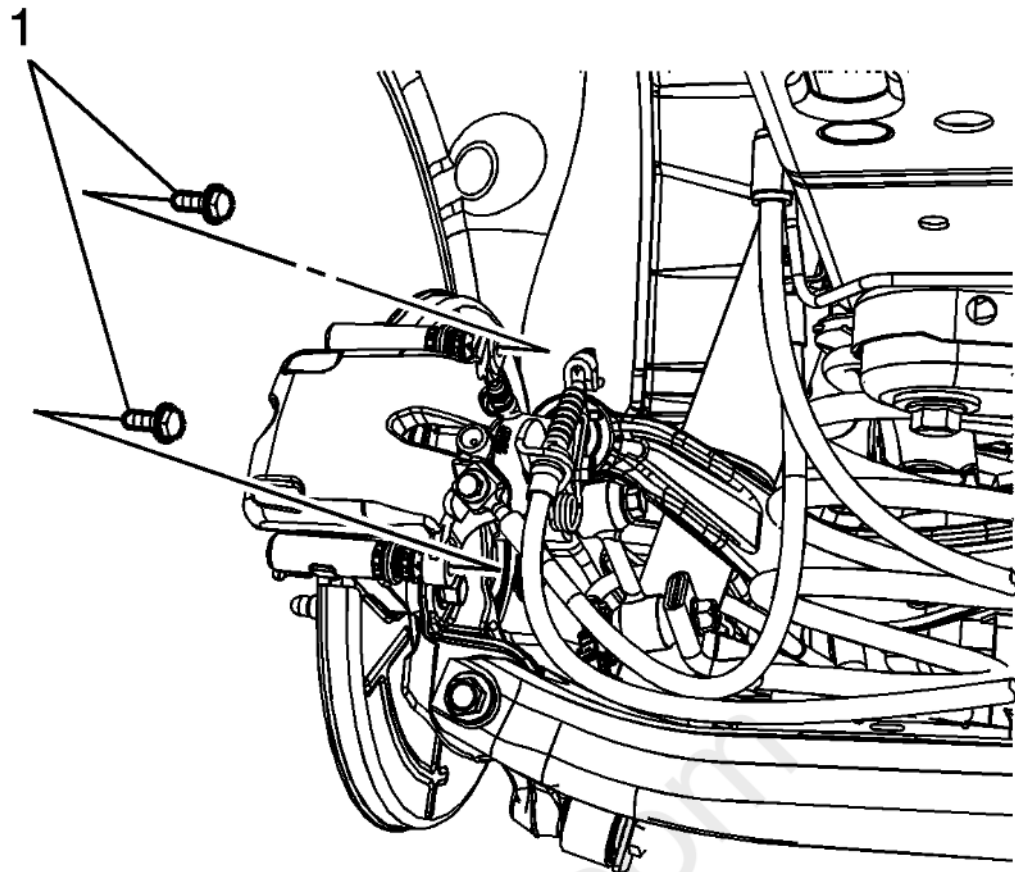


Fig. 25: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

6. Install the brake caliper to the brake caliper bracket.

CAUTION: Refer to [Fastener Caution](#) .

7. Using a backup wrench to hold the brake caliper guide pin stationary, install the brake caliper guide pin bolts (1) and tighten to 27 N.m (20 lb ft).
8. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
9. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
10. Slowly release the brake pedal.
11. Wait 15 seconds, then repeat steps 9-10 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
12. Fill the master cylinder reservoir. Refer to [Master Cylinder Reservoir Filling](#) .
13. Burnish the brake pads and rotors. Refer to [Brake Pad and Rotor Burnishing](#).

BRAKE PAD AND ROTOR BURNISHING

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.

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 48 km/h (30 mph).

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

3. Using moderate to firm pressure, apply the brakes to bring the vehicle to a stop. Do not allow the brakes to lock.
4. Repeat steps 2 and 3 until approximately 20 stops have been completed. Allow sufficient cooling periods between stops in order to properly burnish the brake pads and rotors.

FRONT BRAKE CALIPER REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

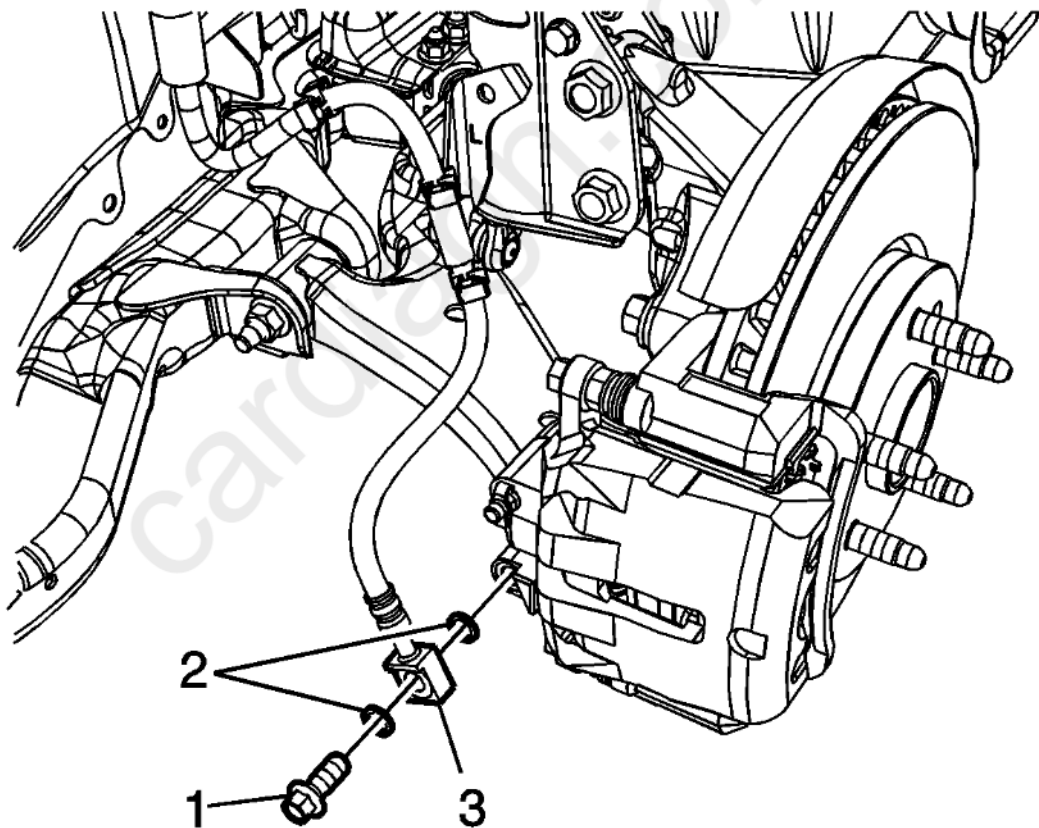


Fig. 26: Brake Hose, Fitting Bolt & Fitting Gaskets
Courtesy of GENERAL MOTORS COMPANY

3. Remove the brake hose fitting bolt (1).

NOTE: Do not reuse the brake hose fitting gaskets.

4. Remove and discard the brake hose fitting gaskets (2) from the brake hose fitting (3).
5. Cap the brake hose fitting to prevent brake fluid loss and contamination.

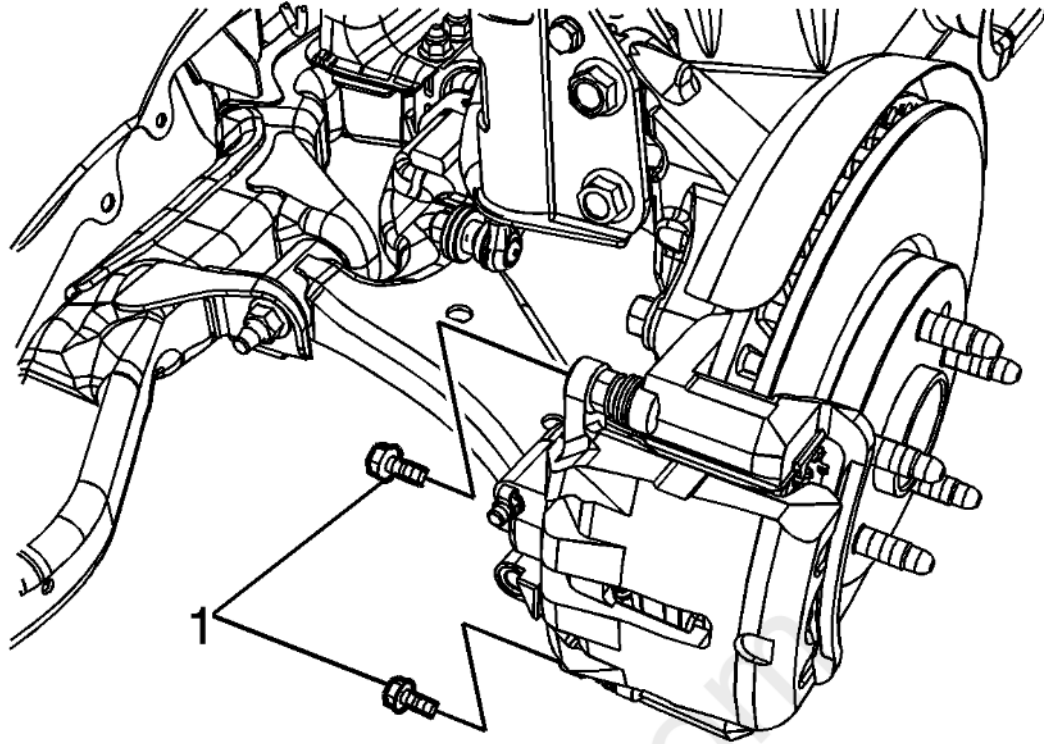


Fig. 27: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY.
- Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

6. Using a backup wrench to hold the brake caliper guide pin stationary, remove the brake caliper guide pin bolts (1).
7. Remove the brake caliper.

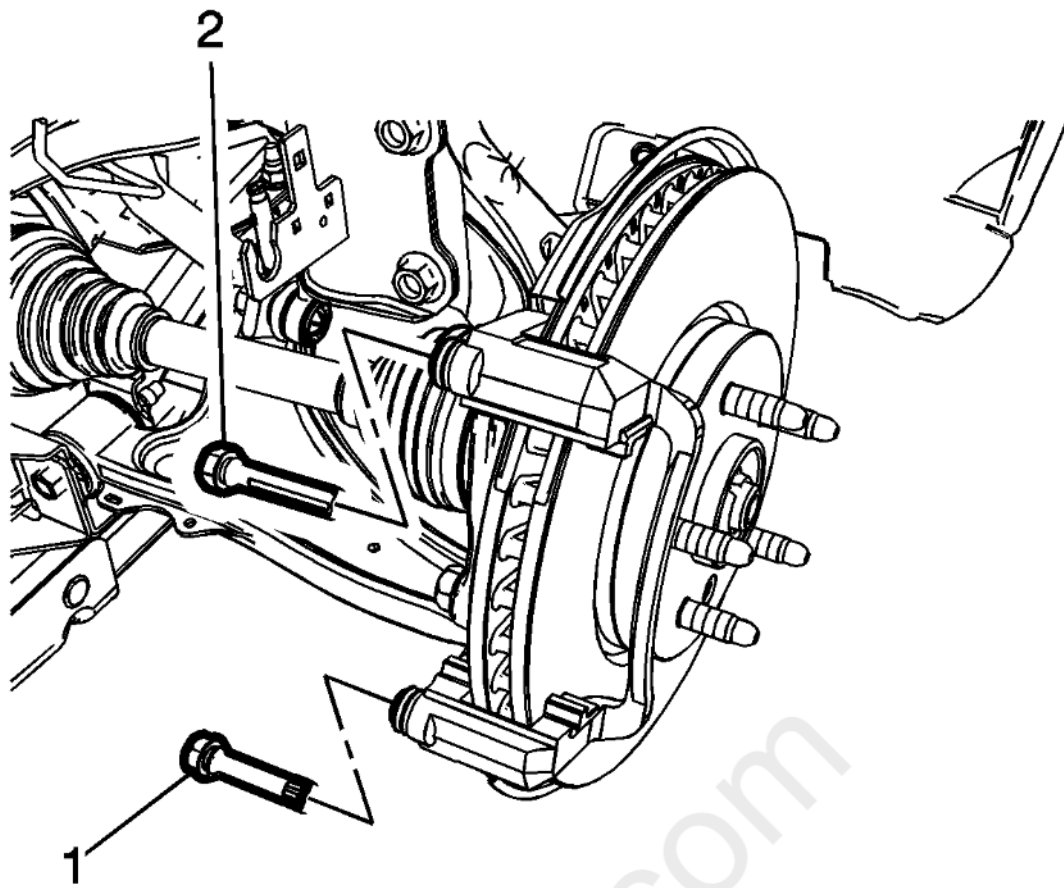


Fig. 28: Brake Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

NOTE: The lower brake caliper guide pin is equipped with a bushing and must be installed in the same location.

8. Remove the lower brake caliper guide pin (1).
9. Remove the upper brake caliper guide pin (2).

Installation Procedure

1. Inspect the brake caliper guide pins and guide pin seals for damage and replace, if necessary.
2. Remove any grease or debris from the brake caliper guide pins, guide pin seals, and guide pin bores in the brake caliper bracket with a clean shop cloth.
3. Apply a light coating of high temperature, silicone brake lubricant to the brake caliper bracket guide pin bores, the inner portion of the guide pin seals, and the brake caliper guide pins.

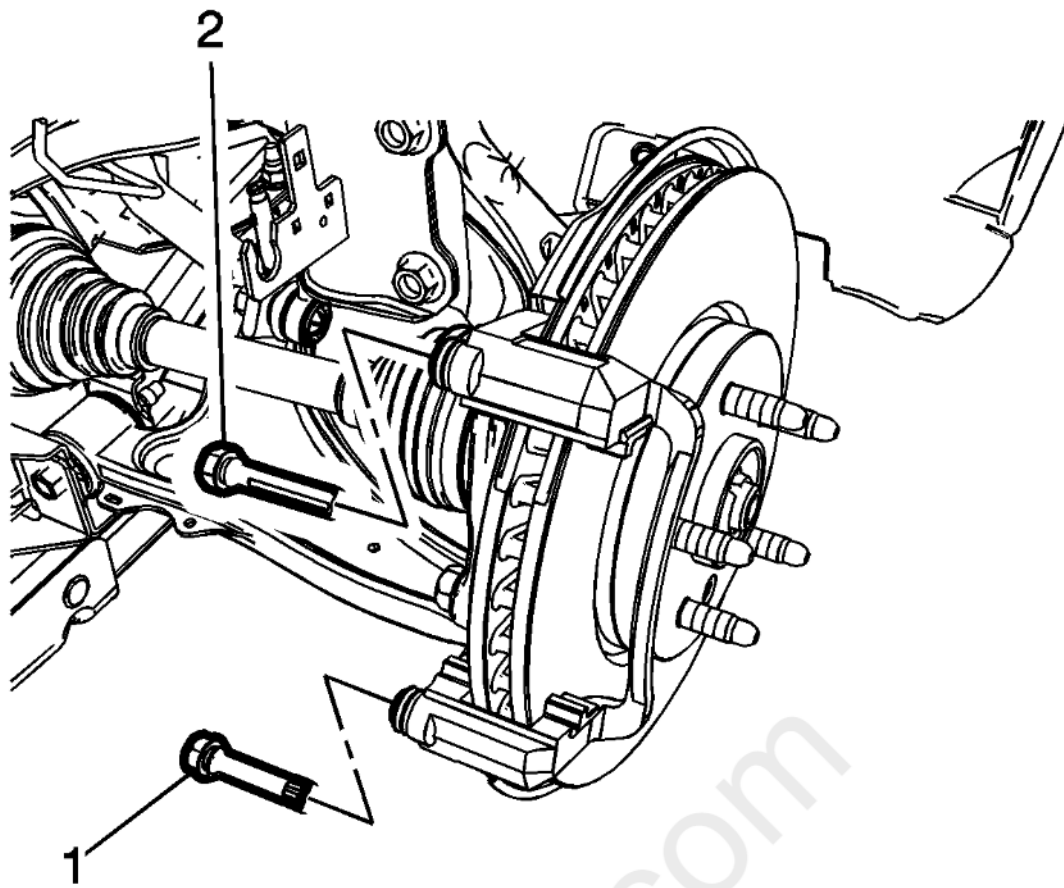


Fig. 29: Brake Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

NOTE: The lower brake caliper guide pin is equipped with a bushing and must be installed in the same location.

4. Install the lower brake caliper guide pin (1).
5. Seat the brake caliper guide pin seal in the groove of the brake caliper guide pin.
6. Install the upper brake caliper guide pin (2).
7. Seat the brake caliper guide pin seal in the groove of the brake caliper guide pin.

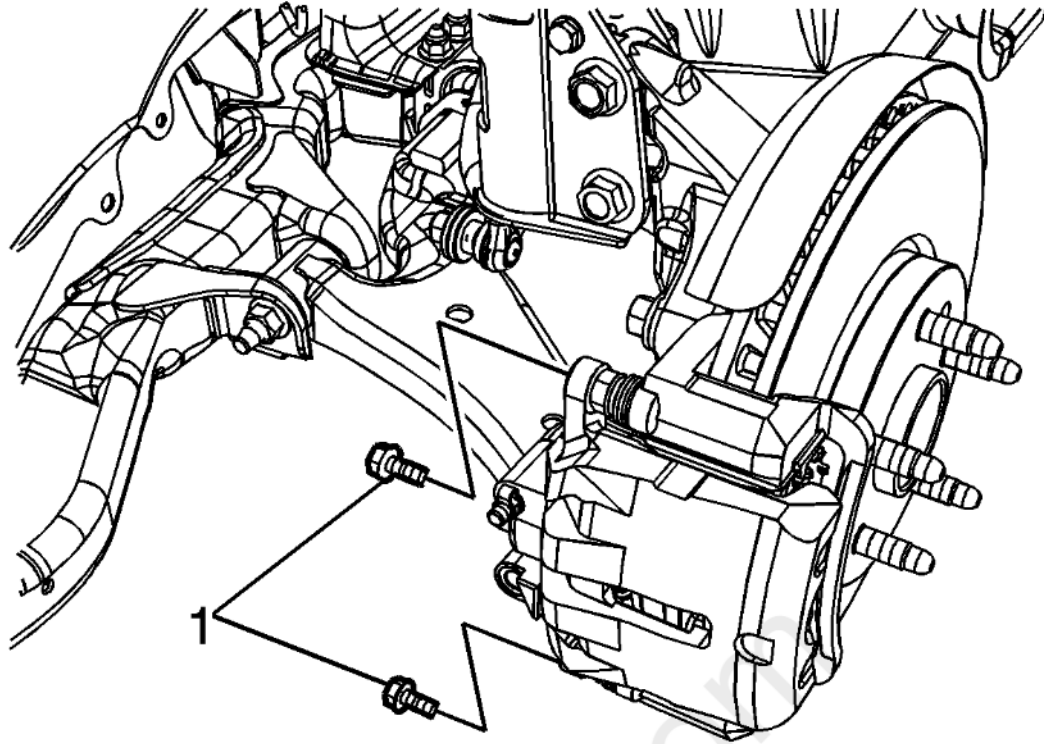


Fig. 30: Brake Caliper Guide Pin Bolts
Courtesy of GENERAL MOTORS COMPANY

8. Install the brake caliper.

CAUTION: Refer to **Fastener Caution** .

9. Hold the brake caliper guide pin stationary and install the brake caliper guide pin bolts (1) and tighten to 27 N.m (20 lb ft).

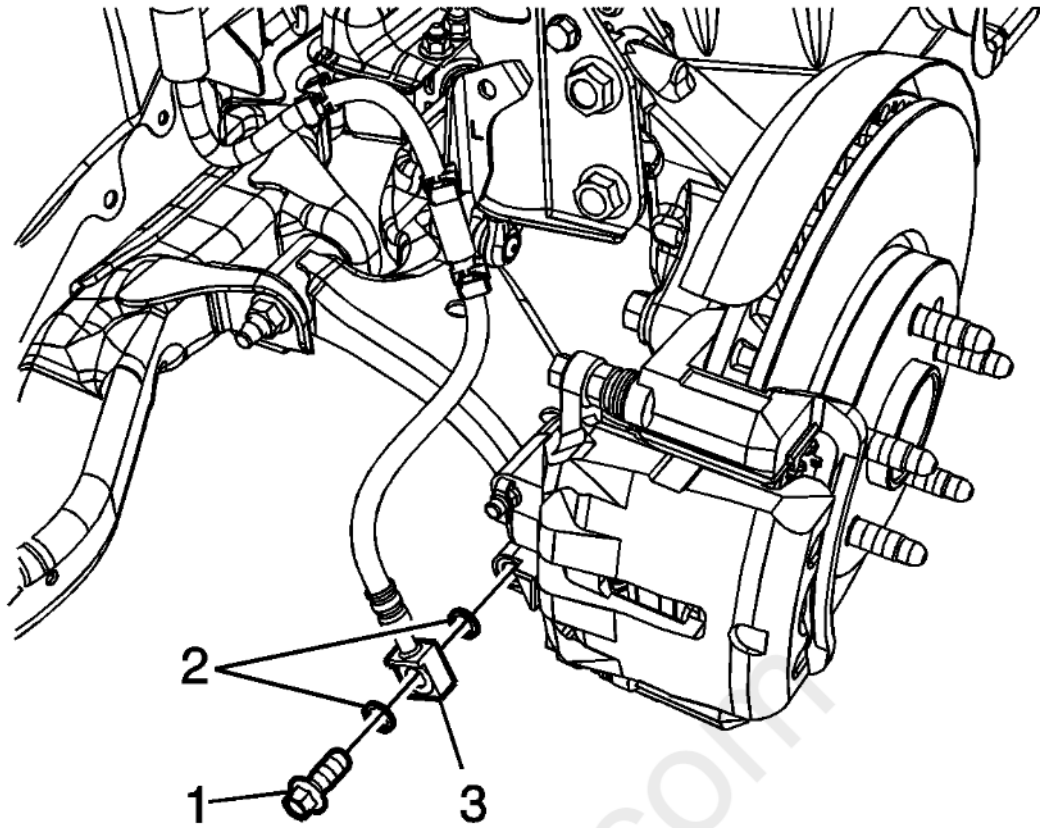


Fig. 31: Brake Hose, Fitting Bolt & Fitting Gaskets

Courtesy of GENERAL MOTORS COMPANY

NOTE: Install new brake hose fitting gaskets.

10. Assemble the brake hose fitting bolt (1) and the 2 new brake hose fitting gaskets (2) to the brake hose fitting (3).
11. Install the brake hose assembly and tighten the brake hose fitting bolt to 40 N.m (30 lb ft).
12. Bleed the hydraulic brake system. Refer to [Hydraulic Brake System Bleeding \(Manual\)](#) [Hydraulic Brake System Bleeding \(Pressure\)](#) .
13. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

REAR BRAKE CALIPER REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
3. Disable the parking brake cable adjuster. Refer to [Parking Brake Cable Adjuster Disabling](#) .

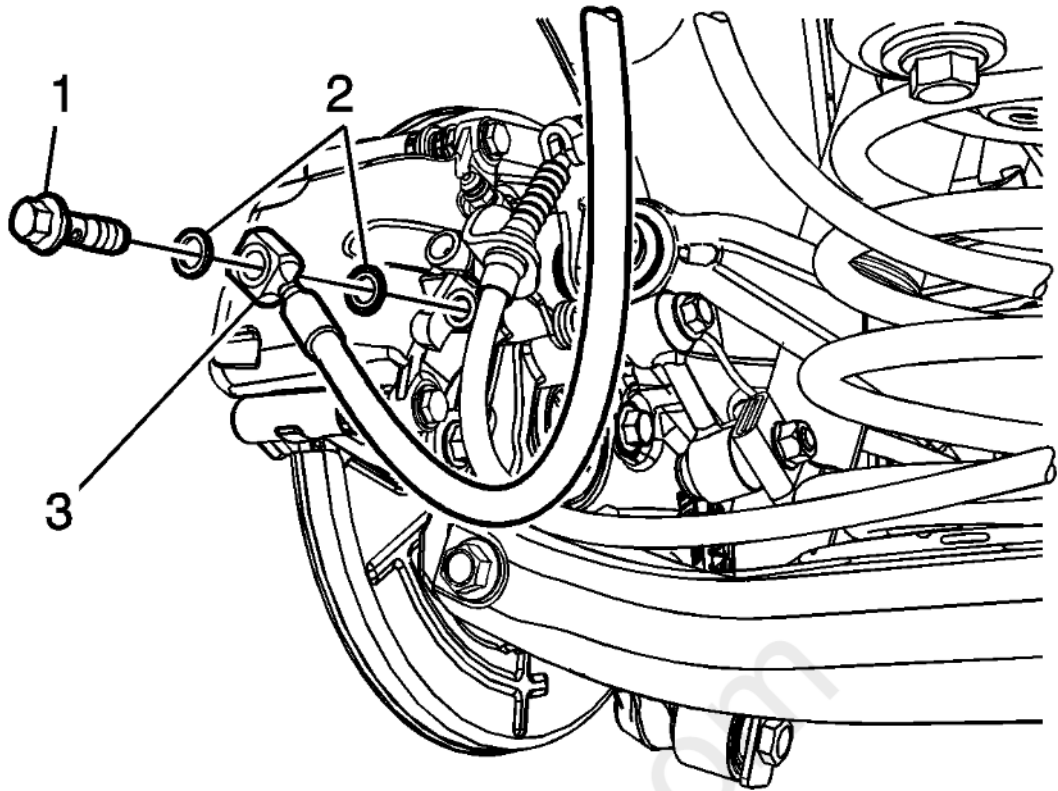


Fig. 32: Brake Hose Fitting Components

Courtesy of GENERAL MOTORS COMPANY

4. Remove the brake hose fitting bolt (1).

NOTE: Do not reuse the brake hose fitting gaskets.

5. Remove and discard the brake hose fitting gaskets (2) from the brake hose (3).
6. Plug the brake hose fitting to prevent brake fluid loss and contamination.

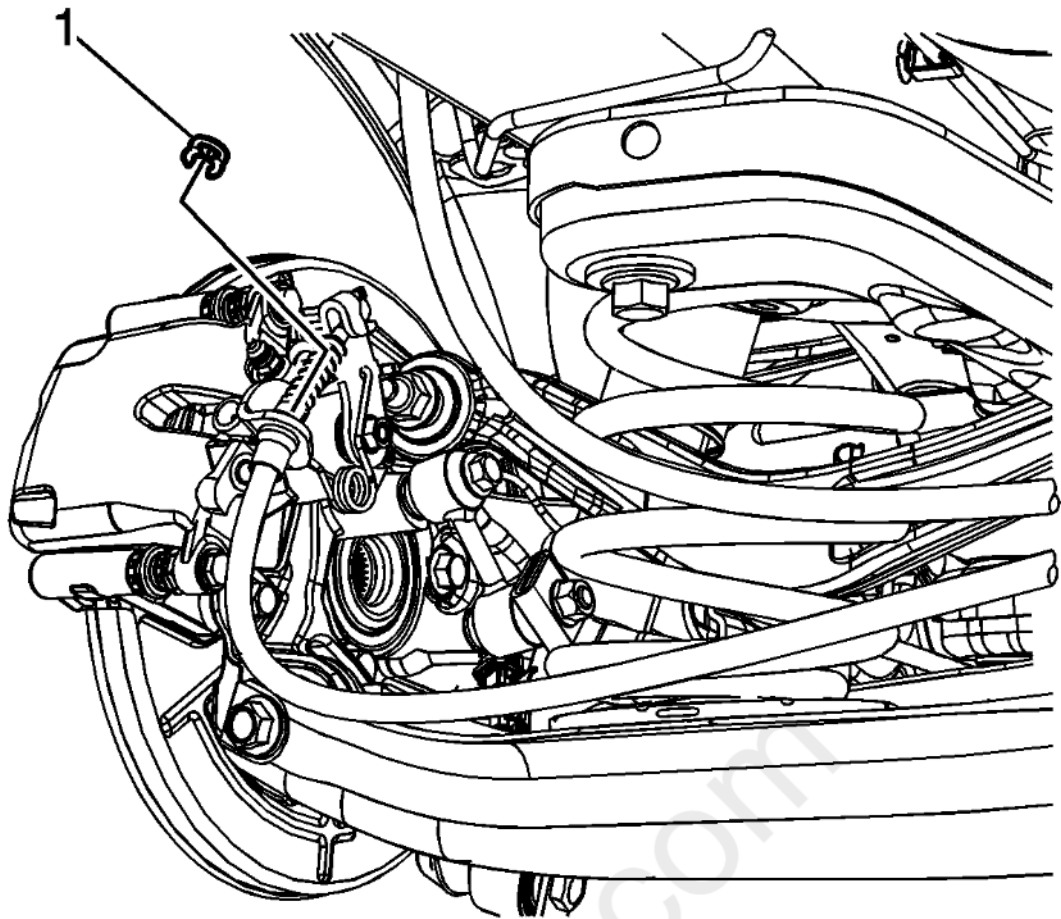


Fig. 33: Parking Brake Cable Retainer

Courtesy of GENERAL MOTORS COMPANY

7. Remove the parking brake cable retainer (1).
8. Disconnect the parking brake cable from the actuator lever.
9. Remove the parking brake cable from the cable bracket and position the parking brake cable end aside.

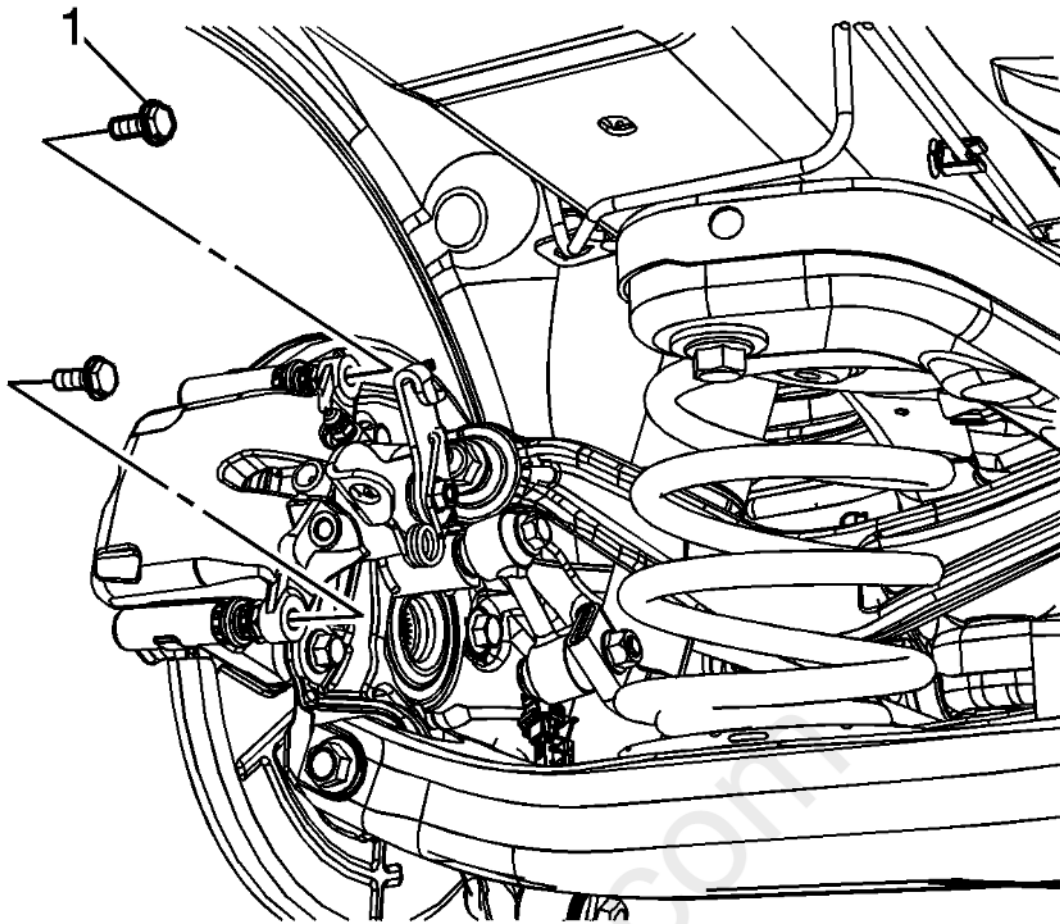


Fig. 34: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY
- Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

10. Using a backup wrench to hold the brake caliper guide pin stationary, remove the brake caliper guide pin bolts (1).
11. Remove the brake caliper.

Installation Procedure

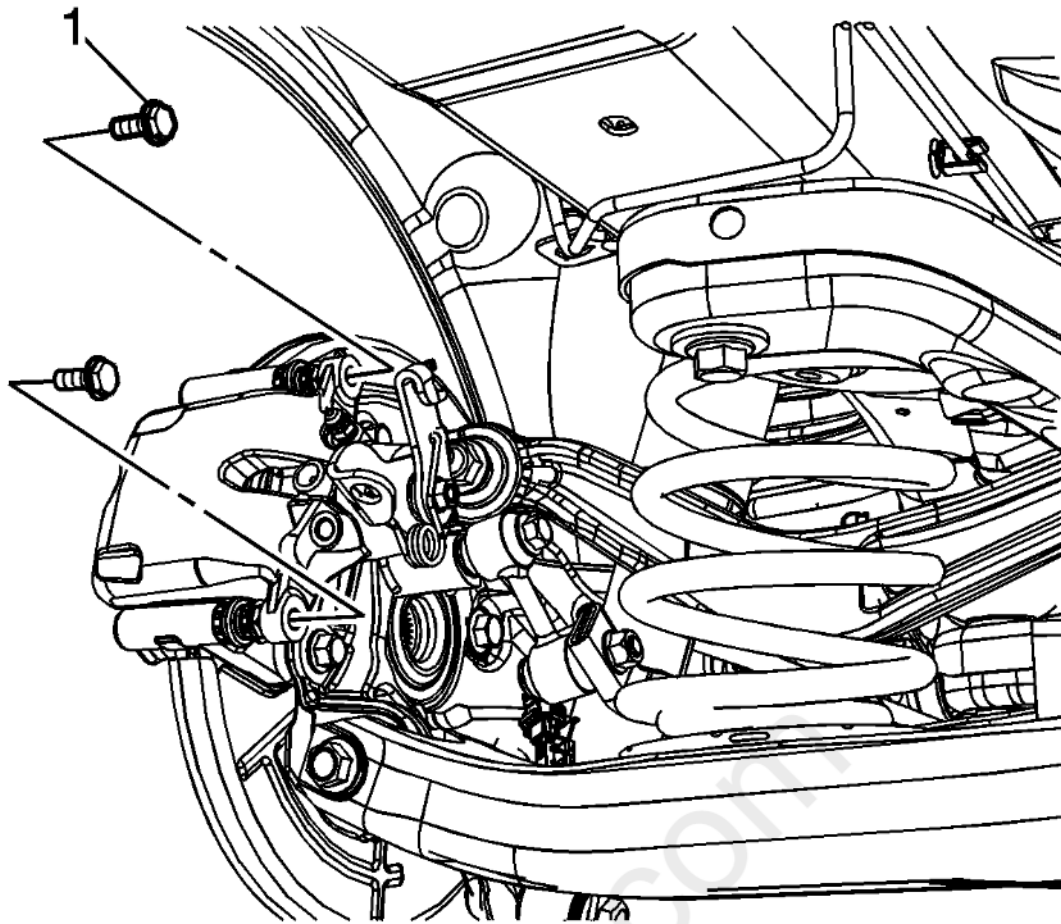


Fig. 35: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

1. Install the brake caliper.

CAUTION: Refer to **Fastener Caution** .

2. Using a backup wrench to hold the brake caliper guide pin stationary, install the brake caliper guide pin bolts (1) and tighten to 27 N.m (20 lb ft).

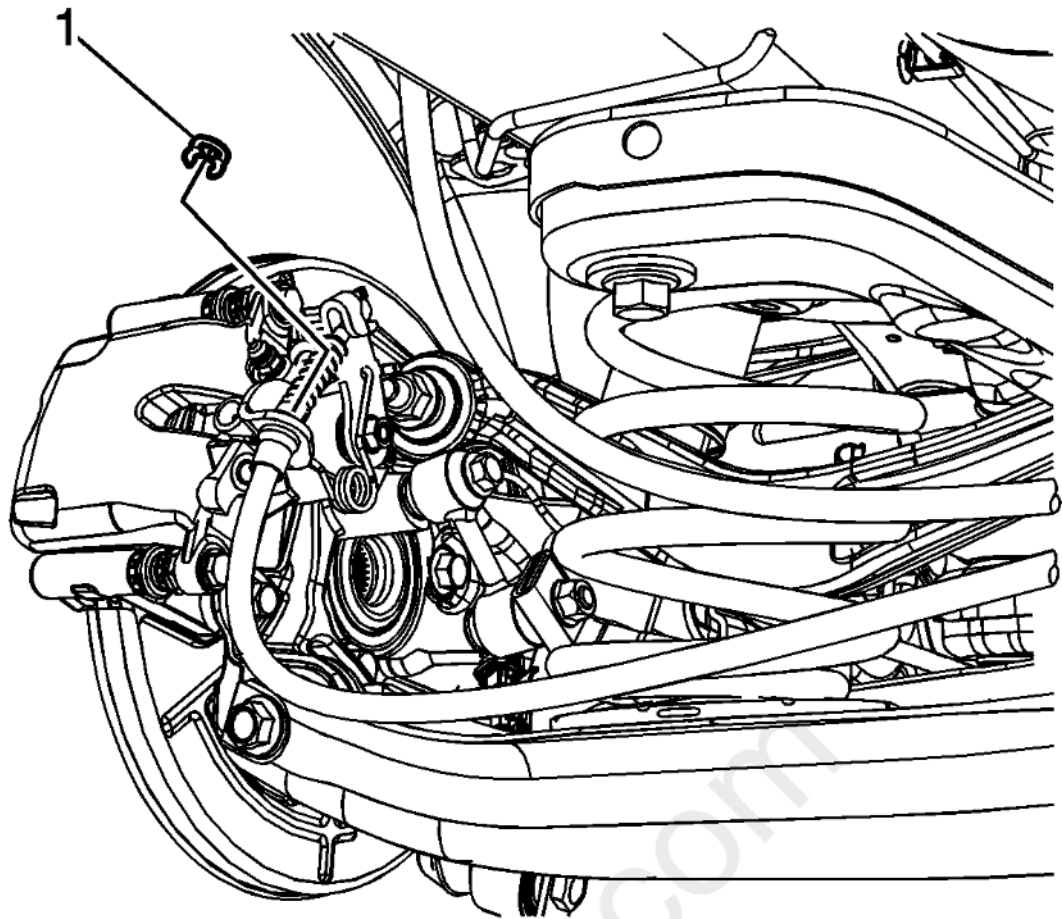


Fig. 36: Parking Brake Cable Retainer

Courtesy of GENERAL MOTORS COMPANY

3. Install the parking brake cable to the cable bracket.
4. Connect the parking brake cable to the actuator lever.
5. Install the parking brake cable retainer (1).

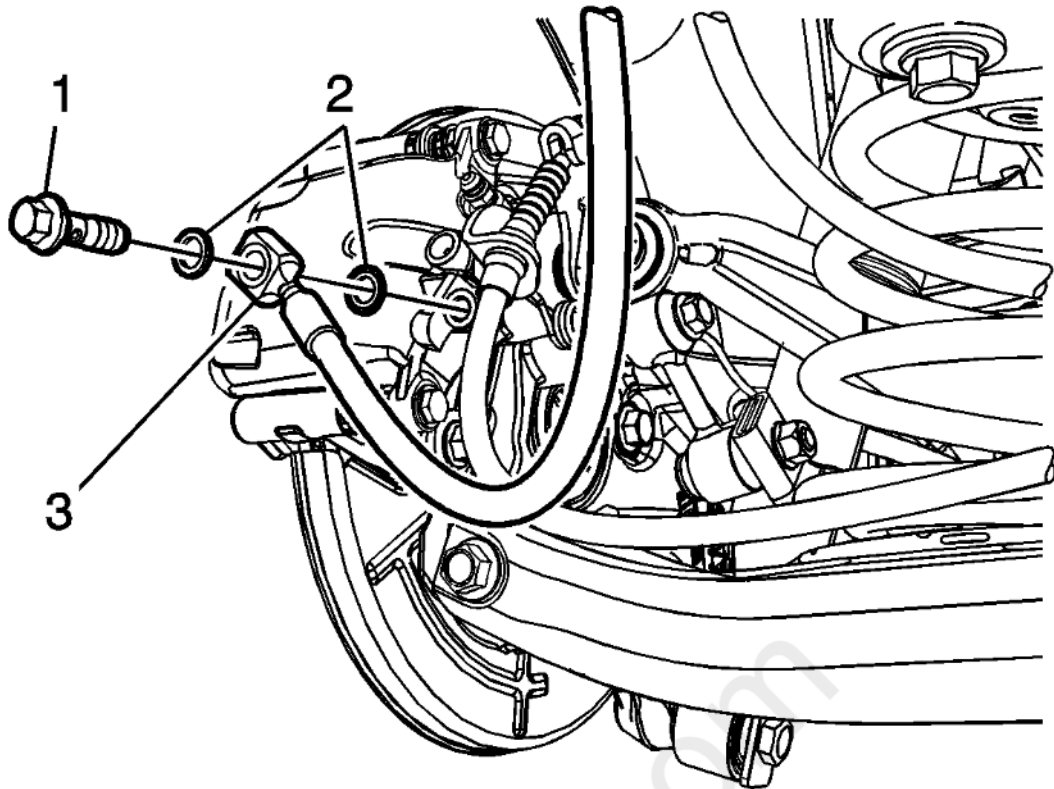


Fig. 37: Brake Hose Fitting Components

Courtesy of GENERAL MOTORS COMPANY

6. Assemble the brake hose fitting bolt (1) and the 2 new brake hose fitting gaskets (2) to the brake hose (3).
7. Install the brake hose assembly to the brake caliper and tighten the fitting bolt to 40 N.m (30 lb ft).
8. Bleed the hydraulic brake system. Refer to [Hydraulic Brake System Bleeding \(Manual\)](#) [Hydraulic Brake System Bleeding \(Pressure\)](#) .
9. Enable the parking brake cable adjuster. Refer to [Parking Brake Cable Adjuster Enabling](#) .
10. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

FRONT BRAKE CALIPER OVERHAUL

WARNING: Refer to [Brake Fluid Irritant Warning](#) .

WARNING: Refer to [Brake Dust Warning](#) .

CAUTION: Refer to [Brake Fluid Effects on Paint and Electrical Components Caution](#) .

Disassembly Procedure

WARNING: Do not place fingers in front of the caliper piston(s) in an attempt to catch or protect it when applying compressed air. The piston(s) can fly out with force and could result in serious bodily injury.

NOTE:

- Replace all the components included in the repair kits used to service this brake caliper.

- Lubricate the rubber parts with GM approved brake fluid from a clean, sealed brake fluid container to make assembly easier.
- 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.

1. Remove the brake caliper from the vehicle. Refer to [Front Brake Caliper Replacement](#).
2. Drain the brake fluid from the brake caliper.

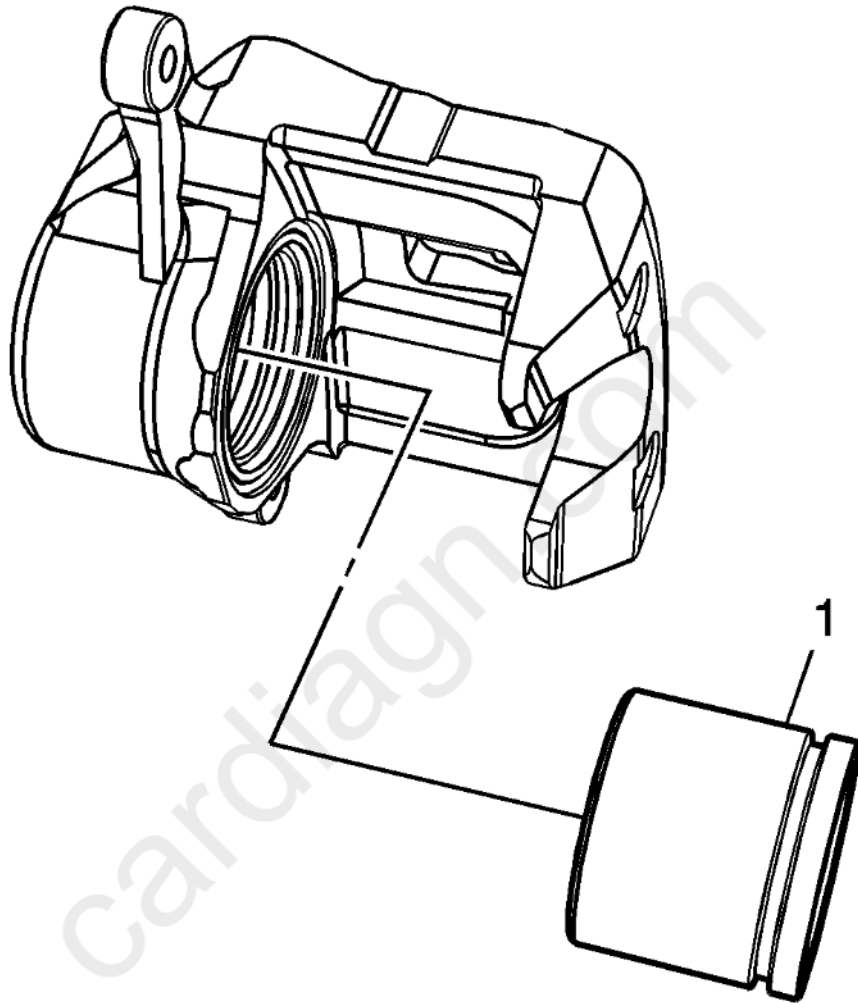


Fig. 38: Brake Caliper Piston

Courtesy of GENERAL MOTORS COMPANY

CAUTION: 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.

3. Place clean shop cloths between the brake caliper piston and the brake caliper housing.
4. Carefully remove the brake caliper piston (1) by directing low pressure compressed air into the brake caliper hydraulic hose inlet.
5. Remove the brake caliper piston and the shop cloths from the brake caliper housing.

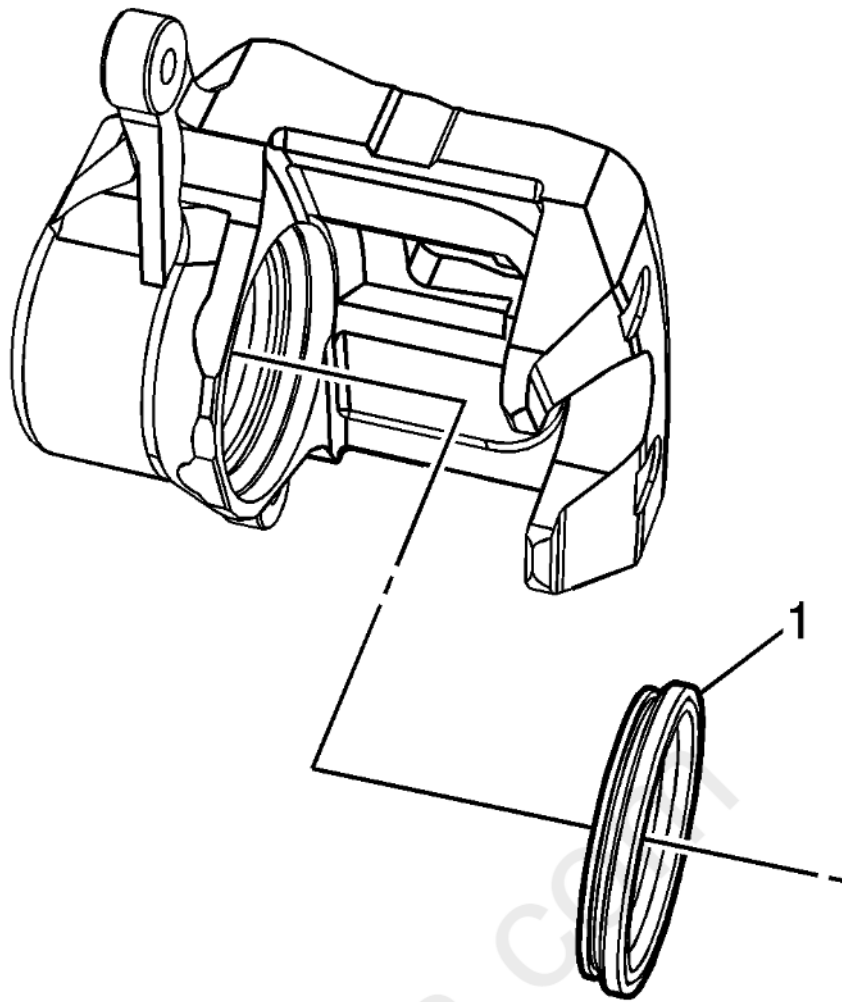


Fig. 39: Piston Dust Boot Seal

Courtesy of GENERAL MOTORS COMPANY

6. Remove the piston dust boot seal (1) from the seal counterbore in the brake caliper and discard the dust boot seal.

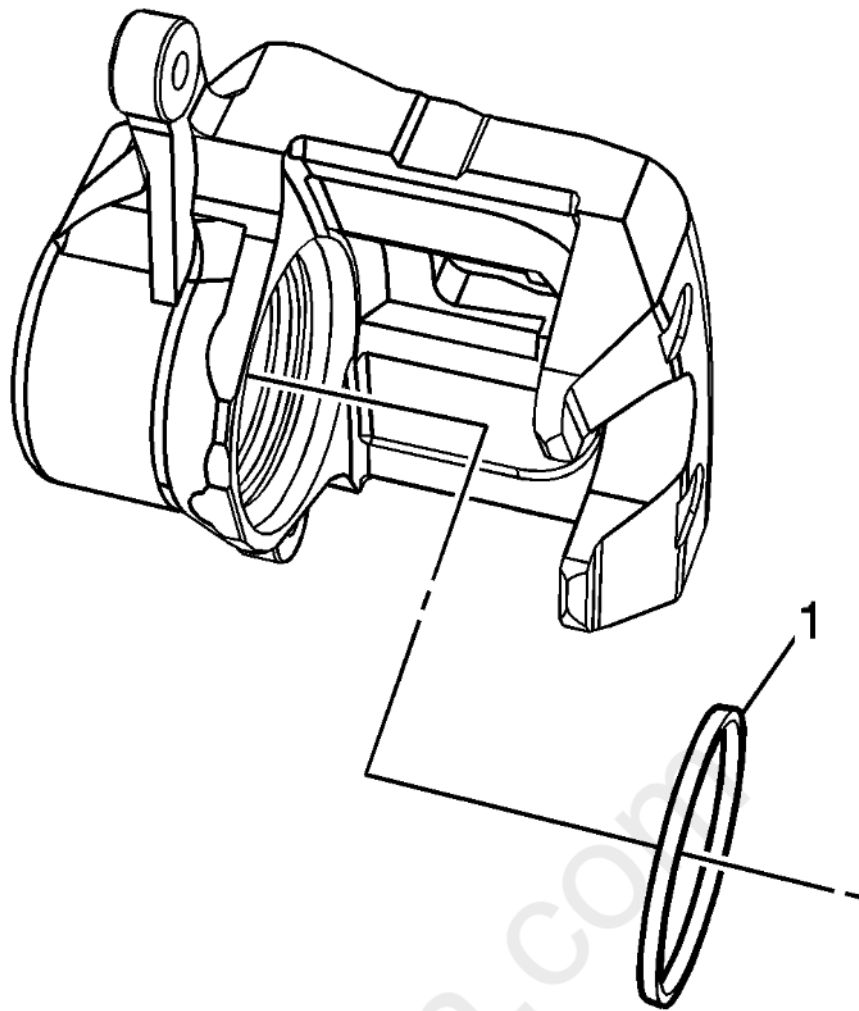


Fig. 40: Piston Seal

Courtesy of GENERAL MOTORS COMPANY

7. Using a small wooden or plastic tool, remove the piston seal (1) from the brake caliper bore and discard the piston seal.

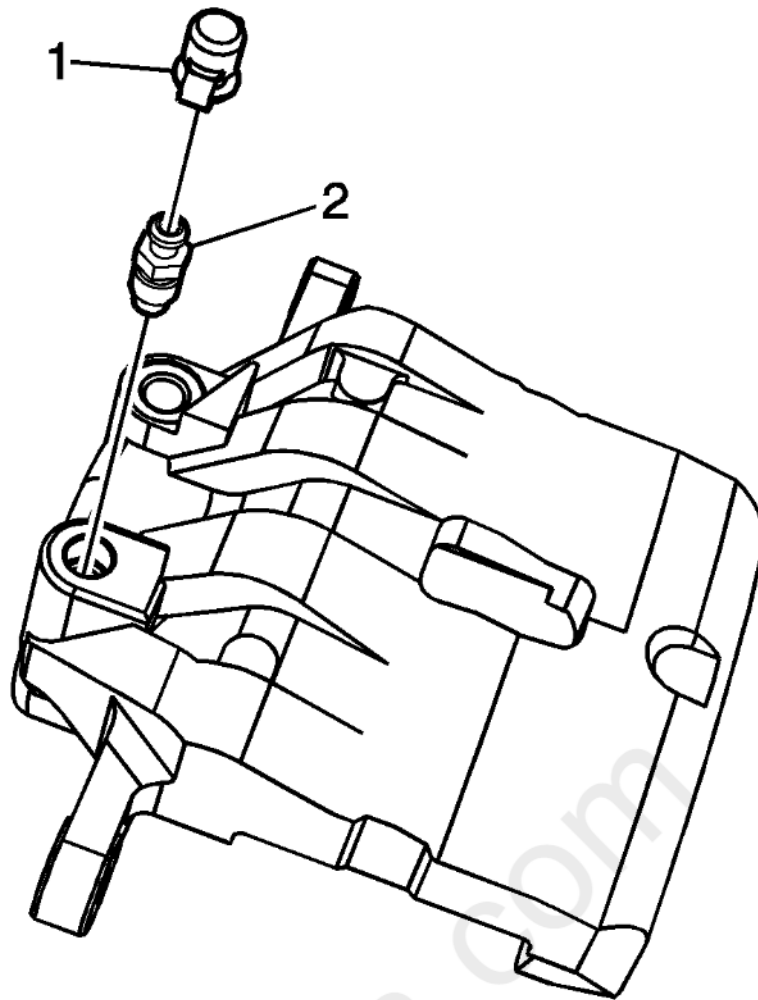


Fig. 41: Brake Caliper Bleeder Valve & Cap
Courtesy of GENERAL MOTORS COMPANY

8. Remove the brake caliper bleeder valve cap (1) and bleeder valve (2).

NOTE: Do not use abrasives to clean the brake caliper pistons.

9. Inspect the brake caliper mounting bracket guide surfaces for corrosion and wear. Remove and replace the brake caliper mounting bracket if damaged or worn.
10. Clean the brake caliper piston bores and seal counterbore with denatured alcohol, or equivalent.
11. Clean the brake caliper piston with denatured alcohol, or equivalent.
12. Dry the caliper piston bore and counterbore with dry, non-lubricated, filtered compressed air.
13. Dry the brake caliper piston with dry, non-lubricated, filtered compressed air.
14. Inspect the caliper bore for cracks, scoring, pitting, and excessive corrosion.
15. If light corrosion is present in the caliper bore, attempt to remove the imperfection with a fine emery paper. If the imperfection cannot be removed, replace the caliper assembly.
16. If cracks, scoring, pitting, and excessive corrosion are present in the caliper bore, replace the caliper assembly.
17. Inspect the caliper piston for cracks, scoring, and/or damage. Replace the caliper piston if any of these conditions exist.

Assembly Procedure

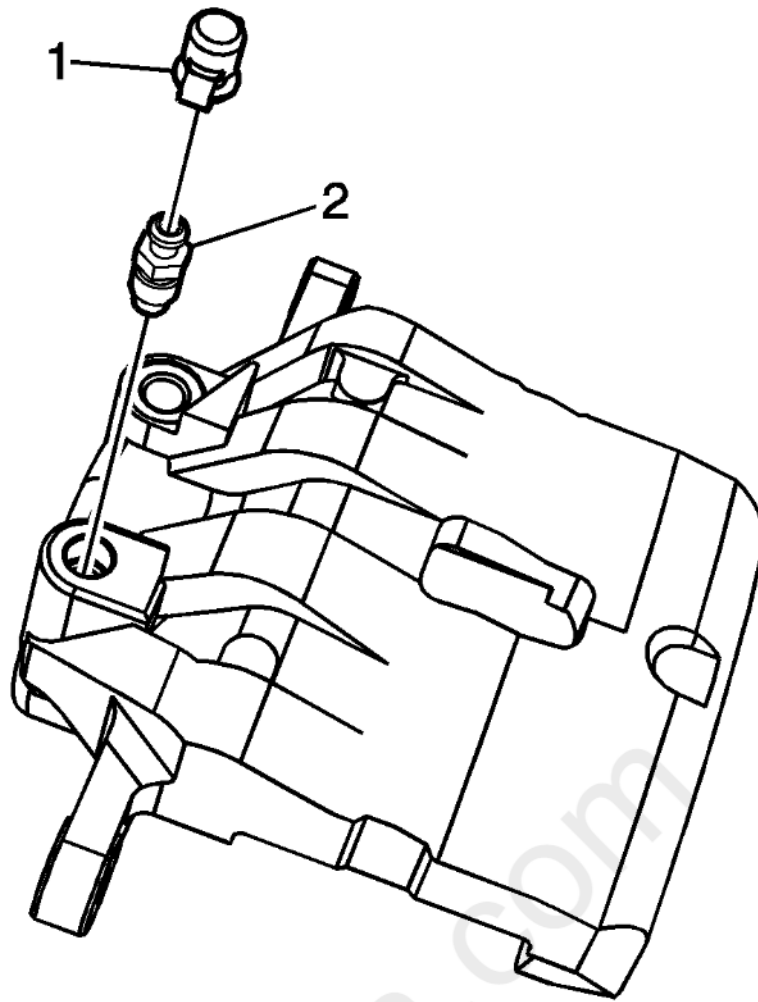


Fig. 42: Brake Caliper Bleeder Valve & Cap
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

1. Install the brake caliper bleeder valve (2) and tighten to 10 N.m (89 lb in).
2. Install the brake caliper bleeder valve cap (1).

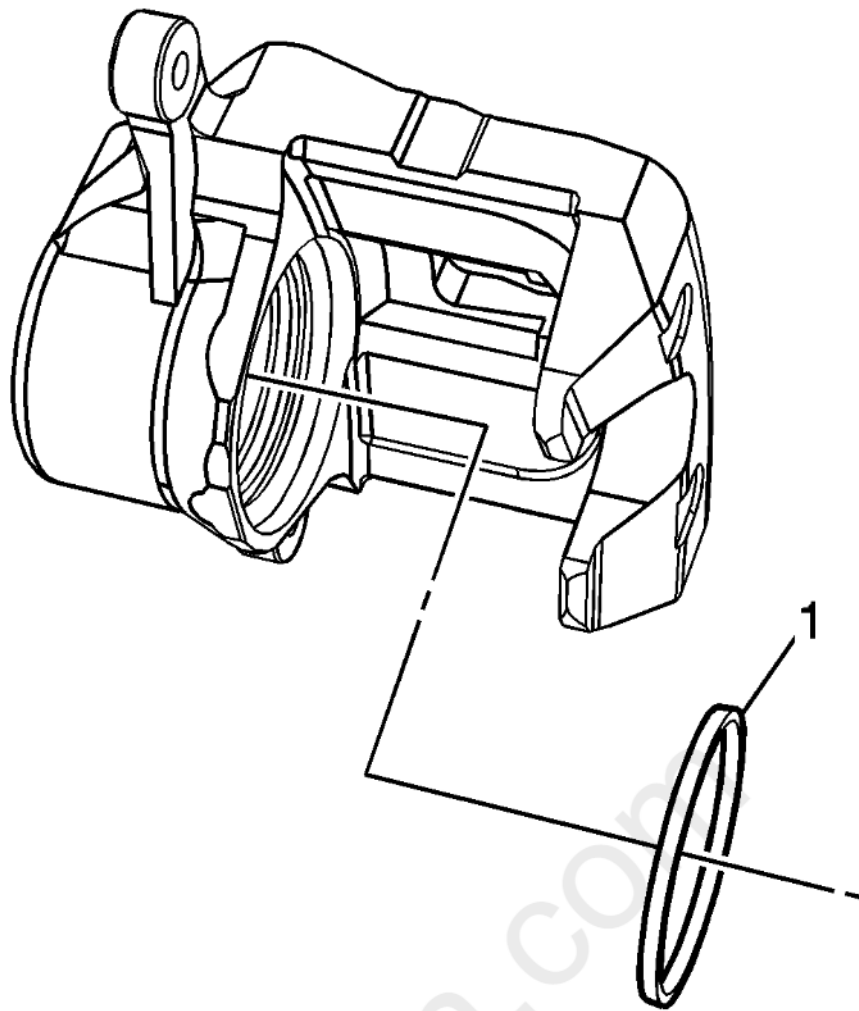


Fig. 43: Piston Seal

Courtesy of GENERAL MOTORS COMPANY

3. Lubricate the new piston seal (1) with GM approved brake fluid from a clean, sealed brake fluid container.
4. Install lubricated piston seal into the brake caliper bore seal groove.
5. Ensure the seal is not twisted.

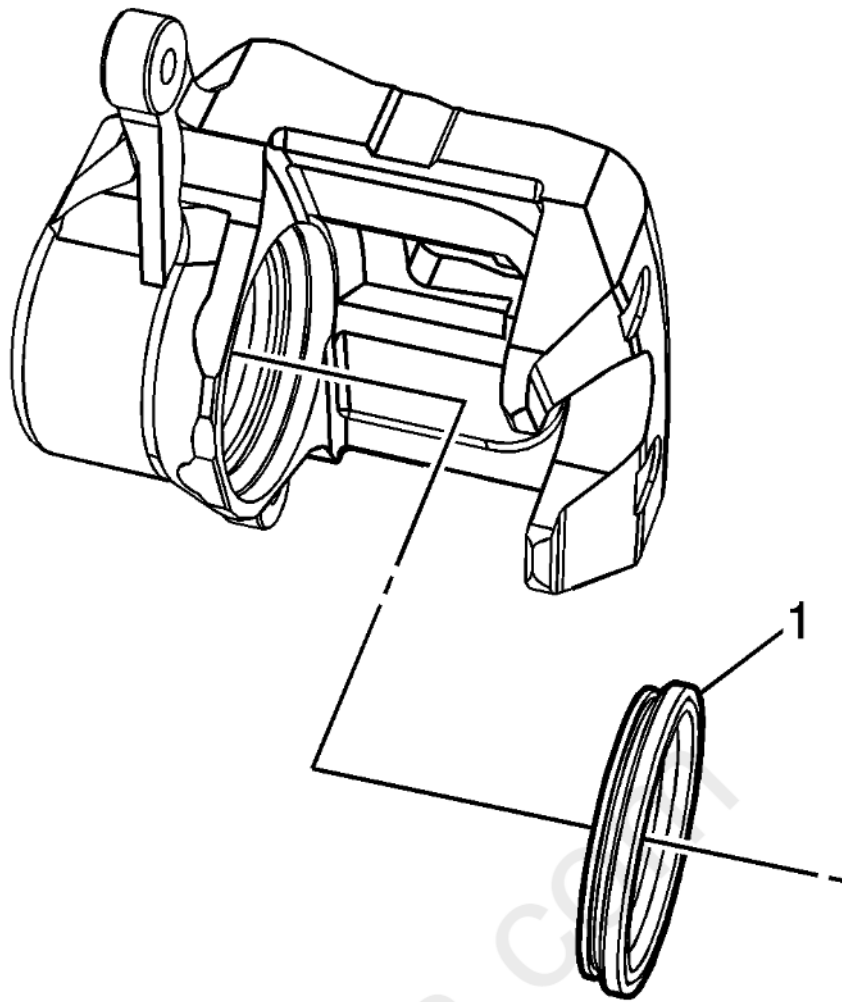


Fig. 44: Piston Dust Boot Seal

Courtesy of GENERAL MOTORS COMPANY

6. Install the piston dust boot seal (1) to the caliper.
7. Ensure the seal is seated evenly and completely into the groove in the caliper housing.

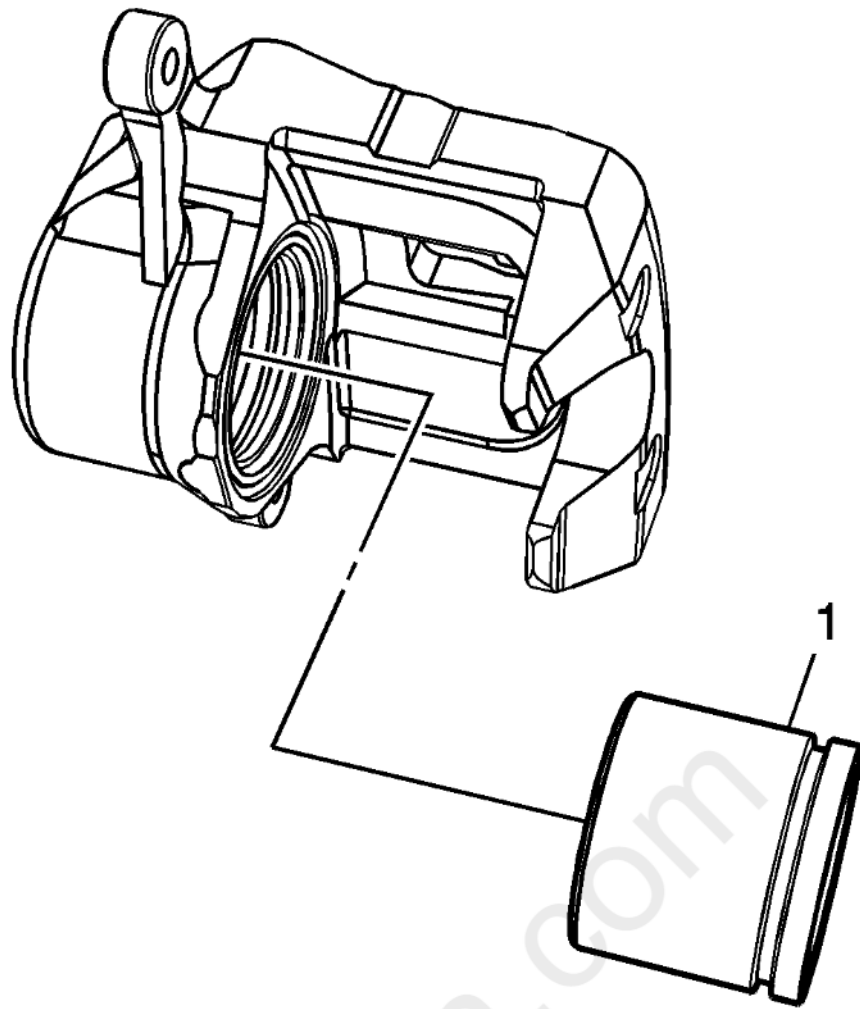


Fig. 45: Brake Caliper Piston

Courtesy of GENERAL MOTORS COMPANY

8. Lightly lubricate the caliper piston with GM approved brake fluid from a clean, sealed brake fluid container.
9. Place the caliper piston into the caliper housing by carefully lifting the edge of the dust boot seal.
10. Carefully push the piston (1) squarely and fully into the brake caliper piston bore.
11. Ensure the caliper dust boot is properly seated into the piston groove and into the groove in the brake caliper bore.
12. Install the brake caliper. Refer to [Front Brake Caliper Replacement](#).

FRONT BRAKE CALIPER BRACKET REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

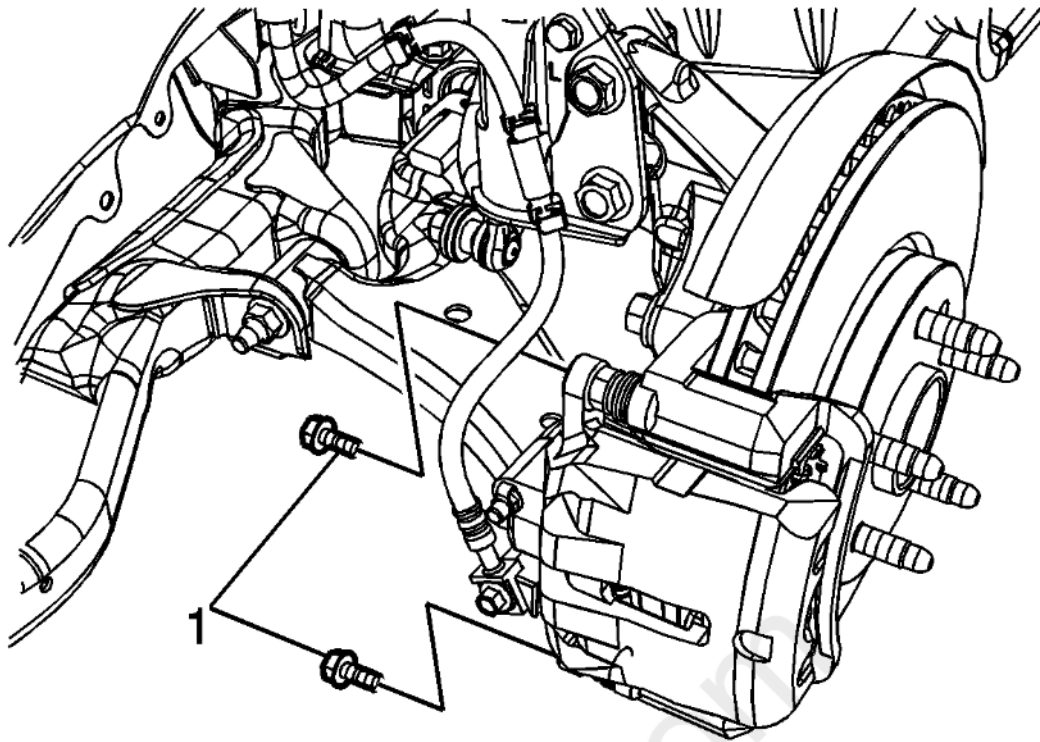


Fig. 46: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE:

- DO NOT use any air tools to remove or install the guide pin bolts. Use hand tools ONLY.
- Install an open end wrench to hold the caliper guide pin in line with the brake caliper while removing or installing the caliper guide pin bolt. DO NOT allow the open end wrench to come in contact with the brake caliper. Allowing the open end wrench to come in contact with the brake caliper will cause a pulsation when the brakes are applied.

3. Hold the brake caliper guide pin stationary and remove the brake caliper guide pin bolts (1).

CAUTION:

Support the brake caliper with heavy mechanic 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.

4. Remove the brake caliper and support with heavy mechanics wire or equivalent.

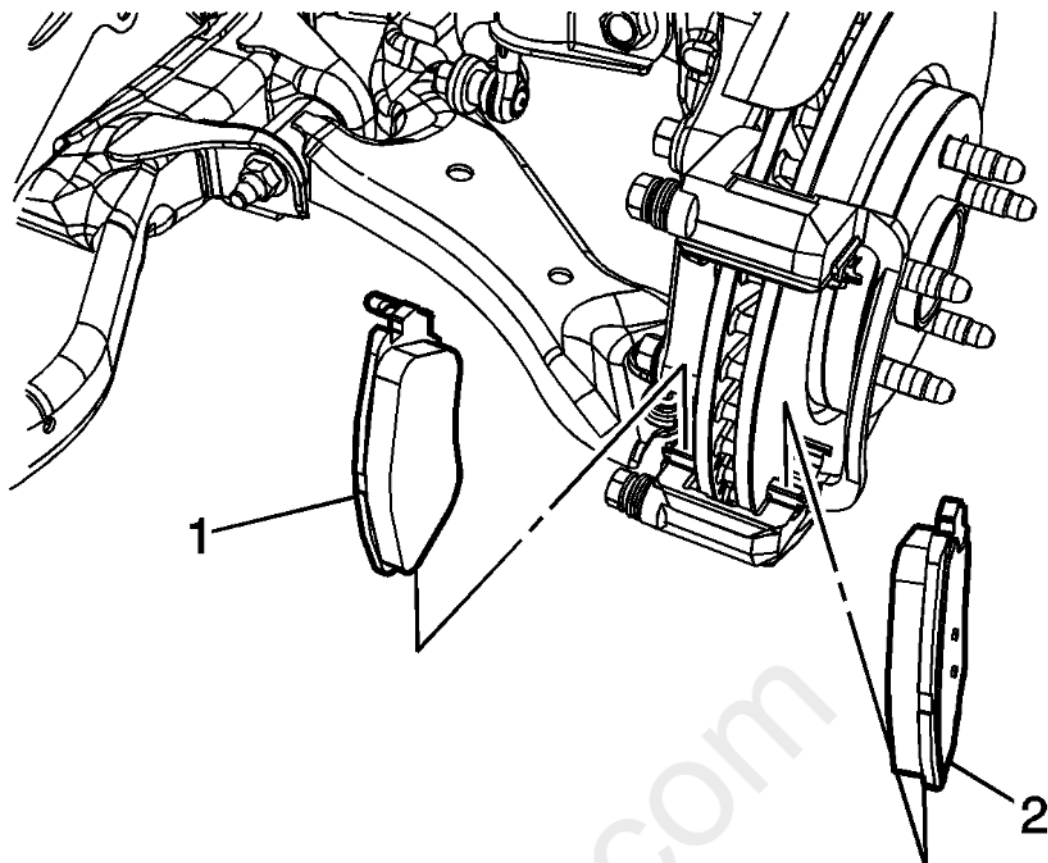


Fig. 47: Inner & Outer Brake Pads

Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the wear sensor for correct installation.

5. Remove the inner brake pad (1).
6. Remove the outer brake pad (2).

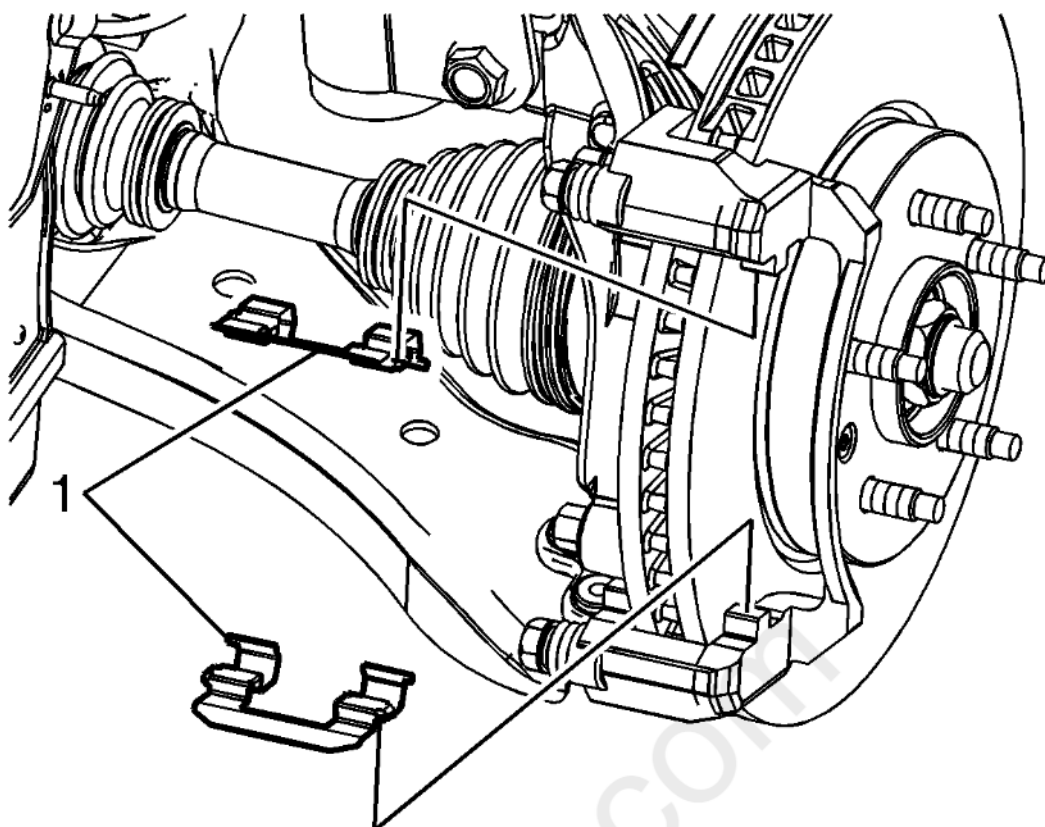


Fig. 48: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

7. Remove the brake pad springs (1).

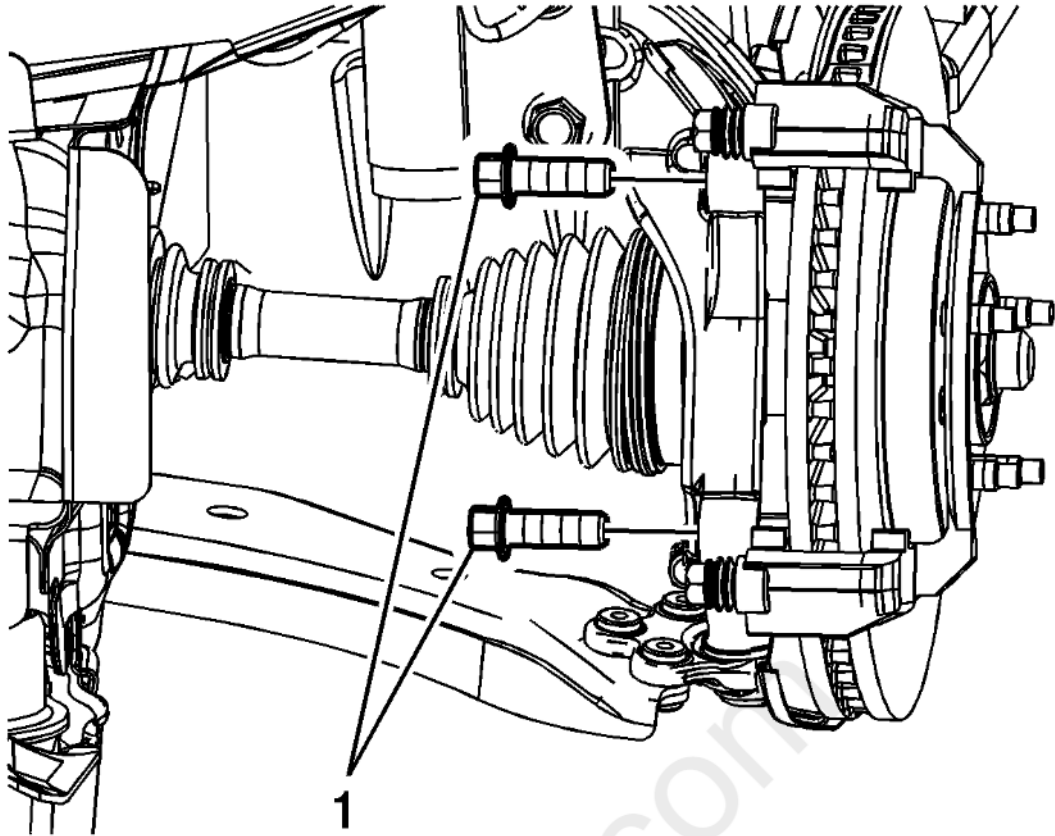


Fig. 49: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Remove the brake caliper bracket bolts (1).

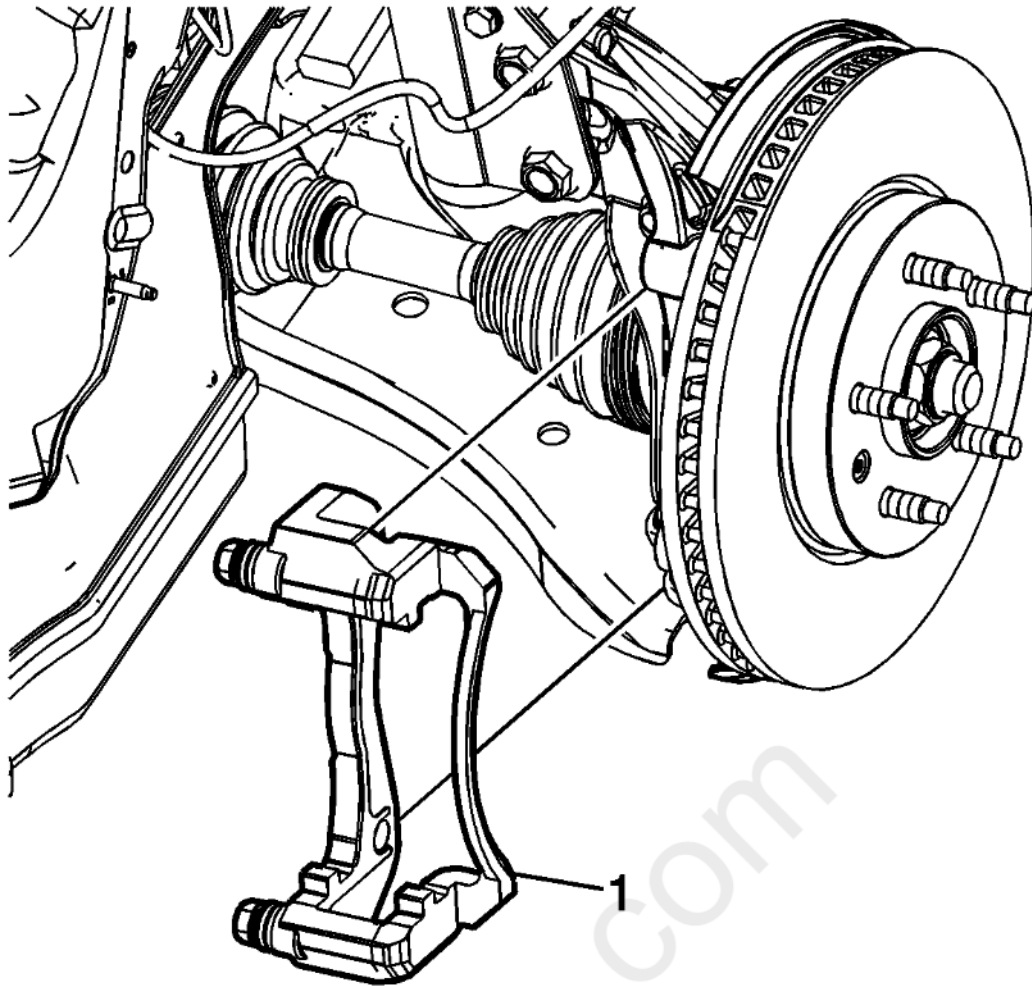


Fig. 50: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

9. Remove the brake caliper bracket (1).

Installation Procedure

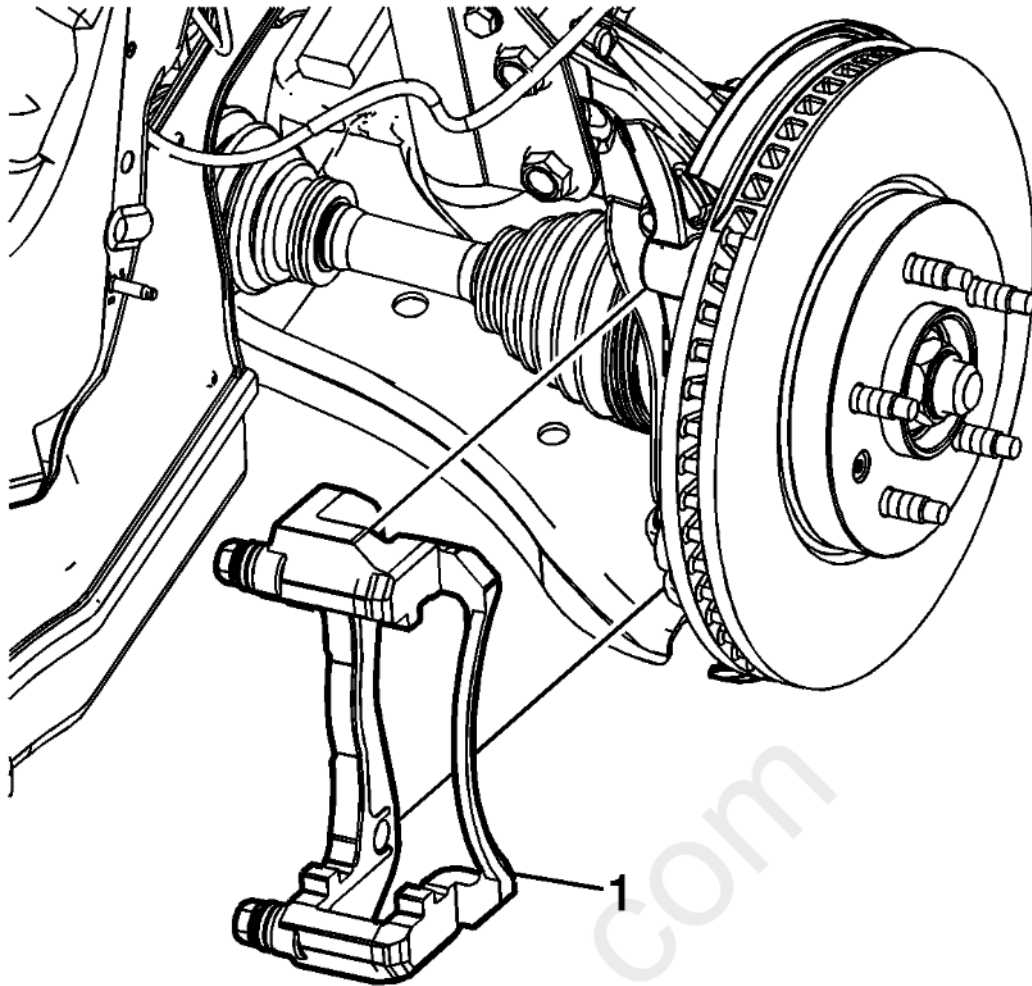


Fig. 51: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

1. Install the brake caliper bracket (1).
2. Prepare the brake caliper bracket bolts and the bracket threaded holes for assembly:
 - Thoroughly clean the residue from the bolt threads with denatured alcohol or equivalent and allow to dry.
 - Thoroughly clean the residue from the threaded holes with denatured alcohol or equivalent and allow to dry.
 - Apply threadlocker to 2/3 of the threaded length of the caliper bracket bolts. Refer to **[Adhesives, Fluids, Lubricants, and Sealers](#)**.
 - Ensure there are no gaps in the threadlocker along the length of the filled area of the bolts.
 - Allow the threadlocker to cure approximately 10 minutes before installation.

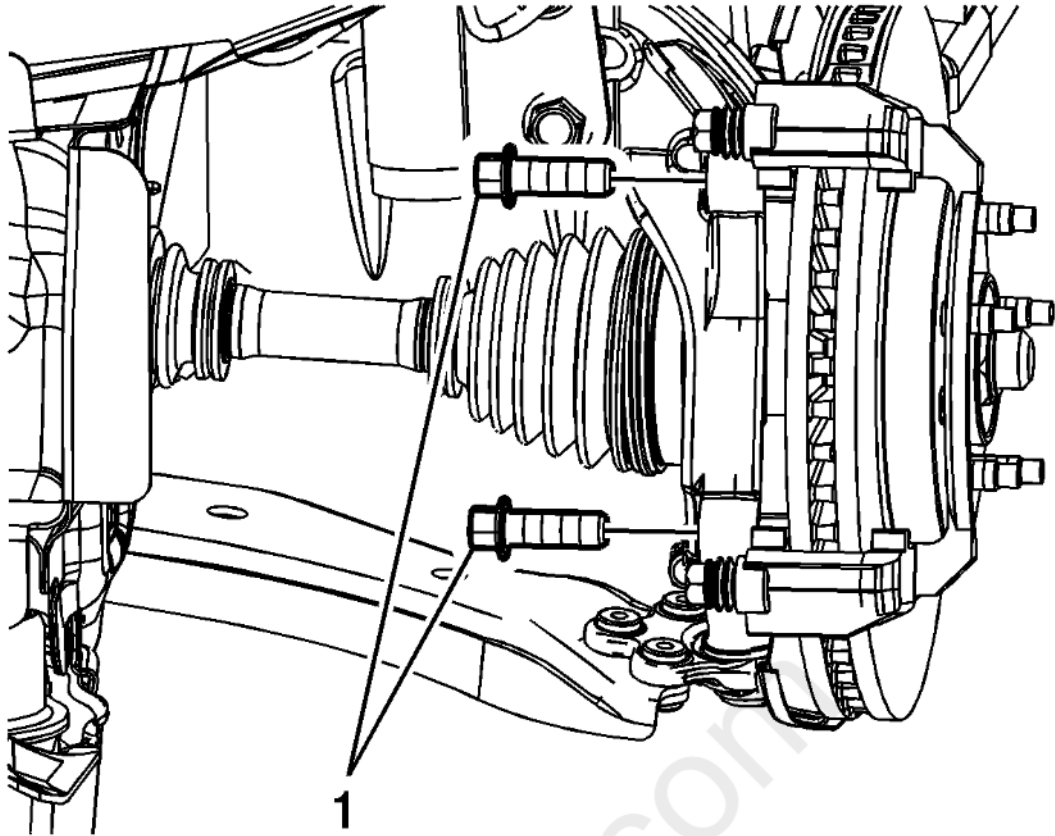


Fig. 52: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

3. Install the brake caliper bracket bolts (1) and tighten to 150 N.m (111 lb ft) + 45 degrees.

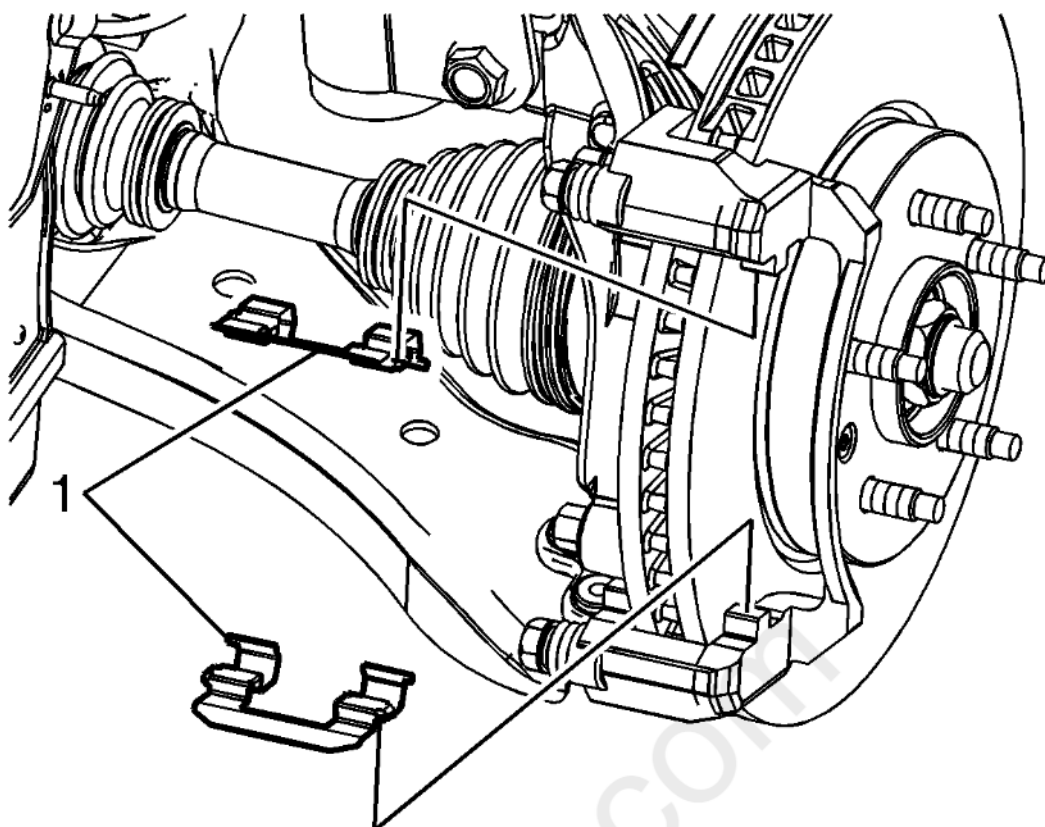


Fig. 53: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

4. Install the brake pad springs (1).

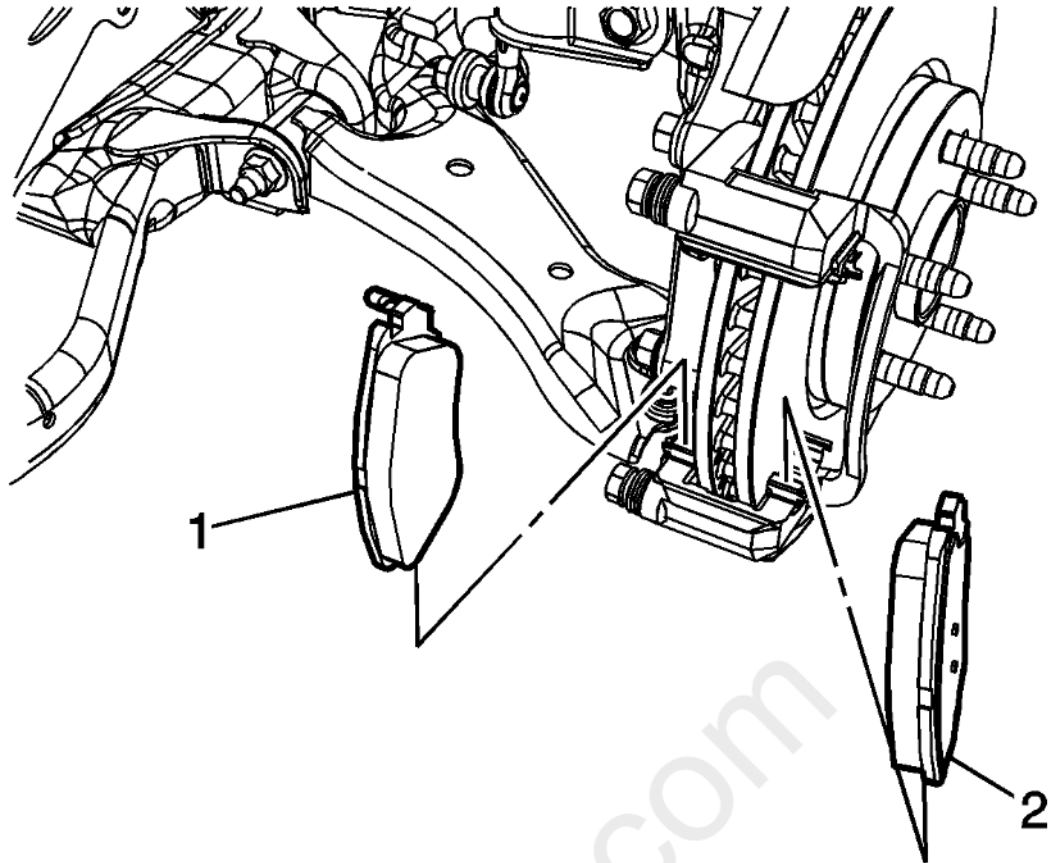


Fig. 54: Inner & Outer Brake Pads

Courtesy of GENERAL MOTORS COMPANY

NOTE: Note the location of the wear sensor for correct installation.

5. Install the inner brake pad (1).
6. Install the outer brake pad (2).
7. Position the brake caliper to the bracket.

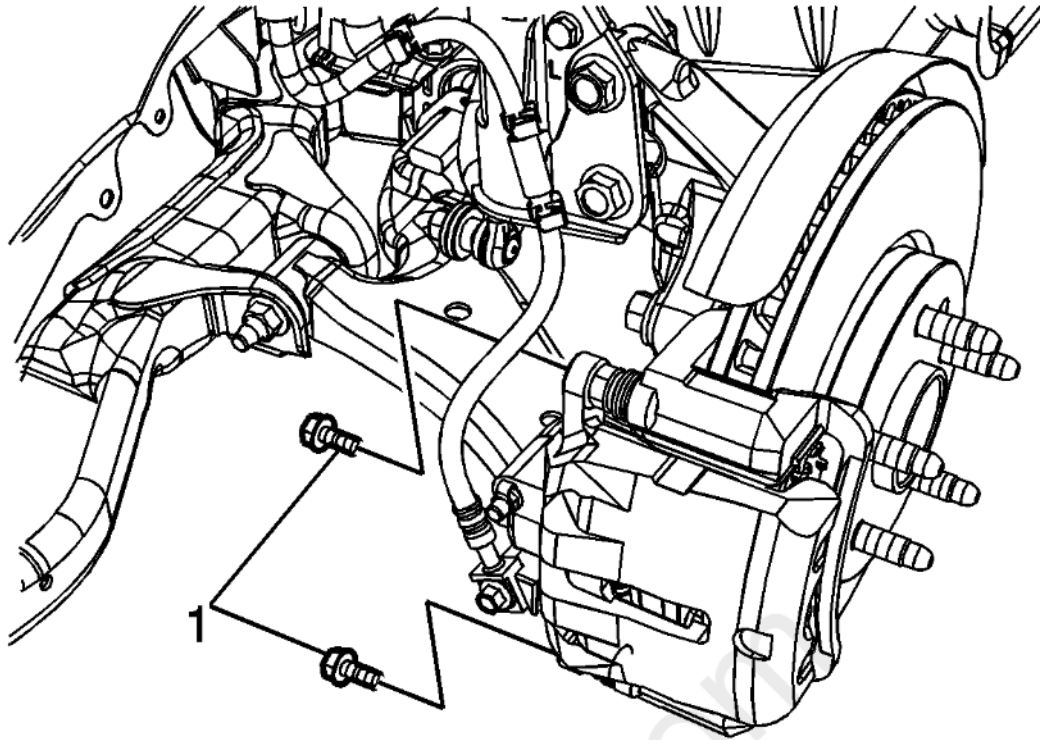


Fig. 55: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Hold the brake caliper guide pins stationary and tighten the brake caliper guide pin bolts (1) to 27 N.m (20 lb ft).
9. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
10. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
11. Slowly release the brake pedal.
12. Wait 15 seconds, then repeat steps 10-11 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.

REAR BRAKE CALIPER BRACKET REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
3. Remove the rear disc brake pads. Refer to [Rear Disc Brake Pads Replacement](#).

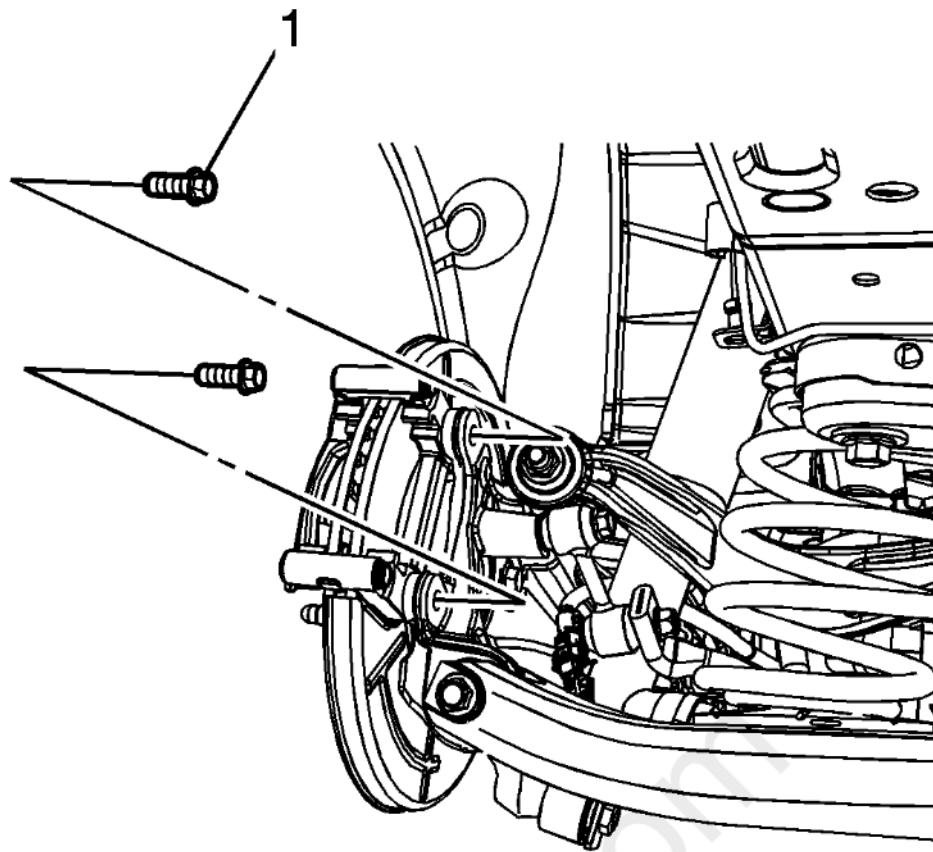


Fig. 56: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Remove the brake caliper bracket bolts (1).

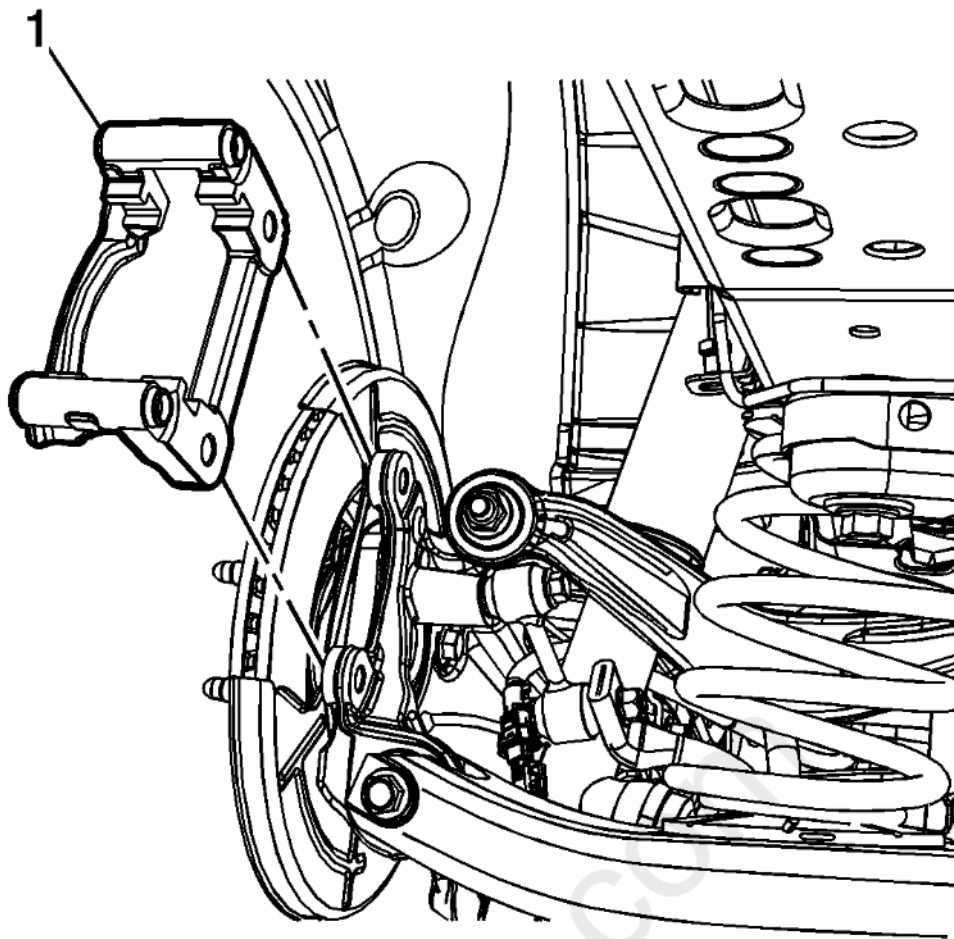


Fig. 57: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake caliper bracket (1).

Installation Procedure

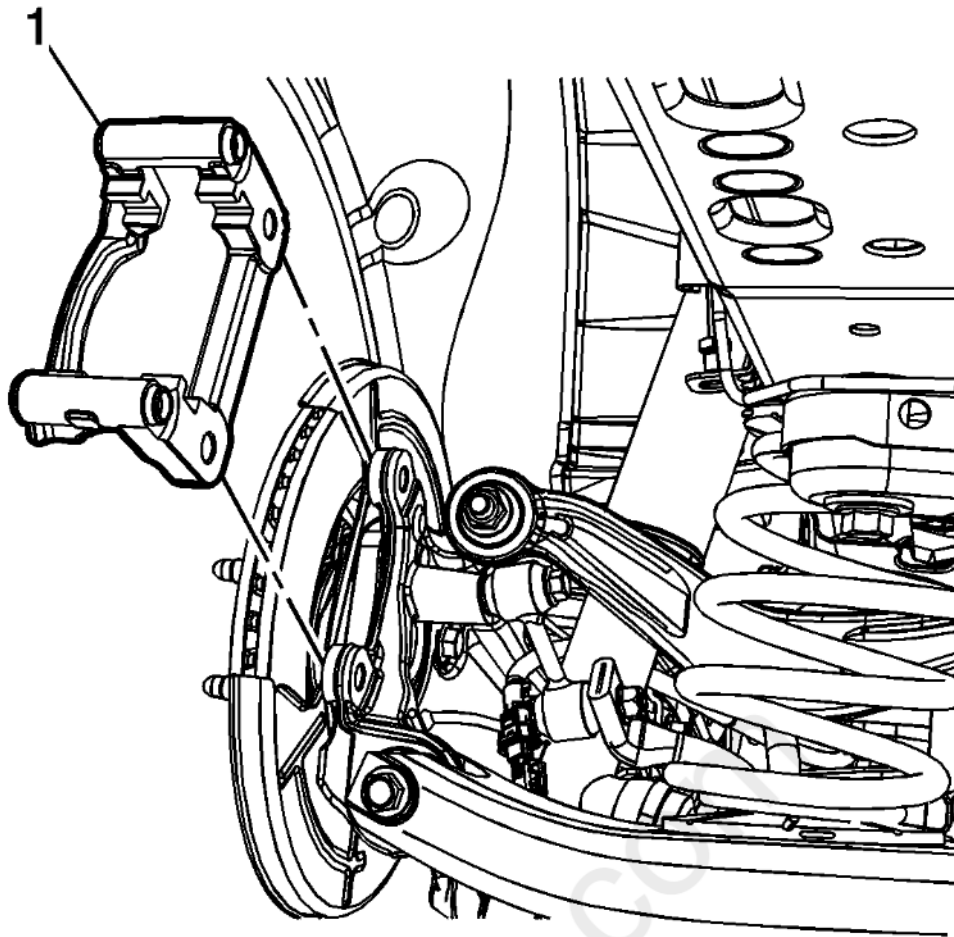


Fig. 58: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

1. Install the brake caliper bracket (1).
2. Prepare the brake caliper bracket bolts and the bracket threaded holes for assembly:
 - Thoroughly clean the residue from the bolt threads with denatured alcohol or equivalent and allow to dry.
 - Thoroughly clean the residue from the threaded holes with denatured alcohol or equivalent and allow to dry.
 - Apply threadlocker to 2/3 of the threaded length of the caliper bracket bolts. Refer to **Adhesives, Fluids, Lubricants, and Sealers**.
 - Ensure there are no gaps in the threadlocker along the length of the filled area of the bolts.
 - Allow the threadlocker to cure approximately 10 minutes before installation.

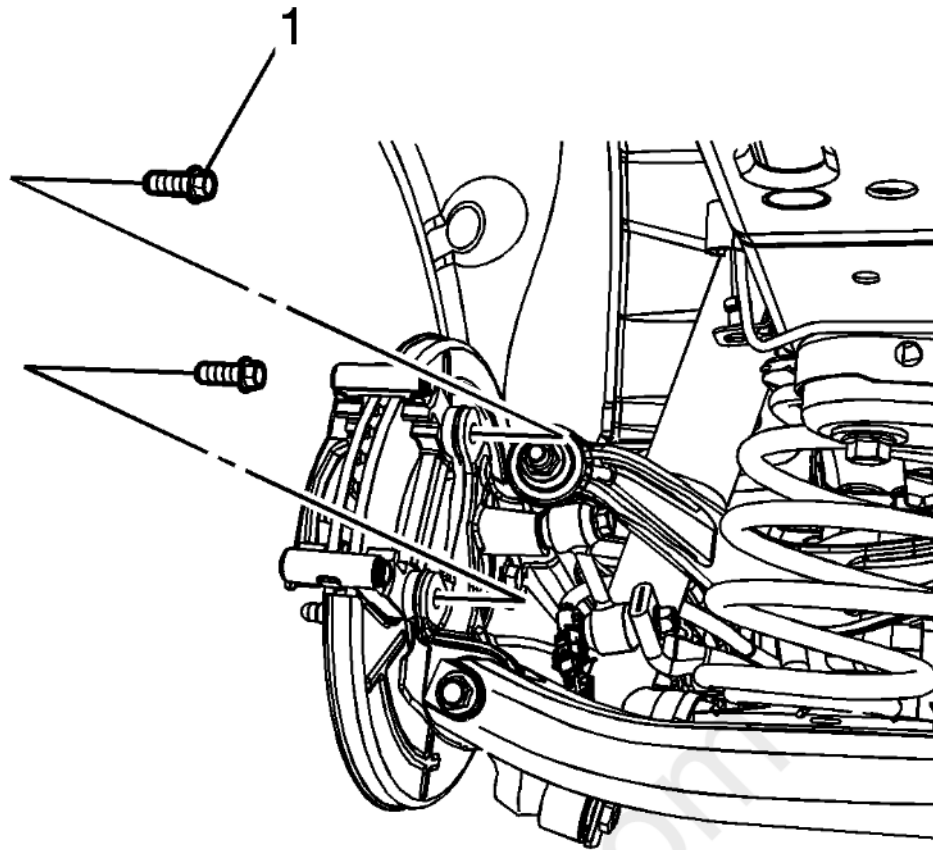


Fig. 59: Brake Caliper Bracket Bolts
Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

3. Install the brake caliper bracket bolts (1) and tighten to 100 N.m (74 lb ft) + 45 degrees.
4. Install the rear disc brake pads. Refer to [Rear Disc Brake Pads Replacement](#).
5. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
6. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
7. Slowly release the brake pedal.
8. Wait 15 seconds, then repeat steps 6-7 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.

FRONT BRAKE ROTOR REPLACEMENT

Special Tools

- CH-41013 Rotor Resurfacing Kit
- CH-42450-A Wheel Hub Resurfacing Kit

For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

NOTE: It is not necessary to replace brake rotors in axle sets.

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .

2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).

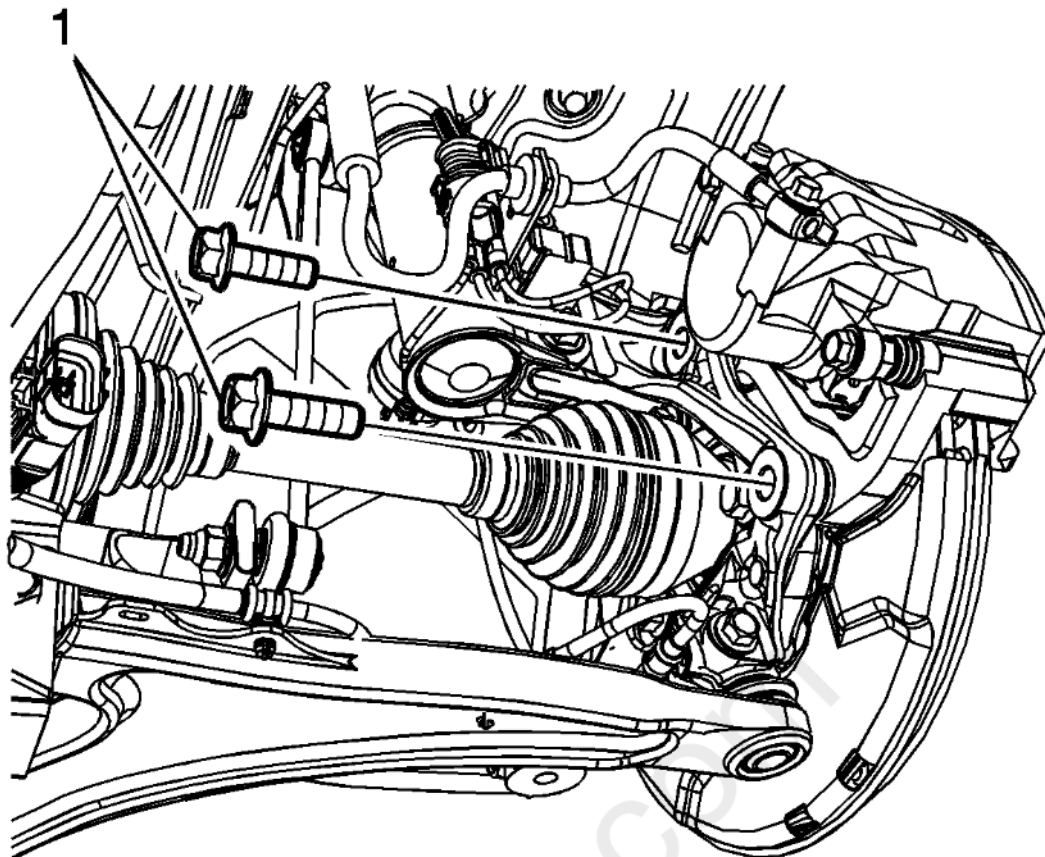


Fig. 60: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

3. Remove the brake caliper bracket bolts (1).

CAUTION: Support the brake caliper with heavy mechanic 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.

4. Remove the brake caliper and bracket as an assembly and support with heavy mechanics wire or equivalent.

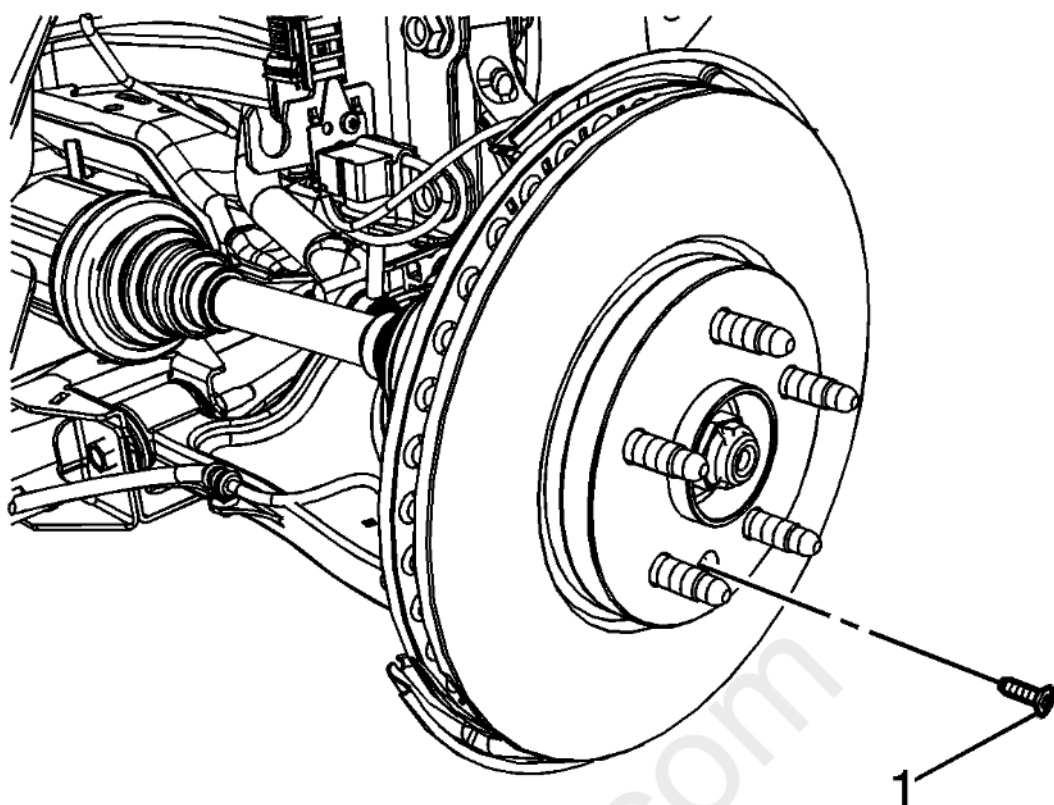


Fig. 61: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake rotor bolt (1).

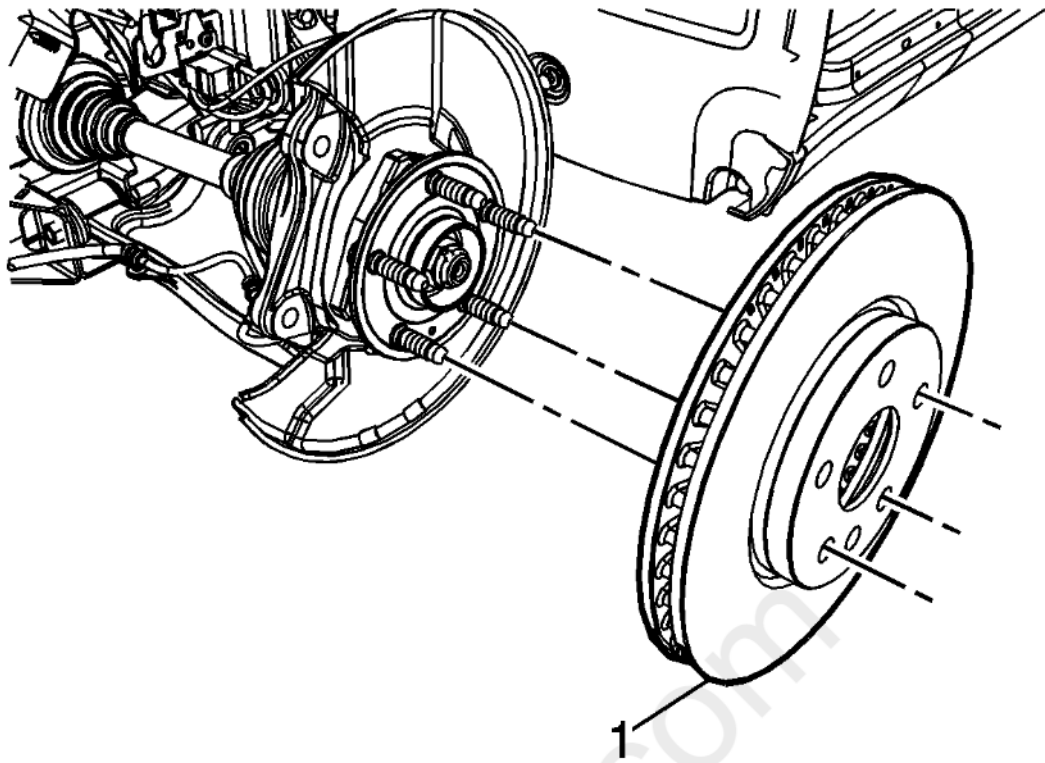


Fig. 62: Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

6. Remove the brake rotor (1).

Installation Procedure

1. If installing a new brake rotor, clean the friction surfaces of the brake rotor with denatured alcohol.
2. Using the **CH-42450-A** Wheel Hub Resurfacing Kit, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange.
3. Using the **CH-41013** Rotor Resurfacing Kit, thoroughly clean any rust or corrosion from the mating surface of the rotor to the hub/axle flange.

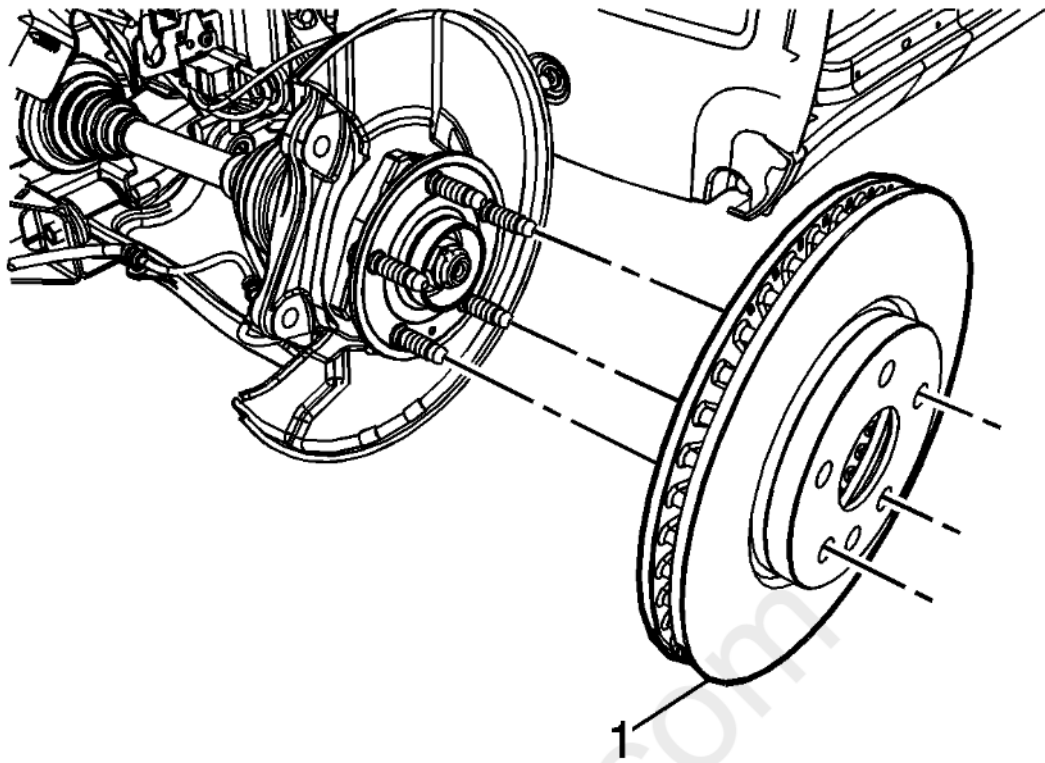


Fig. 63: Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

4. Install the brake rotor (1).

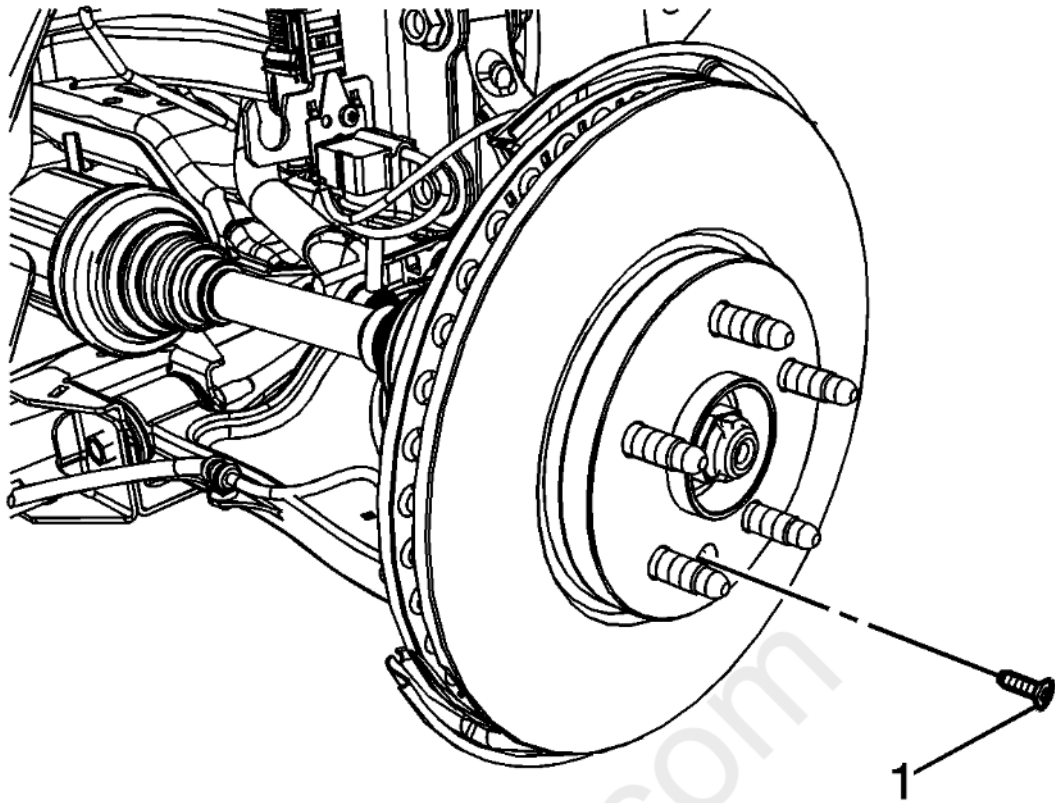


Fig. 64: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

5. Install the brake rotor bolt (1) and tighten to 7 N.m (62 lb in).
6. Prepare the brake caliper bracket bolts and the bracket threaded holes for assembly:
 - Thoroughly clean the residue from the bolt threads with denatured alcohol or equivalent and allow to dry.
 - Thoroughly clean the residue from the threaded holes with denatured alcohol or equivalent and allow to dry.
 - Apply threadlocker to 2/3 of the threaded length of the caliper bracket bolts. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
 - Ensure there are no gaps in the threadlocker along the length of the filled area of the bolts.
 - Allow the threadlocker to cure approximately 10 minutes before installation.

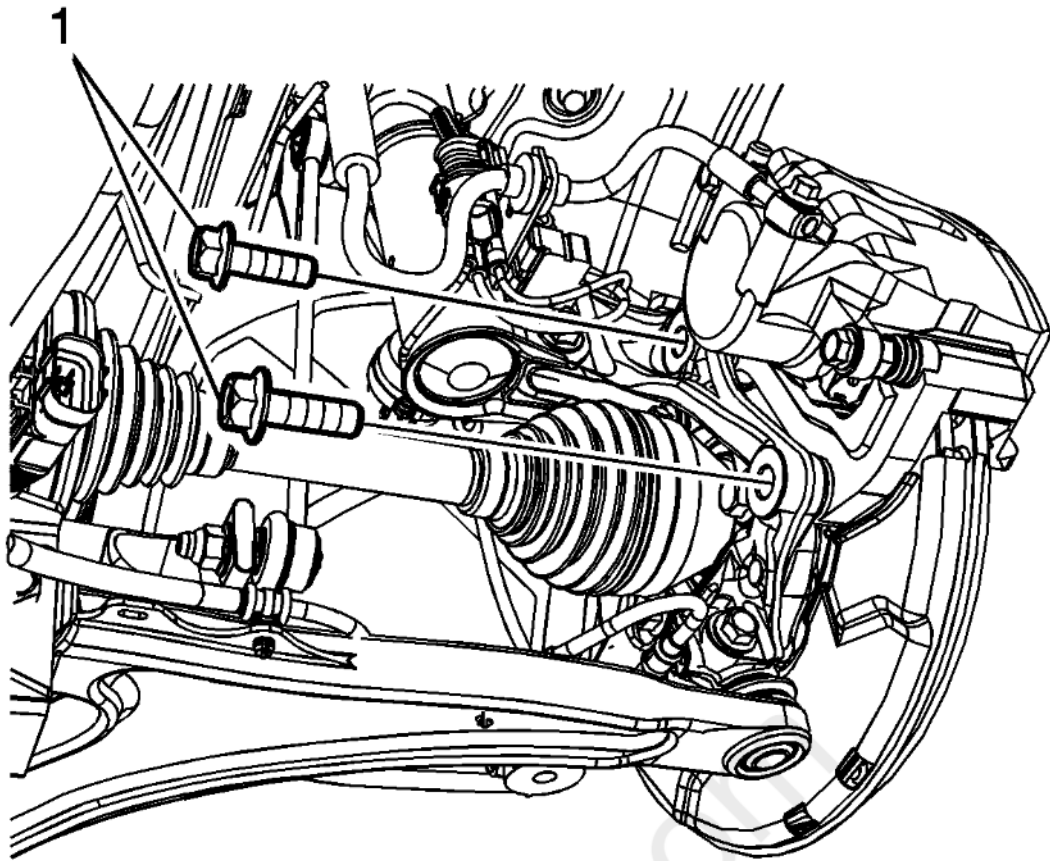


Fig. 65: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

7. Position the brake caliper and bracket assembly to the steering knuckle.
8. Install the brake caliper bracket bolts (1) and tighten to 150 N.m (111 lb ft) +45 degrees.
9. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
10. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
11. Slowly release the brake pedal.
12. Wait 15 seconds, then repeat steps 10-11 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
13. Burnish the brake pads and rotors. Refer to [Brake Pad and Rotor Burnishing](#).

REAR BRAKE ROTOR REPLACEMENT

Special Tools

- CH-41013 Rotor Resurfacing Kit
- CH-42450-A Wheel Hub Resurfacing Kit

For equivalent regional tools, refer to [Special Tools](#).

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

NOTE: It is not necessary to replace brake rotors in axle sets.

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

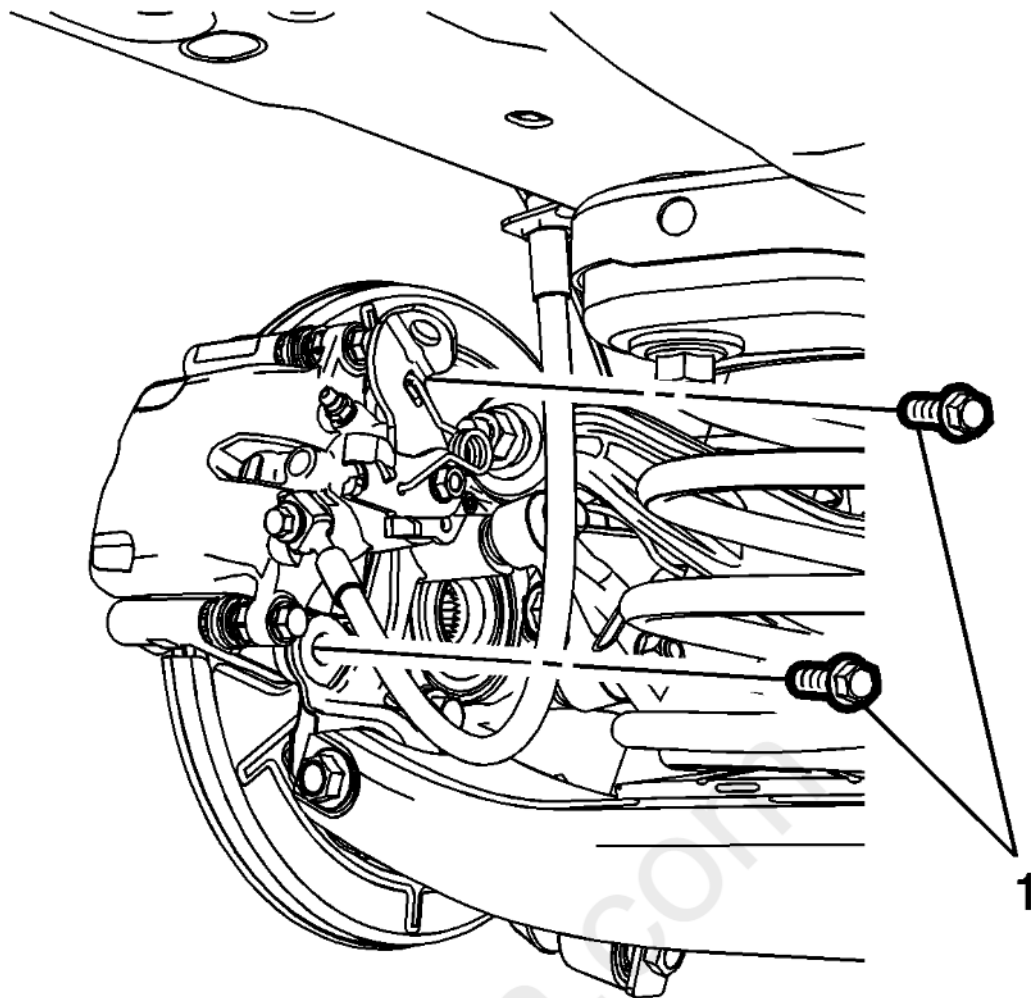


Fig. 66: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

3. Remove the brake caliper bracket bolts (1).

CAUTION: Support the brake caliper with heavy mechanic 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.

4. Remove the brake caliper and bracket assembly and support with heavy mechanics wire or equivalent.

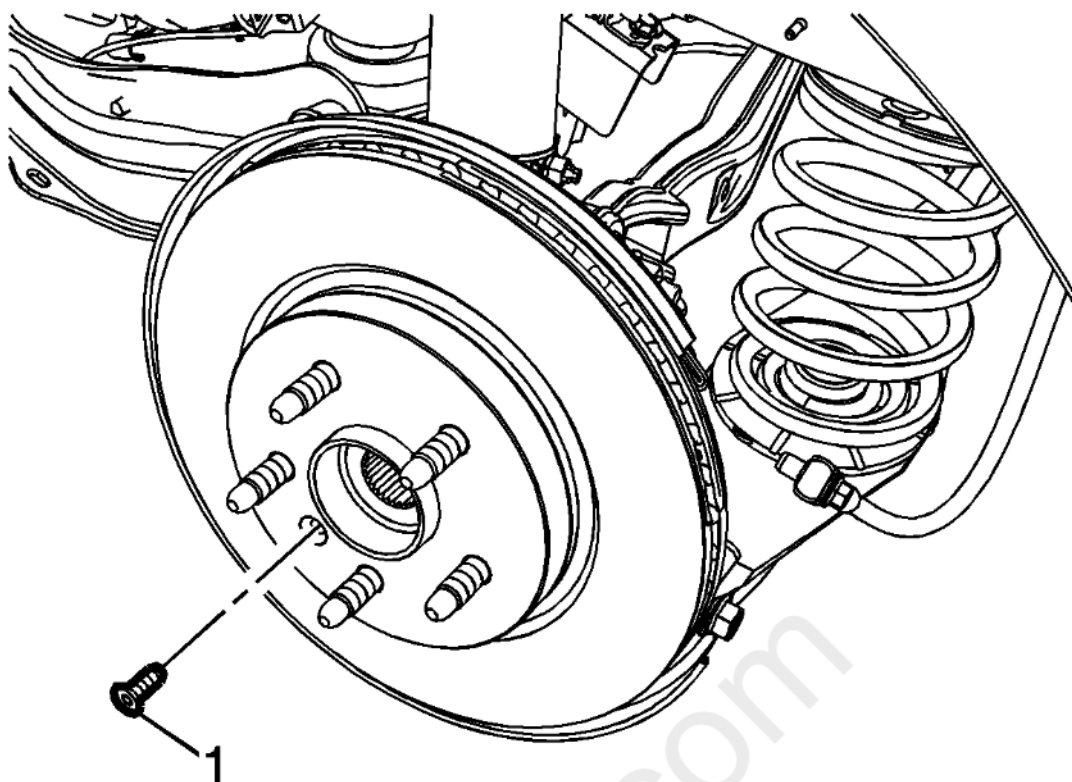


Fig. 67: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake rotor bolt (1).

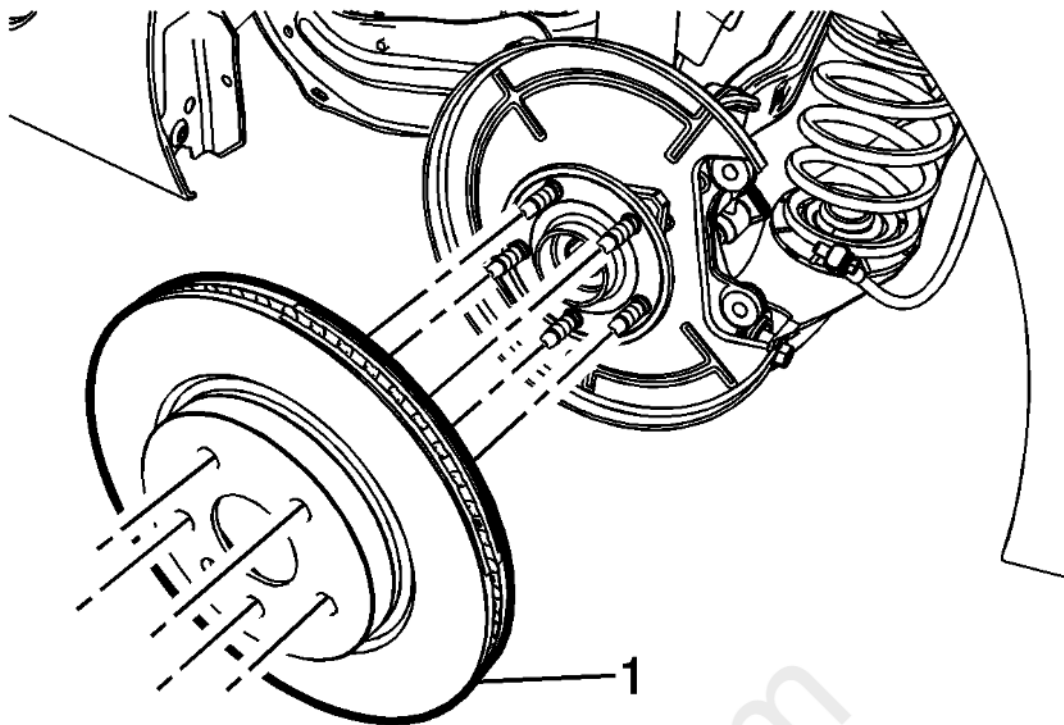


Fig. 68: Rear Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

6. Remove the rear brake rotor (1).

Installation Procedure

1. If installing a new brake rotor, clean the friction surfaces of the brake rotor with denatured alcohol or equivalent.
2. Using the **CH-42450-A** wheel hub resurfacing kit, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange.
3. Using the **CH-41013** rotor resurfacing kit, thoroughly clean any rust or corrosion from the mating surface of the rotor to the hub/axle flange.

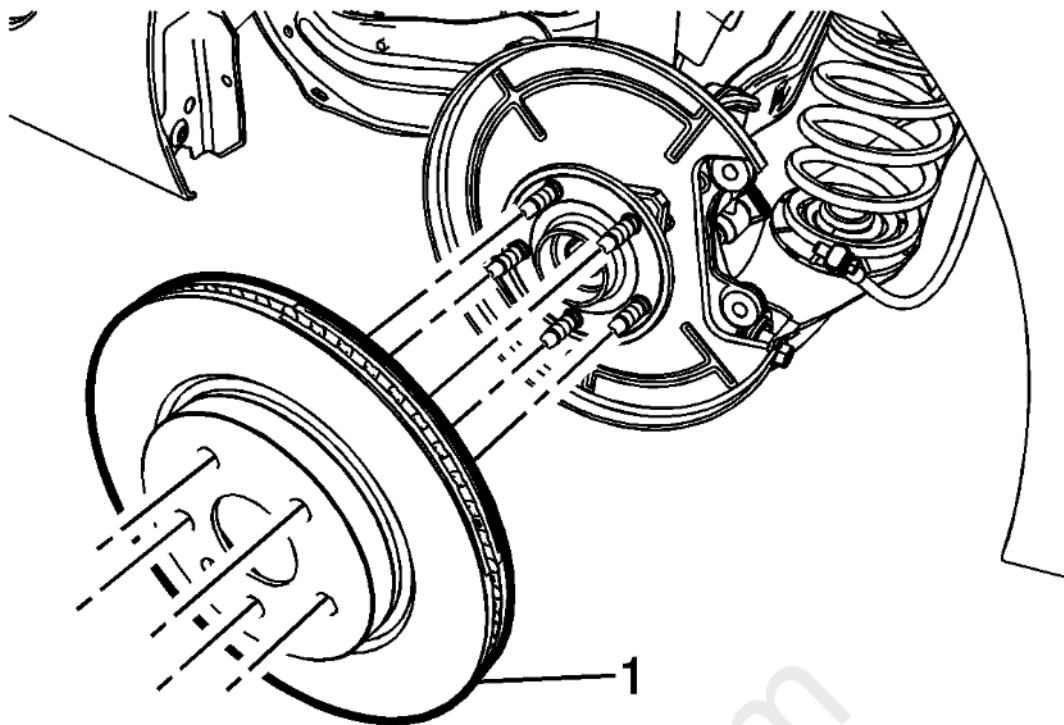


Fig. 69: Rear Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

4. Install the rear brake rotor (1).

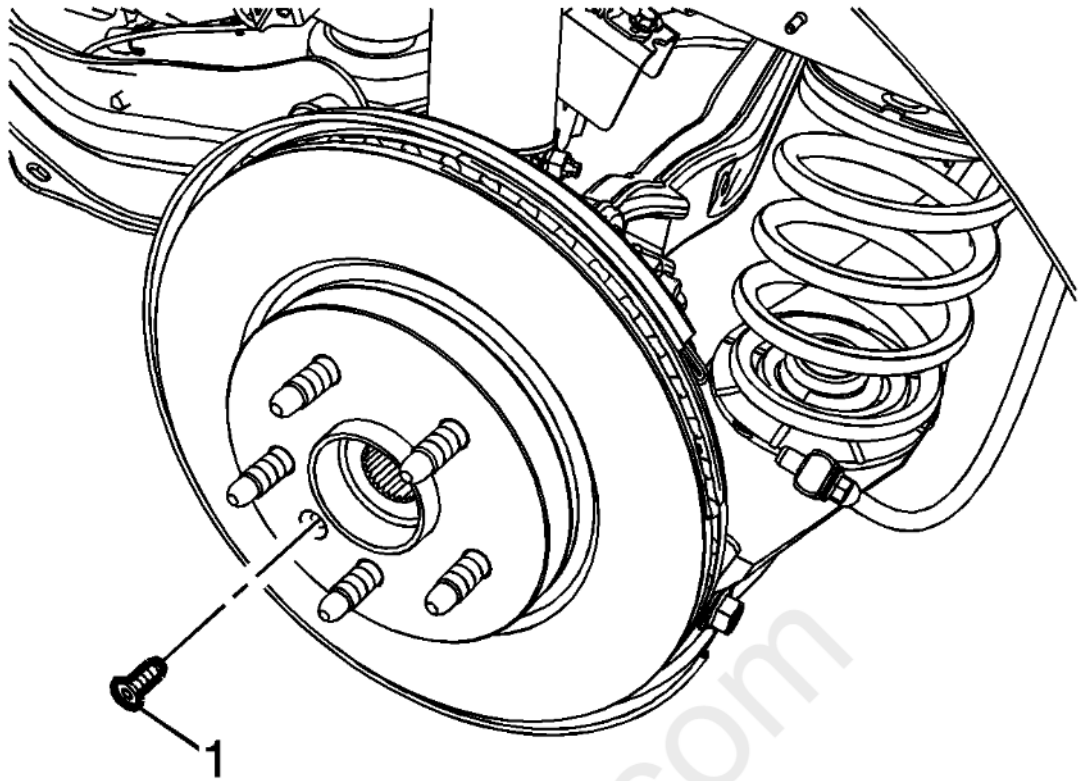


Fig. 70: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to [Fastener Caution](#) .

5. Install the brake rotor bolt (1) and tighten to 7 N.m (62 lb in).
6. Install the brake caliper and bracket assembly.
7. Prepare the brake caliper bracket bolts and the bracket threaded holes for assembly:
 - Thoroughly clean the residue from the bolt threads with denatured alcohol or equivalent and allow to dry.
 - Thoroughly clean the residue from the threaded holes with denatured alcohol or equivalent and allow to dry.
 - Apply threadlocker to 2/3 of the threaded length of the caliper bracket bolts. Refer to [Adhesives, Fluids, Lubricants, and Sealers](#).
 - Ensure there are no gaps in the threadlocker along the length of the filled area of the bolts.
 - Allow the threadlocker to cure approximately 10 minutes before installation.

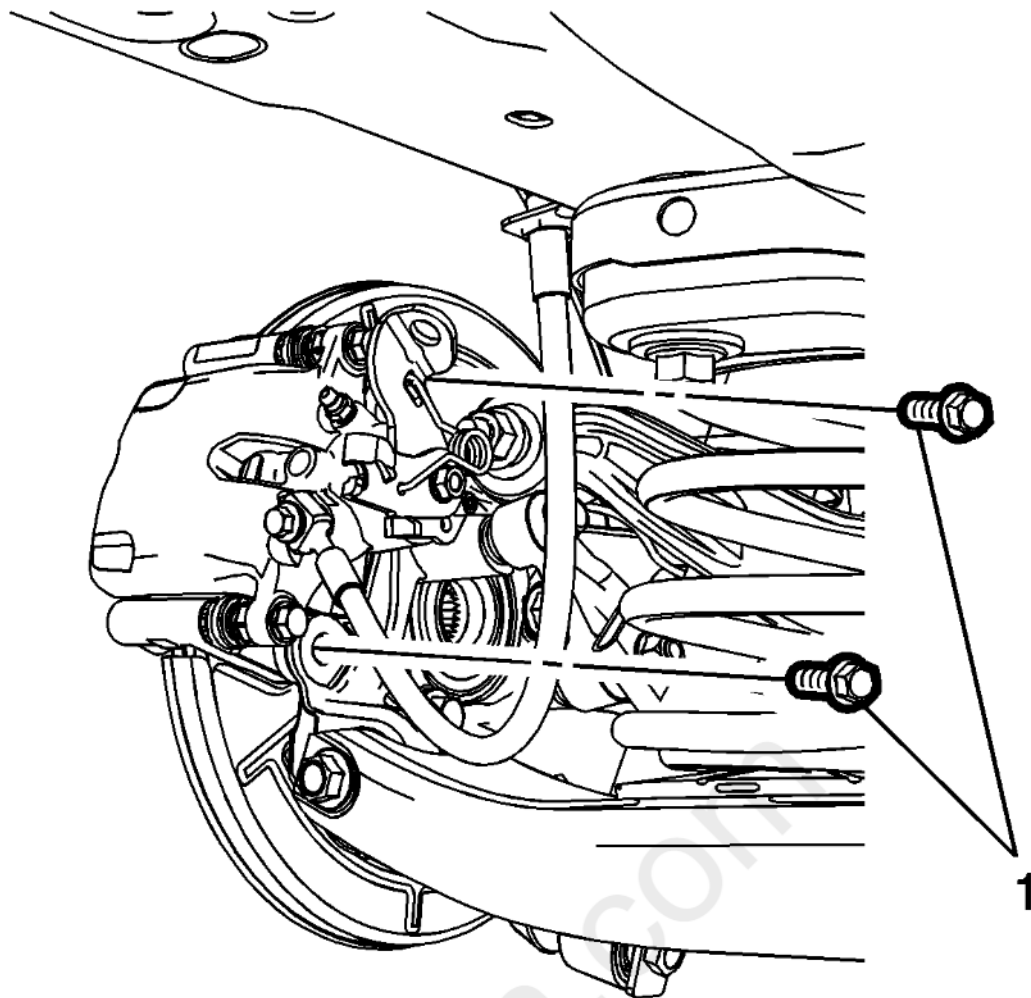


Fig. 71: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

8. Install the brake caliper bracket bolts (1) and tighten to 100 N.m (74 lb ft) + 45 degrees.
9. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
10. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
11. Slowly release the brake pedal.
12. Wait 15 seconds, then repeat steps 10-11 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
13. Burnish the brake pads and rotors. Refer to [Brake Pad and Rotor Burnishing](#).

FRONT BRAKE SHIELD REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
3. Remove the front wheel bearing and hub assembly. Refer to [Front Wheel Bearing and Hub Replacement](#) .

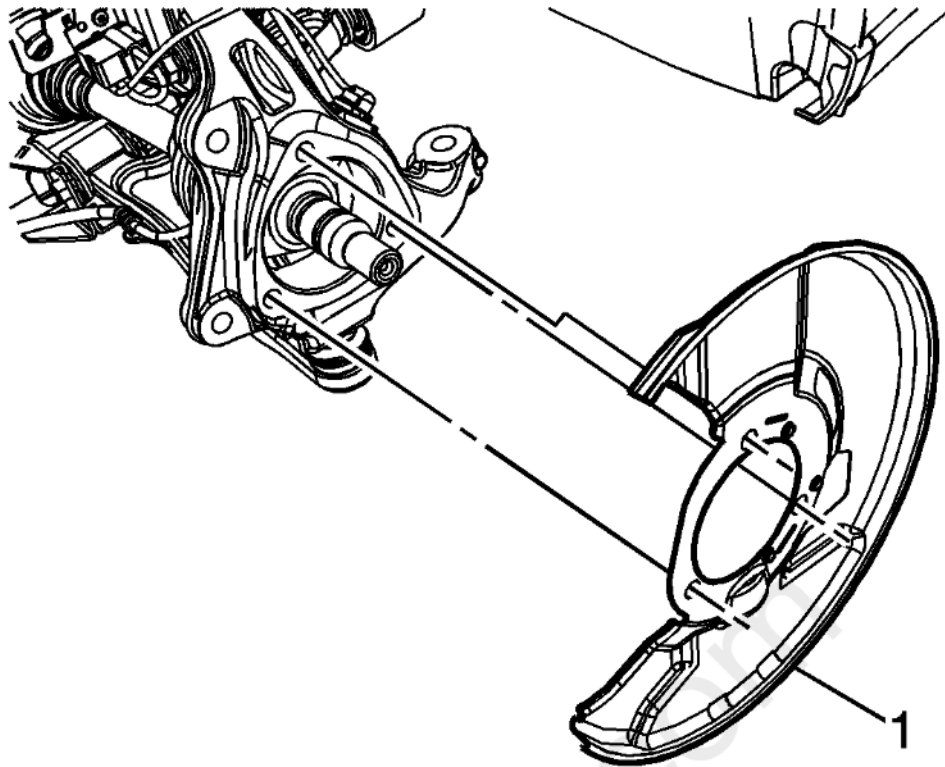


Fig. 72: Front Brake Shield

Courtesy of GENERAL MOTORS COMPANY

4. Remove the front brake shield (1).

Installation Procedure

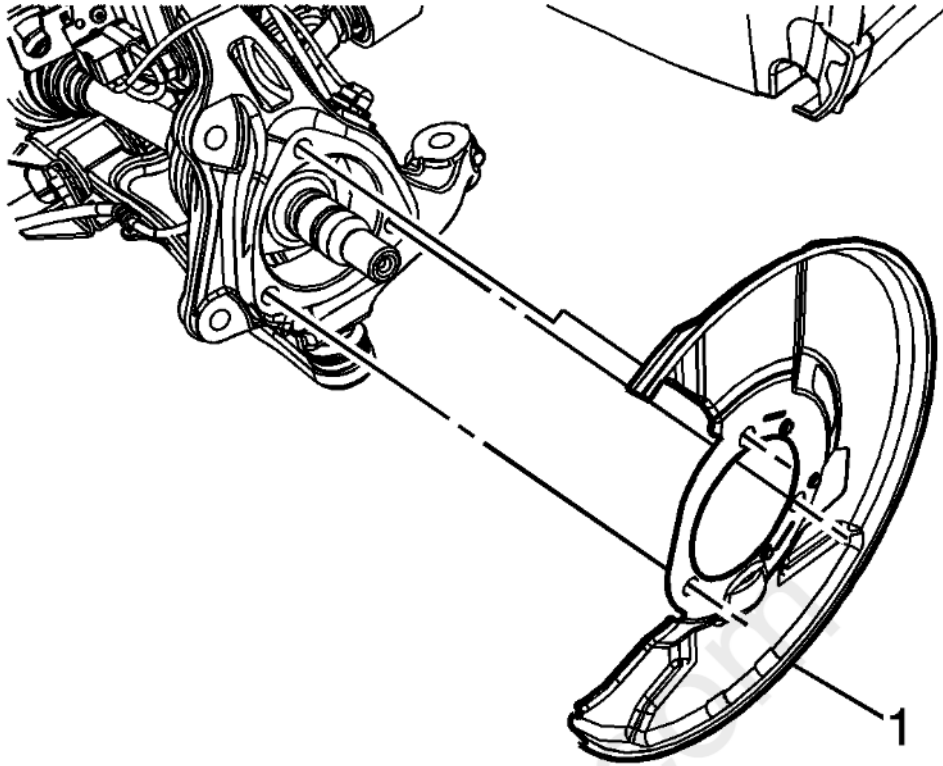


Fig. 73: Front Brake Shield

Courtesy of GENERAL MOTORS COMPANY

1. Install the front brake shield (1).
2. Install the front wheel bearing and hub assembly. Refer to [Front Wheel Bearing and Hub Replacement](#) .
3. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

REAR BRAKE SHIELD REPLACEMENT

Removal Procedure

WARNING: Refer to [Brake Dust Warning](#) .

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Remove the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
3. Remove the rear wheel bearing and hub assembly. Refer to [Rear Wheel Bearing and Hub Replacement](#) .

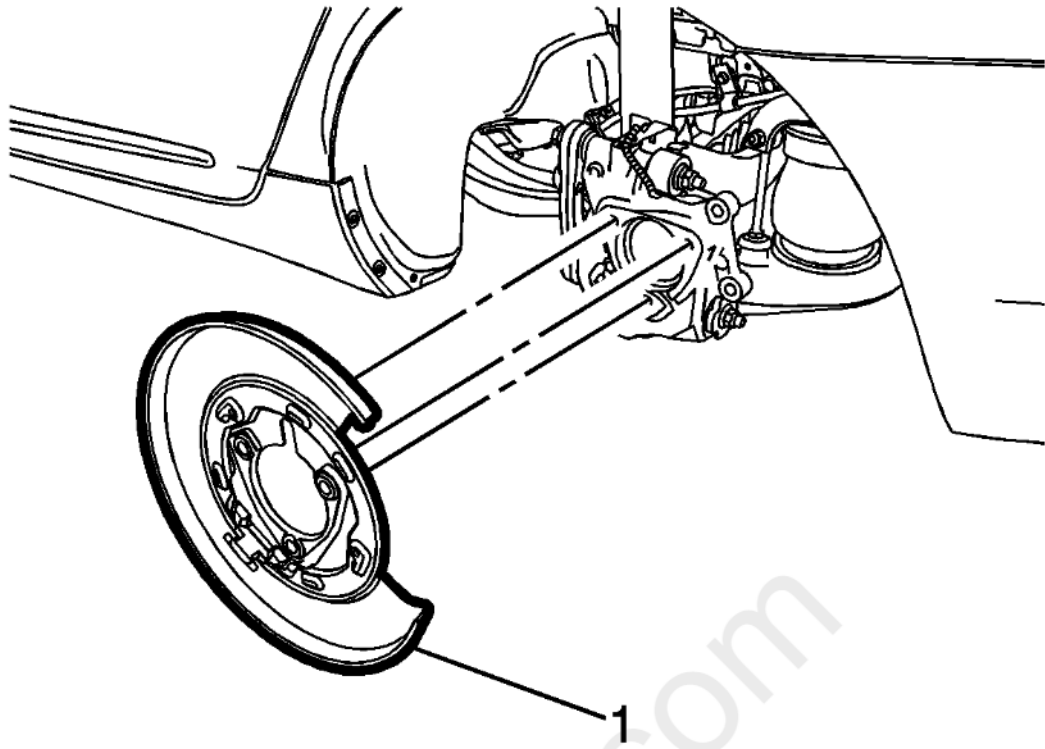


Fig. 74: Rear Brake Backing Plate
Courtesy of GENERAL MOTORS COMPANY

4. Remove the rear brake shield (1).

Installation Procedure

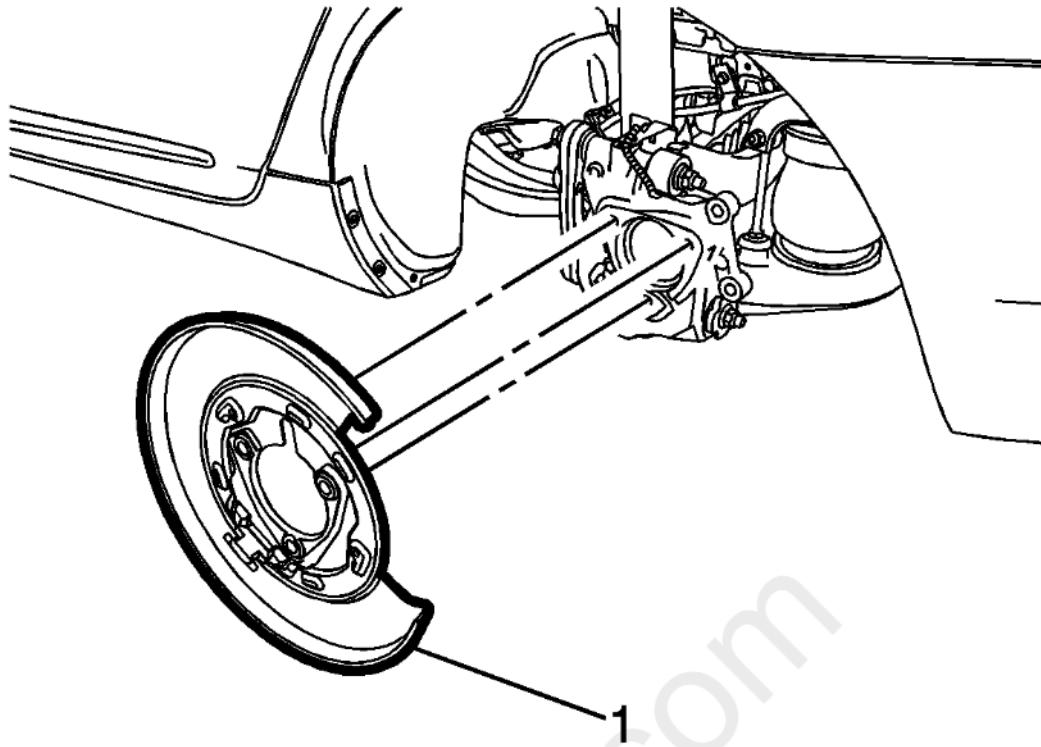


Fig. 75: Rear Brake Backing Plate
 Courtesy of GENERAL MOTORS COMPANY

1. Install the rear brake shield (1).
2. Install the rear wheel bearing and hub assembly. Refer to [Rear Wheel Bearing and Hub Replacement](#).
3. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION

NOTE:

- Brake rotor thickness variation **MUST** be checked **BEFORE** checking for assembled lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. [Brake Rotor Thickness Variation Measurement](#)
- Brake rotor assembled lateral runout (LRO) exceeding the maximum allowable specification can cause thickness variation to develop in the brake rotor over time, usually between 4 800 - 11 300 km (3, 000 - 7, 000 mi). [Brake Rotor Assembled Lateral Runout Measurement](#)

Review the following acceptable methods for bringing the brake rotor assembled LRO to within specifications. Determine which method to use for the specific vehicle being repaired.

- The indexing method of correcting assembled LRO is most effective when the LRO specification is only exceeded by a relatively small amount: 0.025 - 0.127 mm (0.001 - 0.005 in). Indexing is used to achieve the best possible match of high spots to low spots between related components. [Brake Rotor Assembled Lateral Runout Correction - Indexing](#)
- The on-vehicle brake lathe method is used to bring the LRO to within specifications through compensating for LRO while refinishing the brake rotor. [Brake Rotor Assembled Lateral Runout](#)

If the assembled LRO cannot be corrected using these methods, then other components must be suspected as causing and/or contributing to the LRO concern.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - INDEXING

NOTE: This Procedure is not used in Europe

Special Tools

CH-45101-100 Conical Brake Rotor Washers

For equivalent regional tools, refer to Special Tools.

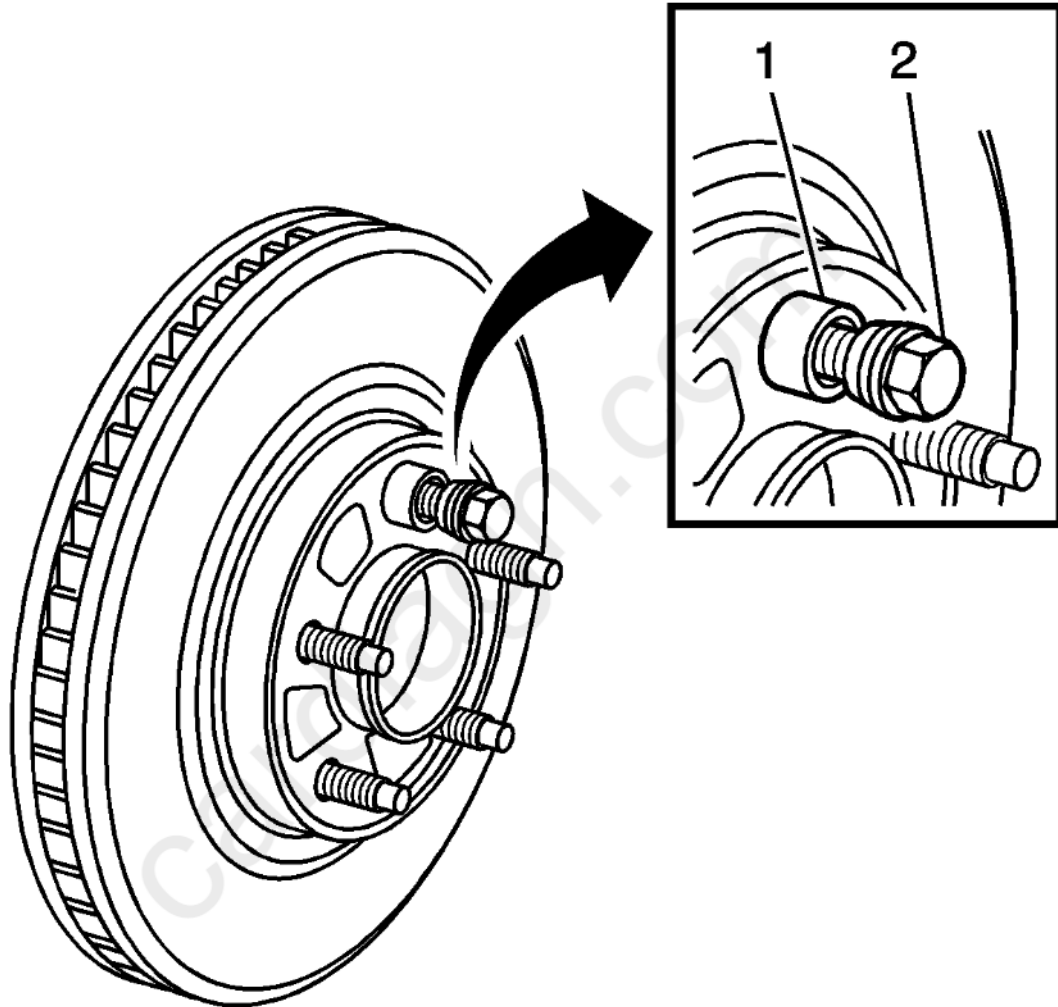


Fig. 76: Lug Nuts & Conical Washers
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Dust Warning .

NOTE:

- Brake rotor thickness variation **MUST** be checked **BEFORE** checking for assembled lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. Brake Rotor Thickness Variation Measurement
- Brake rotor assembled LRO exceeding the maximum allowable specification can cause thickness variation to develop in the brake rotor over time, usually between 4, 800 - 11, 300 km (3, 000 - 7, 000 mi). Brake Rotor Assembled Lateral Runout Measurement

1. Remove the **CH-45101-100** Conical Brake Rotor Washers and the lug nuts that were installed during the assembled LRO measurement procedure.
2. Inspect the mating surface of the hub/axle flange and the brake rotor to ensure that there are no foreign particles or debris remaining.
3. Index the brake rotor in a different orientation to the hub/axle flange.
4. Hold the rotor firmly in place against the hub/axle flange and install one of the **CH-45101-100** Conical Brake Rotor Washers (1) and one lug nut (2) onto the upper-most wheel stud.
5. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

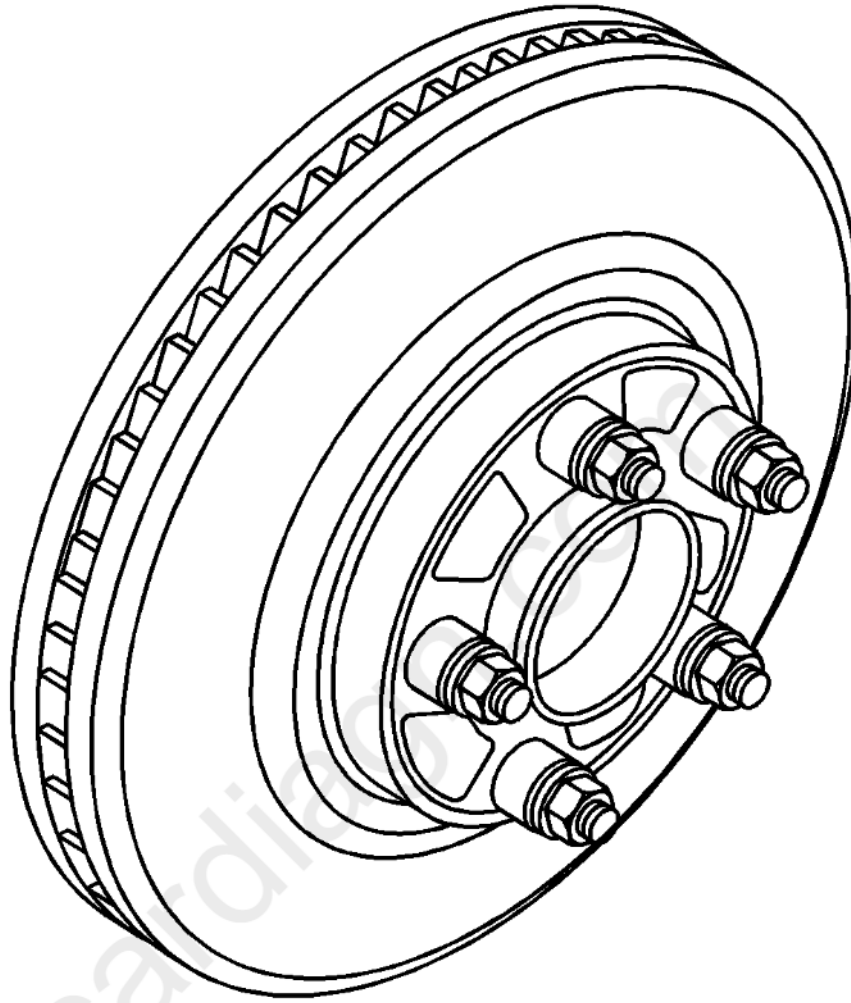


Fig. 77: Lug Nuts & Conical Washers

Courtesy of GENERAL MOTORS COMPANY

6. Install the remaining **CH-45101-100** Conical Brake Rotor Washers and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern.
7. Tighten the lug nuts in a star-pattern to specification, in order to properly secure the rotor. **Tire and Wheel Removal and Installation**
8. Measure the assembled LRO of the brake rotor. **Brake Rotor Assembled Lateral Runout Measurement**
9. Compare the amount of change between this measurement and the original measurement.
10. If this measurement is within specifications, proceed to step 14.
11. If this measurement still exceeds specifications, repeat steps 1 - 9 until the best assembled LRO measurement is obtained.
12. Matchmark the final location of the rotor to the wheel studs if the orientation is different than it was originally.
13. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to **Brake Rotor Assembled Lateral Runout Correction**.
14. If the brake rotor assembled LRO is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **CH-45101-100** Conical

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - CORRECTION PLATES

NOTE: This procedure not used in Europe

Special Tools

CH-45101-100 Conical Brake Rotor Washers

For equivalent regional tools, refer to [Special Tools](#).

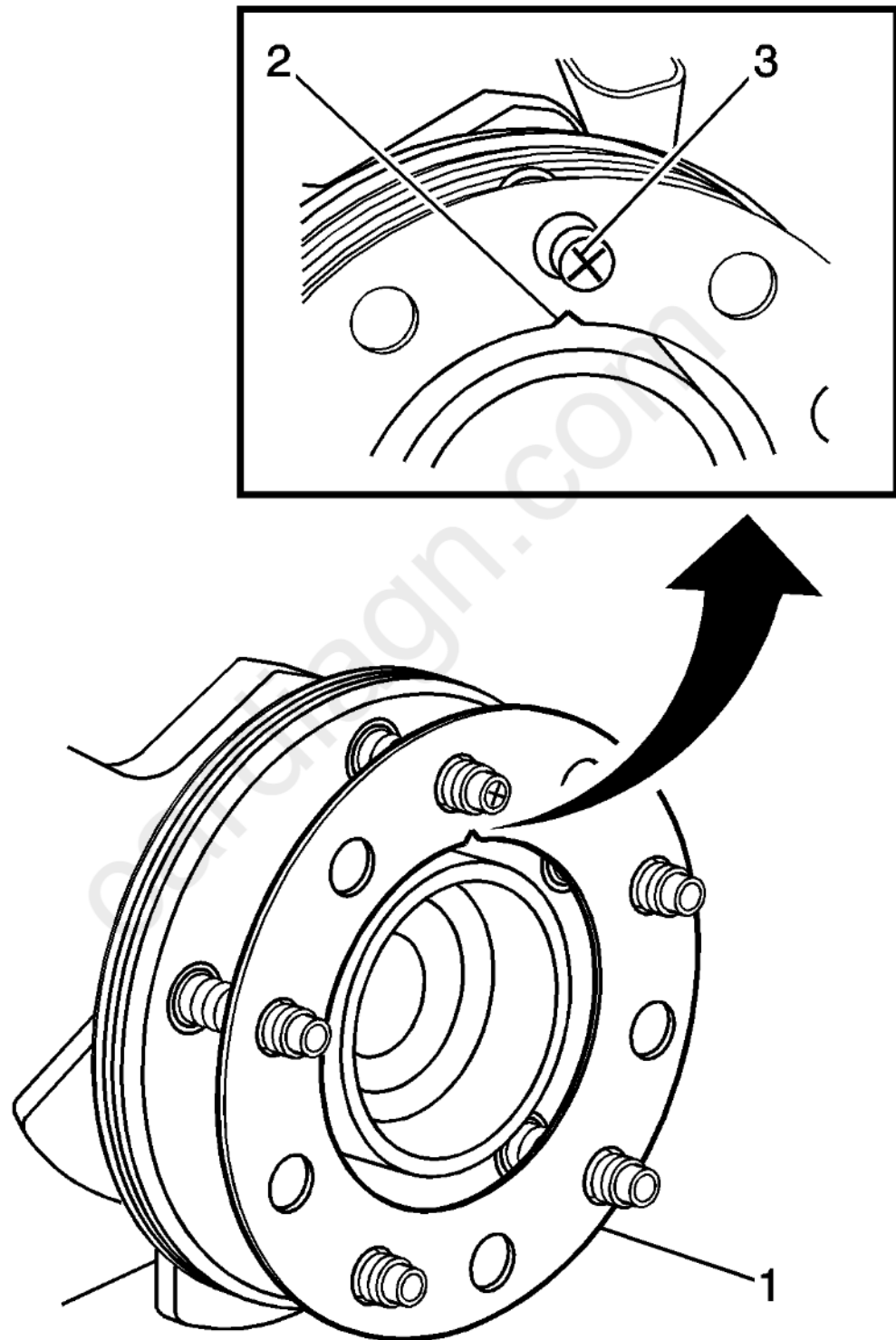


Fig. 78: Identifying Correction Plate, High Spot Mark & V-Shaped Notch
Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to Brake Dust Warning.

NOTE:

- Brake rotor thickness variation **MUST** be checked **BEFORE** checking for assembled lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. [Brake Rotor Thickness Variation Measurement](#)
- Brake rotor assembled LRO exceeding the maximum allowable specification can cause thickness variation to develop in the brake rotor over time, usually between 4, 800 - 11, 300 km (3, 000 - 7, 000 mi). [Brake Rotor Assembled Lateral Runout Measurement](#)

1. Rotate the brake rotor to position the high spot, identified and marked during the brake rotor assembled LRO measurement procedure, to face upward.
2. Remove the **CH-45101-100** Conical Brake Rotor Washers and the lug nuts that were installed during the assembled LRO measurement procedure and/or the indexing correction procedure.
3. Inspect the mounting surface of the hub/axle flange and the brake rotor to ensure that there are no foreign particles or debris remaining.
4. Select the correction plate, following the manufacturer's instructions, which has a specification closest to the assembled LRO measurement.

For example: If the assembled LRO measurement was 0.076 mm (0.003 in), the 0.076 mm (0.003 in) correction plate would be used. If the measurement was 0.127 mm (0.005 in), the 0.152 mm (0.006 in) correction plate would be used.

5. Determine the positioning for the correction plate (1) using the high spot mark (3) made during the brake rotor assembled LRO measurement procedure.

NOTE:

- **Do NOT** install used correction plates in an attempt to correct brake rotor assembled LRO.
- **Do NOT** stack up, or install more than one correction plate onto one hub/axle flange location, in an attempt to correct brake rotor assembled LRO.

6. Install the correction plate (1) onto the hub/axle flange, with the V-shaped notch (2) orientated to align with the high spot mark (3), that was positioned to face upward.

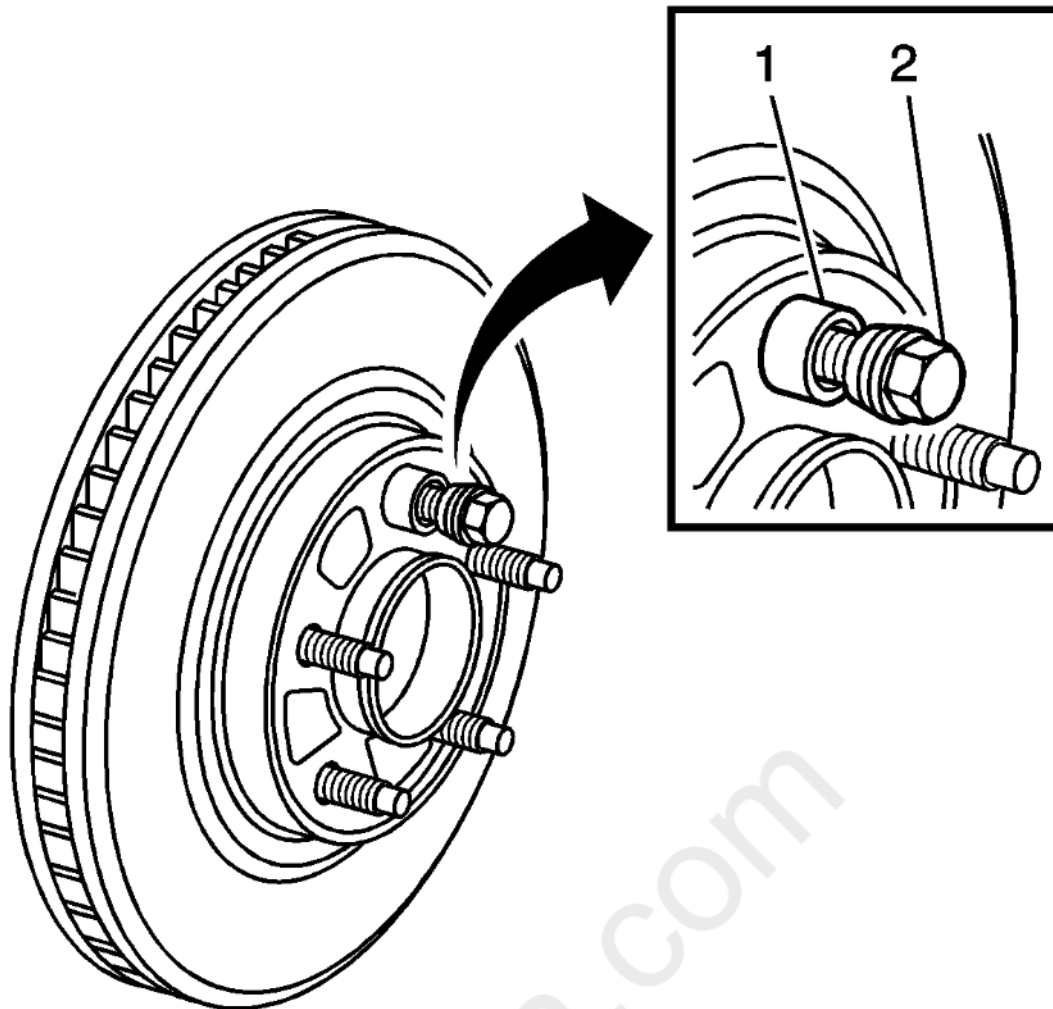


Fig. 79: Lug Nuts & Conical Washers

Courtesy of GENERAL MOTORS COMPANY

7. Install the brake rotor to the hub/axle flange. Use the matchmark made prior to removal for proper orientation to the flange.
8. Hold the rotor firmly in place against the hub/axle flange and install one of the **CH-45101-100** Conical Brake Rotor Washers (1) and one lug nut (2) onto the upper-most wheel stud.
9. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

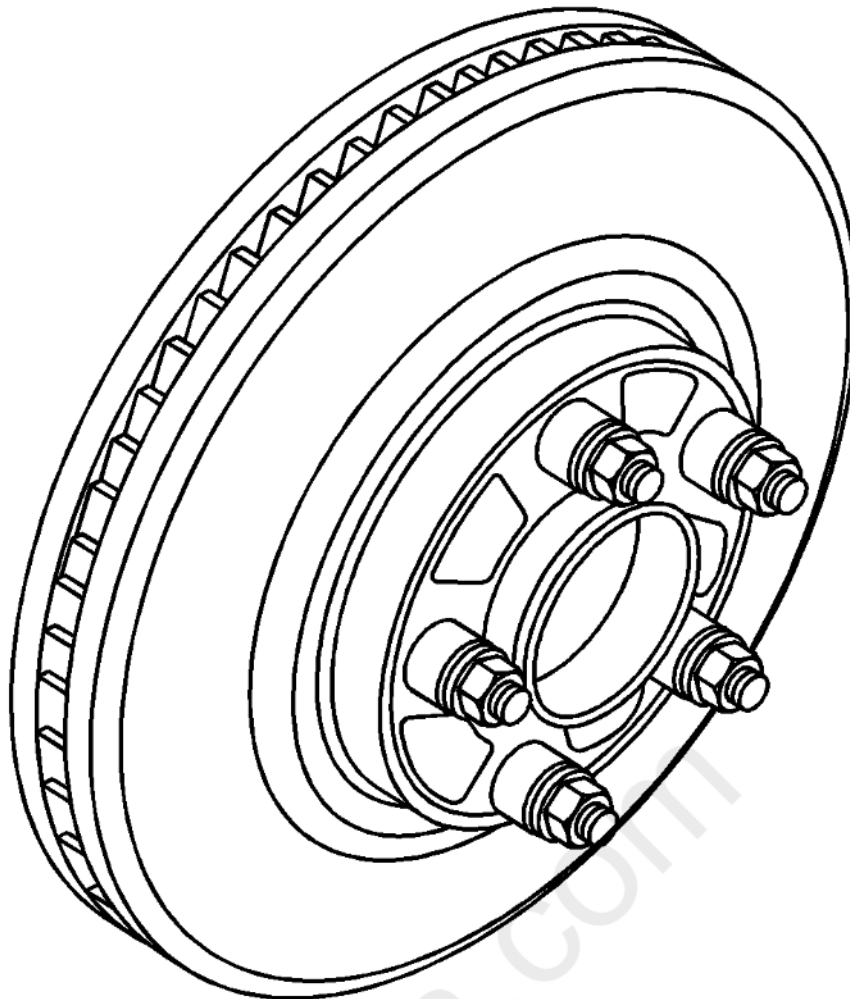


Fig. 80: Lug Nuts & Conical Washers

Courtesy of GENERAL MOTORS COMPANY

10. Install the remaining **CH-45101-100** Conical Brake Rotor Washers and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern.
11. Tighten the lug nuts in a star-pattern to specification, in order to properly secure the rotor. [Tire and Wheel Removal and Installation](#)
12. Measure the assembled LRO of the brake rotor. [Brake Rotor Assembled Lateral Runout Measurement](#)
13. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to [Brake Rotor Assembled Lateral Runout Correction](#).
14. If the brake rotor assembled LRO measurement is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **CH-45101-100** Conical Brake Rotor Washers and the lug nuts.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - ON VEHICLE LATHE

NOTE: This procedure is not used in Europe.

Special Tools

CH-45101-100 Conical Brake Rotor Washers

For equivalent regional tools, refer to [Special Tools](#).

WARNING: Refer to [Brake Dust Warning](#) .

NOTE:

- Brake rotor thickness variation **MUST** be checked **BEFORE** checking for assembled lateral runout (LRO). Thickness variation

exceeding the maximum acceptable level can cause brake pulsation. [Brake Rotor Thickness Variation Measurement](#)

- Brake rotor assembled LRO exceeding the maximum allowable specification can cause thickness variation to develop in the brake rotor over time, usually between 4 800 - 11 300 km (3, 000 - 7, 000 mi). [Brake Rotor Assembled Lateral Runout Measurement](#)

1. Ensure that the caliper and caliper bracket that are already being supported, are clear from contacting any rotating components, such as the brake rotor.
2. Remove the **CH-45101-100** Conical Brake Rotor Washers and the lug nuts that were installed during the assembled LRO measurement procedure and/or the indexing correction procedure.
3. Inspect the mounting surface of the hub/axle flange and the brake rotor to ensure that there are no foreign particles or debris remaining.
4. Set up the lathe, following the manufacturer's instructions.
5. Refinish the brake rotor, following the brake lathe manufacturer's instructions.
6. After each successive cut, inspect the brake rotor thickness. [Brake Rotor Thickness Measurement](#)
7. If at any time the brake rotor exceeds the minimum allowable thickness after refinish specification, the brake rotor must be replaced. After replacing the rotor, proceed to step 10.
8. After refinishing the brake rotor, use the following procedure in order to obtain the desired non-directional finish:
 1. Follow the brake lathe manufacturer's recommended speed setting for applying a non-directional finish.
 2. 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.
 3. After applying a non-directional finish, clean each friction surface of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
9. Remove the lathe from the vehicle.
10. Measure the assembled LRO of the brake rotor. [Brake Rotor Assembled Lateral Runout Measurement](#)
11. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to [Brake Rotor Assembled Lateral Runout Correction](#).
12. If the brake rotor assembled LRO is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **CH-45101-100** Conical Brake Rotor Washers and the lug nuts.

BRAKE ROTOR REFINISHING

Special Tools

- **CH-41013** Rotor Resurfacing Kit
- **CH-42450-A** Wheel Hub Resurfacing Kit

For equivalent regional tools, refer to [Special Tools](#).

WARNING: Refer to [Brake Dust Warning](#) .

NOTE:

- 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.

Brake Rotor Thickness Measurement

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.

NOTE:

If the vehicle is equipped with cross-drilled rotors, use a lathe with positive rake tooling. This setup requires less cutting pressure, which will result in less vibration, and a better surface finish. Also, use a vibration dampener when cutting. Otherwise, refinish according to the following instructions.

NOTE:

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 **CH-42450-A** Wheel Hub Resurfacing Kit, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange.
2. Using the **CH-41013** Rotor Resurfacing Kit, 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. **Brake Rotor Thickness Measurement**

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:
 1. Follow the brake lathe manufacturer's recommended speed setting for applying a non-directional finish.
 2. 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.

NOTE: Thoroughly cleaning the brake rotor will prevent the possible transfer of finite metal dust left as a by-product of machining to the brake pad material during the burnishing process, thereby reducing the possibility for brake squeal or other brake noises to occur.

3. After applying a non-directional finish, clean each friction surface of the brake rotor with a solution of mild dish washing detergent and water, or a GM approved brake cleaner and a clean shop towel to remove metal particles remaining from machining. Repeat the cleaning process if necessary to remove all metal particles.
13. Remove the brake rotor from the brake lathe.
14. Measure the assembled LRO of the brake rotor to ensure optimum performance of the disc brakes.
Brake Rotor Assembled Lateral Runout Measurement
15. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. **Brake Rotor Assembled Lateral Runout Correction**

DESCRIPTION AND OPERATION

DISC BRAKE SYSTEM DESCRIPTION AND OPERATION

System Component Description

The disc brake system consists of the following components:

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. Enables a sliding motion of brake pads when mechanical output force is applied.

Disc Brake Caliper Hardware (Floating Caliper)

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.

System Operation (Floating Caliper)

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.

System Operation (Fixed Caliper)

Mechanical output force is applied from the hydraulic brake caliper inboard and outboard pistons to the inner and outer brake pads. The brake calipers are a fixed, opposed-piston design, allowing the output force to be equally distributed through the distribution of the pressurized brake fluid within the caliper. 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 the brake pad hardware and of the brake caliper inboard and outboard pistons is essential for even distribution of braking force.

System Characteristics

Brake Noise

Brake noise can occur and to a degree, some brake noise is normal. Variations in driving conditions such as the weather, environment, driving patterns, differences in vehicle loading, and type or style of driving, can affect brake wear. Any one of these variations can cause brake noise to become apparent. Inspect and verify that all metal-to-metal contact areas of the brake pads, brake pad guides or springs, brake caliper housing, caliper bracket and/or suspension knuckle, as applicable, are clean and free of corrosion and scale.

Brake noise is a "slip-stick" vibration of disc brake components and, if it occurs intermittently, can be considered normal. Most brake noise may be eliminated or temporarily reduced by performing 3 or 4 aggressive brake applications. If the brake noise persists or consistently recurs, application of a damping compound to the brake pad mounting plate where it contacts the caliper can lessen the vibration as the components move relative to each other. Refer to Adhesives, Fluids, Lubricants, and Sealers in this section for recommended compounds.

The following brake noises are characteristic of all brake systems. These noises cannot be avoided, and may not indicate improper operation of the brake system.

Squeak/Squeal Noise

A squeak or squeal noise can occur on vehicles with front semi-metalllic brake pads during light to medium brake pedal application at low to moderate vehicle speeds. Occasionally this noise may appear from the front or rear brakes after a period of non-use such as overnight, or cold brakes and/or in high humidity conditions.

Grinding Noise

Common occurrence for rear brakes and some front disc brakes during initial brake applications after the vehicle has been parked overnight. Caused by light corrosion forming on the metal brake component friction surfaces during vehicle non-use. Typically disappears after the first few brake applications.

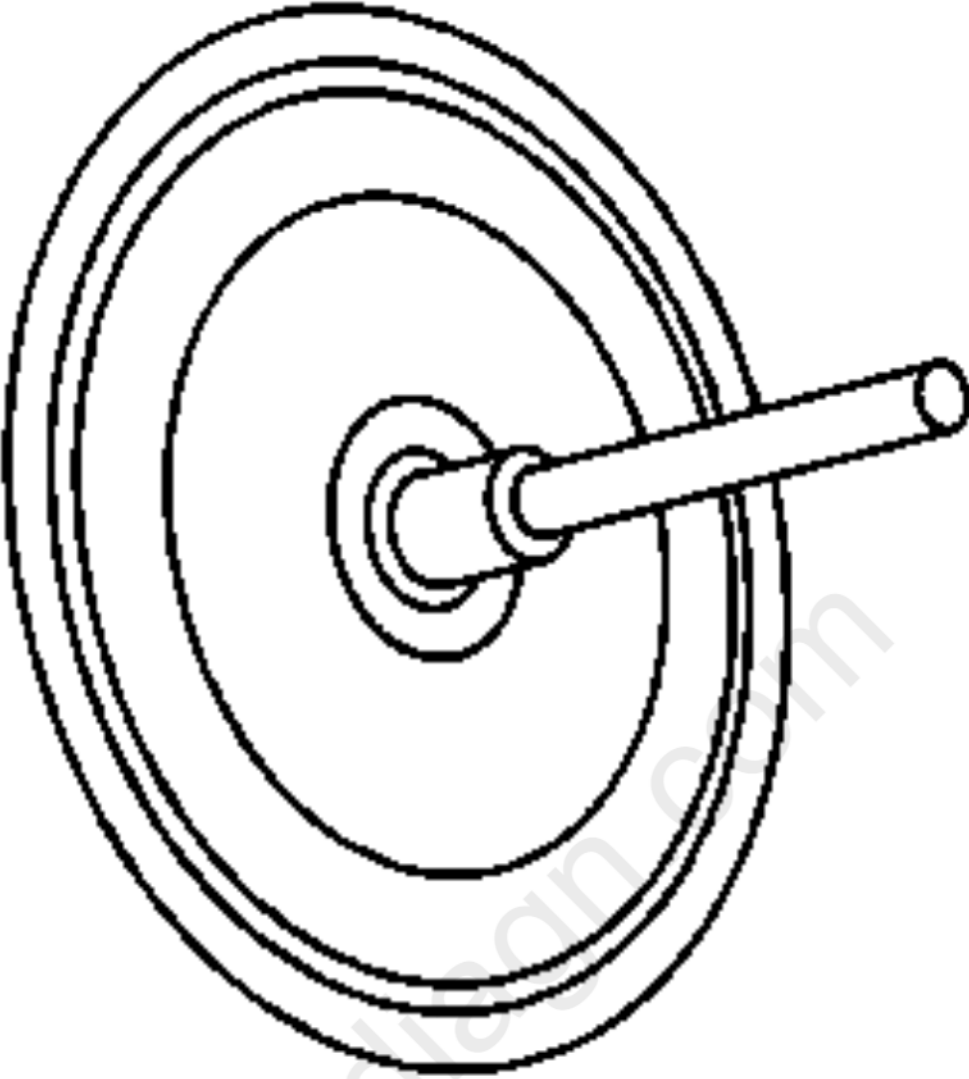
Groan Noise

A groan type noise may be heard during a quick stop, or when slowly moving forward from a complete stop. On vehicles equipped with antilock brake systems (ABS), a groan or moan noise may occur during heavy brake application or on road surfaces with compromised traction such as loose gravel, or on wet or icy roads. This is a normal function of ABS activation.

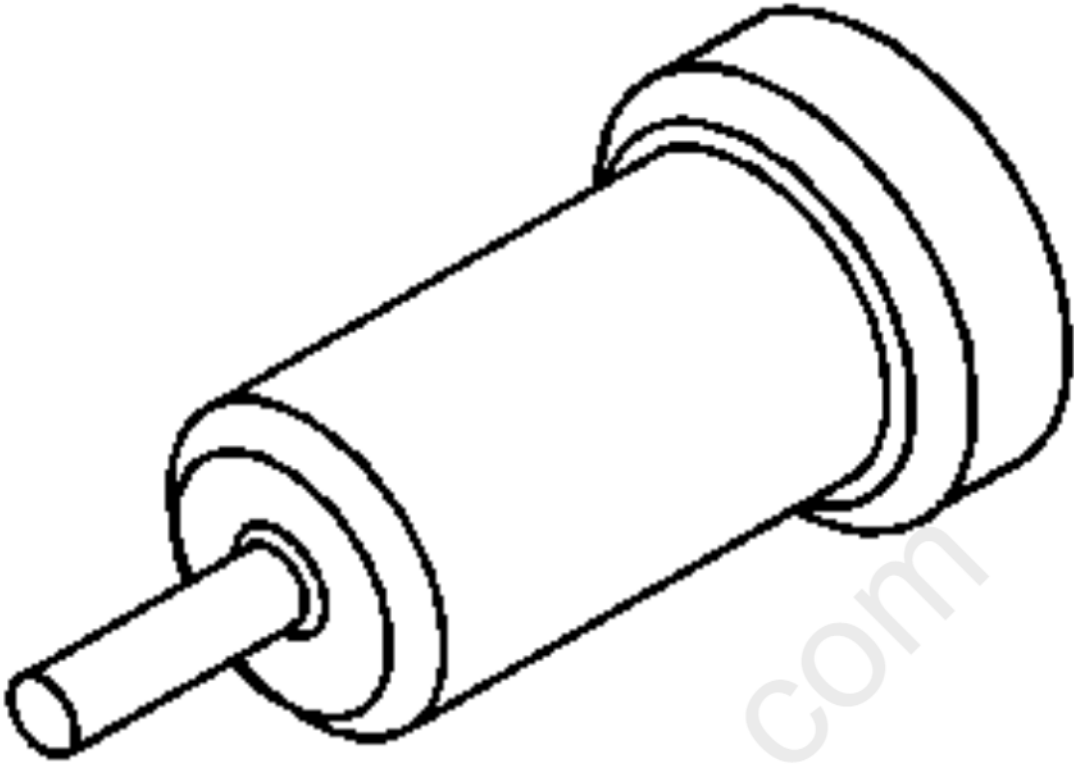
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description

Illustration	Tool Number/ Description
	CH 41013 J 41013 Rotor Resurfacing Kit Not used in Europe

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Illustration	Tool Number/ Description
	CH 42450-A J 42450-A Wheel Hub Resurfacing Kit Not used in Europe

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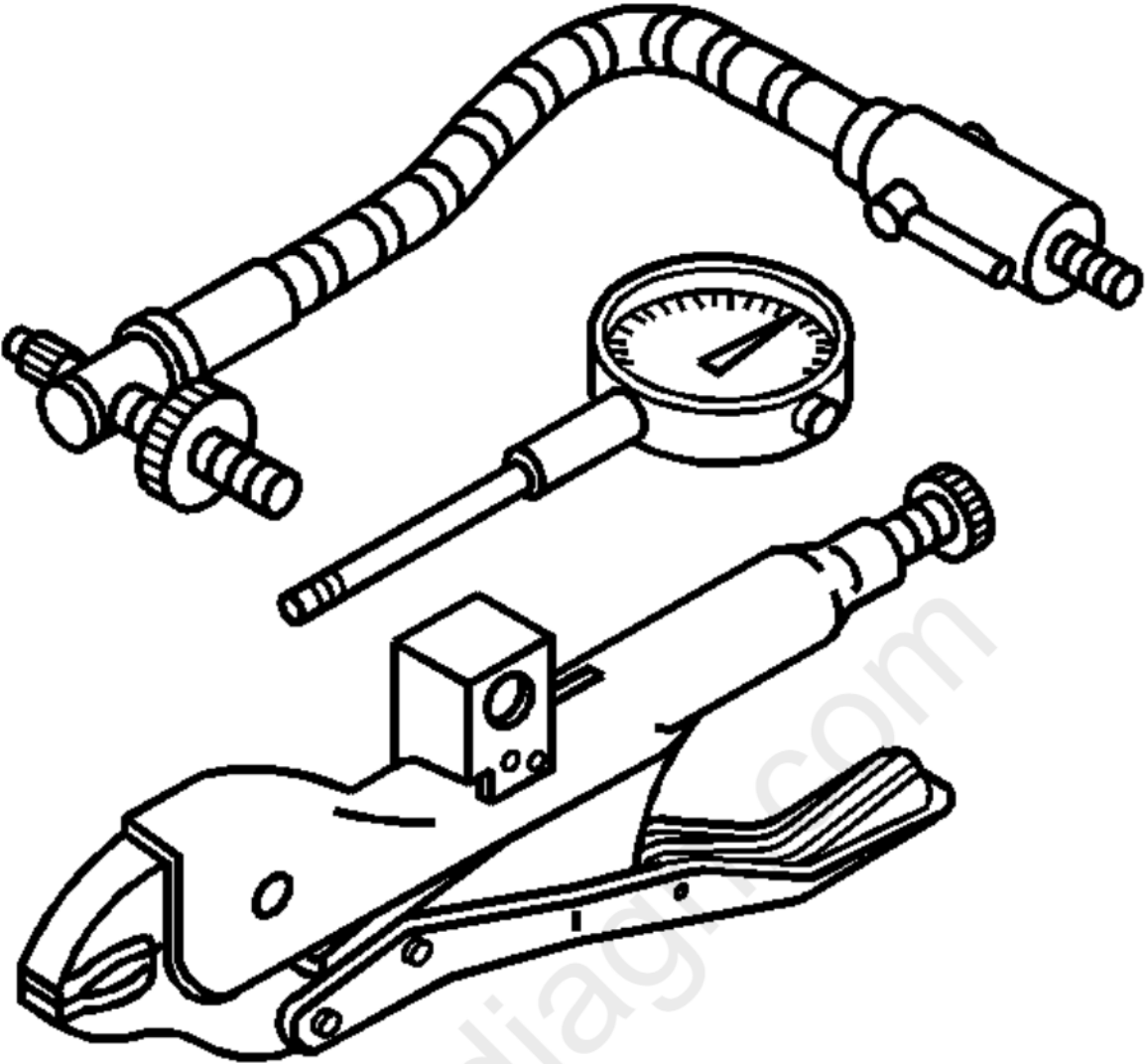
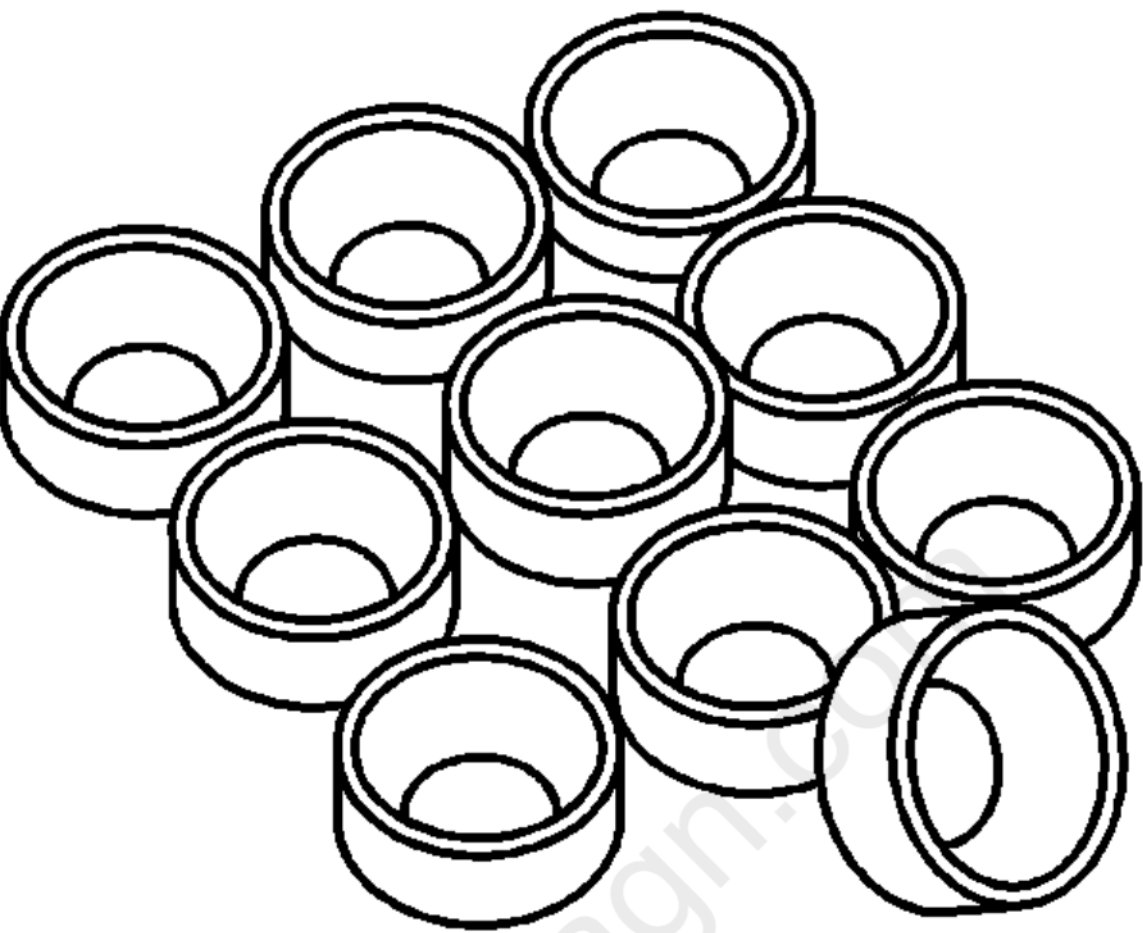
Illustration	Tool Number/ Description
	CH 45101 J 45101 Hub and Wheel Runout Gauge Not used in Europe

Illustration	Tool Number/ Description
 A line drawing of 12 conical brake rotor washers. They are arranged in a loose cluster, with some showing the outer rim and others showing the inner conical surface. Each washer has a distinct conical shape with a flat outer rim and a slightly recessed center. A faint watermark 'cardiagn.com' is visible across the bottom half of the illustration.	CH 45101-100 J 45101-100 Conical Brake Rotor Washers Not used in Europe