

2017 BRAKES**Disc Brakes - Encore, Trax****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

Single Use Threaded Fastener/Component Tightening Specifications

NOTE: <i>All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.</i>	
Application	Specification
	Metric (English)
Brake Caliper Bracket Bolt - Front	160 N.m (118 lb ft)
Brake Caliper Bracket Bolt - Rear	100 N.m (74 lb ft)

Reusable Threaded Fastener Tightening Specifications

NOTE: <i>All fasteners listed in this table can be reused after removal.</i>	
Application	Specification
	Metric (English)
Brake Caliper Bleeder Valve	17 N.m (13 lb ft)
Brake Caliper Guide Pin Bolt	28 N.m (21 lb ft)
Brake Caliper Vibration Dampener	9 N.m (80 lb in)
Brake Hose Fitting Bolt	40 N.m (30 lb ft)
Brake Rotor Bolt	9 N.m (80 lb in)
Brake Shield Bolt	9 N.m (80 lb in)

DISC BRAKE COMPONENT SPECIFICATIONS

Application	Specification	
	Metric	English
Front Rotor		
• Rotor Diameter	300.0 mm	11.810 in
• Rotor Discard Thickness*	23.0 mm	0.905 in
• Rotor Maximum Allowable Assembled Lateral Runout	0.06 mm	0.002 in

Application	Specification	
	Metric	English
• Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
• Rotor Minimum Allowable Thickness After Refinish	23.2 mm	0.913 in
• Rotor Thickness New	26.0 mm	1.023 in
Rear Rotor		
• Rotor Diameter	268.0 mm	10.551 in
• Rotor Discard Thickness*	10 mm	0.393 in
• Rotor Maximum Allowable Assembled Lateral Runout	0.05 mm	0.002 in
• Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
• Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Rotor Minimum Allowable Thickness After Refinish	10.2 mm	0.402 in
• Rotor Thickness New	12.0 mm	0.472 in
* All brake rotors have a minimum thickness dimension cast into them. Replace any rotor that is worn or machined below this specification.		

DIAGNOSTIC INFORMATION AND PROCEDURES

BRAKE ROTOR THICKNESS MEASUREMENT

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](#).

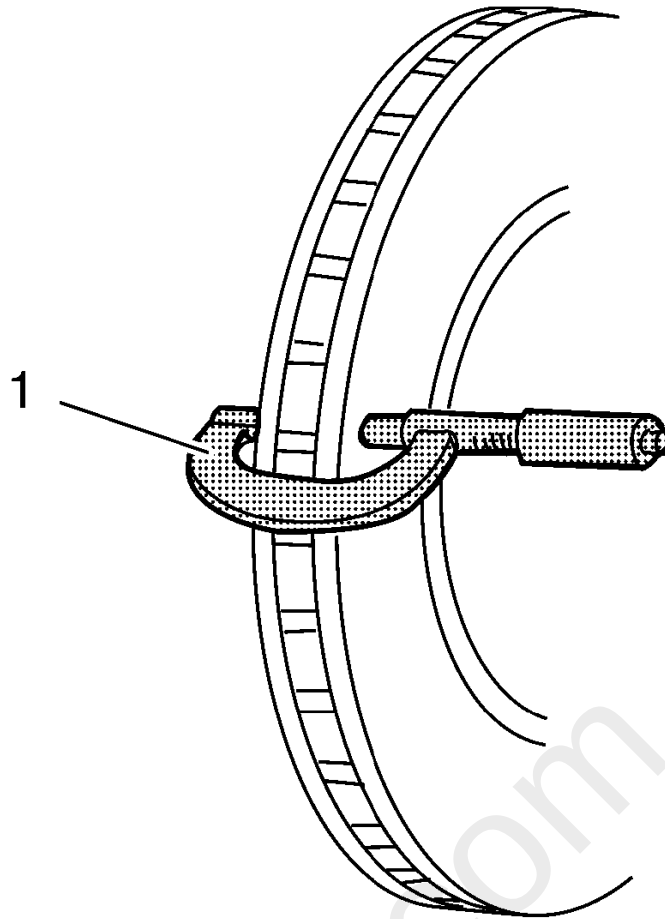


Fig. 1: Micrometer On Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.
3. Using a micrometer (1) 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 brake rotor.

Make sure 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 brake rotor, about 13 mm (1/2 in), for each measurement.

4. Compare the lowest thickness measurement recorded to the specifications. Refer to [Disc Brake Component Specifications](#).
5. If the lowest thickness measurement of the brake rotor is above the minimum allowable thickness after refinishing specification, the brake 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 discard thickness specification, the brake 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](#).

2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.

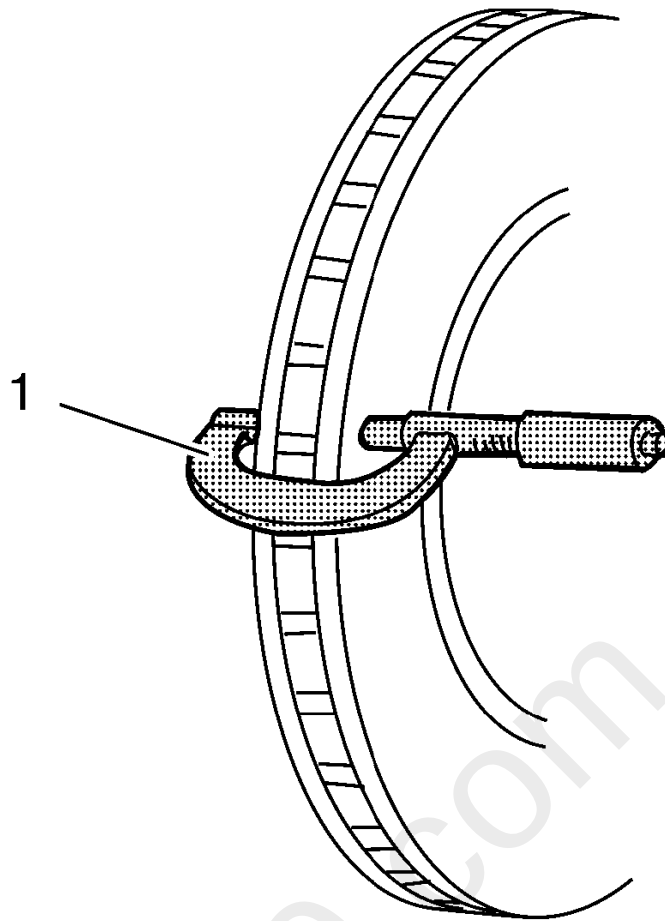


Fig. 2: Micrometer On Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

3. Using a micrometer (1) 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 brake rotor.

Make sure 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 brake 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.

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

5. Compare the thickness variation measurement to the following specification:

Specification

- J93, J94: 0.02 mm (0.0008 in)
- JPW, J97: 0.02 mm (0.0008 in)

6. If the brake rotor thickness variation measurement exceeds the specification, the brake 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](#).
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 brake rotor.

 - Cracks and/or heat spots
 - Too much blueing discoloration
4. If the friction surfaces of the brake rotor exhibit one or more of the braking surface conditions, the brake rotor requires refinishing or replacement.

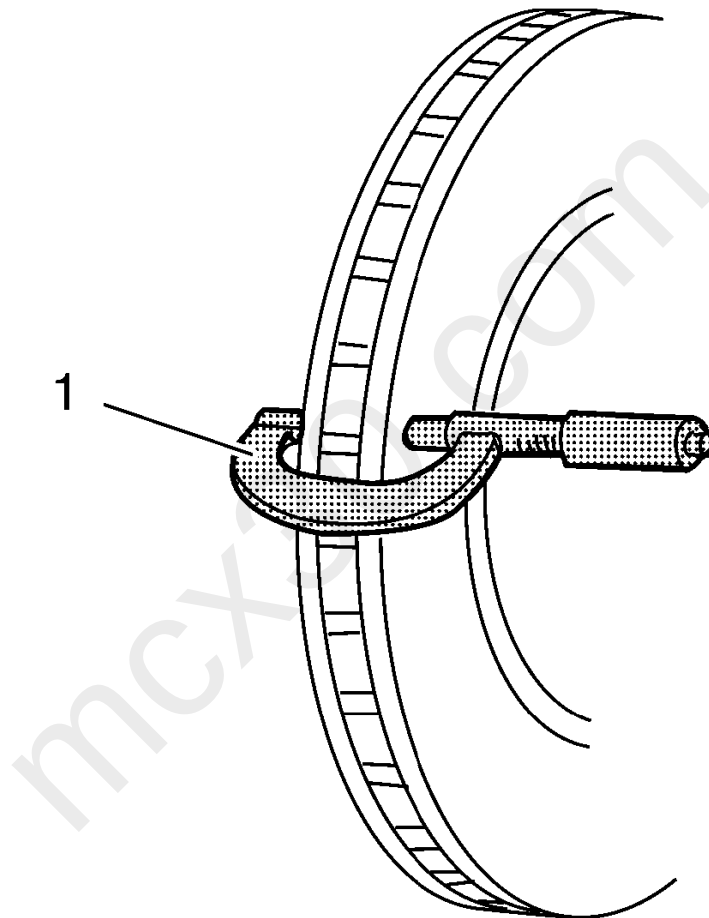


Fig. 3: Micrometer On Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

5. Using a micrometer (1) calibrated in thousandths-of-a-millimeter, or ten-thousandths-of-an-inch, measure and record the scoring depth of any grooves present on the brake 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 disc rotor scoring depth exceeds the specification, or if an excessive amount of scoring is present, the brake rotor requires refinishing or replacement.

Special Tools

- **CH-41013** Rotor Surfacing 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 inspected **BEFORE** inspecting for assembled lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. Refer to [Brake Rotor Thickness Variation Measurement](#).

1. Matchmark 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 make sure that there are no foreign particles, corrosion, rust, or debris remaining. If the wheel hub/axle flange and/or 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](#).
 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 matchmark made prior to removal.

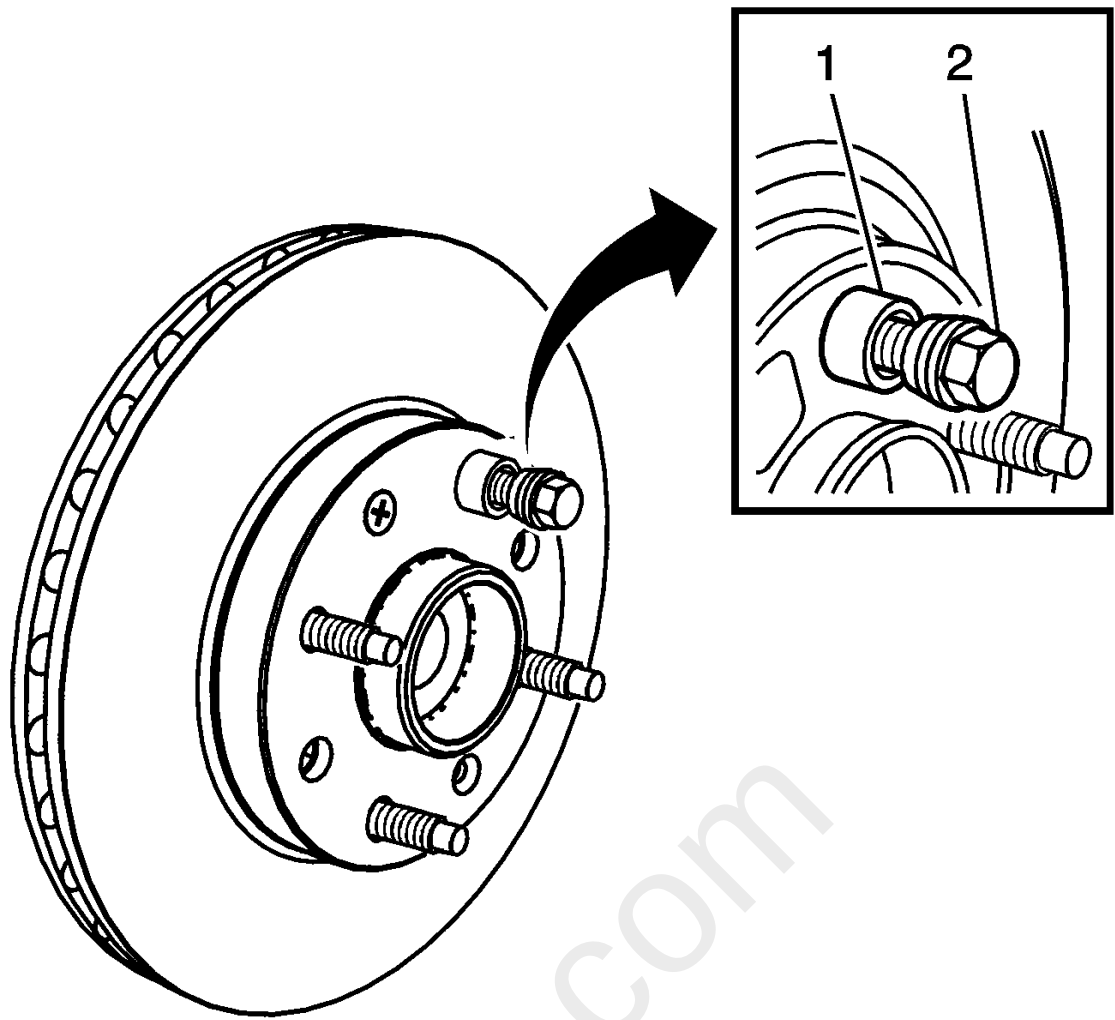


Fig. 4: One Lug Nut & Conical Brake Rotor Washers
Courtesy of GENERAL MOTORS COMPANY

4. Hold the brake 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 brake rotor secure and tighten the lug nut firmly by hand.

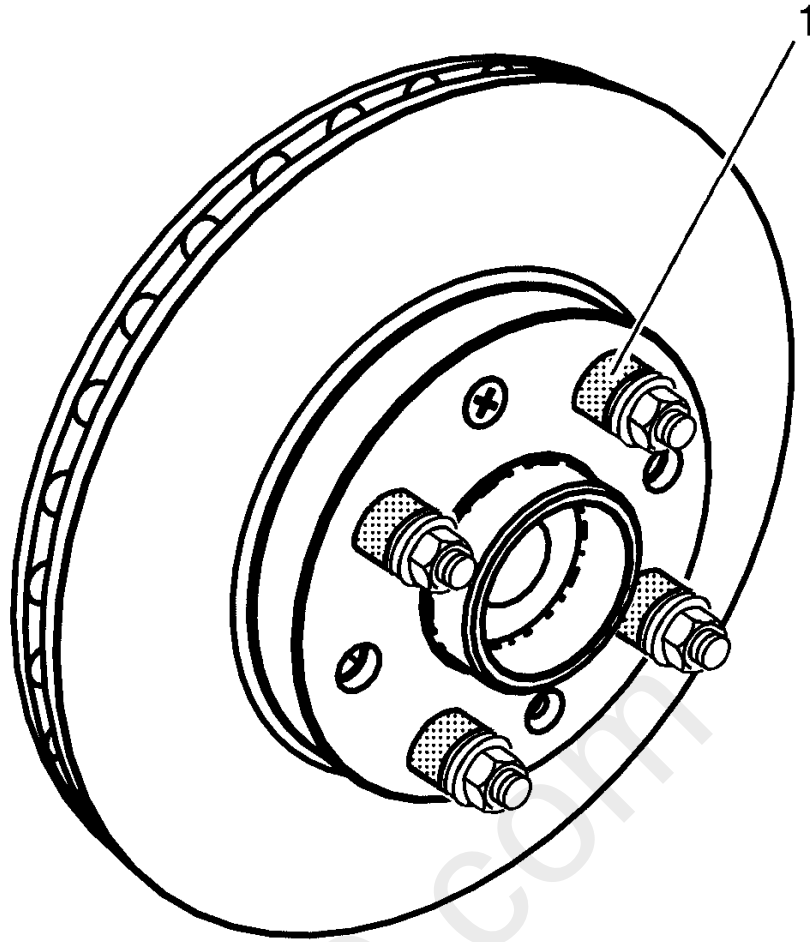


Fig. 5: Lug Nuts And Conical Brake Rotor Washers
Courtesy of GENERAL MOTORS COMPANY

6. Install the remaining **CH-45101-100** conical brake rotor washers (1) and lug nuts onto the wheel studs and tighten the nuts firmly by hand in the tightening sequence.
7. Tighten the lug nuts in sequence, in order to properly secure the rotor. 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.

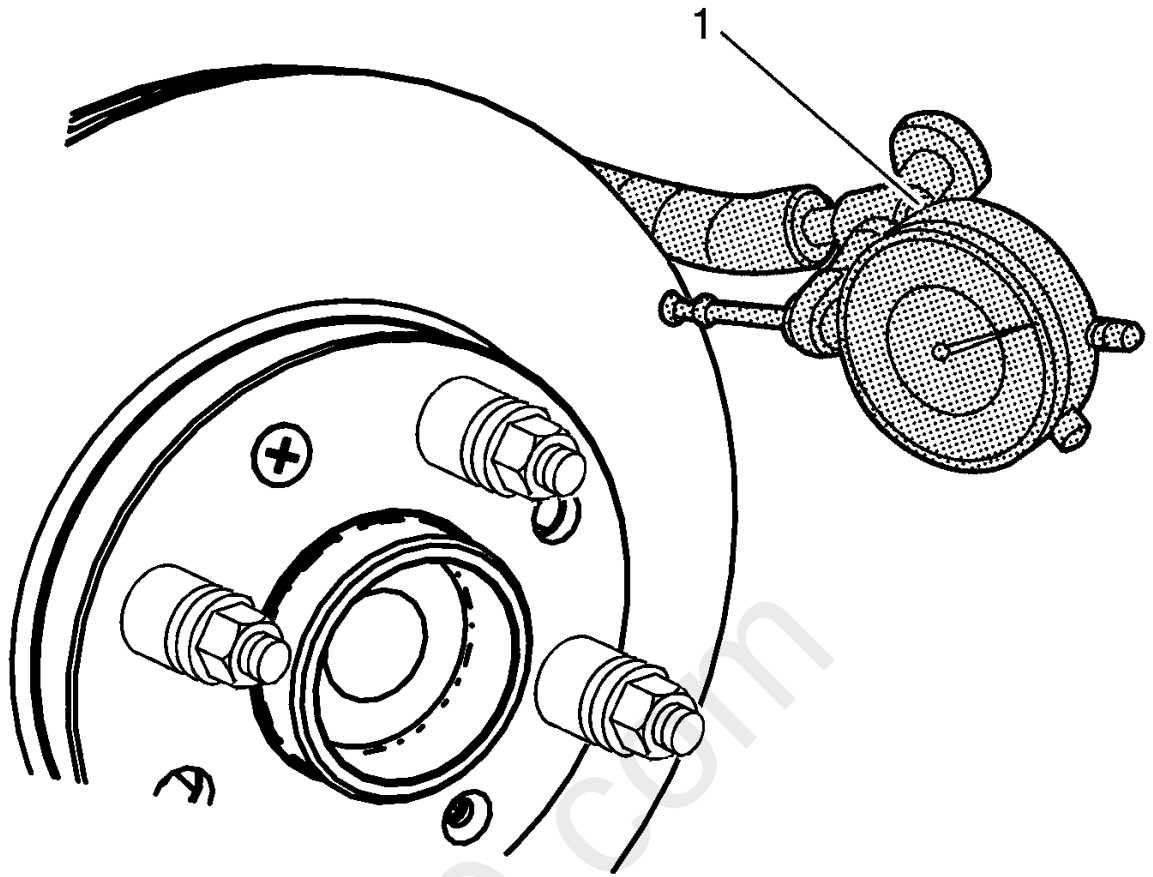


Fig. 6: Hub And Wheel Runout Gauge
Courtesy of GENERAL MOTORS COMPANY

10. Mount a dial indicator, **CH-45101** hub and wheel runout gauge (1), 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 assembled 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)

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 assembled 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).

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 brake rotor in place before removing the **CH-45101-100** conical brake rotor washers and the lug nuts.

BRAKE PAD INSPECTION

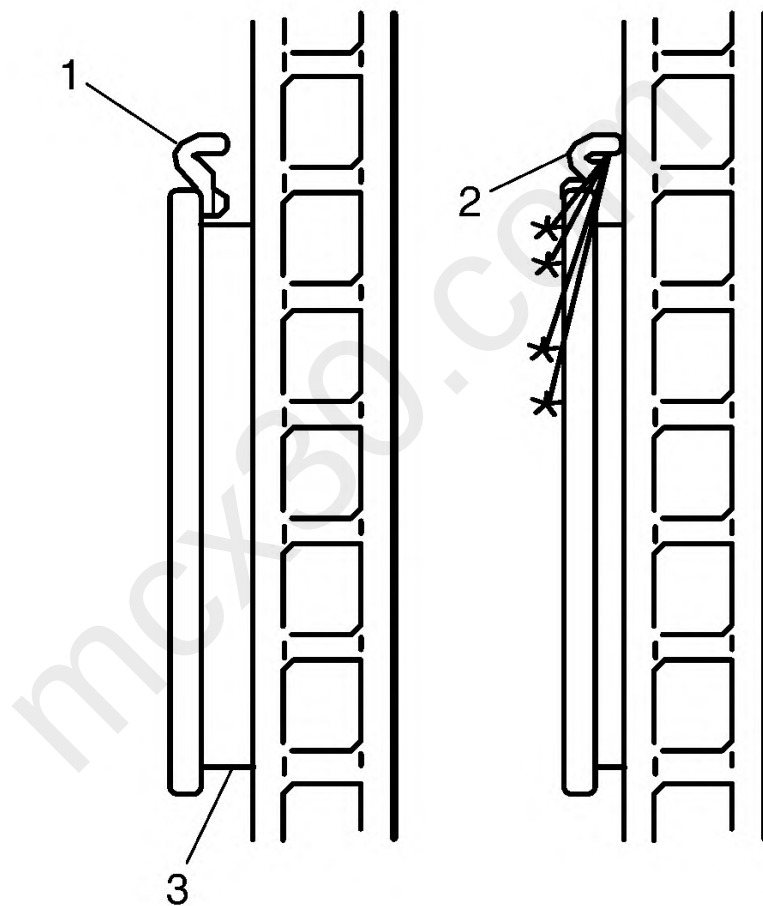


Fig. 7: Disc Brake Pads And Audible Wear Sensors

Courtesy of GENERAL MOTORS COMPANY

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

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. Front 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 2.00 mm (0.079 in) of the mounting plates.
7. 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.
8. Replace the disc brake pads if any have separated from the mounting plates.
9. 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

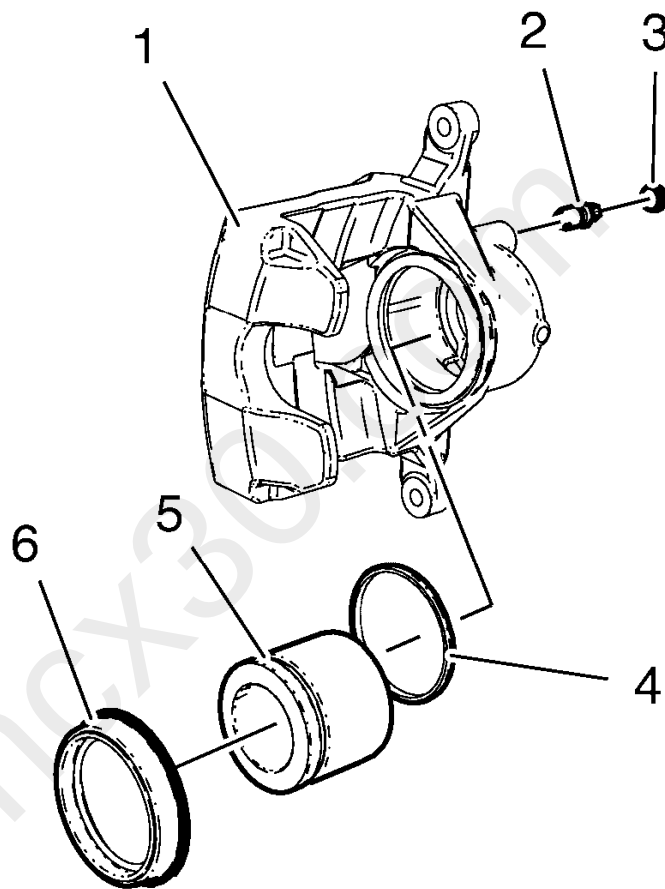


Fig. 8: Brake Caliper Components

Courtesy of GENERAL MOTORS COMPANY

WARNING: Refer to **Brake Dust 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 (6) and on the disc brake pads. If there is any evidence of brake fluid leakage, the brake caliper requires overhaul or replacement.

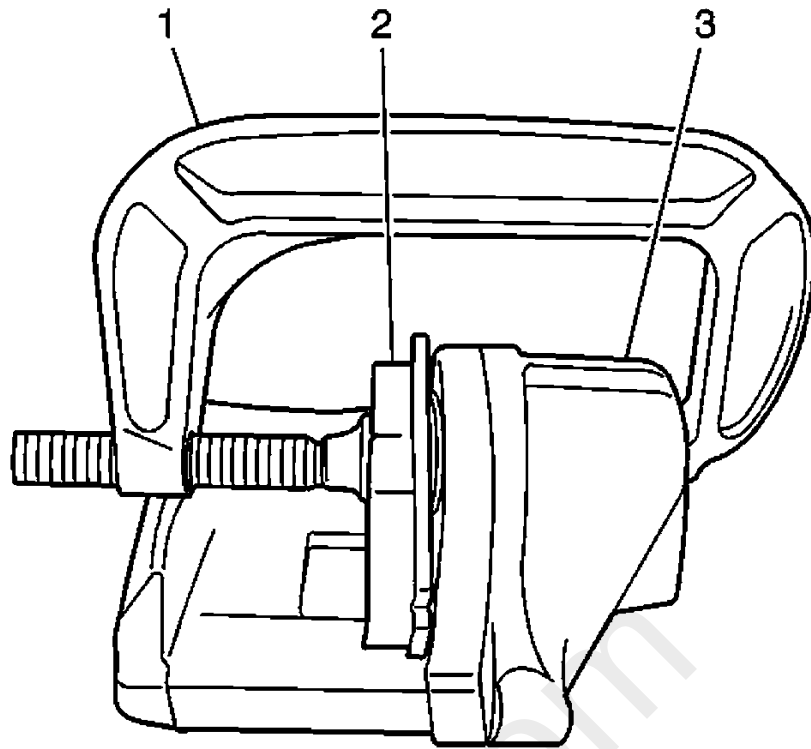


Fig. 9: Brake Caliper, Inner Brake Pad And C-Clamp
Courtesy of GENERAL MOTORS COMPANY

4. Inspect for smooth and complete travel of the caliper pistons into the caliper bores:
 - The movement of the caliper pistons into the caliper bores should be smooth and even. If the caliper piston is frozen or difficult to bottom, the caliper requires overhaul or replacement.
 - 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.

FRONT DISC BRAKE MOUNTING AND HARDWARE INSPECTION

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

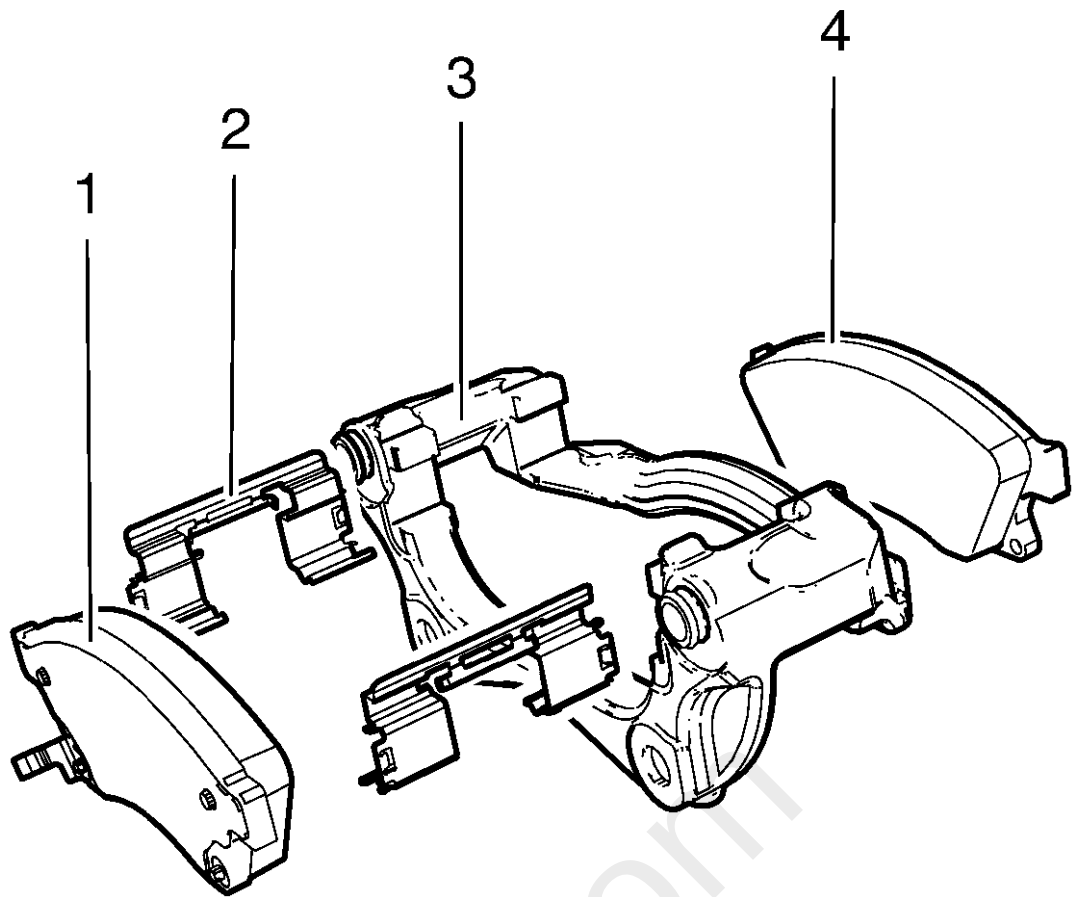


Fig. 10: Exploded View Of Brake Pads And Brake Caliper Mounting Bracket
Courtesy of GENERAL MOTORS COMPANY

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 to [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 (3). 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 (1).
 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](#).
10. Remove the disc brake pads (1, 4) from the brake caliper mounting bracket (3).

11. Inspect the disc brake pad mounting hardware for the following:
 - Missing mounting hardware.
 - Excessive corrosion.
 - Bent pad retainer spring (2).
 - Looseness at the brake caliper mounting bracket (3).
 - Looseness at the disc brake pads (1, 4).
 - Excessive contaminants in the brake caliper mounting bracket (3) 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.

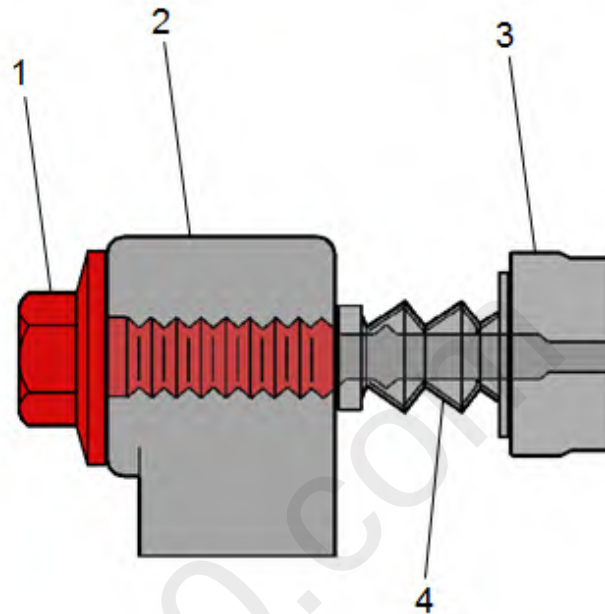


Fig. 11: View Of Caliper, Pin, Boots & Caliper Mounting Bracket
Courtesy of GENERAL MOTORS COMPANY

14. Inspect the caliper bolts (1) for the following:
 - Binding
 - Seizing
 - Looseness in the brake caliper mounting bracket (3).
 - Bent or damaged brake caliper mounting bolts (1).
 - Cracked or torn boots (4).
 - Missing boots.
 - Bent or damaged brake caliper mounting bracket (3).
 - Cracked or damaged brake caliper (2).
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](#).

REPAIR INSTRUCTIONS

FRONT DISC BRAKE PADS REPLACEMENT

Removal Procedure

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

WARNING: Refer to [Brake Fluid Irritant 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.

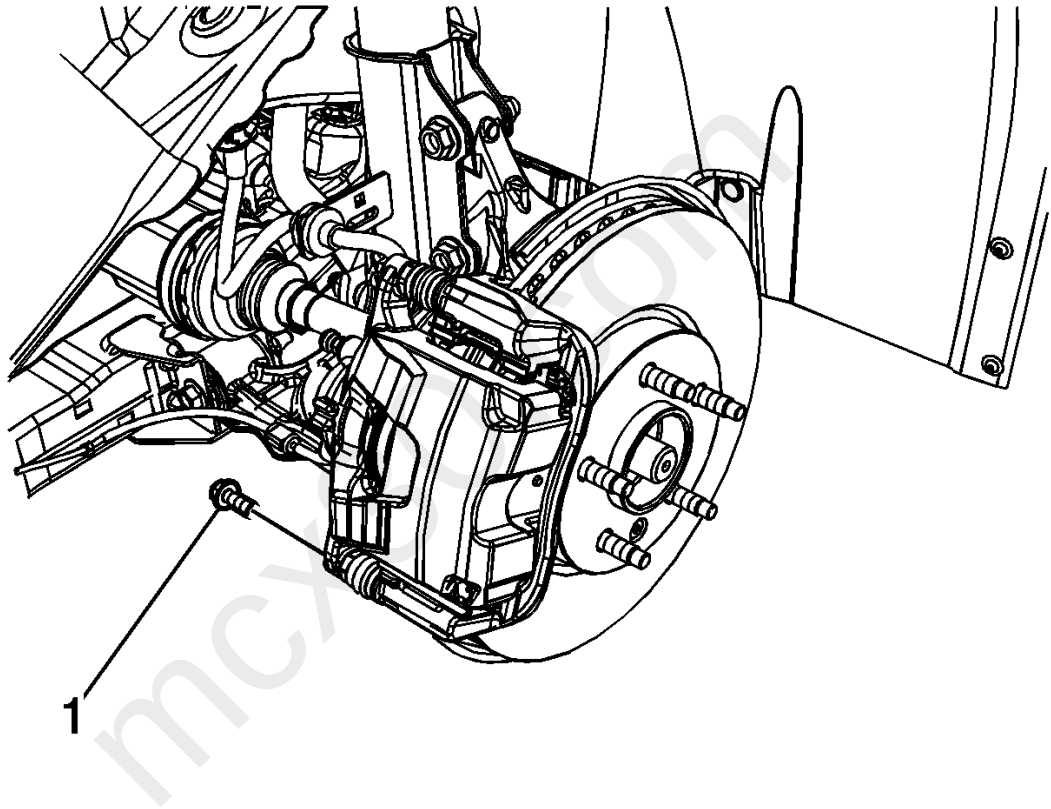


Fig. 12: Lower Brake Caliper Guide Pin Bolt

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 pin stationary, remove the lower brake caliper guide pin bolt (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. Rotate the brake caliper upward and support with heavy mechanics wire.

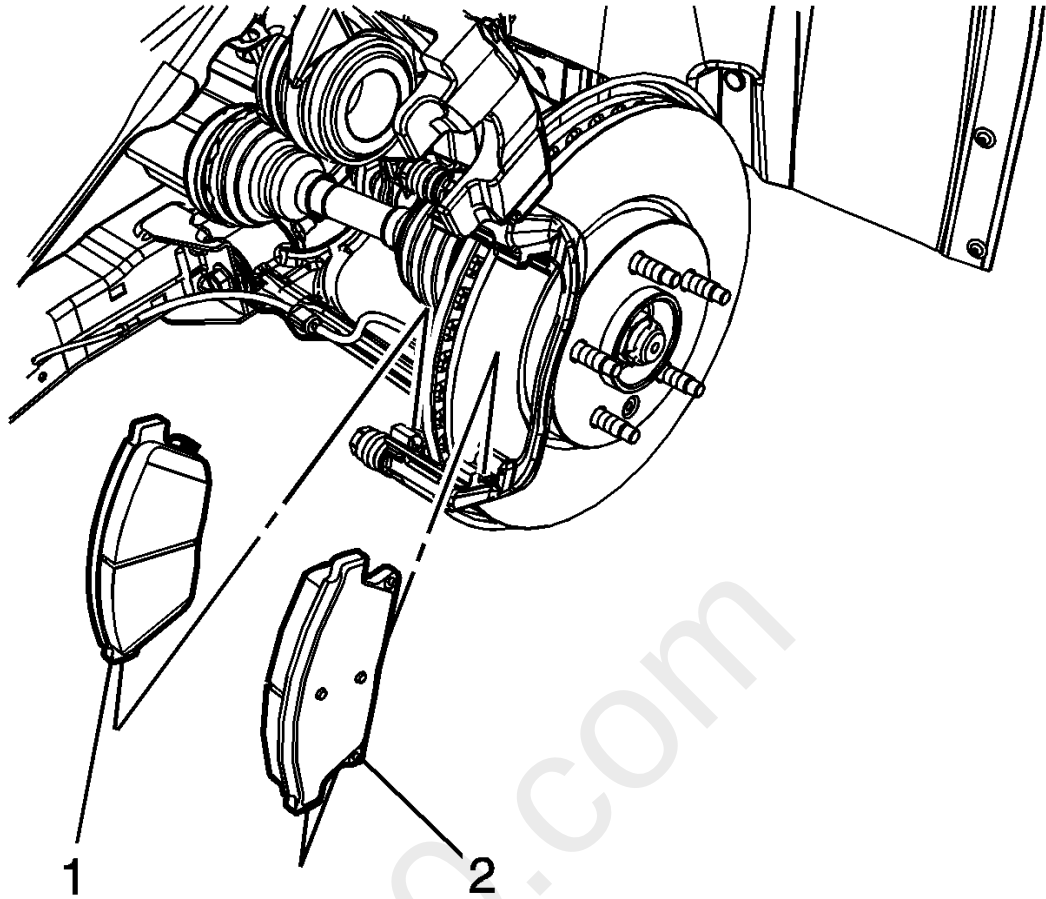


Fig. 13: Inner And Outer Brake Pads

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).

11. Remove the outer brake pad (2).

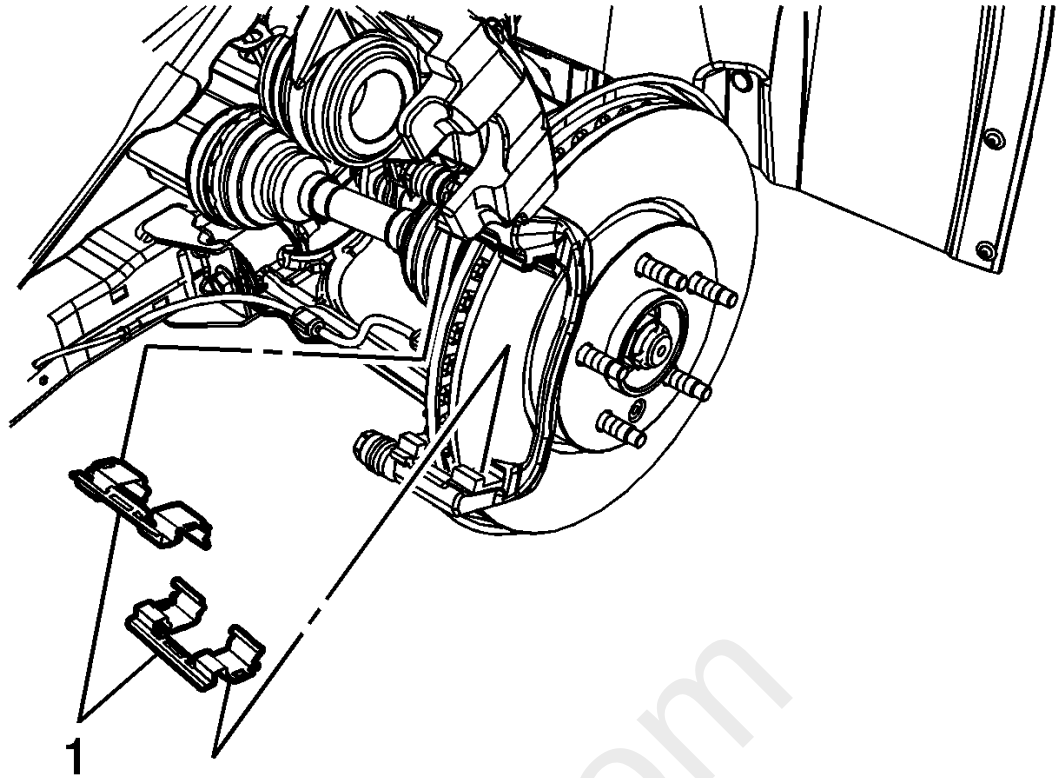


Fig. 14: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

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

Installation Procedure

1. Thoroughly clean the contact surfaces of the brake caliper bracket of any corrosion or debris.

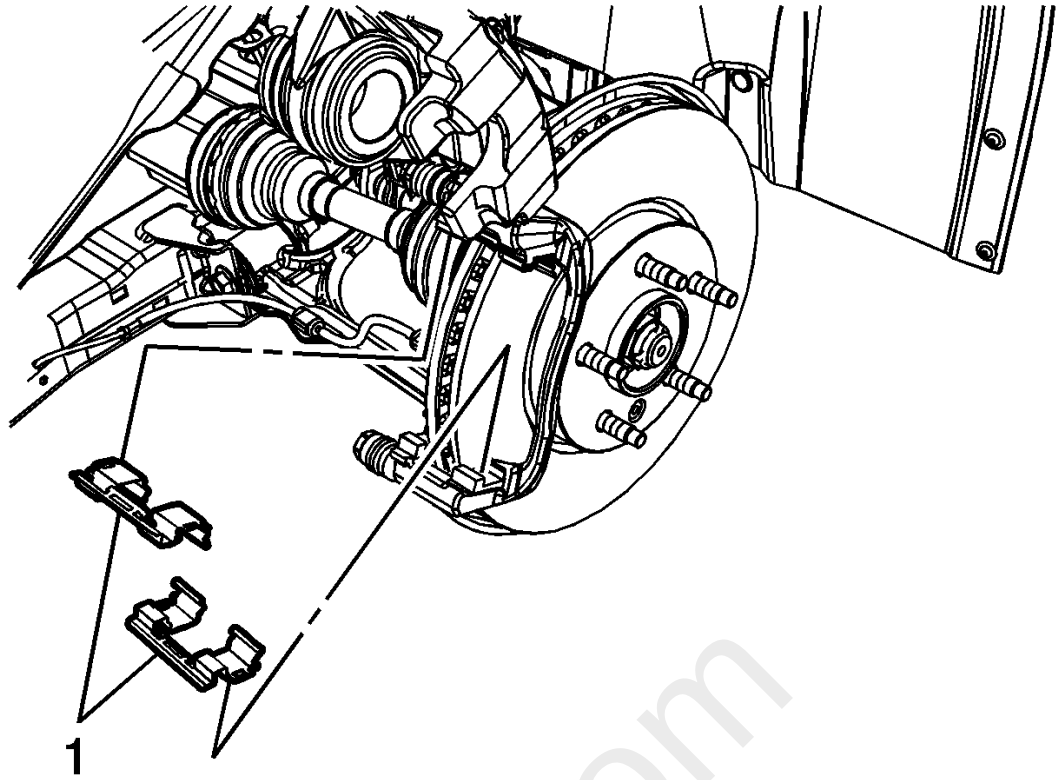


Fig. 15: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

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

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

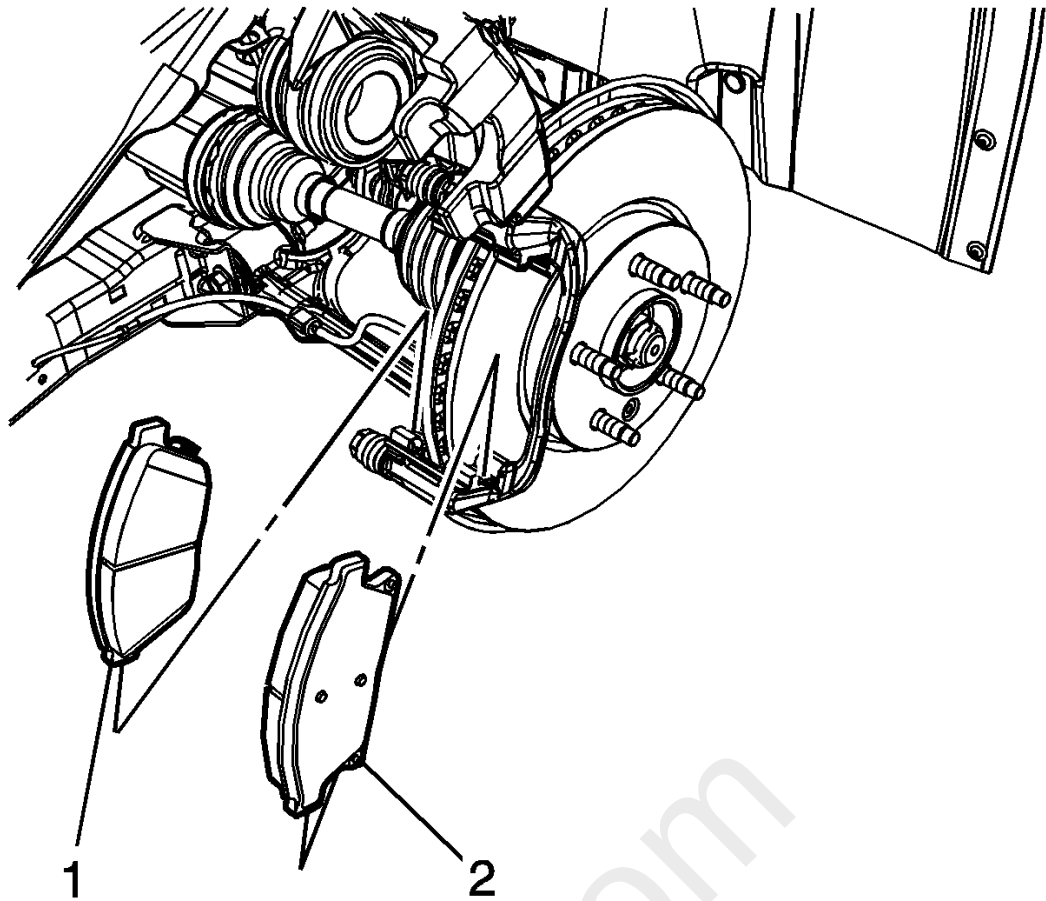


Fig. 16: Inner And Outer Brake Pads

Courtesy of GENERAL MOTORS COMPANY

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

3. Install the inner brake pad (1).
4. Install the outer brake pad (2).
5. Position the brake caliper over the brake pads and to the caliper bracket.

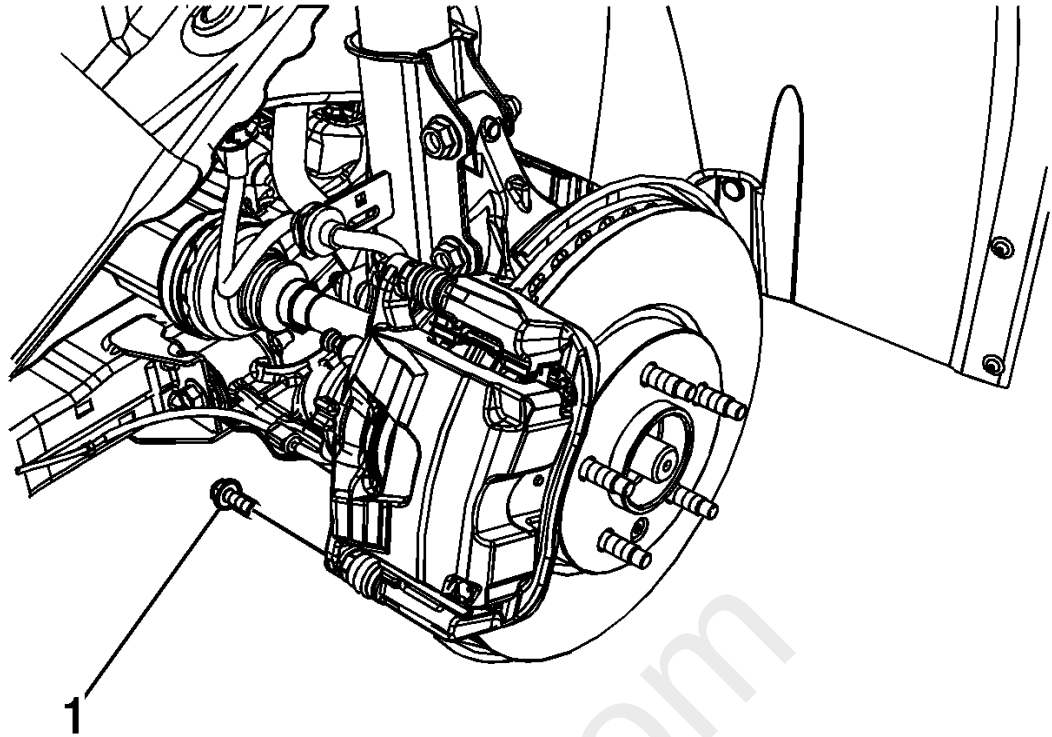


Fig. 17: Lower Brake Caliper Guide Pin Bolt
Courtesy of GENERAL MOTORS COMPANY

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

6. Using a backup wrench to hold the brake caliper guide pin stationary, install the lower brake caliper guide pin bolt (1) and tighten to 28 N.m (21 lb ft).
7. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
8. With the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance.
9. Slowly release the brake pedal.
10. Wait 15 seconds, then repeat steps 8-9 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
11. Fill the master cylinder reservoir. Refer to [Master Cylinder Reservoir Filling](#) .
12. 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](#) .

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](#) .

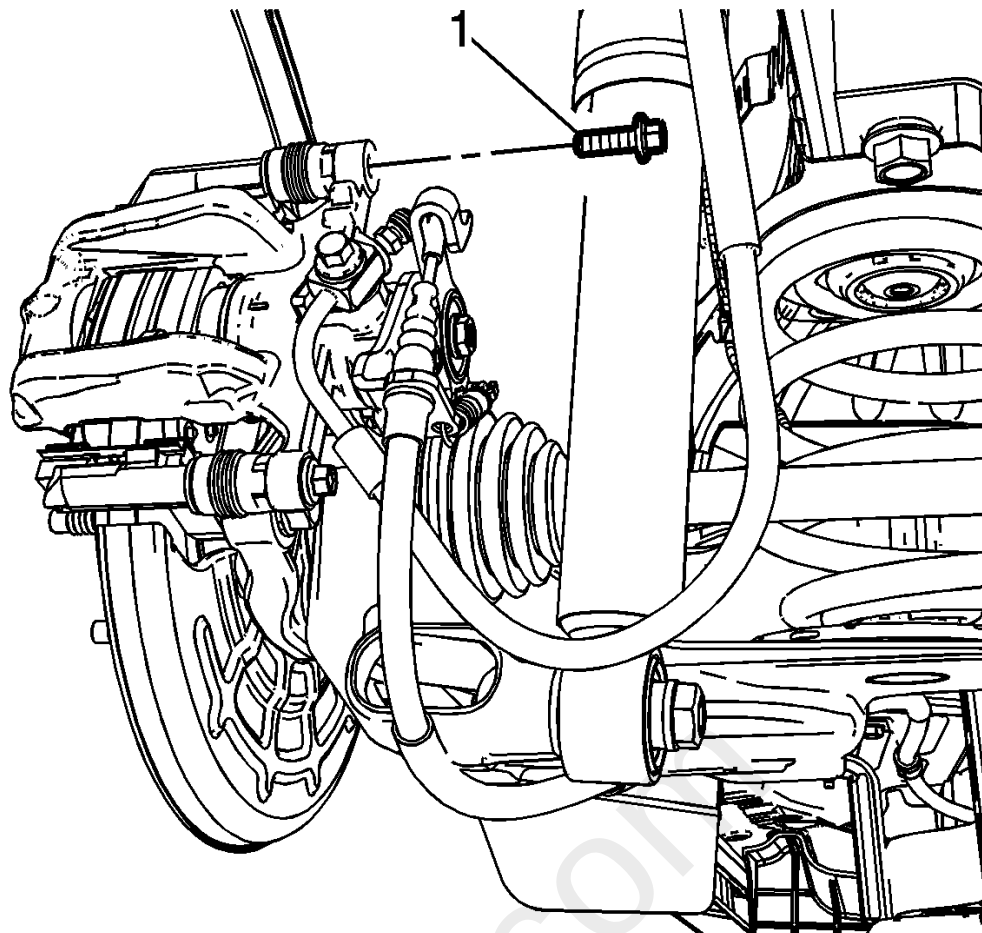


Fig. 18: Caliper Guide Pin Bolts

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 upper brake caliper guide pin bolt (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. Rotate the brake caliper downward and support with heavy mechanics wire.

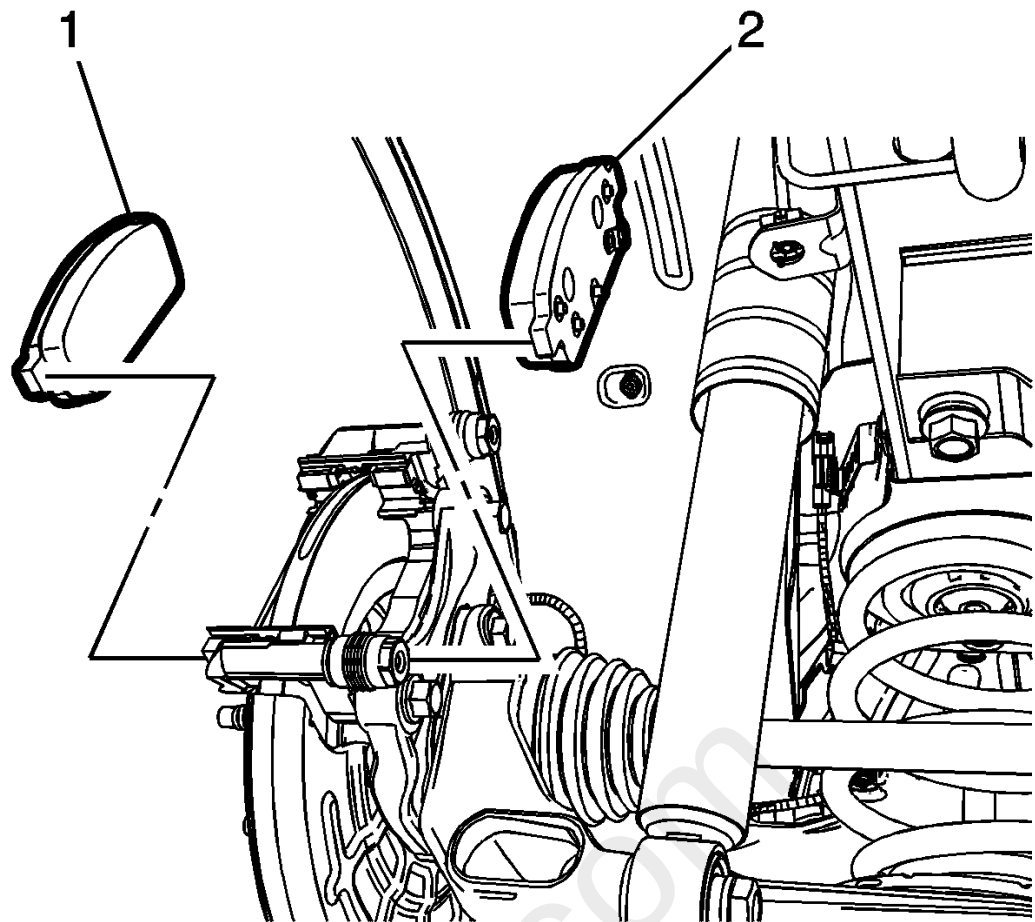


Fig. 19: Disc Brake Pads

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).

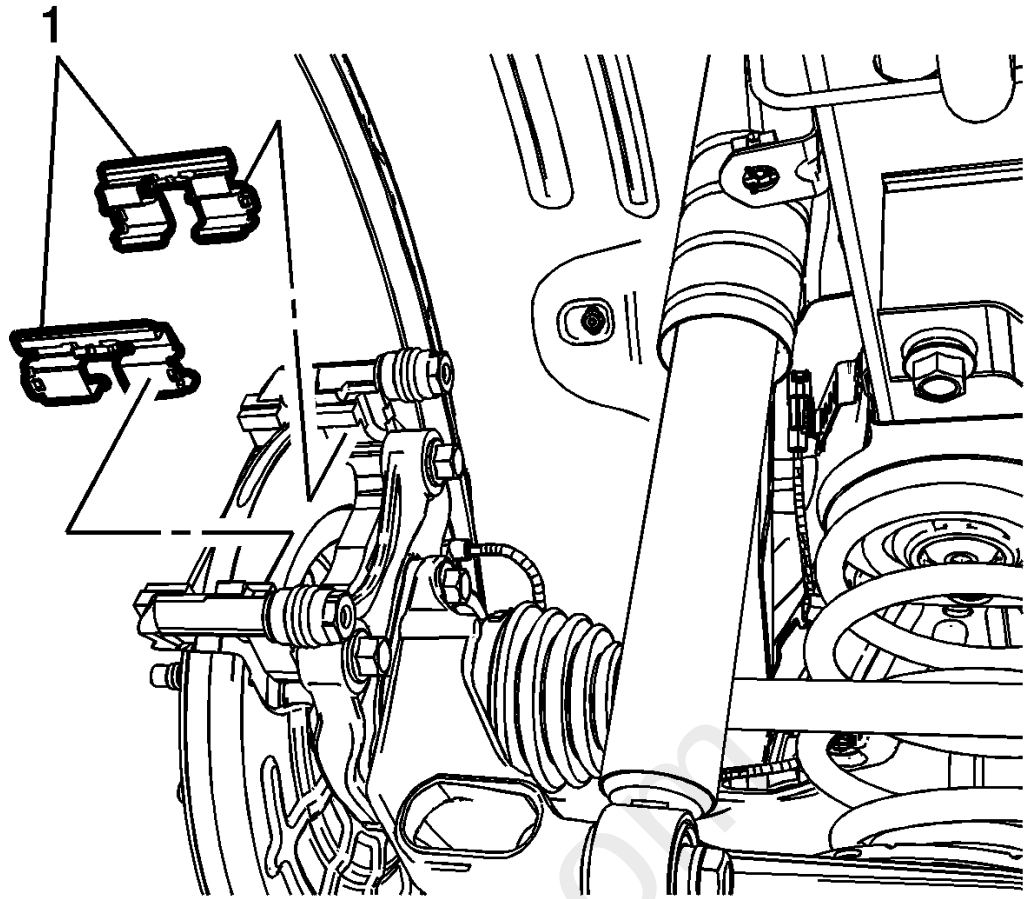


Fig. 20: Lower Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

10. Remove the upper and lower brake pad springs (1).

Installation Procedure

1. Thoroughly clean the contact surfaces of the brake caliper bracket of any corrosion or debris.

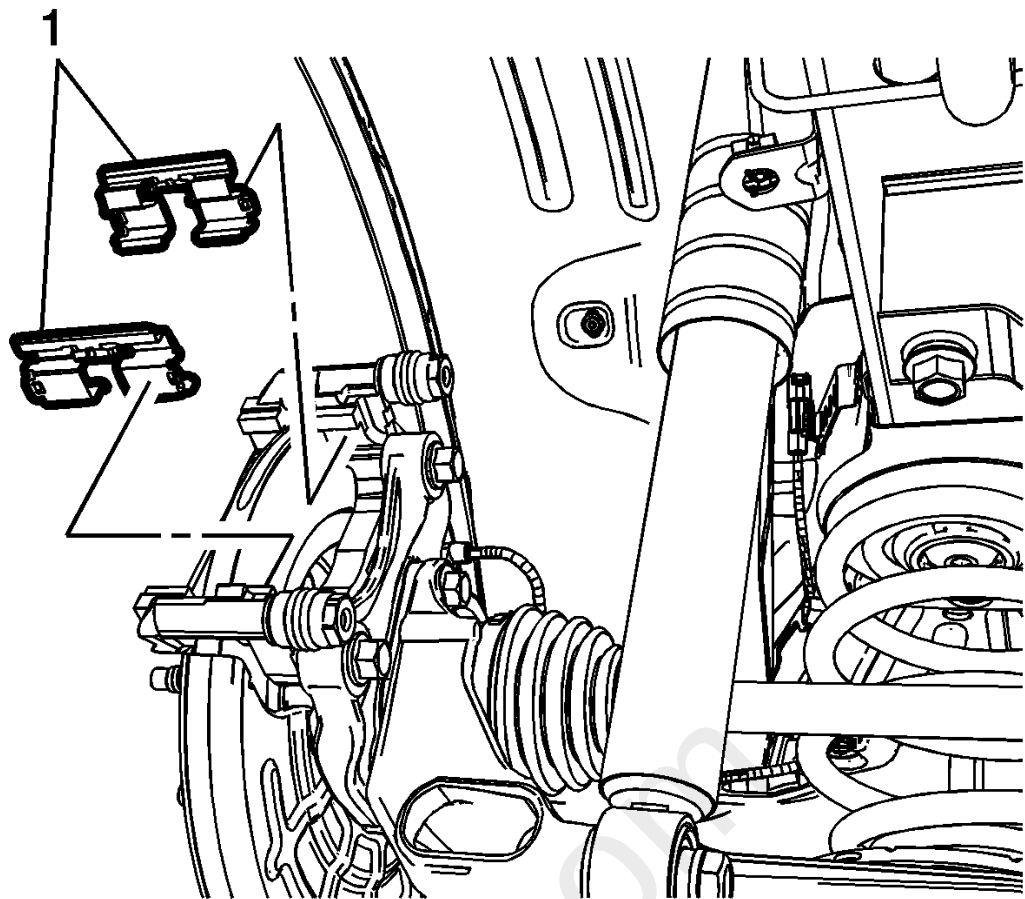


Fig. 21: Lower Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

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

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

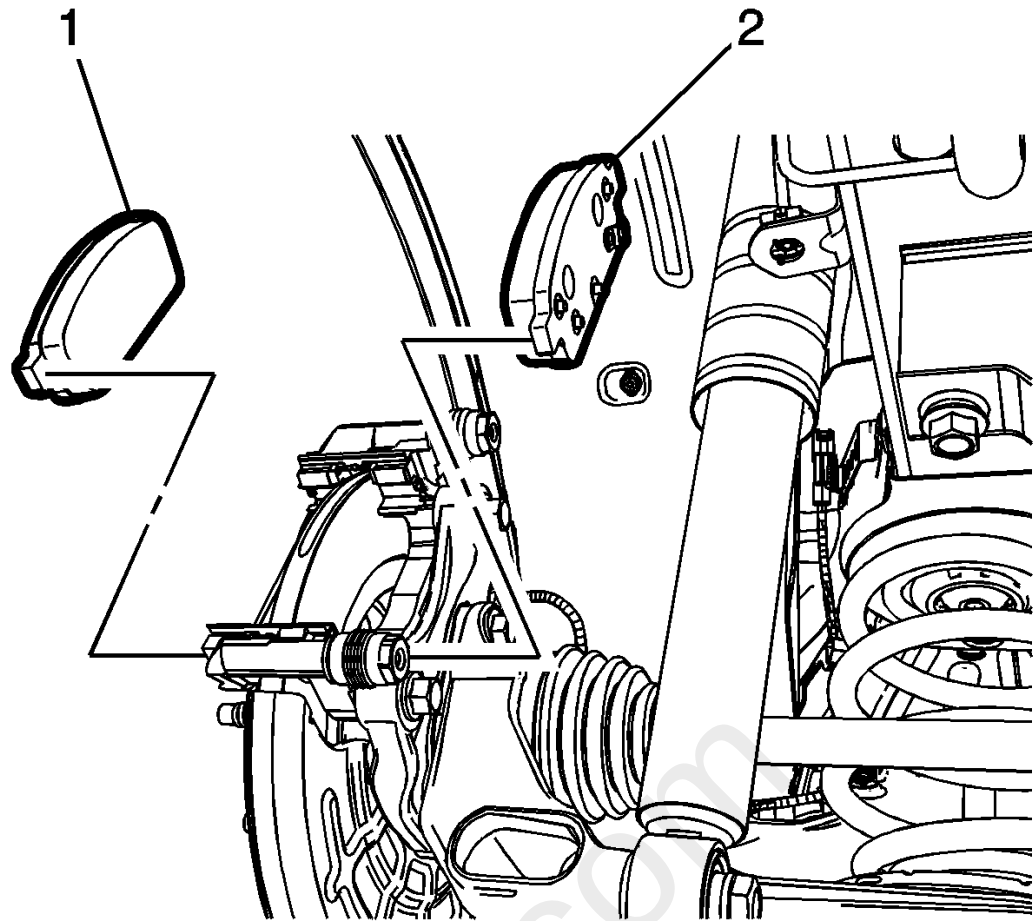


Fig. 22: Disc Brake Pads

Courtesy of GENERAL MOTORS COMPANY

3. Install the outer brake pad (1).

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

4. Install the inner brake pad (2).
5. 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.
6. Ensure the notches in the brake caliper piston align correctly with the pins on the inner disc brake pad.
7. Position the brake caliper over the brake pads and to the caliper bracket.

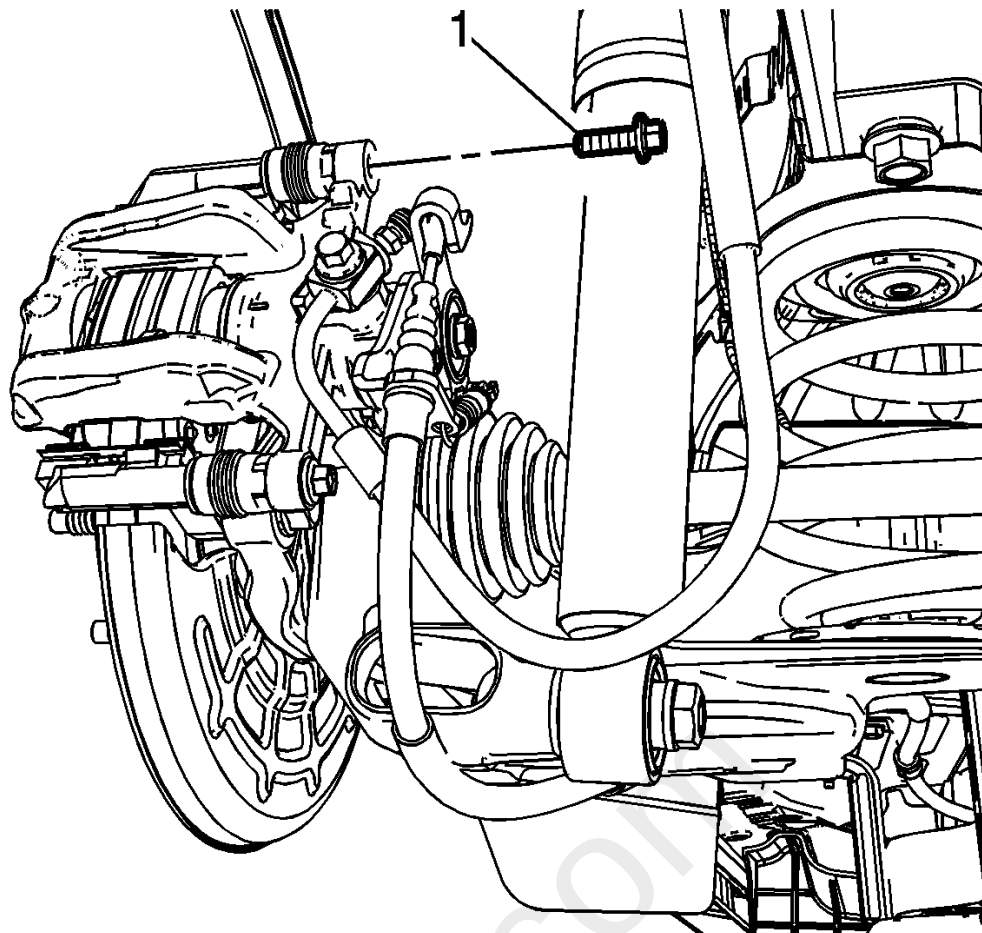


Fig. 23: Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

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

8. Using a backup wrench to hold the brake caliper guide pin stationary, install the upper brake caliper guide pin bolt (1) and tighten to 28 N.m (21 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 8-9 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and brake pads.
13. Fill the master cylinder reservoir. Refer to [Master Cylinder Reservoir Filling](#) .
14. 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 surface 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 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 as it may adversely affect the heating characteristics of the NEW brake pad material.

3. Using moderate 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](#) .

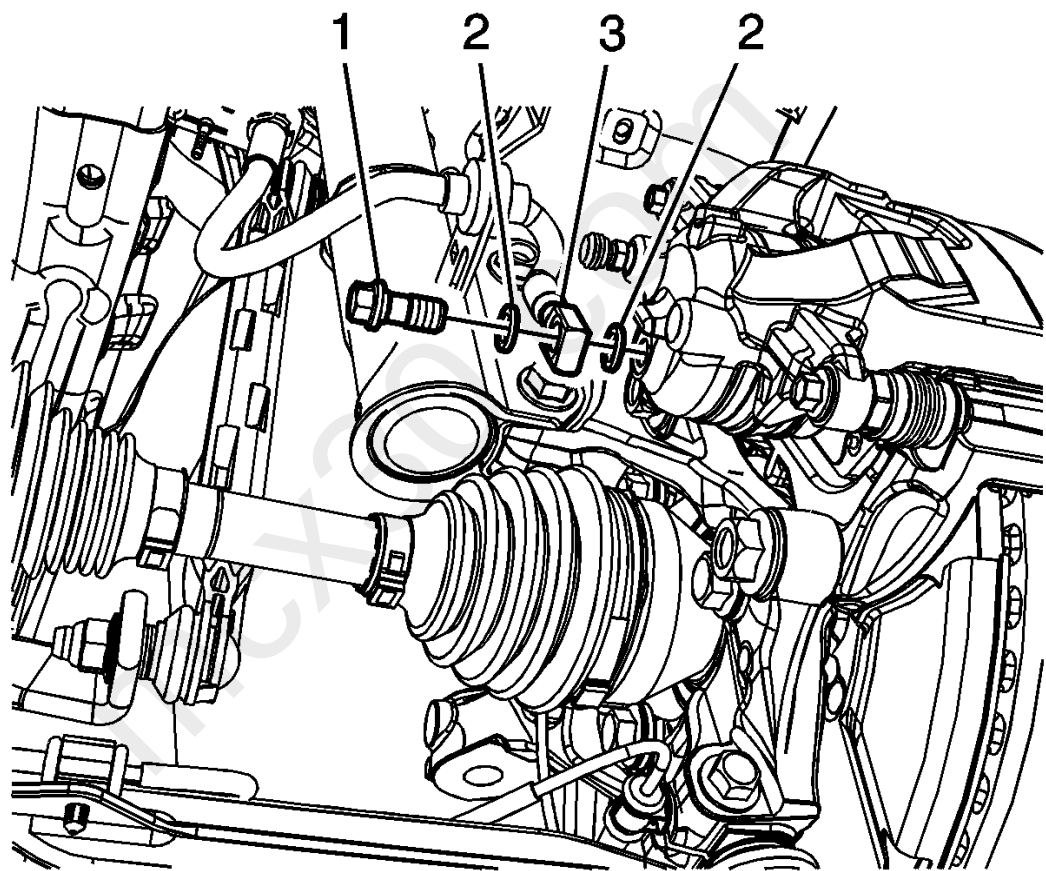


Fig. 24: Brake Hose Fitting And Bolt

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.

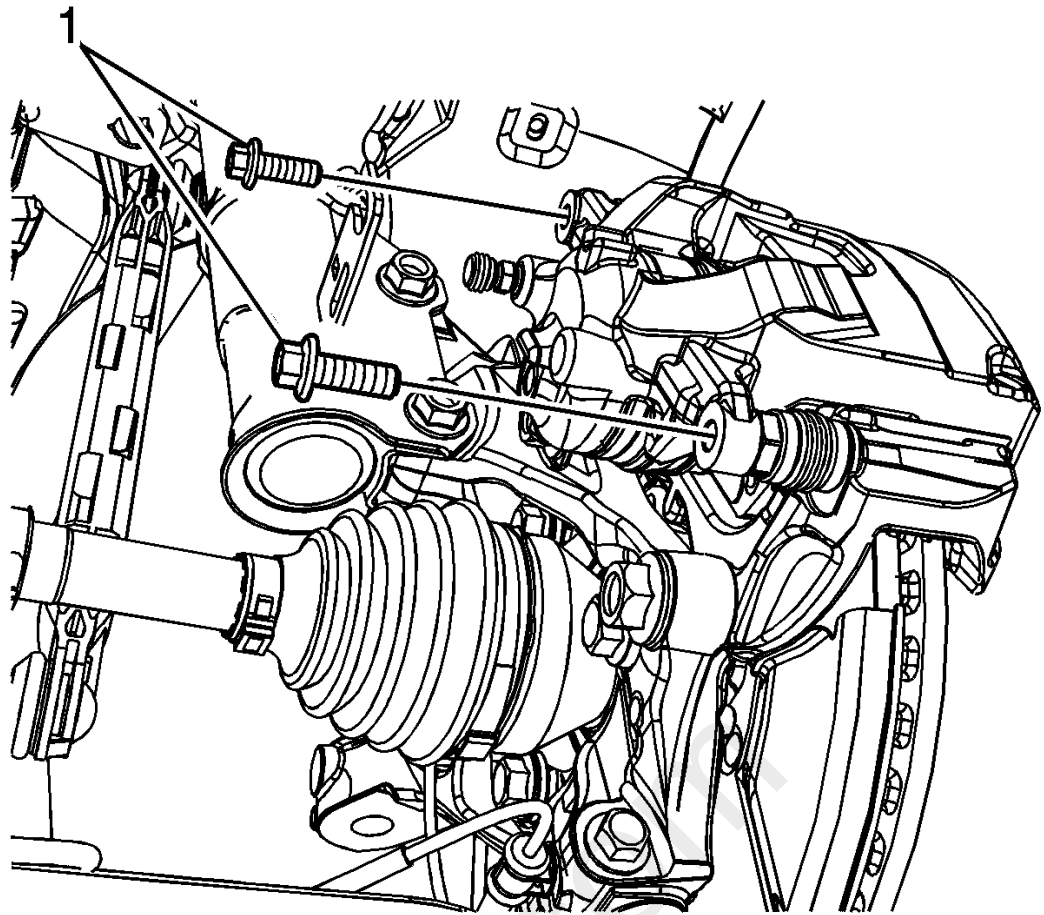


Fig. 25: Brake Caliper Guide Pin Bolts

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.

Installation Procedure

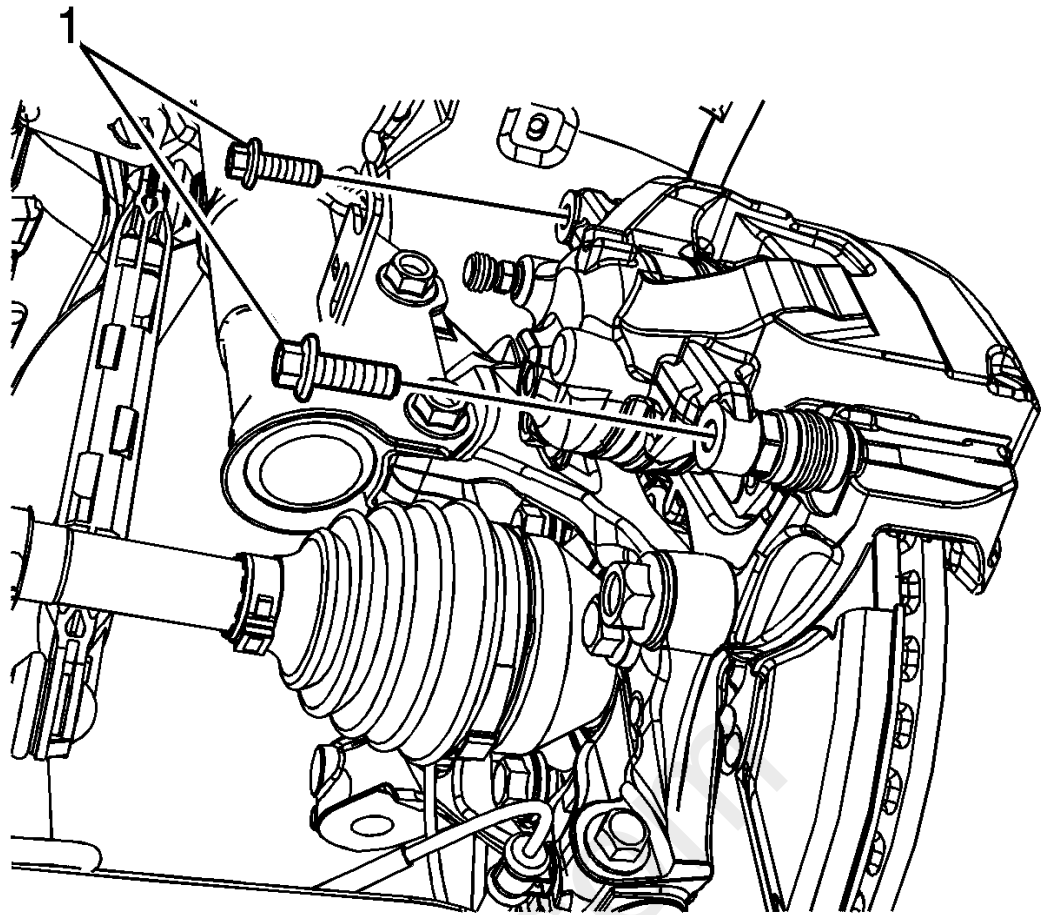


Fig. 26: Brake Caliper Guide Pin Bolts

Courtesy of GENERAL MOTORS COMPANY

1. Position the brake caliper over the brake pads and to the caliper bracket.

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 28 N.m (21 lb ft).

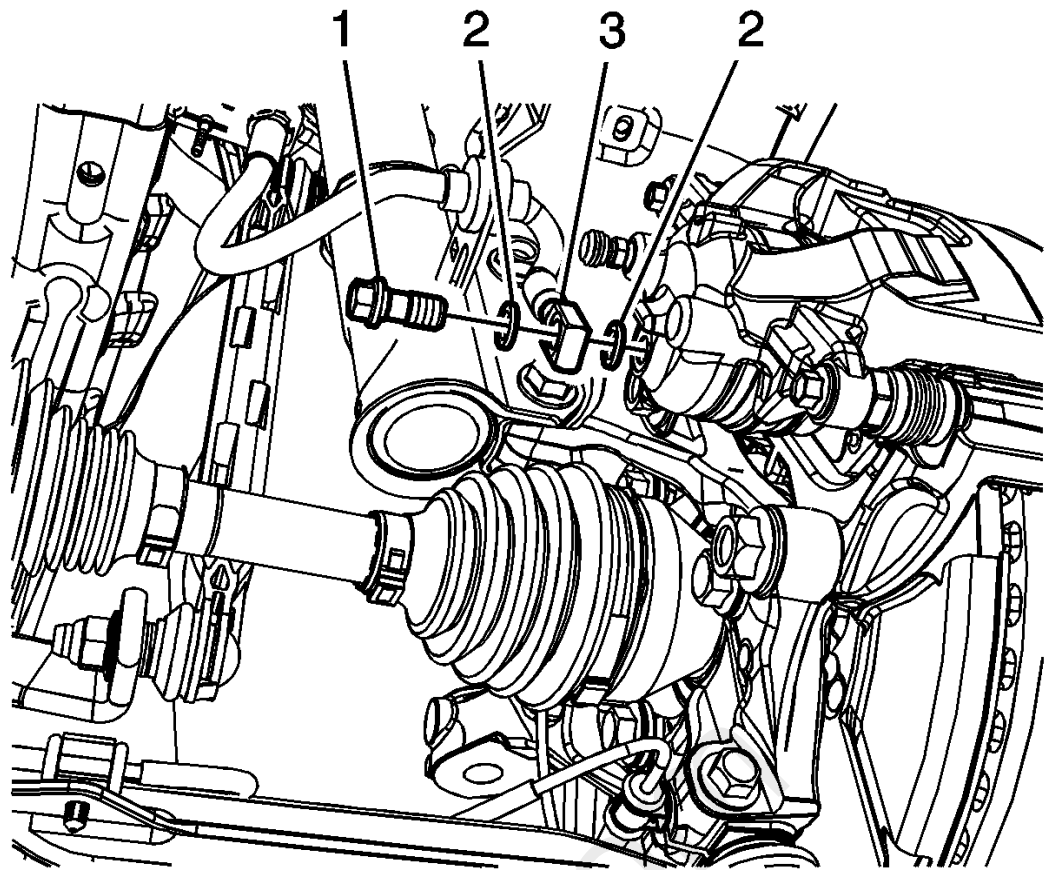


Fig. 27: Brake Hose Fitting And Bolt

Courtesy of GENERAL MOTORS COMPANY

NOTE: Install new brake hose fitting gaskets.

3. Assemble the brake hose fitting bolt (1) and the 2 new brake hose fitting gaskets (2) to the brake hose fitting (3).
4. Install the brake hose assembly and tighten the brake hose fitting bolt to 40 N.m (30 lb ft).
5. Bleed the hydraulic brake system. Refer to [Hydraulic Brake System Bleeding \(Manual\)](#) [Hydraulic Brake System Bleeding \(Pressure\)](#) .
6. 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](#) .

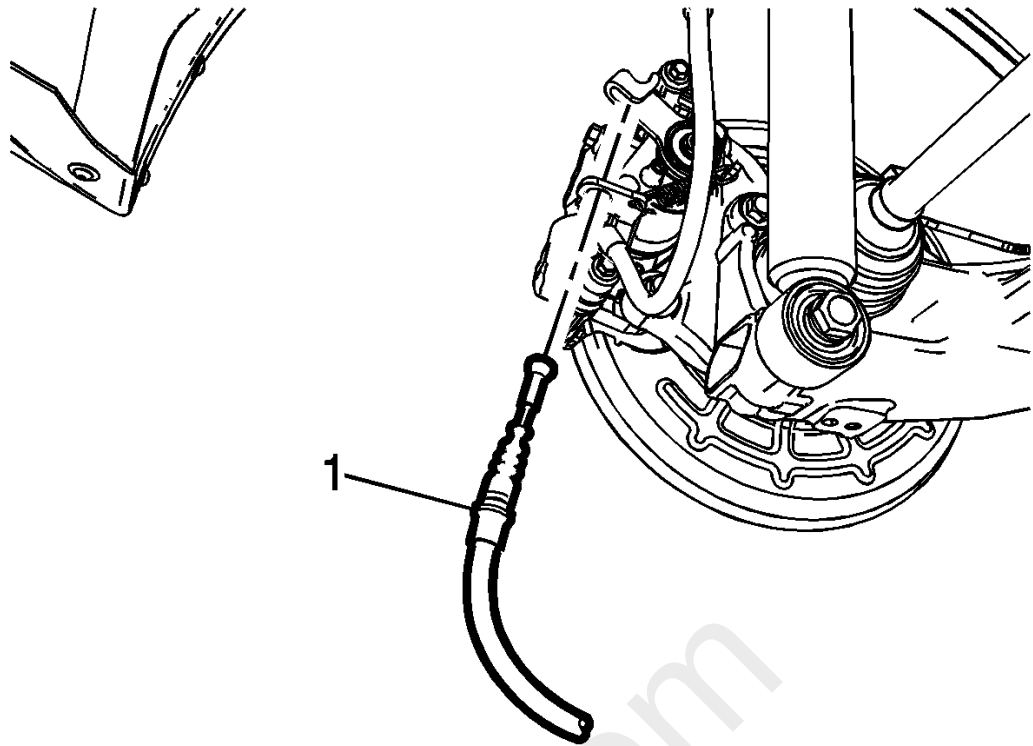


Fig. 28: Left Parking Brake Cable

Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the parking brake cable (1) from the parking brake actuator lever.

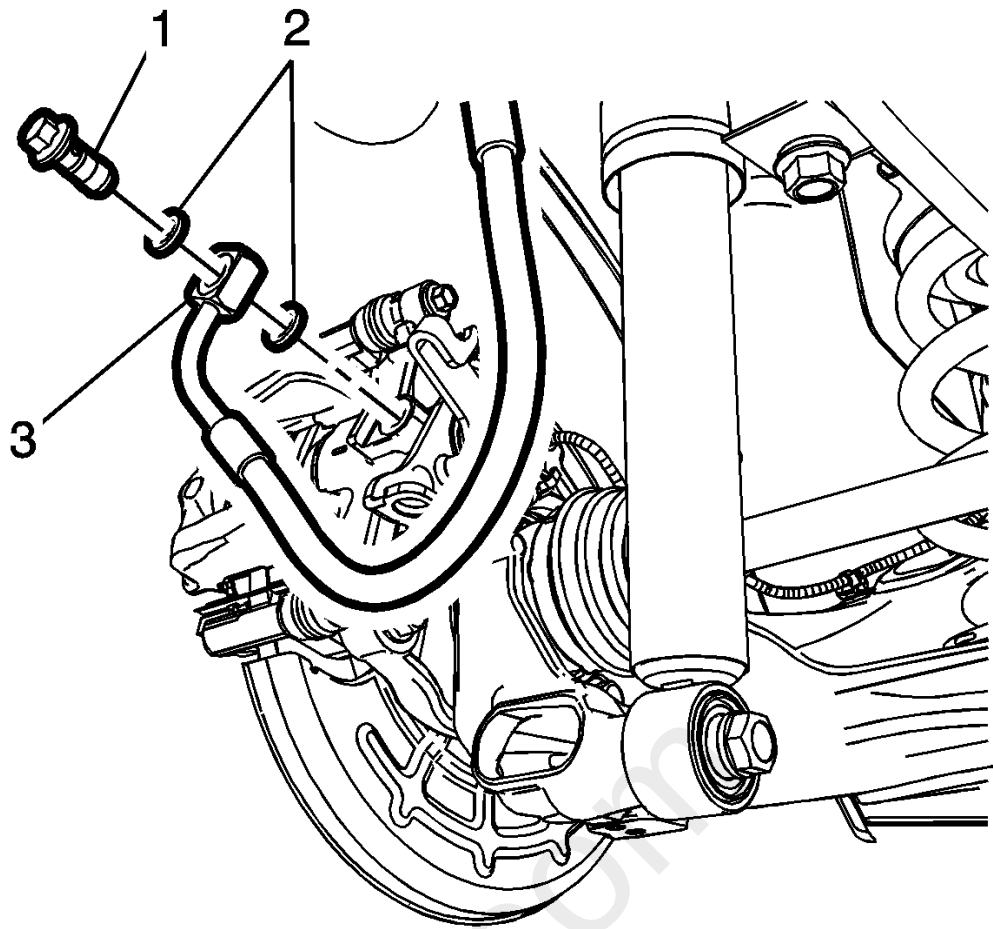


Fig. 29: Brake Hose Fitting Bolt

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 fitting (3).
6. Cap the brake hose fitting to prevent brake fluid loss and contamination.

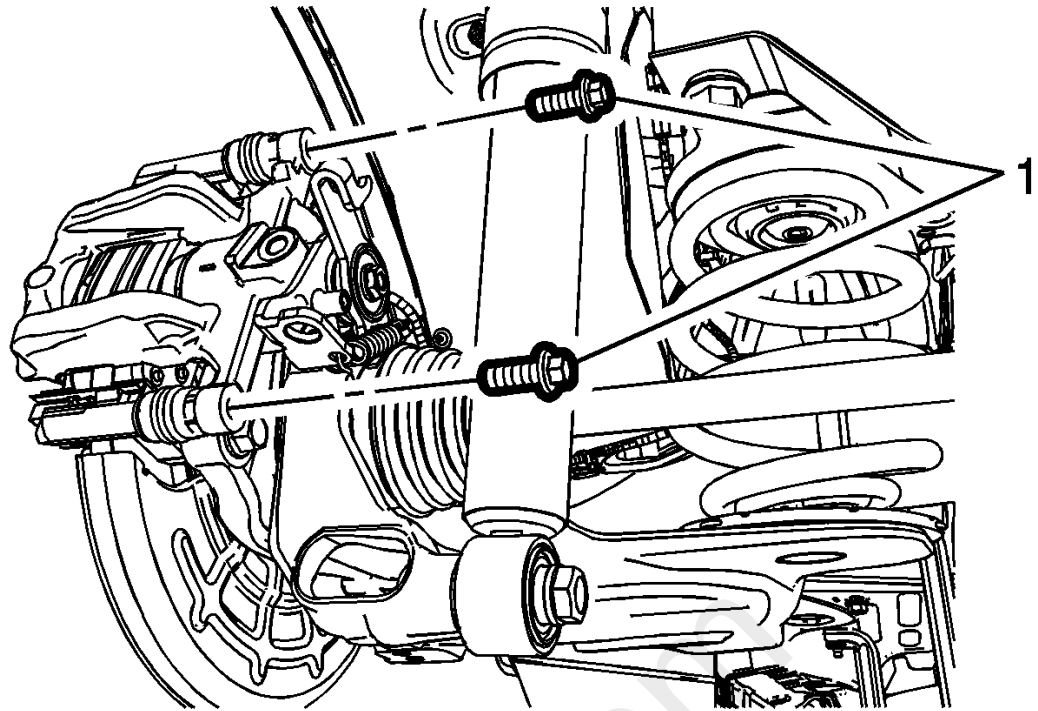


Fig. 30: Caliper Guide Pins

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.

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

Installation Procedure

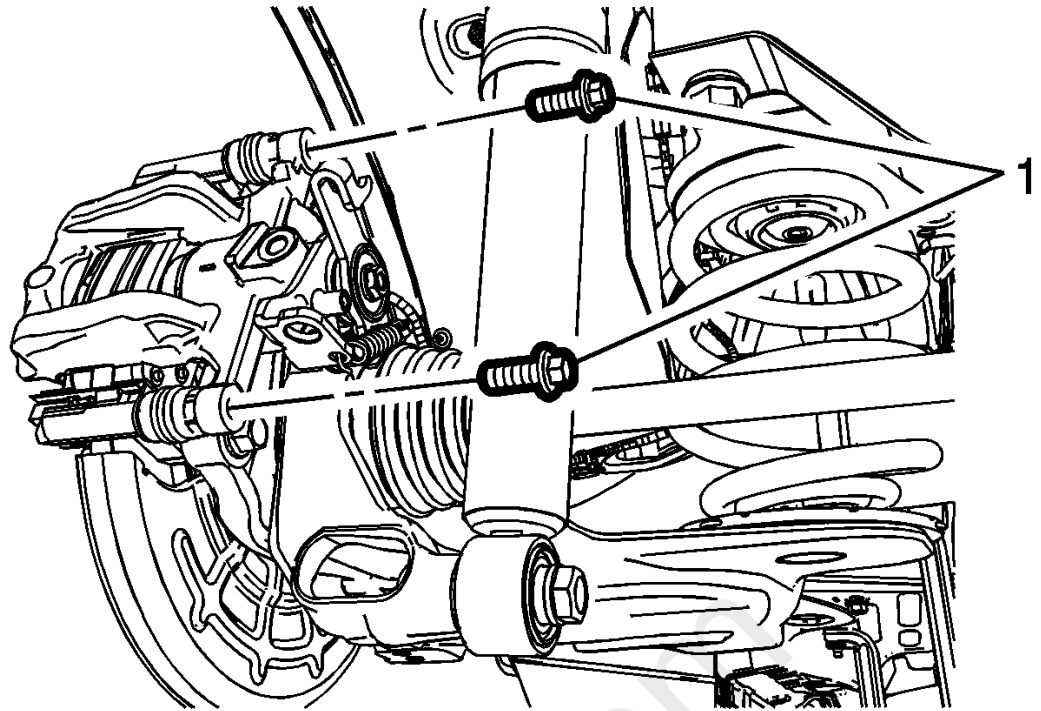


Fig. 31: Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

1. Position the brake caliper over the brake pads and to the caliper bracket.

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 28 N.m (21 lb ft).

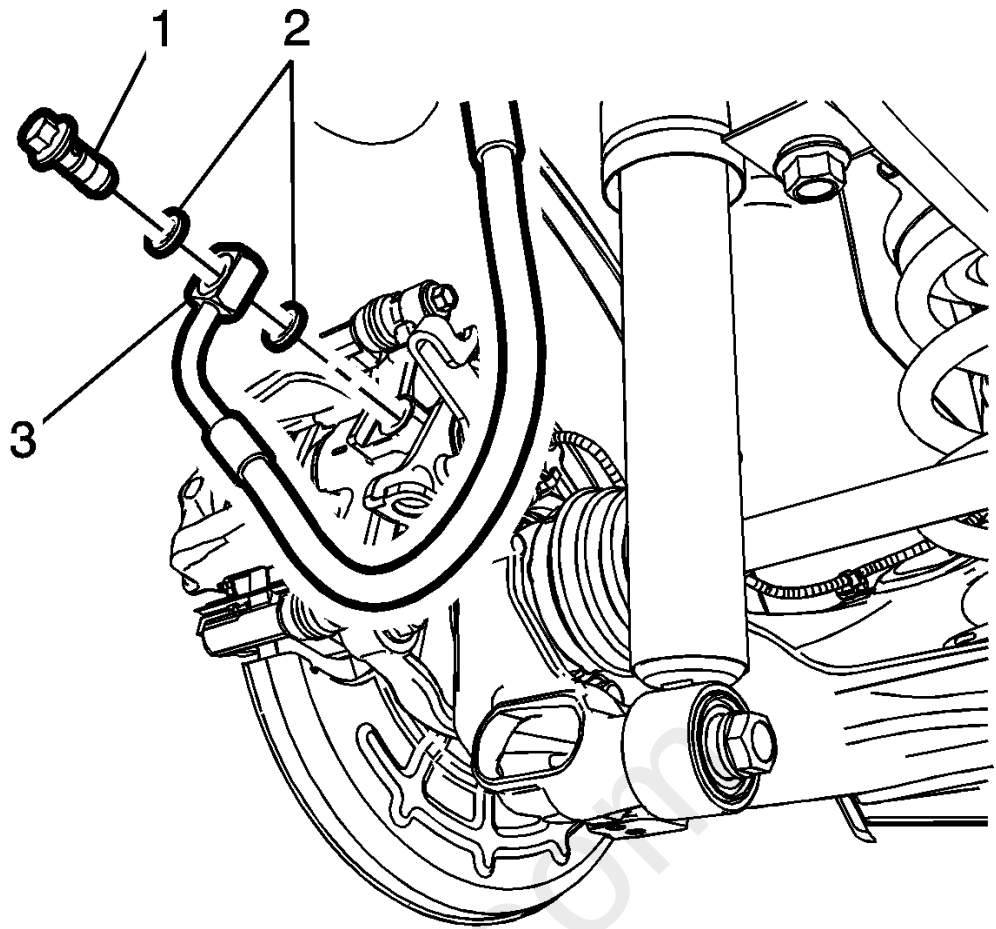


Fig. 32: Brake Hose Fitting Bolt

Courtesy of GENERAL MOTORS COMPANY

NOTE: Install new brake hose fitting gaskets.

3. Assemble the brake hose fitting bolt (1) and the new brake hose fitting gaskets (2) to the brake hose fitting (3).
4. Install the brake hose assembly and tighten the brake hose fitting bolt to 40 N.m (30 lb ft).

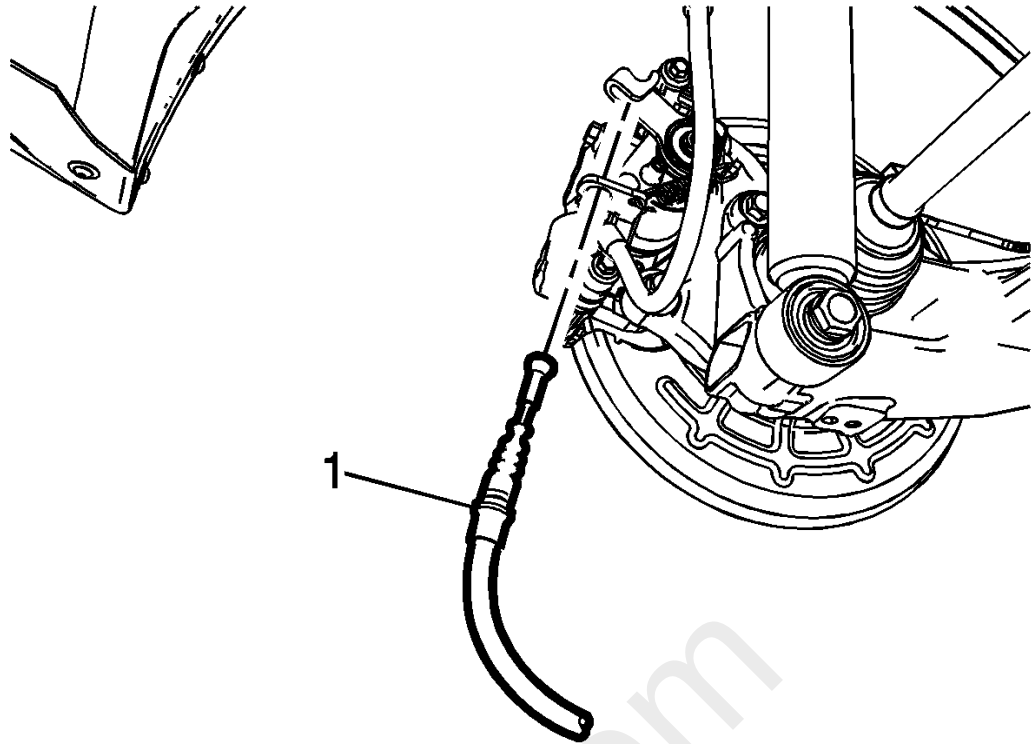


Fig. 33: Left Parking Brake Cable

Courtesy of GENERAL MOTORS COMPANY

5. Install the parking brake cable (1) to the parking brake actuator lever.
6. Bleed the hydraulic brake system. Refer to [Hydraulic Brake System Bleeding \(Manual\)](#) [Hydraulic Brake System Bleeding \(Pressure\)](#) .
7. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

FRONT BRAKE CALIPER OVERHAUL

Disassembly Procedure

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

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

WARNING: Use of eye goggles is necessary to prevent personal injury.

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

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

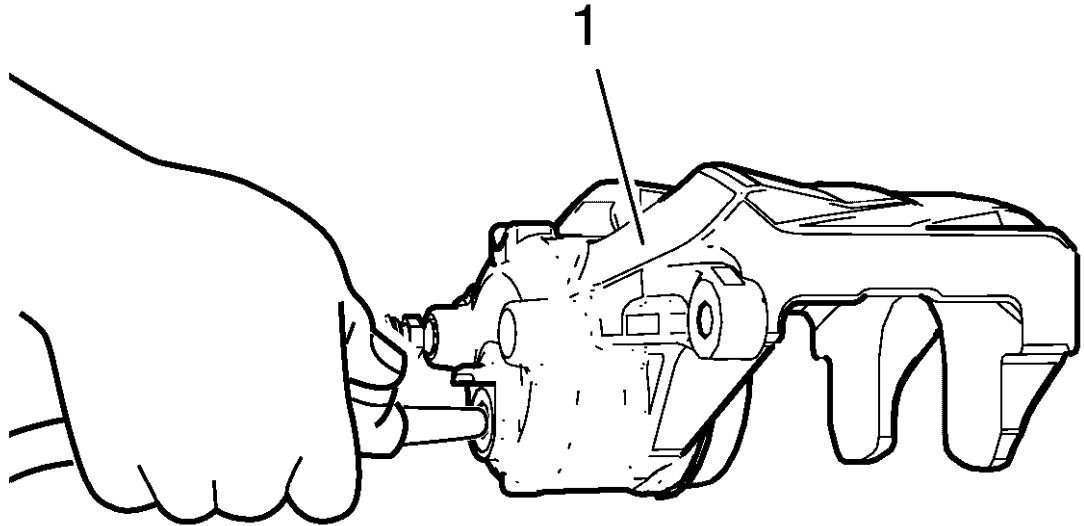


Fig. 34: Using Low Pressure Compressed Air To Remove Brake Caliper Piston
Courtesy of GENERAL MOTORS COMPANY

- 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.
- 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.

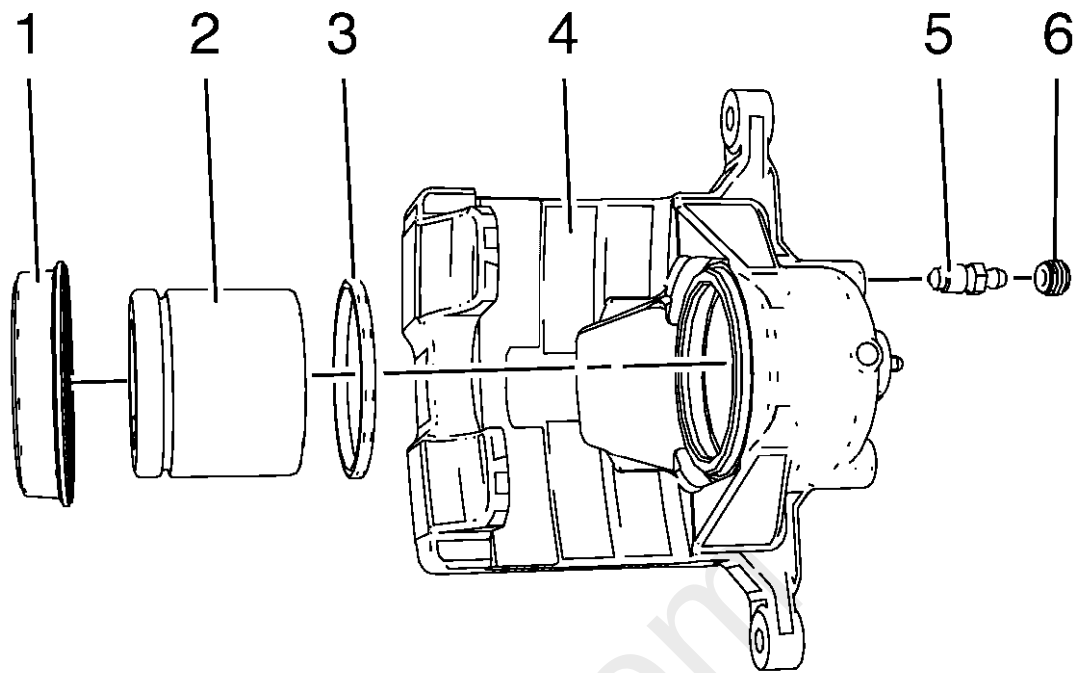


Fig. 35: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS COMPANY

2. Remove the brake caliper piston from the caliper bore by directing low pressure compressed air into the caliper (1) through the fluid inlet hole.
3. Remove the piston dust boot seal (1) from the seal counterbore in the caliper (4). Discard the boot seal.
4. Using a small wooden or plastic tool, remove the piston seal (3) from the caliper bore. Discard the piston seal.
5. Remove the bleeder valve cap (6).
6. Remove the bleeder valve (5).

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

7. If cracks, scoring, pitting, excessive rust, and/or excessive corrosion are present in the caliper bore, replace the caliper assembly.
8. If light rust or light corrosion are 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.
9. Clean the brake caliper piston bore and seal counterbore, and the caliper piston with denatured alcohol, or equivalent.
10. Dry the caliper piston bore and counterbore, and the piston with non-lubricated, filtered, compressed air.
11. Inspect the caliper piston for cracks, scoring, and/or damage to the plating. Replace the caliper piston if any of these conditions exist.
12. Inspect the caliper mounting holes for cracks, scoring, pitting, rust and/or excessive corrosion. Replace the caliper assembly if any of these conditions exist.

Assembly Procedure

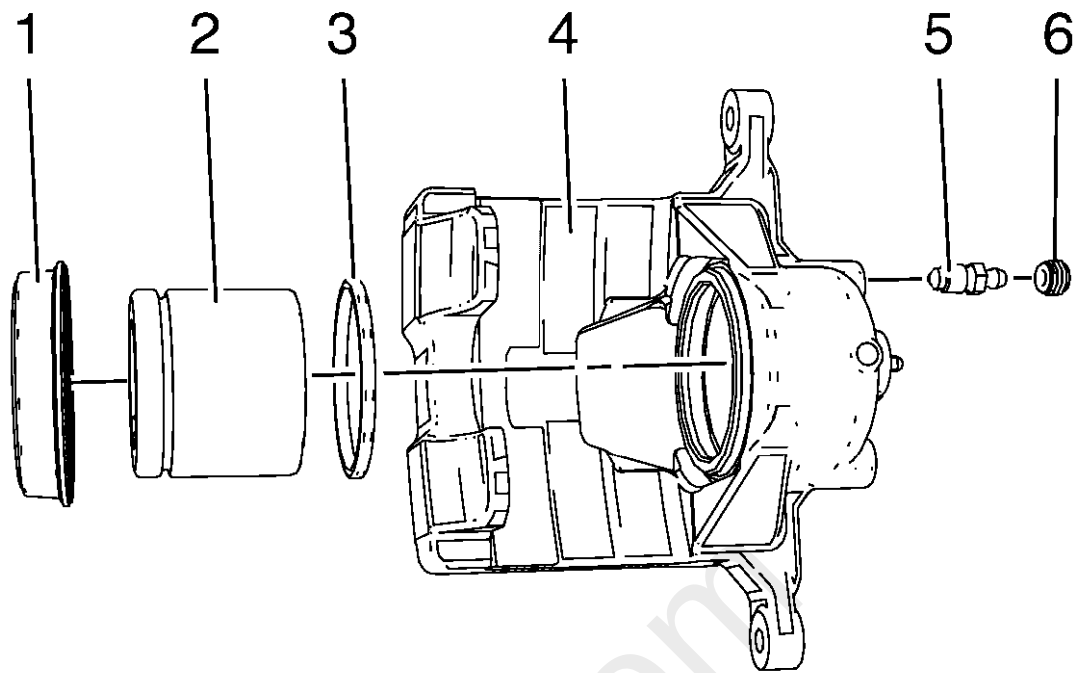


Fig. 36: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS COMPANY

1. Lubricate the new piston seal (3) with brake fluid from a clean, sealed brake fluid container.
2. Install the lubricated, new piston seal into the caliper bore.
3. Apply a thin coat of brake fluid from a clean, sealed brake fluid container.

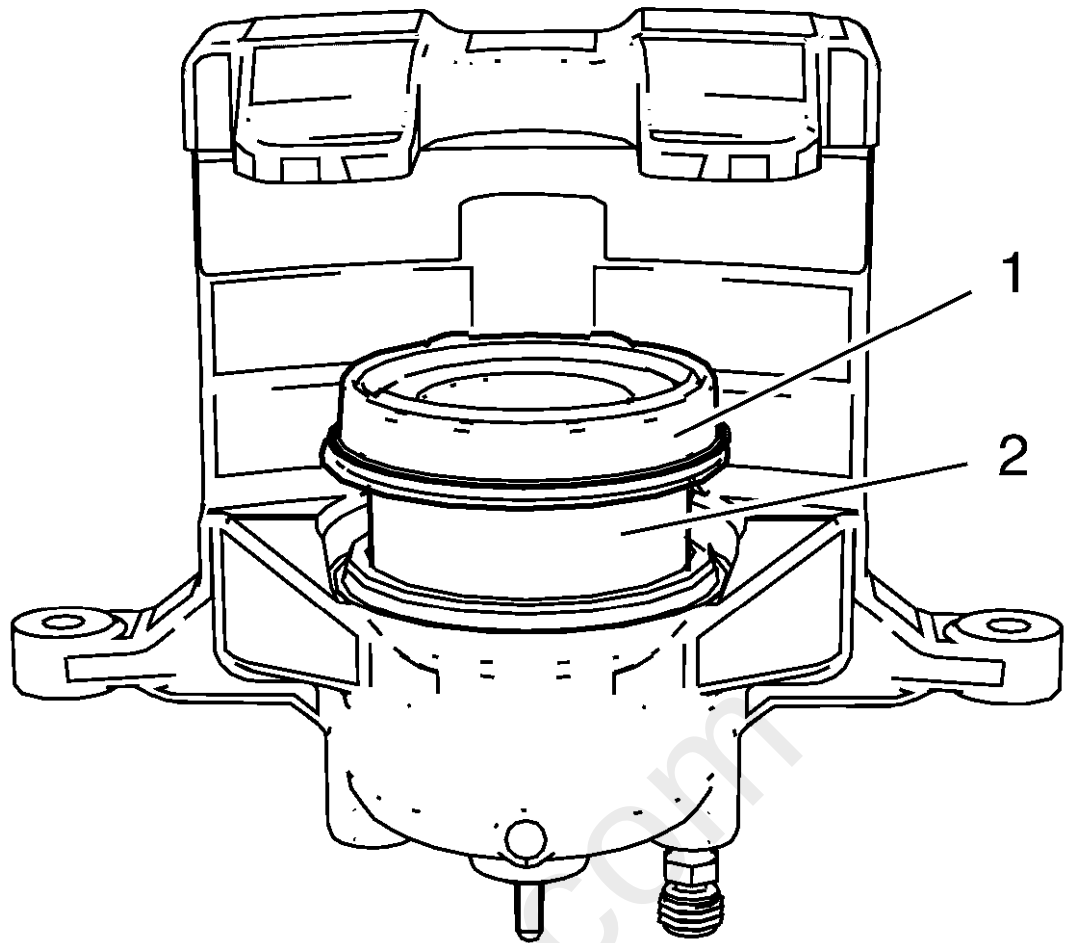


Fig. 37: View Of Caliper Piston And Caliper Piston Dust Boot Seal
Courtesy of GENERAL MOTORS COMPANY

4. Install the new piston dust boot seal (1) over the caliper piston (2).
5. Install the bottom half of the caliper piston into the caliper bore.
6. Compress the caliper piston to the bottom of the caliper bore.
7. Fully seat the piston dust boot seal into caliper counterbore.

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

8. Install the bleeder valve to the caliper and tighten to 17 N.m (13 lb ft).
9. Install the bleeder valve cap.
10. Install the brake caliper to the vehicle. Refer to [Front Brake Caliper Replacement](#).

REAR BRAKE CALIPER VIBRATION DAMPENER 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](#) .

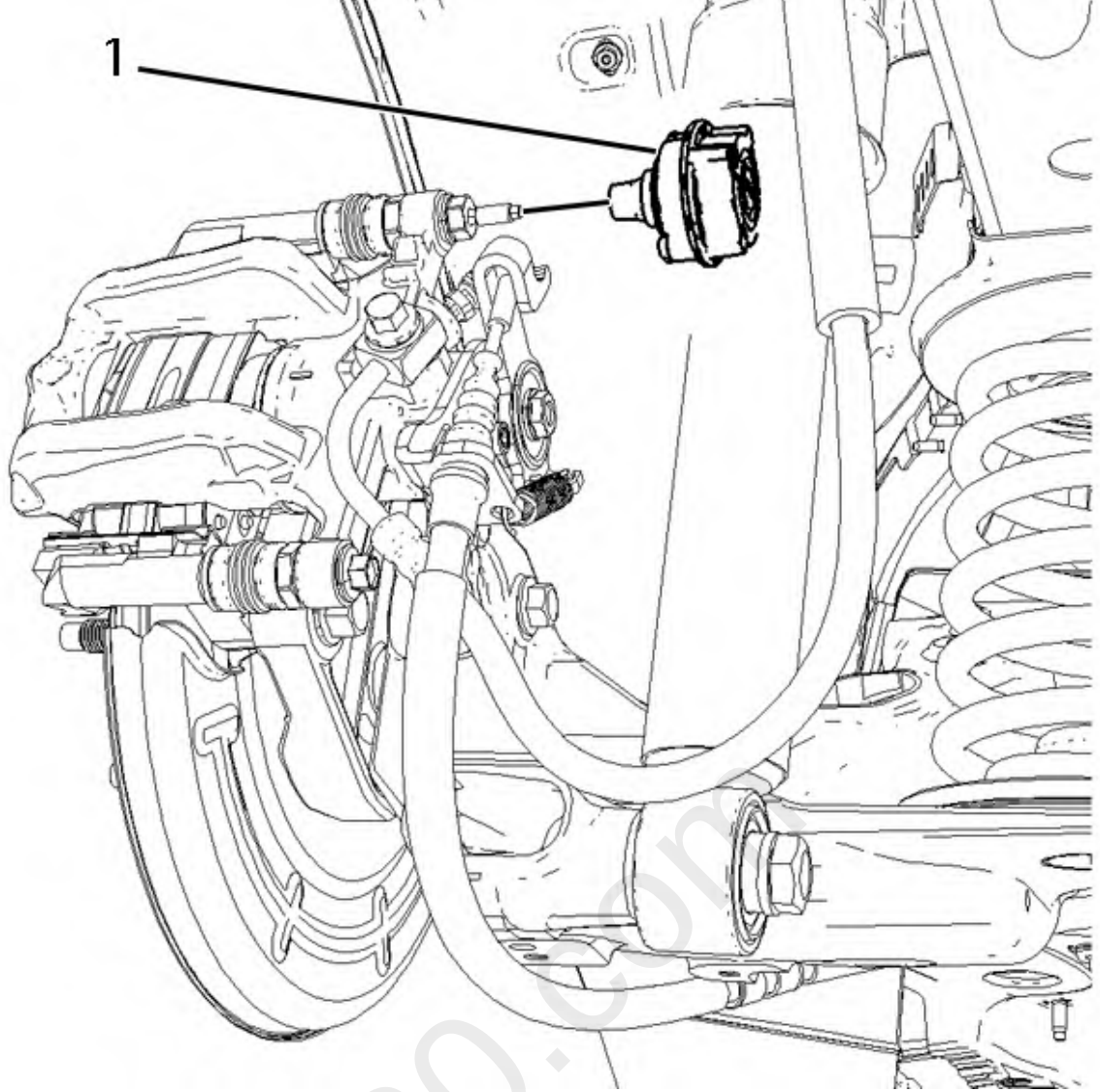


Fig. 38: Brake Caliper Vibration Dampener
Courtesy of GENERAL MOTORS COMPANY

3. Remove the brake caliper vibration dampener (1) from the upper brake caliper guide pin stud.

Installation Procedure

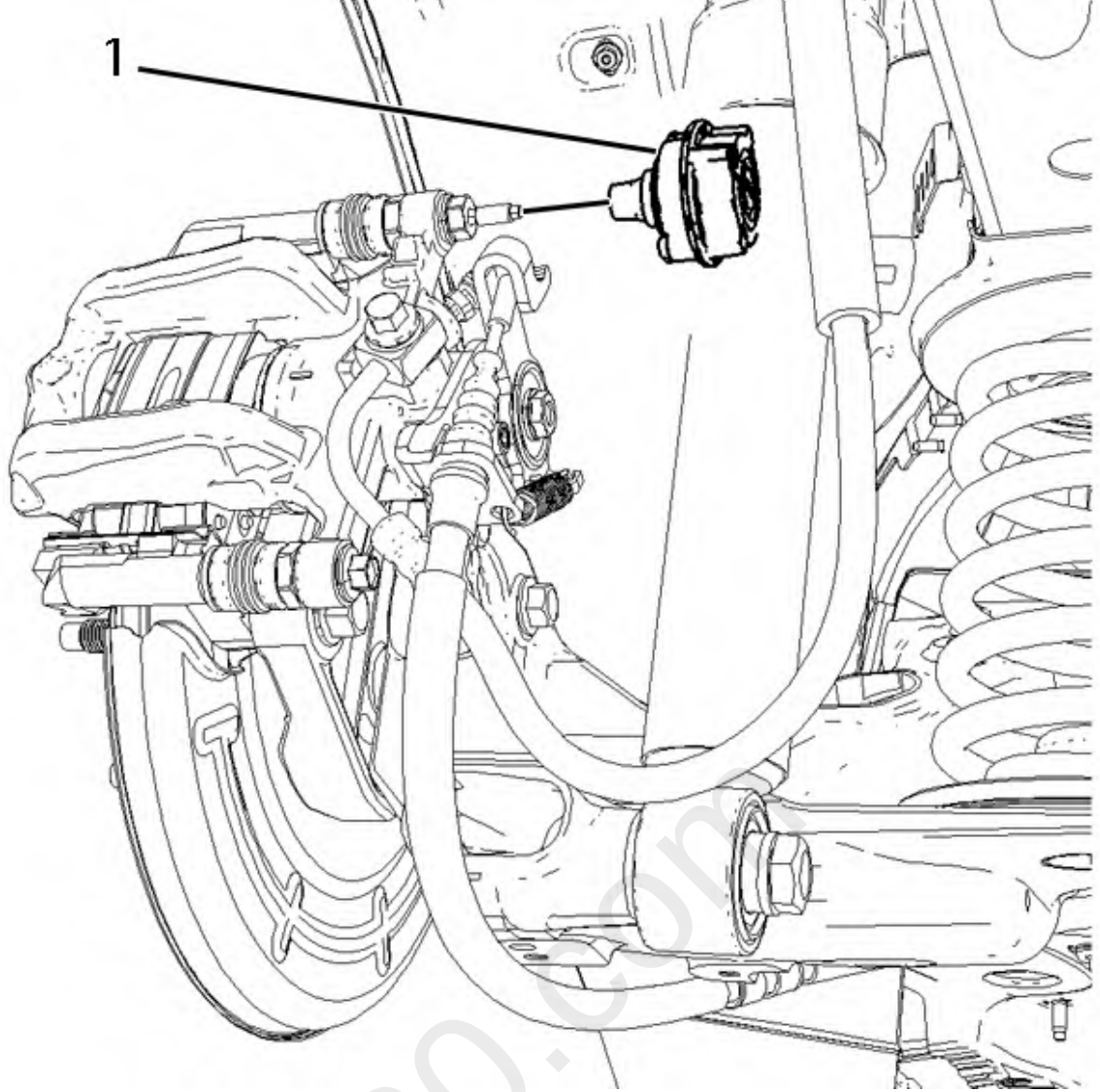


Fig. 39: Brake Caliper Vibration Dampener
Courtesy of GENERAL MOTORS COMPANY

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

1. Install the brake caliper vibration dampener (1) to the upper brake caliper guide pin stud and tighten to 9 N.m (80 lb in).
2. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

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](#) .

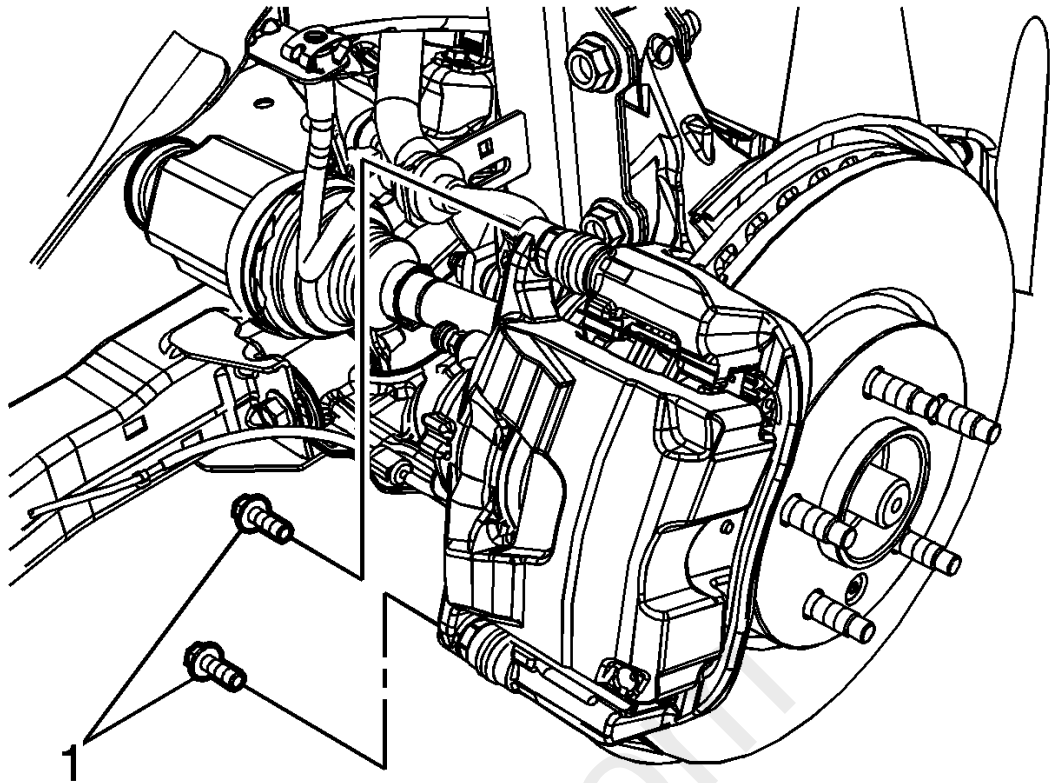


Fig. 40: Upper And Lower Brake Caliper Guide Pin Bolts

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.

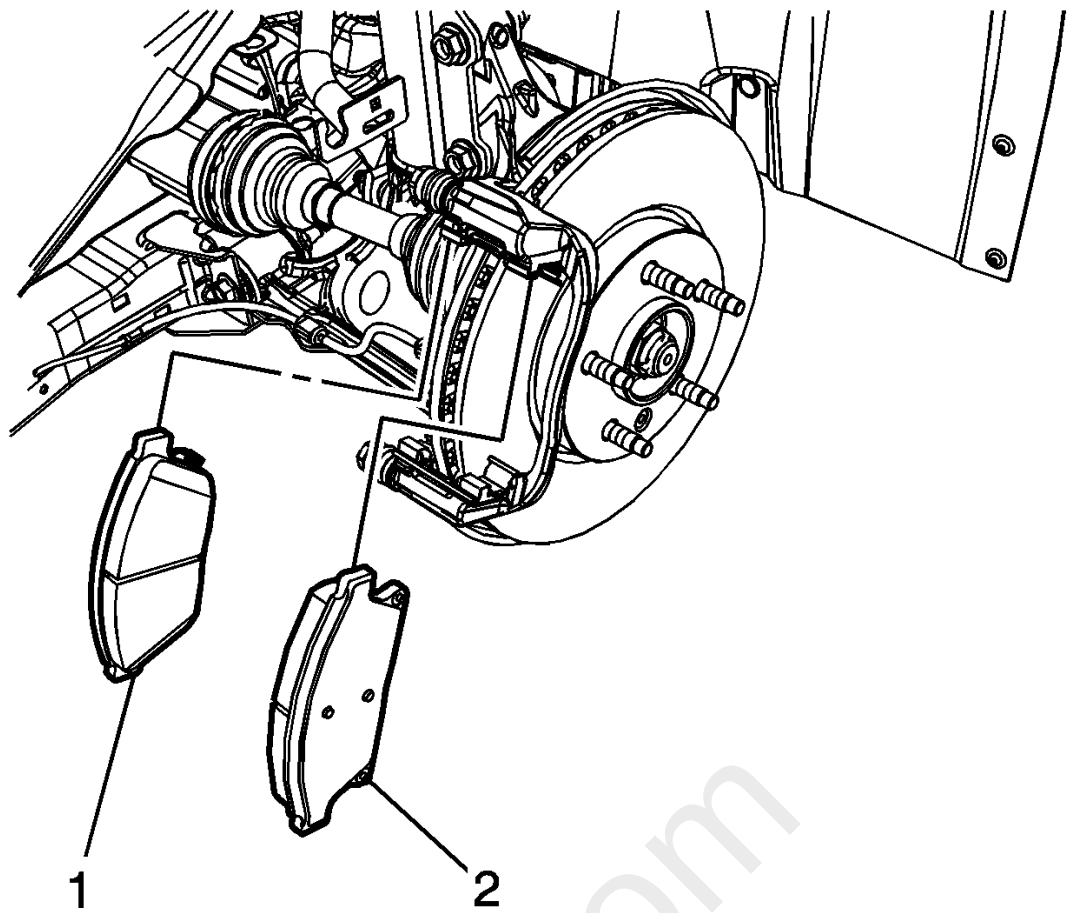


Fig. 41: Brake Pads

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).

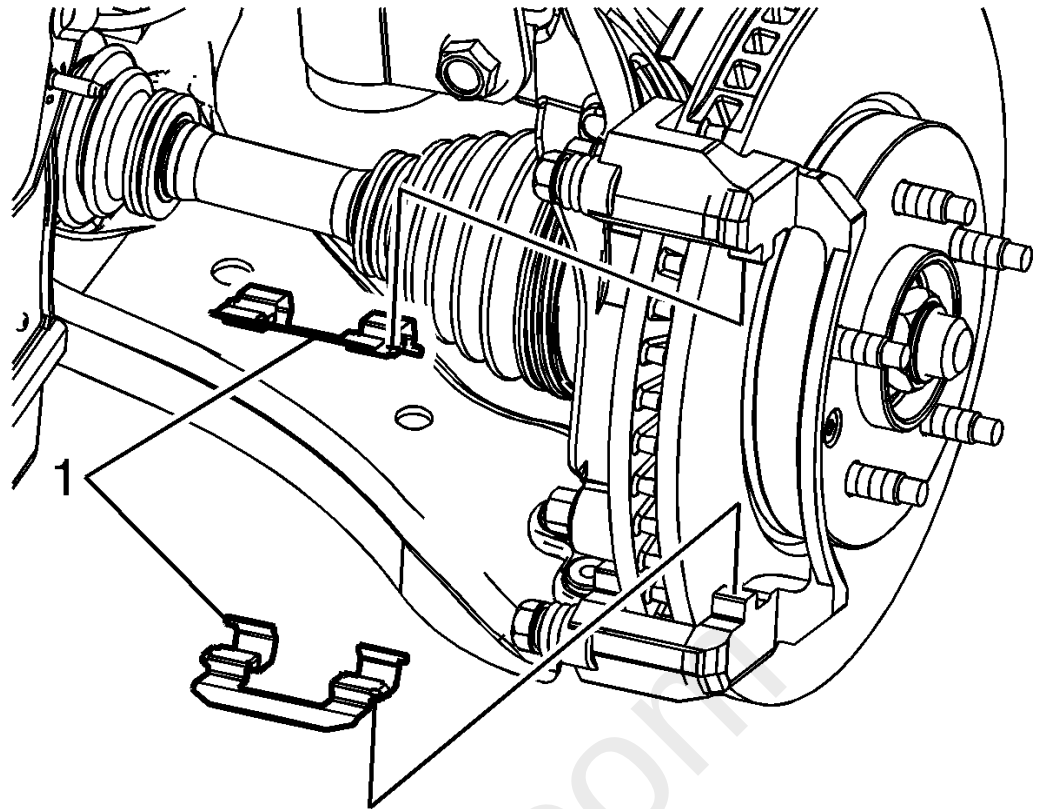


Fig. 42: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

7. Remove the brake pad springs (1).

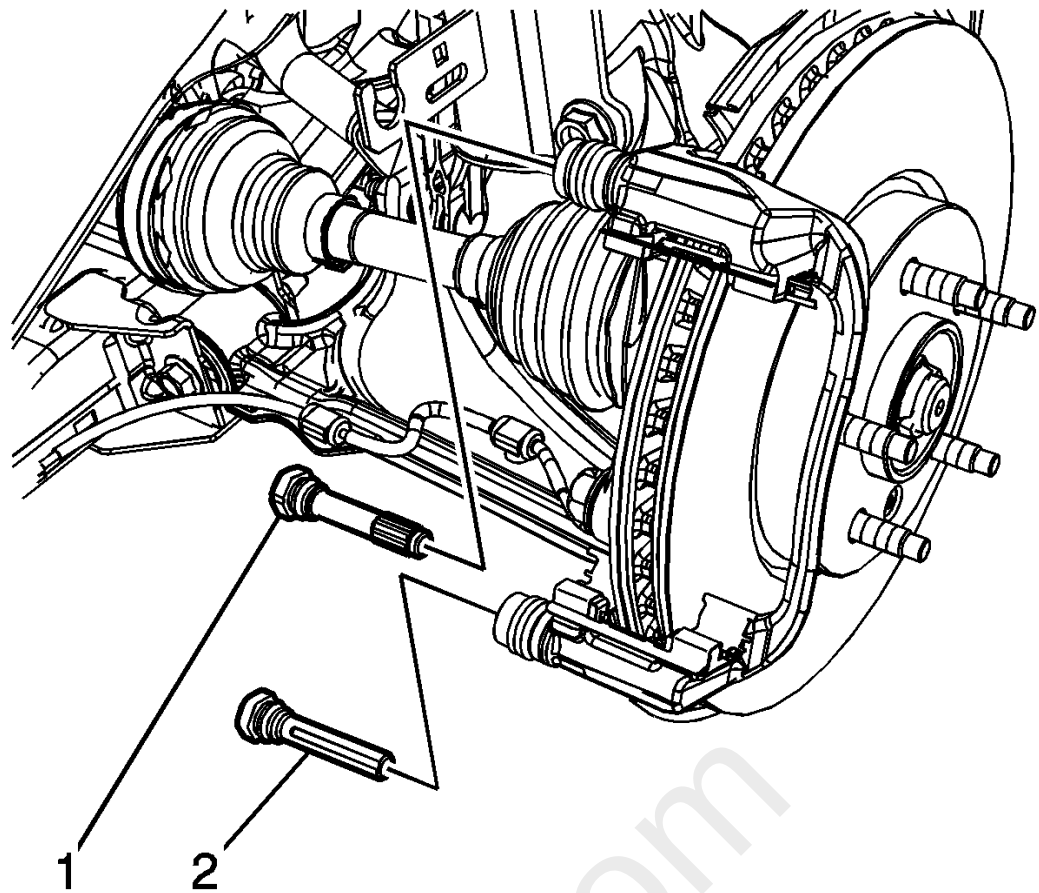


Fig. 43: Upper And Lower Brake Caliper Guide Pins

Courtesy of GENERAL MOTORS COMPANY

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

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

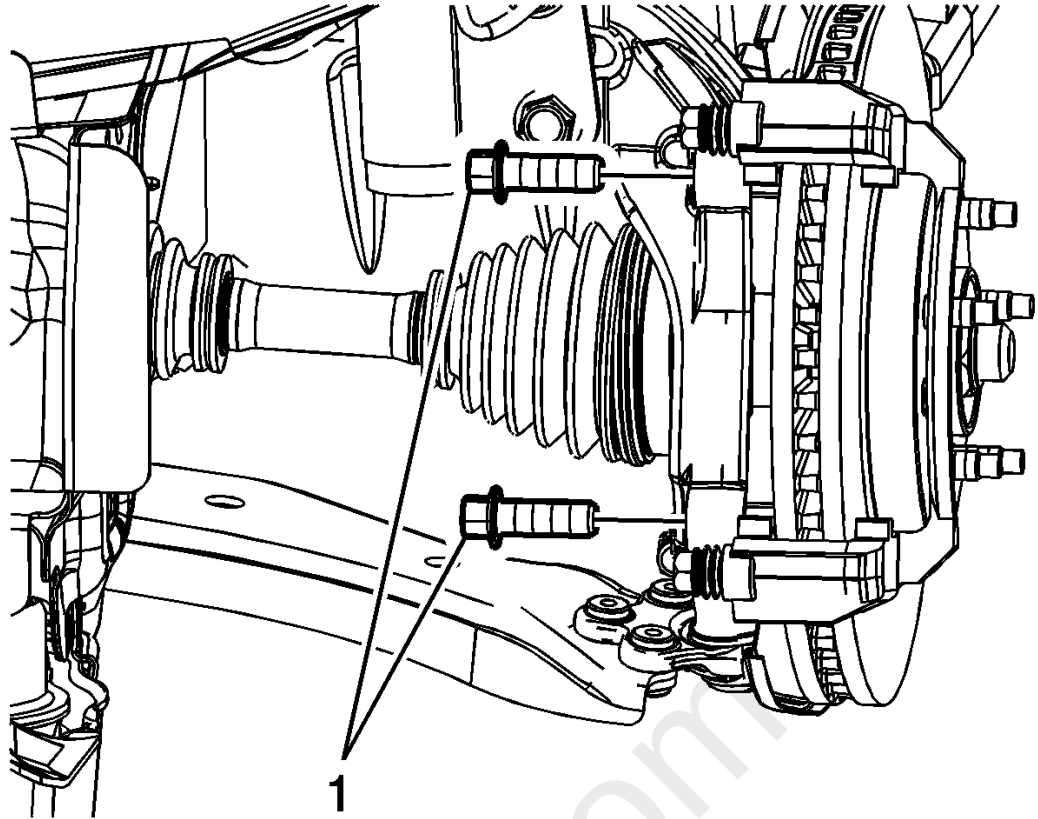


Fig. 44: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not reuse the brake caliper bracket bolts.

11. Remove and discard the brake caliper bracket bolts (1).

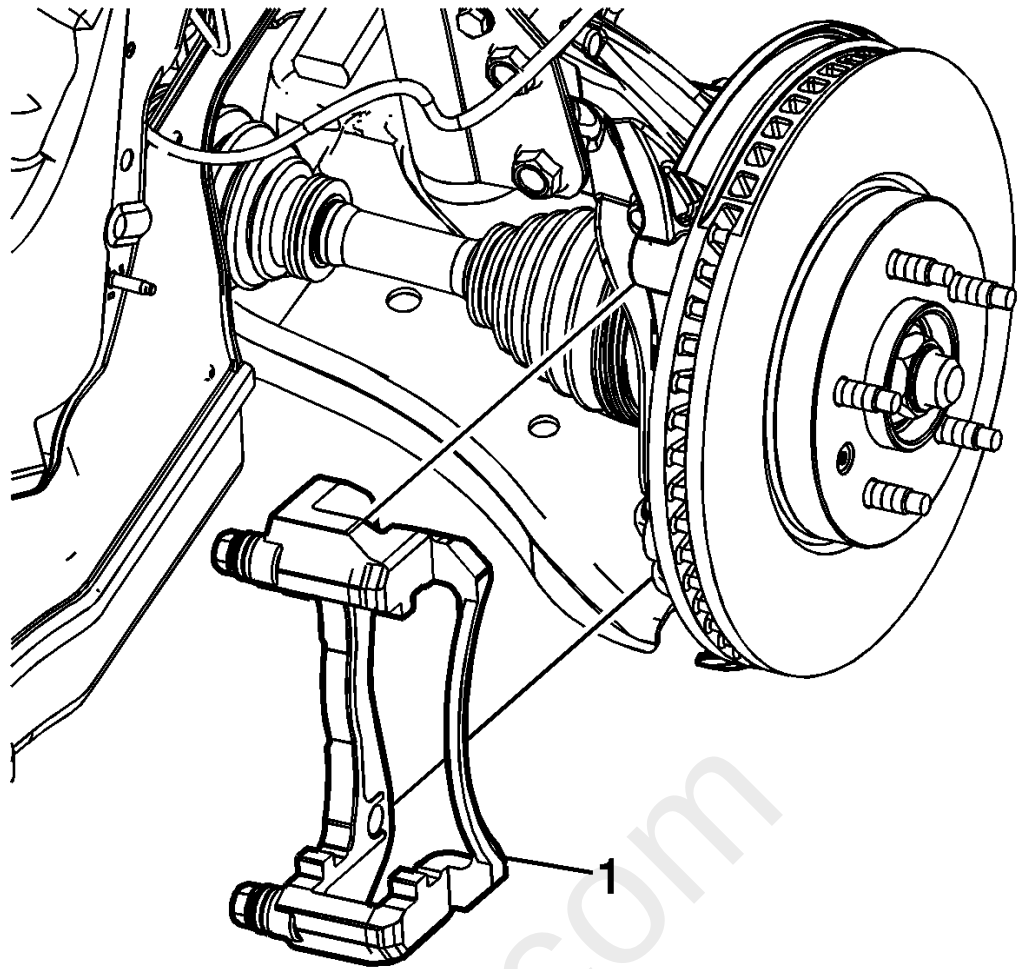


Fig. 45: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

12. Remove the brake caliper bracket (1).

Installation Procedure

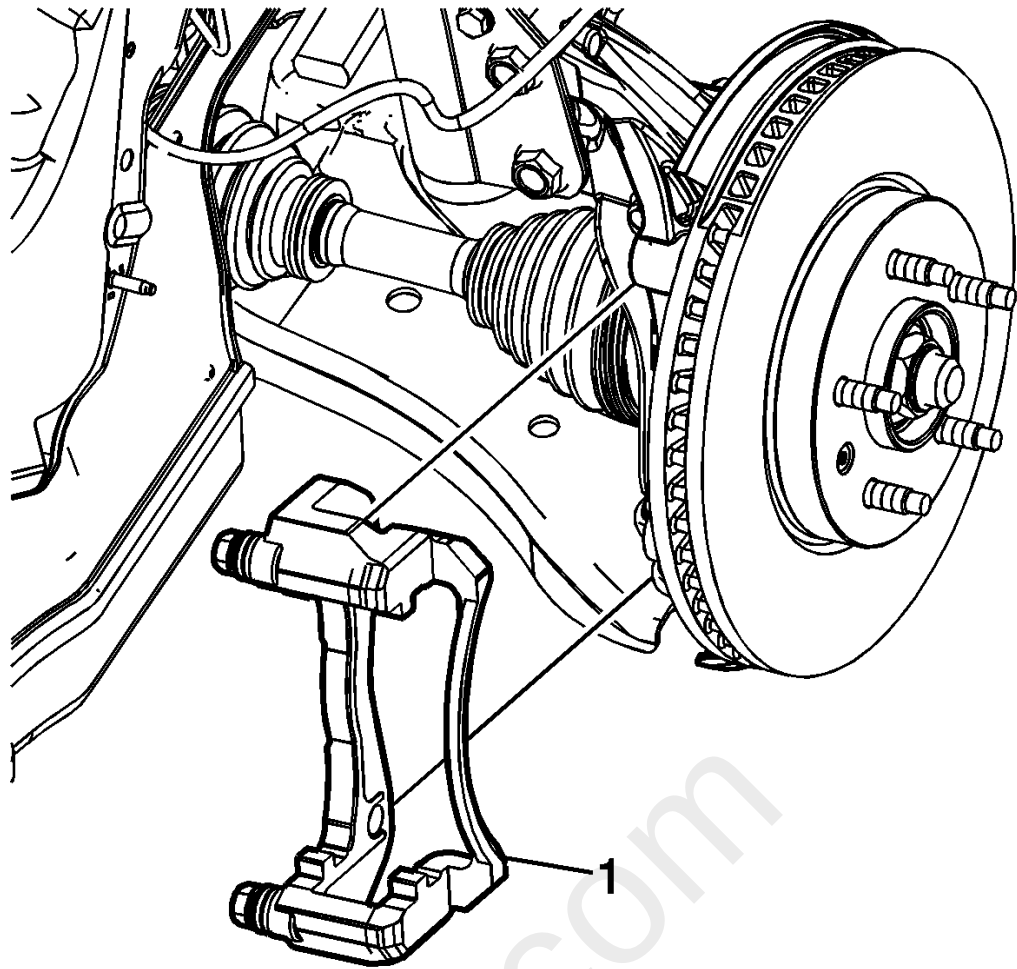


Fig. 46: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

1. Install the brake caliper bracket (1).

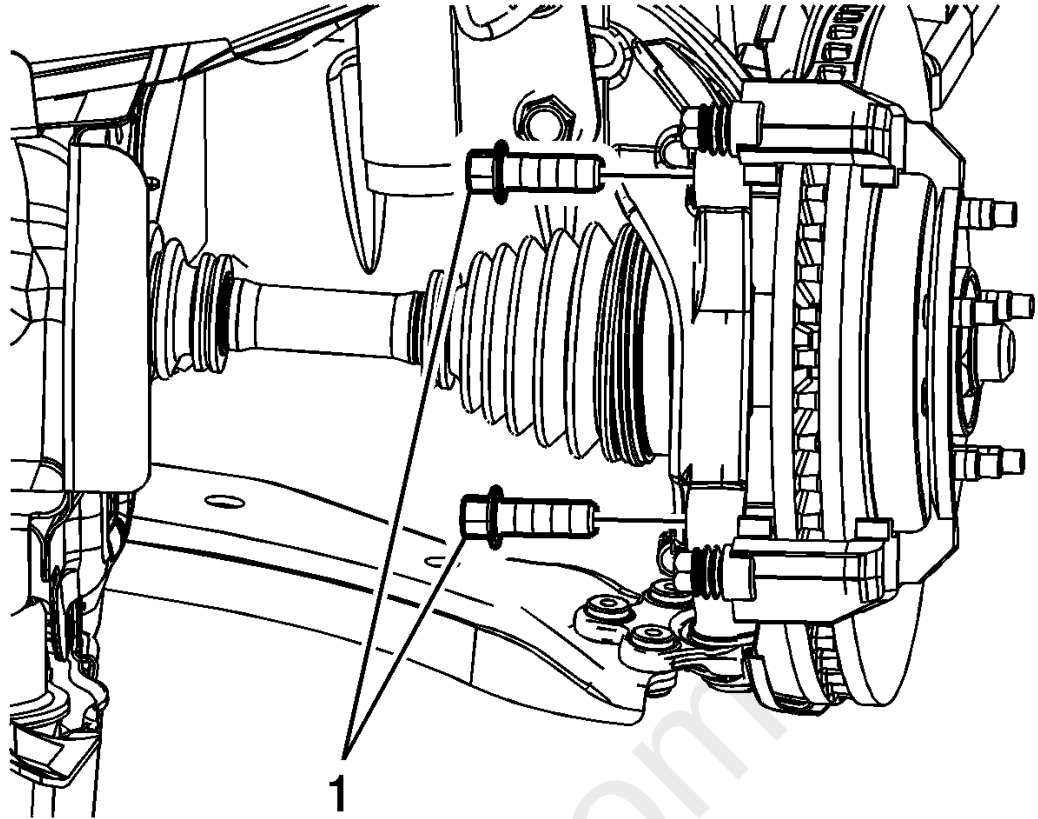


Fig. 47: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

2. Install new brake caliper bracket bolts (1) and tighten to 160 N.m (118 lb ft).

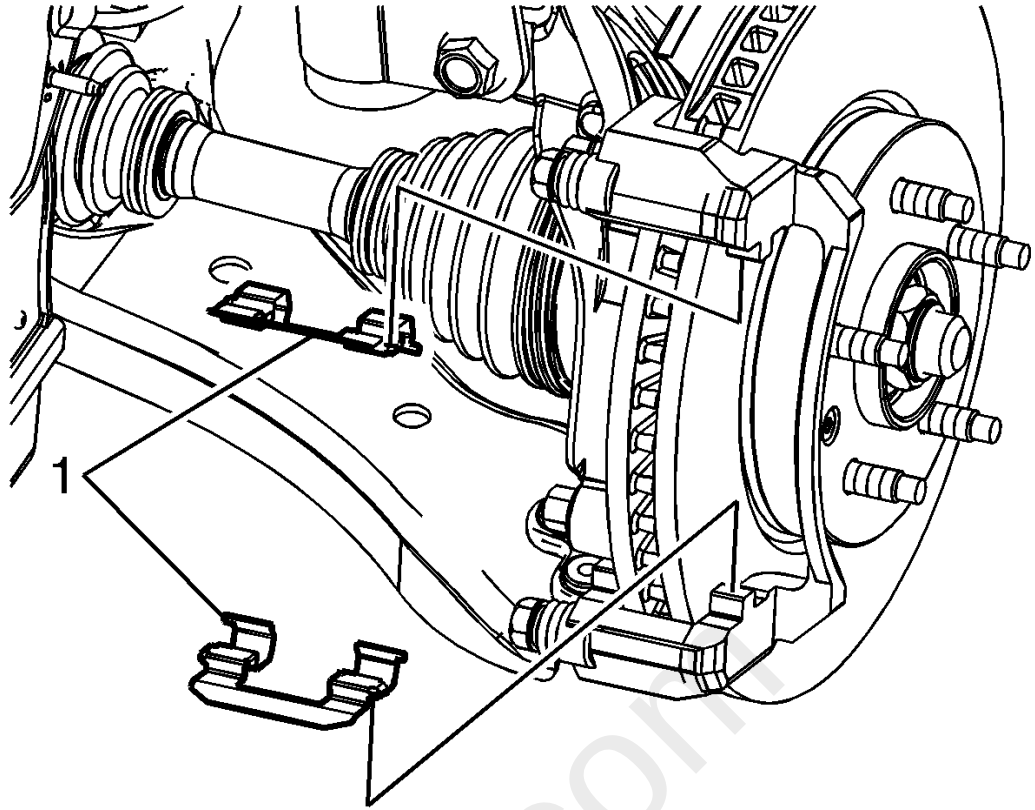


Fig. 48: Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

3. Install the brake pad springs (1).

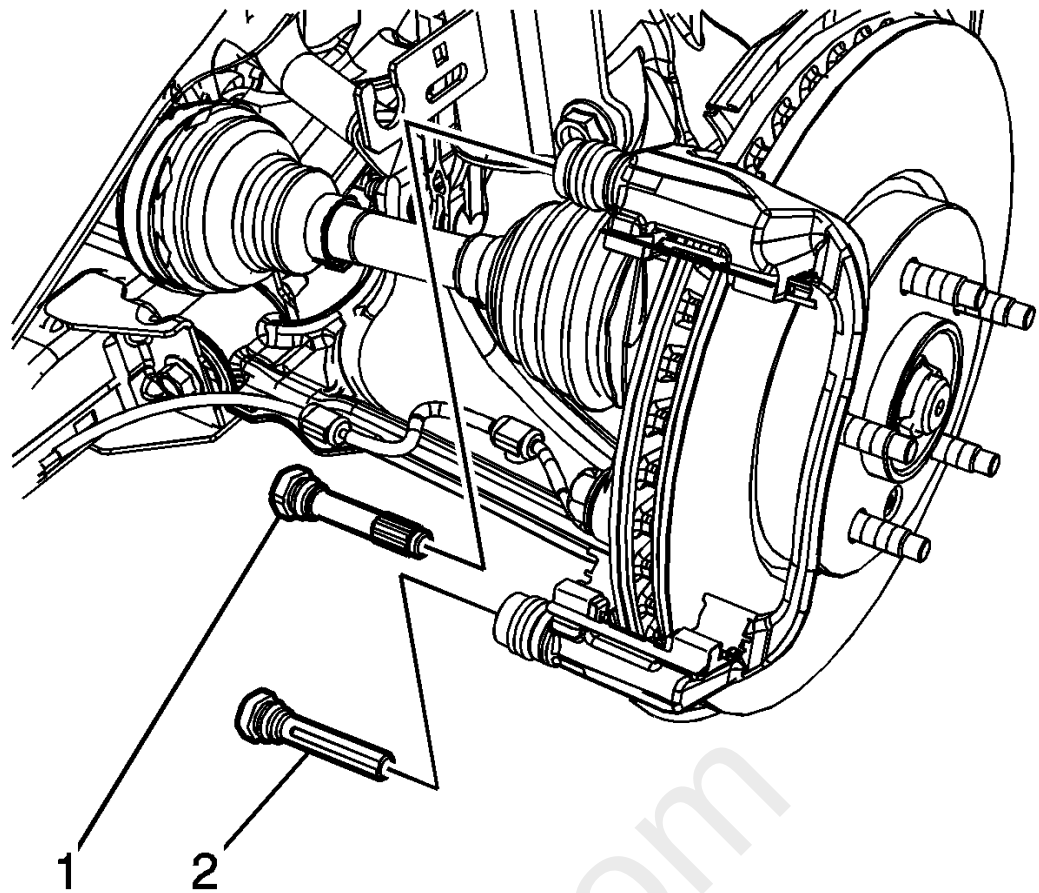


Fig. 49: Upper And Lower Brake Caliper Guide Pins
Courtesy of GENERAL MOTORS COMPANY

4. Install the 2 brake caliper guide pin seals.
5. Ensure the brake caliper guide pin seals are fully seated in the groove of the brake caliper bracket.

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

6. Install the upper brake caliper guide pin (1).
7. Install the lower brake caliper guide pin (2).
8. Ensure the brake caliper guide pin seals are fully seated in the groove of the brake caliper guide pins.

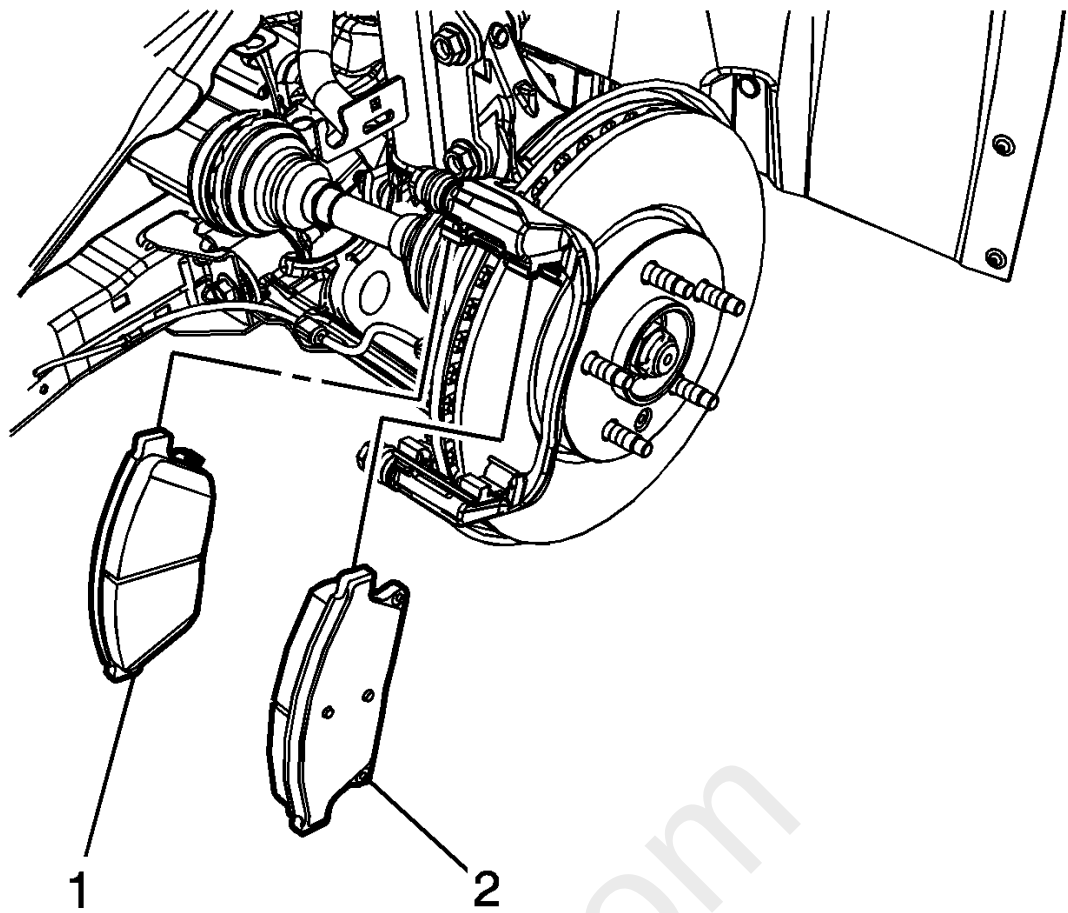


Fig. 50: Brake Pads

Courtesy of GENERAL MOTORS COMPANY

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

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

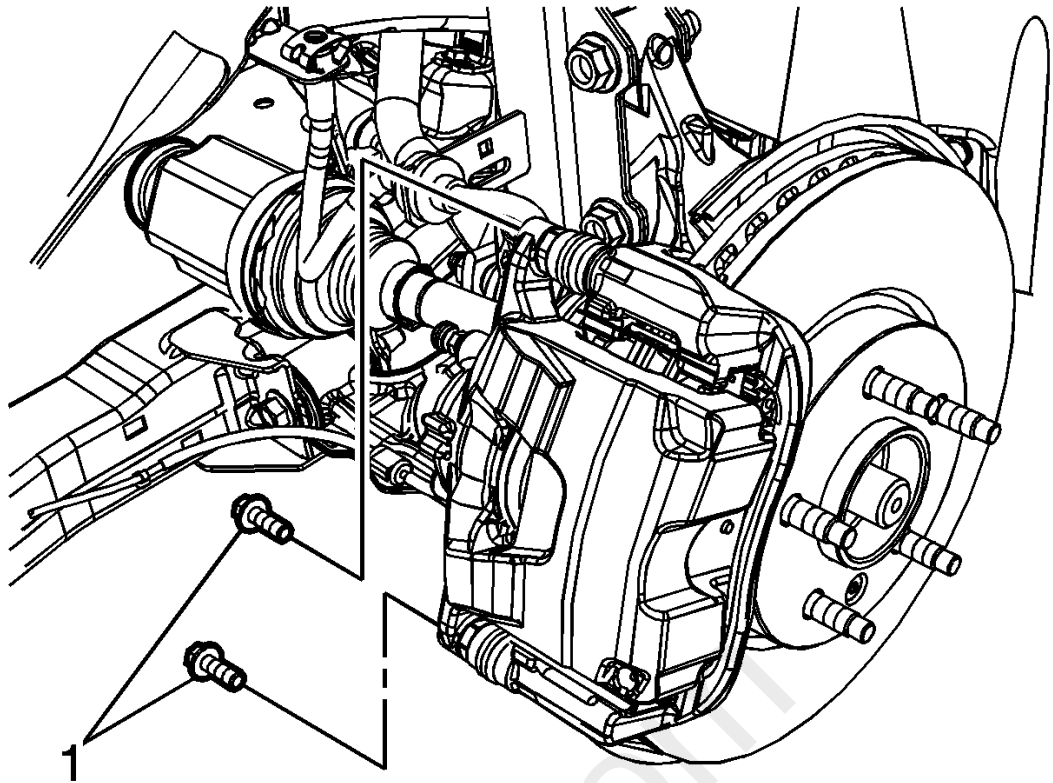


Fig. 51: Upper And Lower Brake Caliper Guide Pin Bolts
Courtesy of GENERAL MOTORS COMPANY

12. Using a backup wrench to hold the brake caliper guide pin stationary, install the brake caliper guide pin bolts (1) and tighten to 28 N.m (21 lb ft).
13. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

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 brake caliper. Refer to [Rear Brake Caliper Replacement](#).

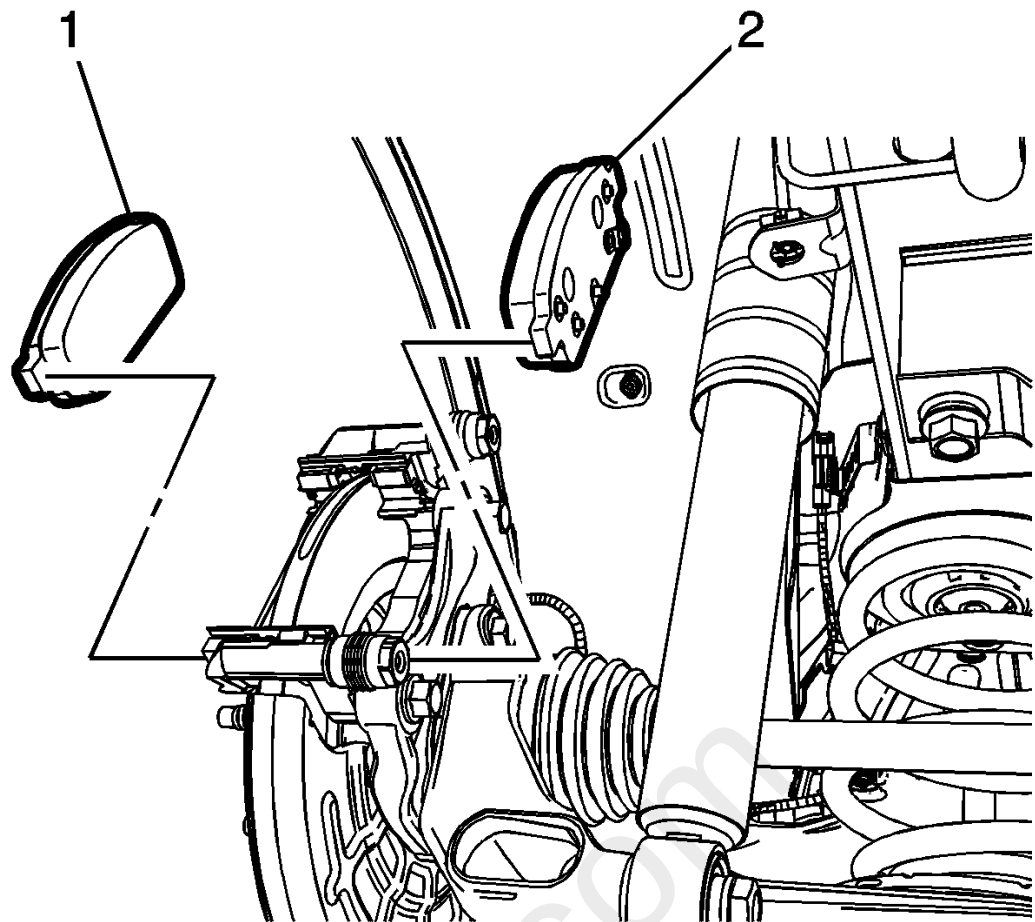


Fig. 52: Disc Brake Pads

Courtesy of GENERAL MOTORS COMPANY

4. Remove the outer brake pad (1).

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

5. Remove the inner brake pad (2).

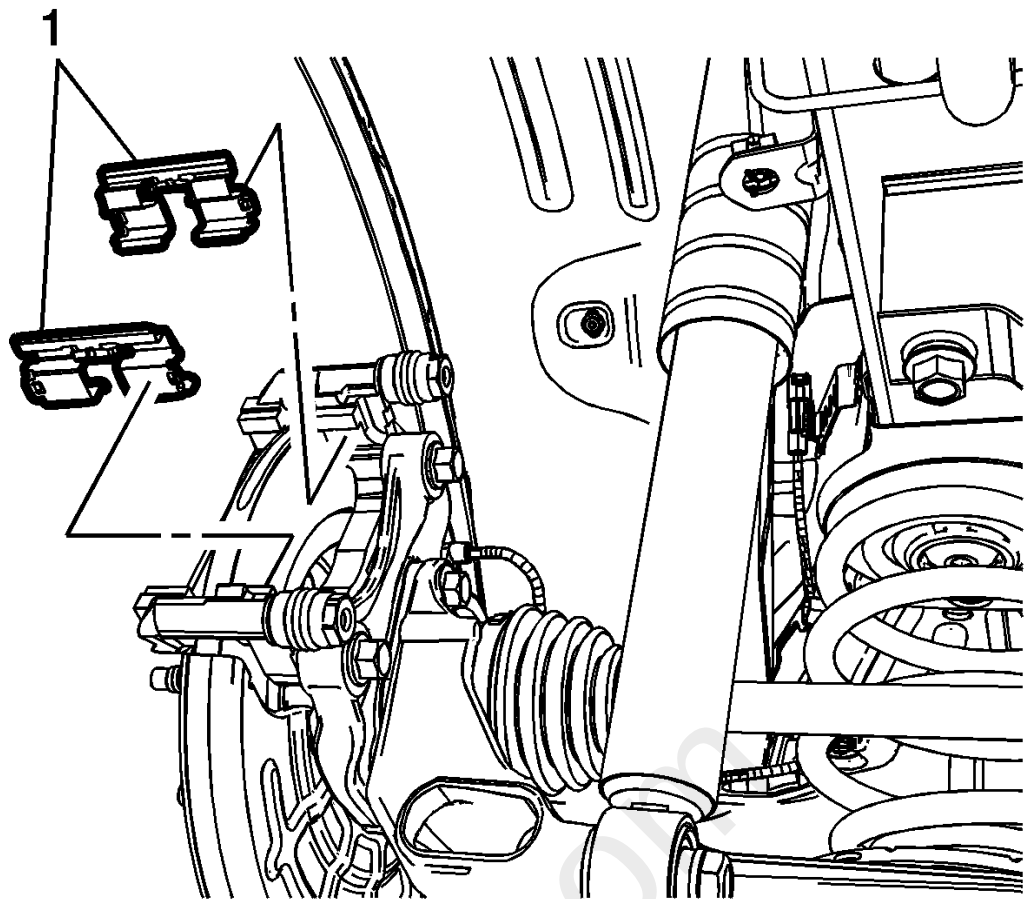


Fig. 53: Lower Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

6. Remove the upper and lower brake pad springs (1).

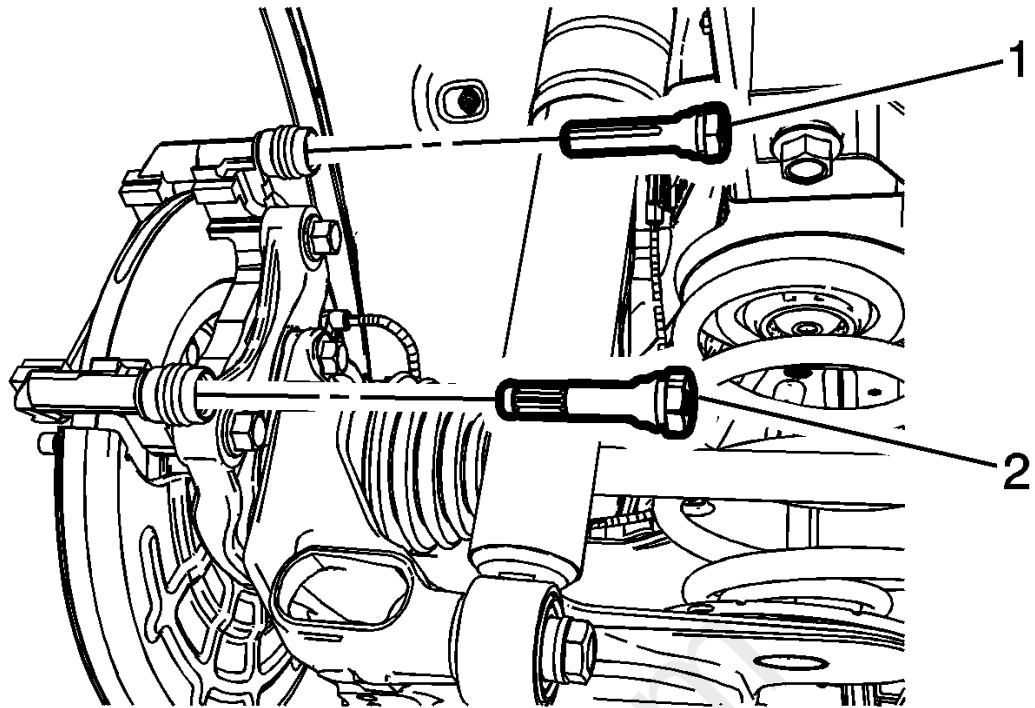


Fig. 54: Upper Brake Caliper Guide Pin

Courtesy of GENERAL MOTORS COMPANY

7. Remove the upper brake caliper guide pin (1).

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 (2).

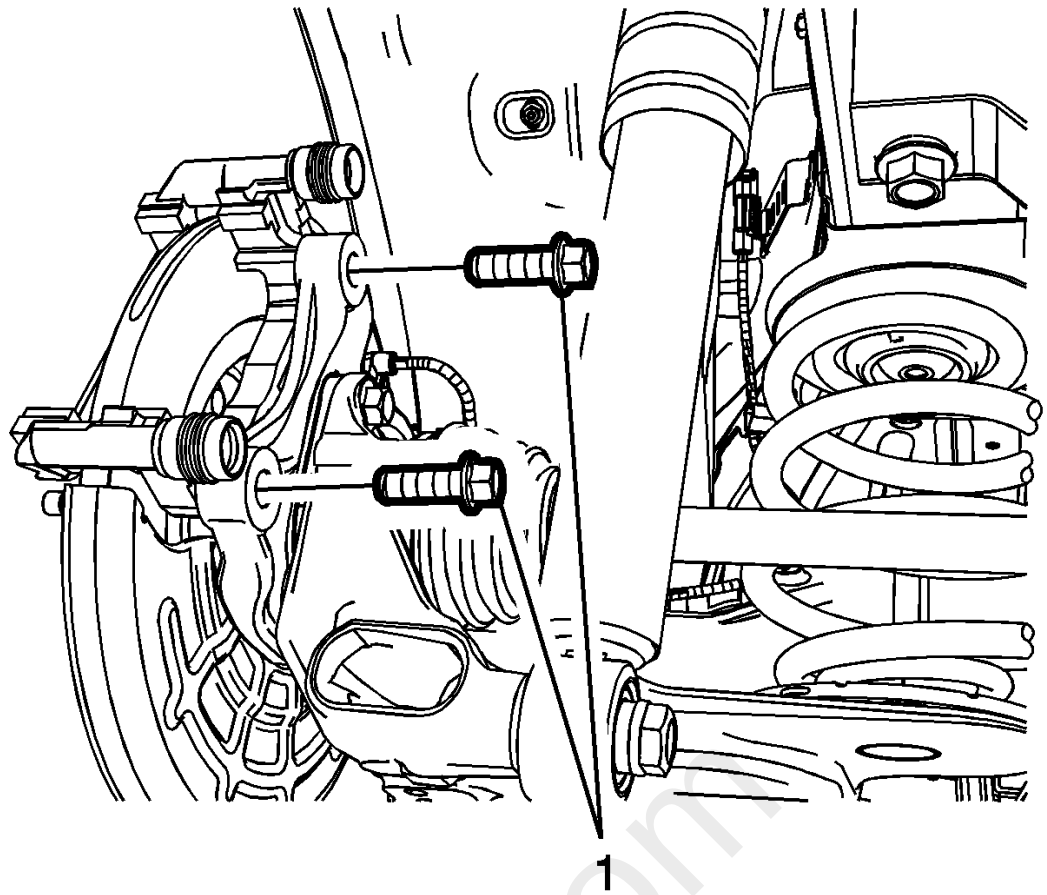


Fig. 55: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not reuse the brake caliper bracket bolts.

9. Remove and discard the brake caliper bracket bolts (1).

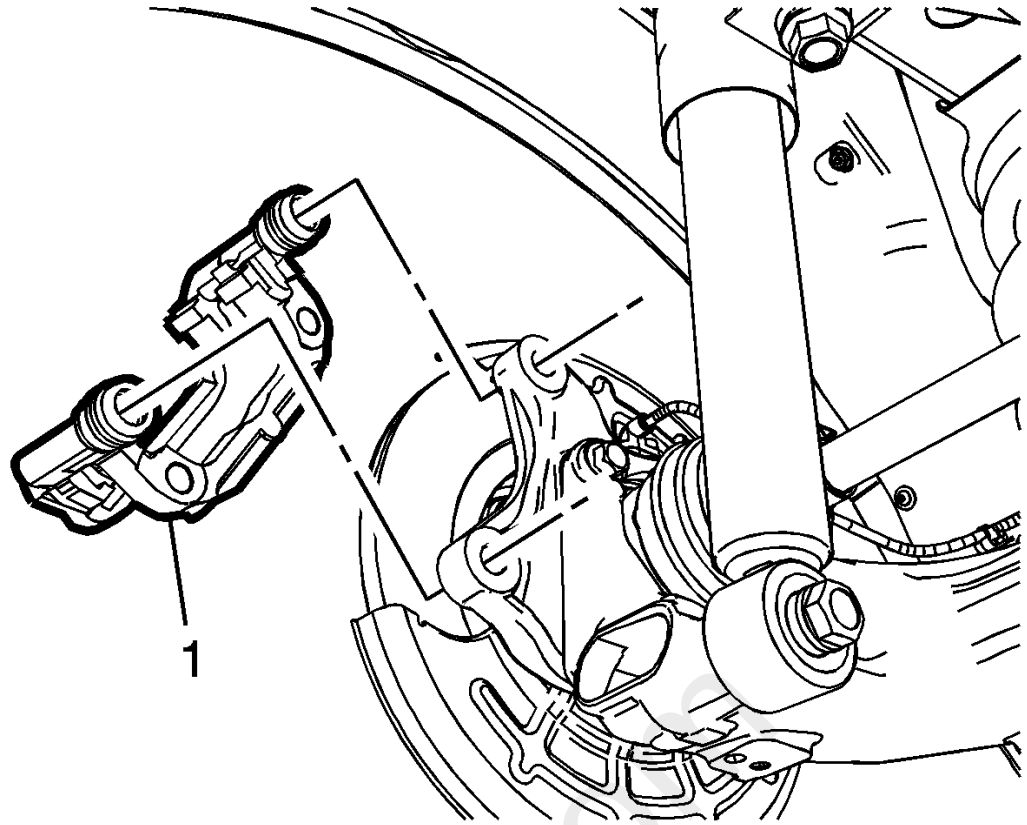


Fig. 56: Rear Brake Caliper Bracket
Courtesy of GENERAL MOTORS COMPANY

10. Remove the rear brake caliper bracket (1).

Installation Procedure

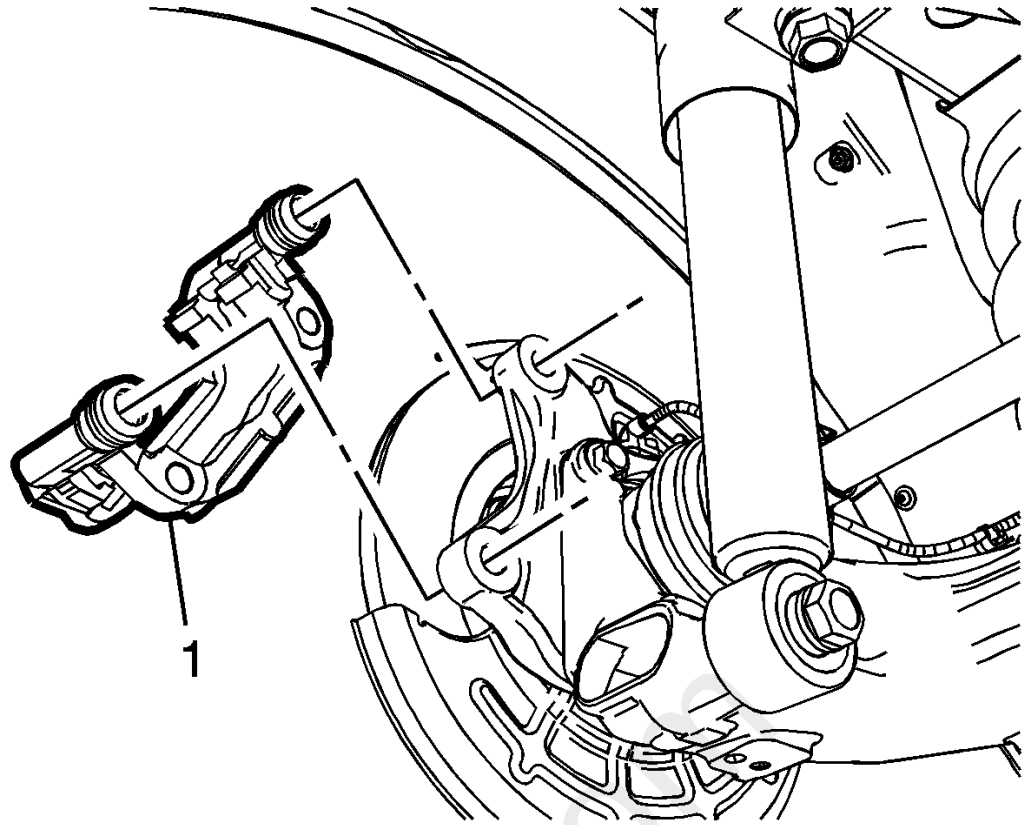


Fig. 57: Rear Brake Caliper Bracket
Courtesy of GENERAL MOTORS COMPANY

1. Install the rear brake caliper bracket (1).

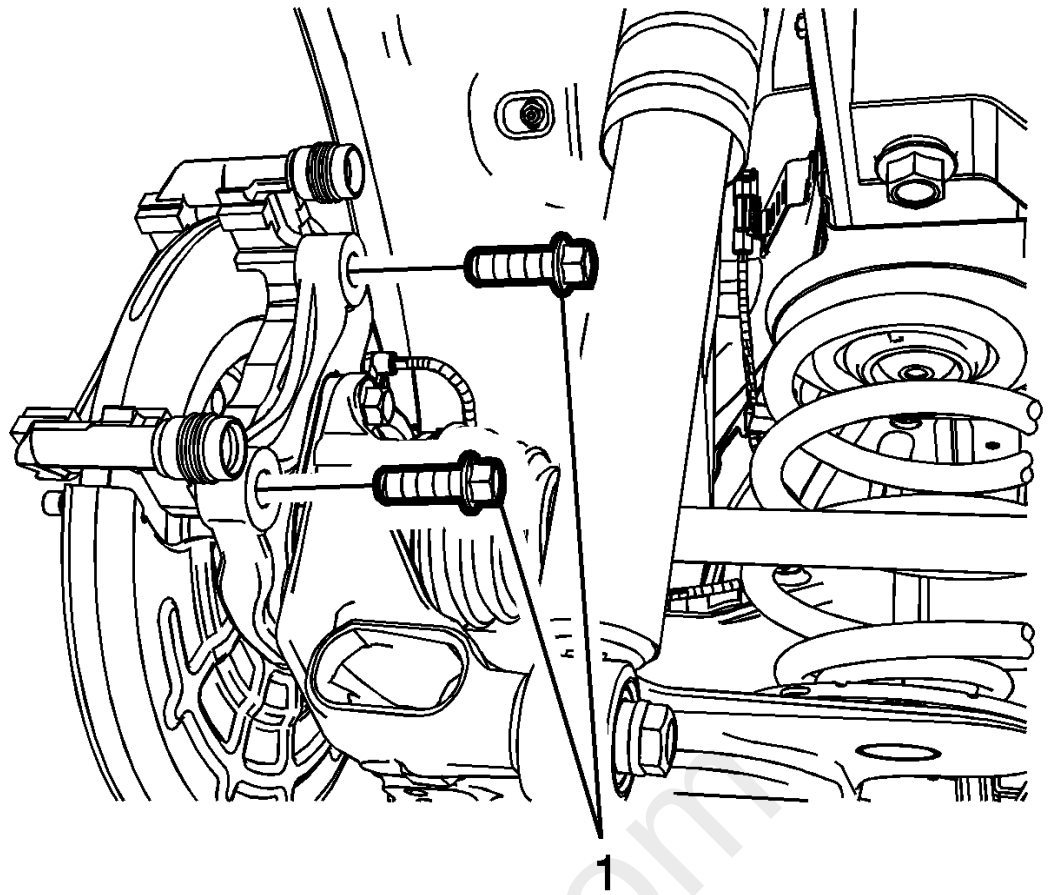


Fig. 58: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

2. Install new brake caliper bracket bolts (1) and tighten to 100 N.m (74 lb ft).

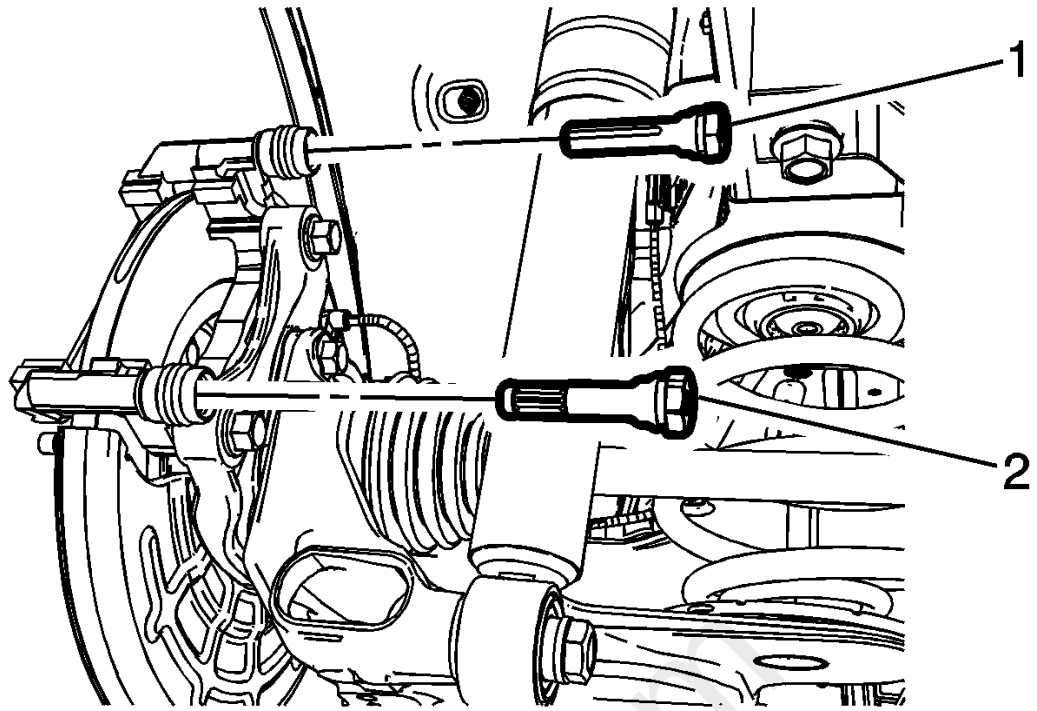


Fig. 59: Upper Brake Caliper Guide Pin
Courtesy of GENERAL MOTORS COMPANY

3. Install the upper brake caliper guide pin (1).

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 (2).

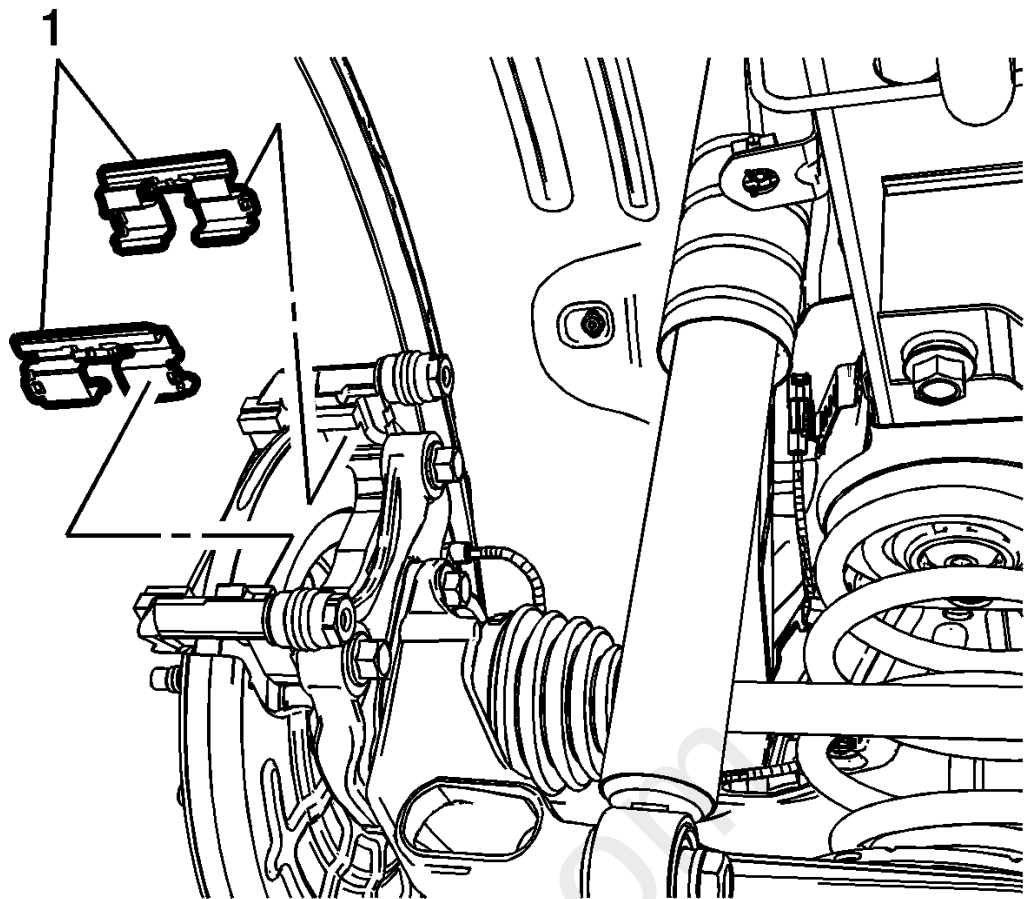


Fig. 60: Lower Brake Pad Springs

Courtesy of GENERAL MOTORS COMPANY

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

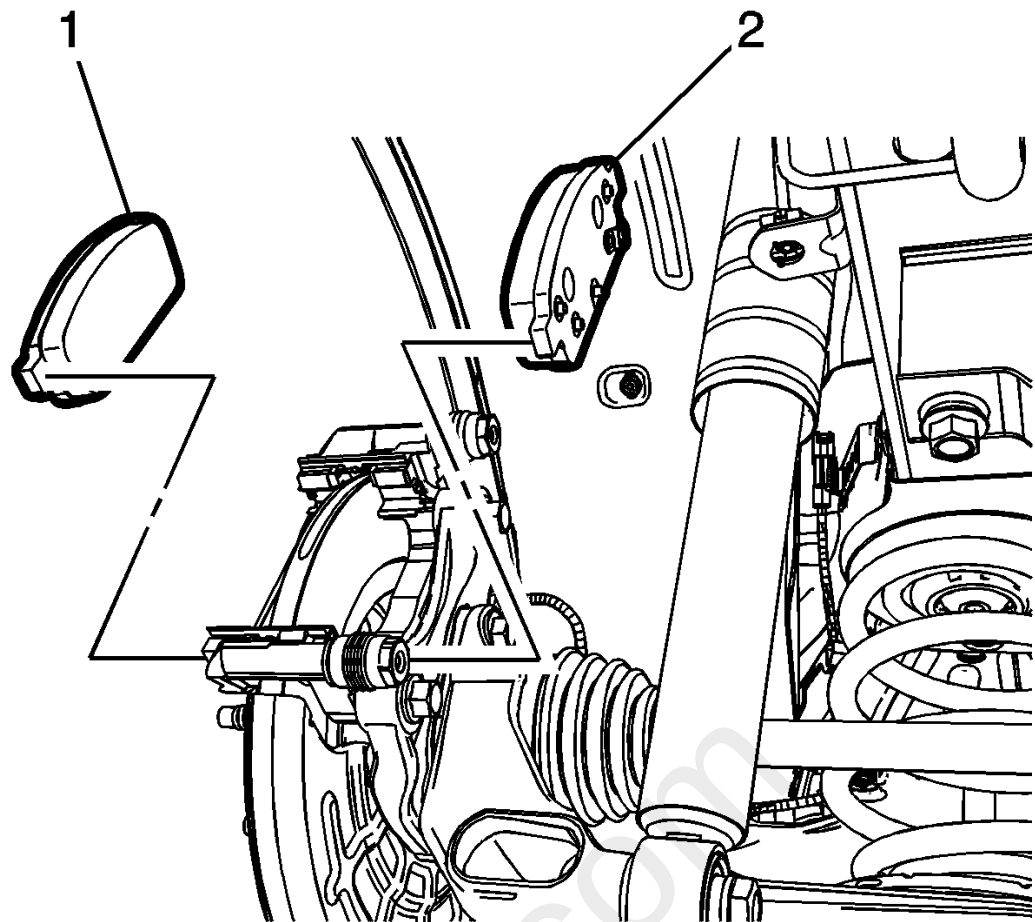


Fig. 61: Disc Brake Pads

Courtesy of GENERAL MOTORS COMPANY

6. Install the outer brake pad (1).

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

7. Install the inner brake pad (2).
8. Install the rear brake caliper. Refer to [Rear Brake Caliper Replacement](#).
9. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#).

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](#).

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](#).

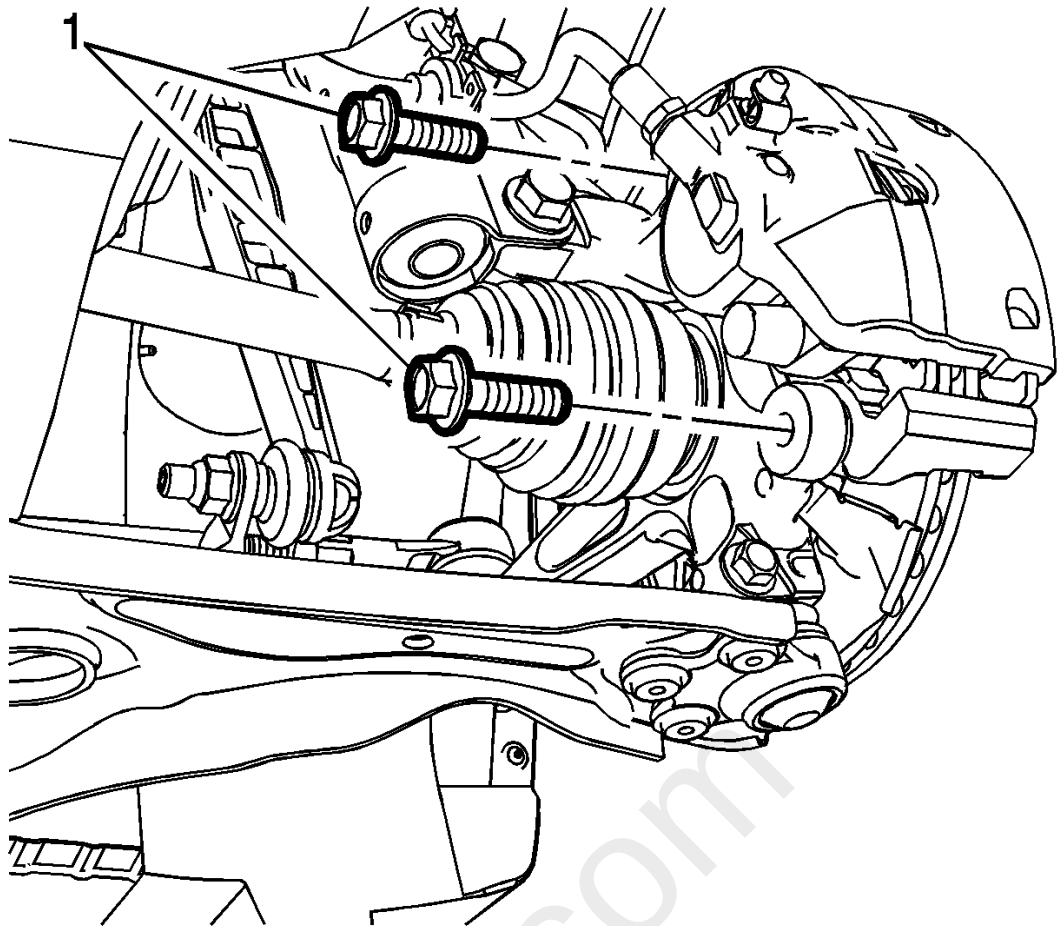


Fig. 62: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not reuse the brake caliper bracket bolts.

3. Remove and discard 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.

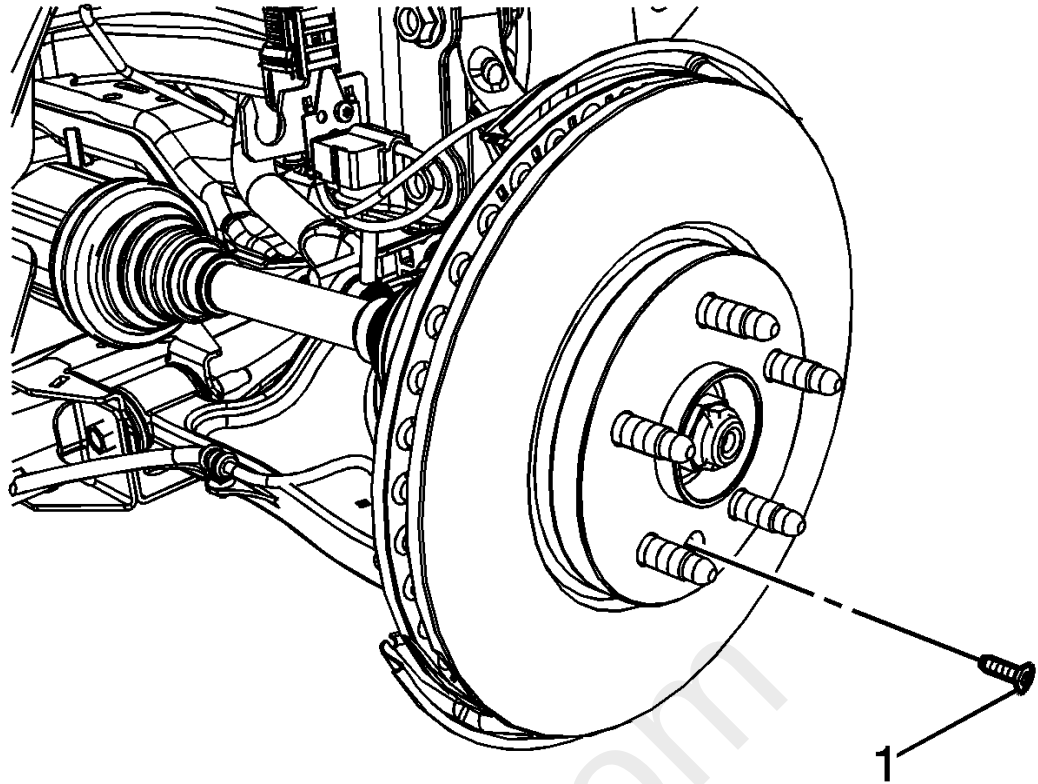


Fig. 63: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake rotor bolt (1).

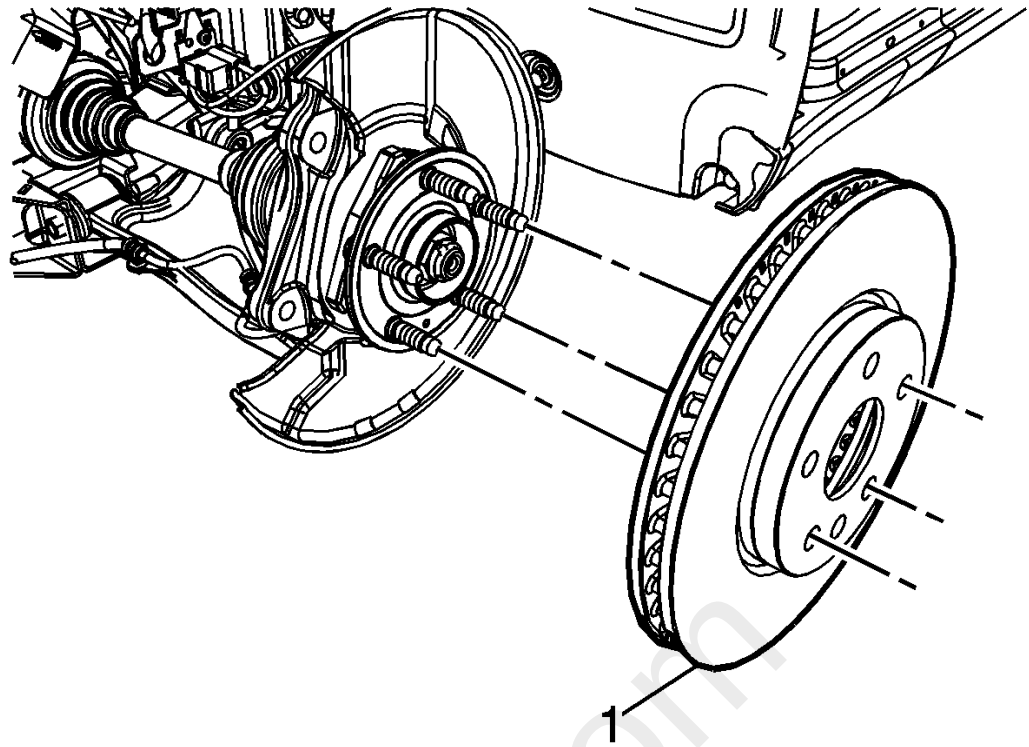


Fig. 64: Brake Rotor

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.

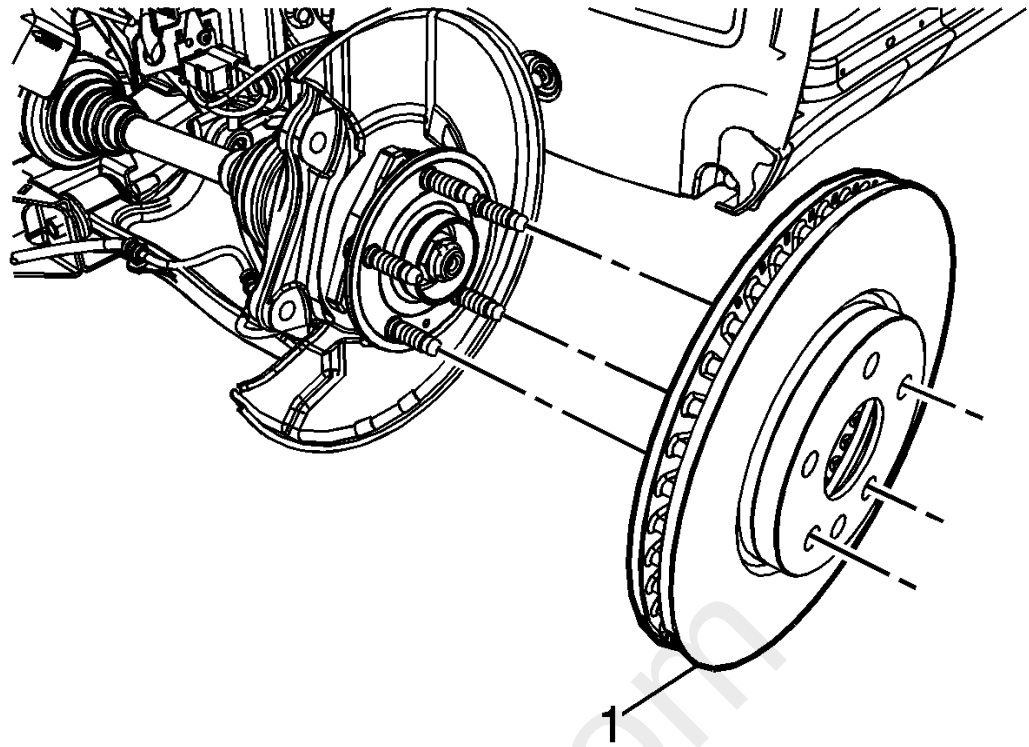


Fig. 65: Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

4. Install the brake rotor (1).

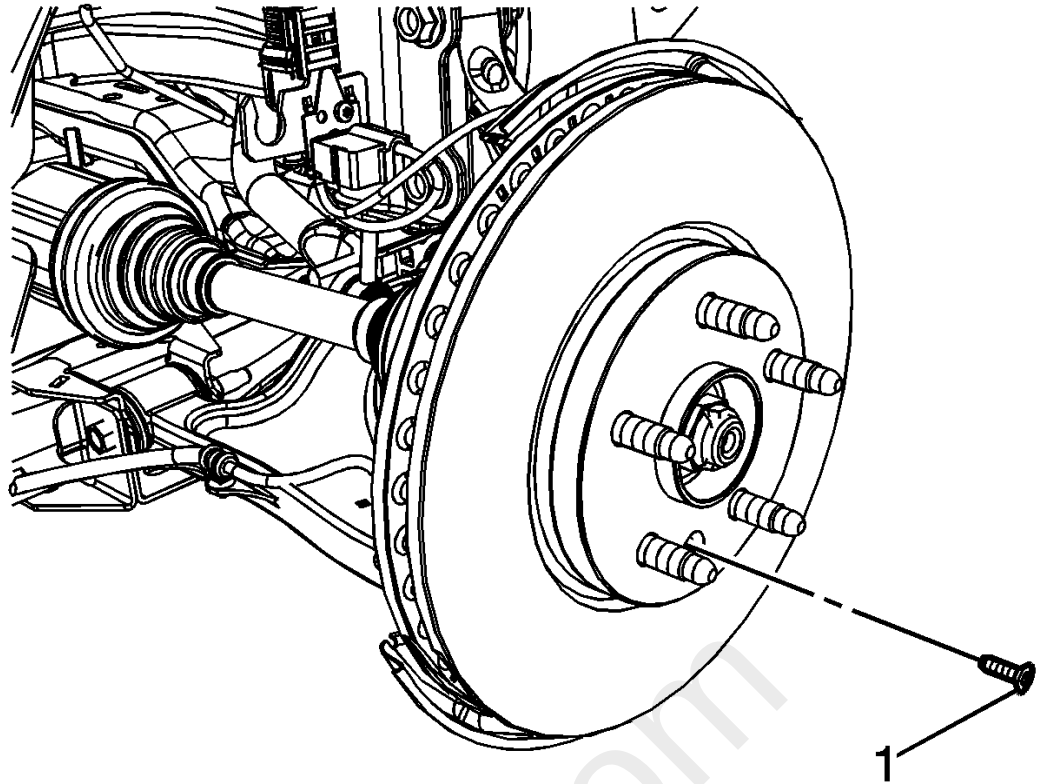


Fig. 66: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

5. Install the brake rotor bolt (1) and tighten to 9 N.m (80 lb in)
6. Position the brake caliper and bracket assembly over the brake rotor and to the steering knuckle.

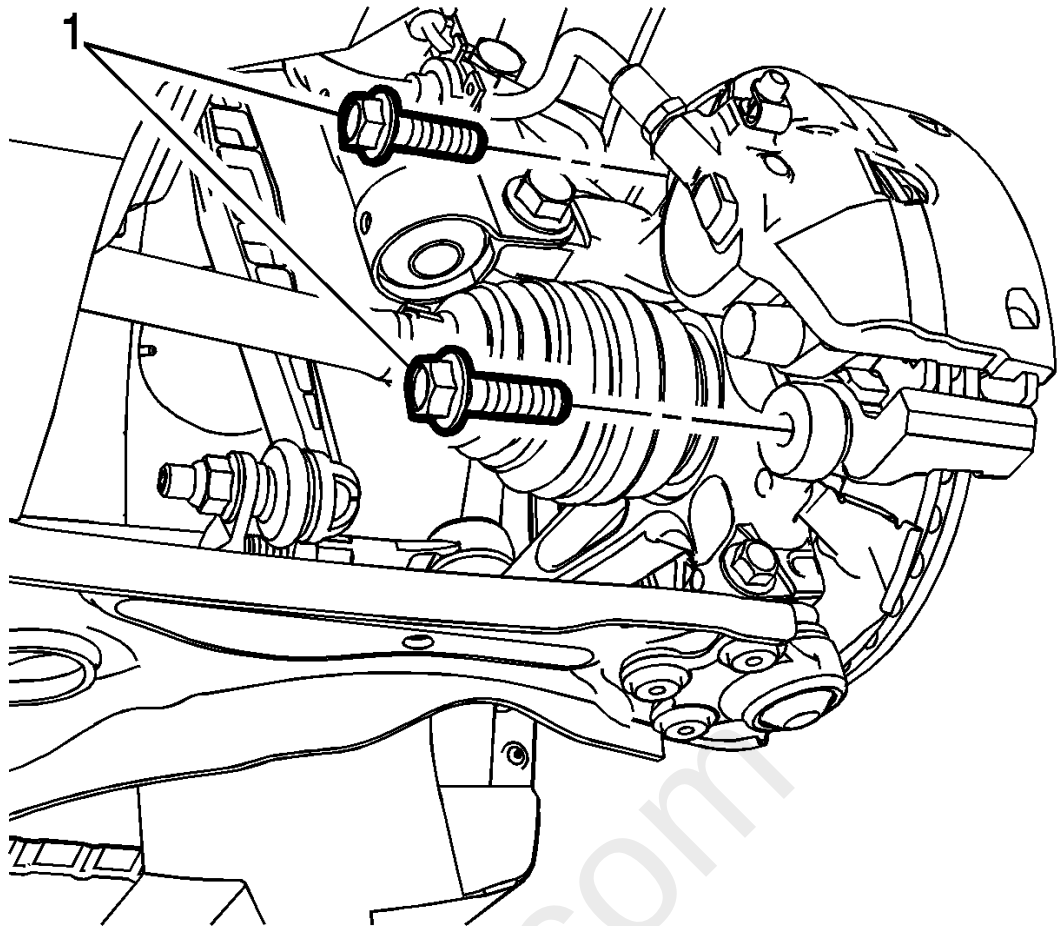


Fig. 67: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

7. Install new brake caliper bracket bolts (1) and tighten to 160 N.m (118 lb ft).
8. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
9. 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](#) .

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](#) .

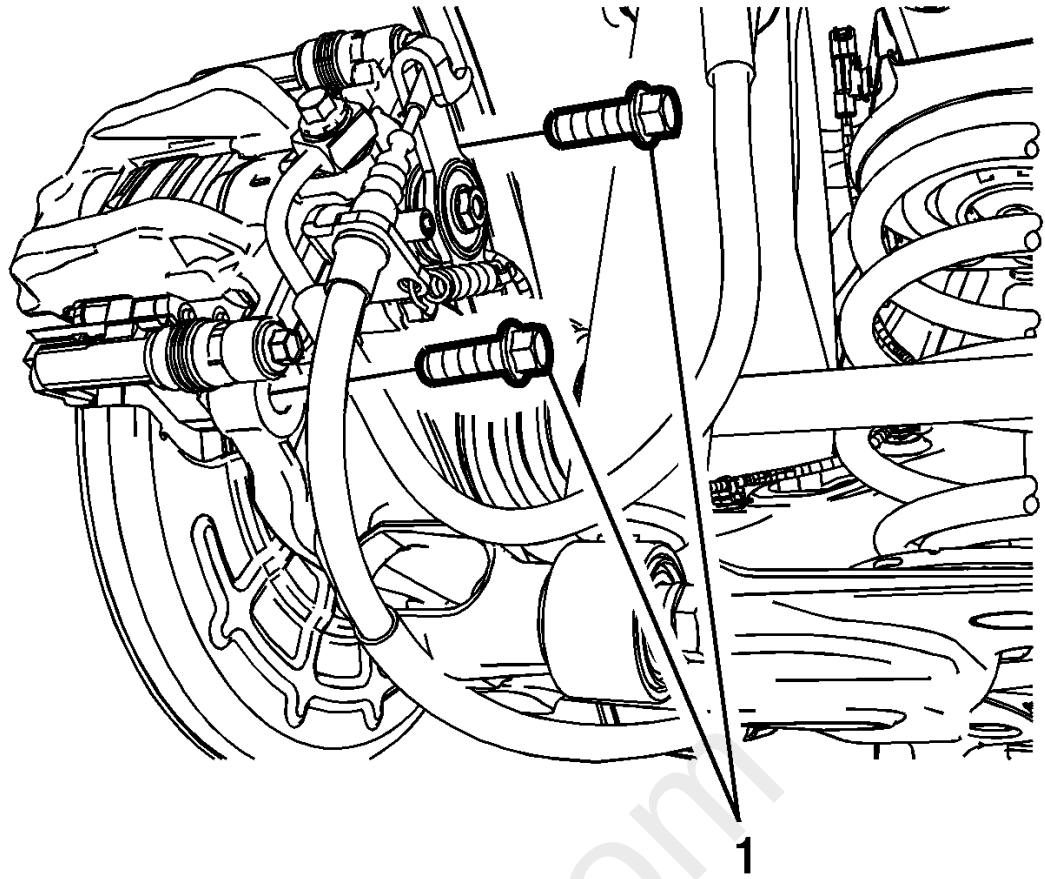


Fig. 68: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

NOTE: Do not reuse the brake caliper bracket bolts.

3. Remove and discard 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.

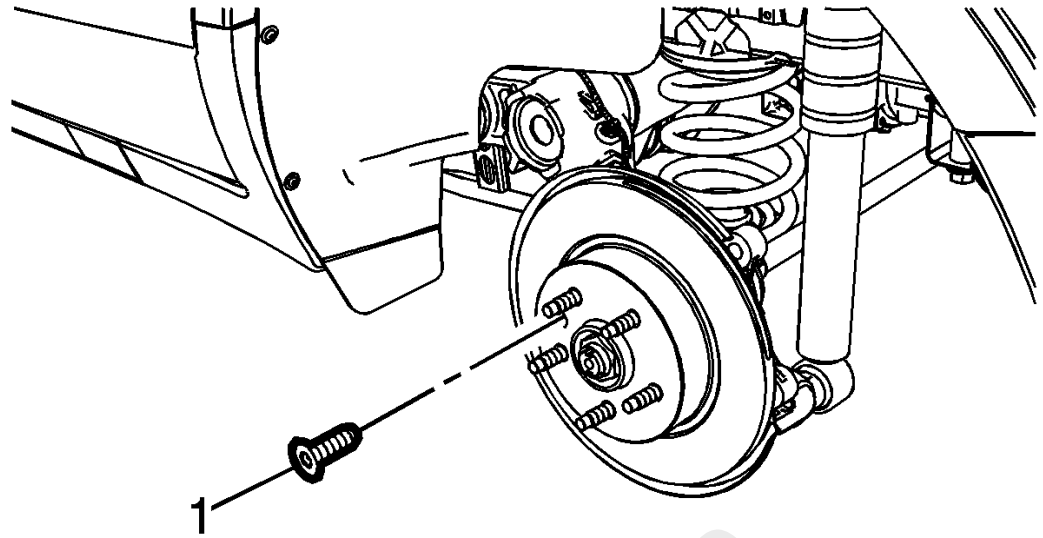


Fig. 69: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

5. Remove the brake rotor bolt (1).

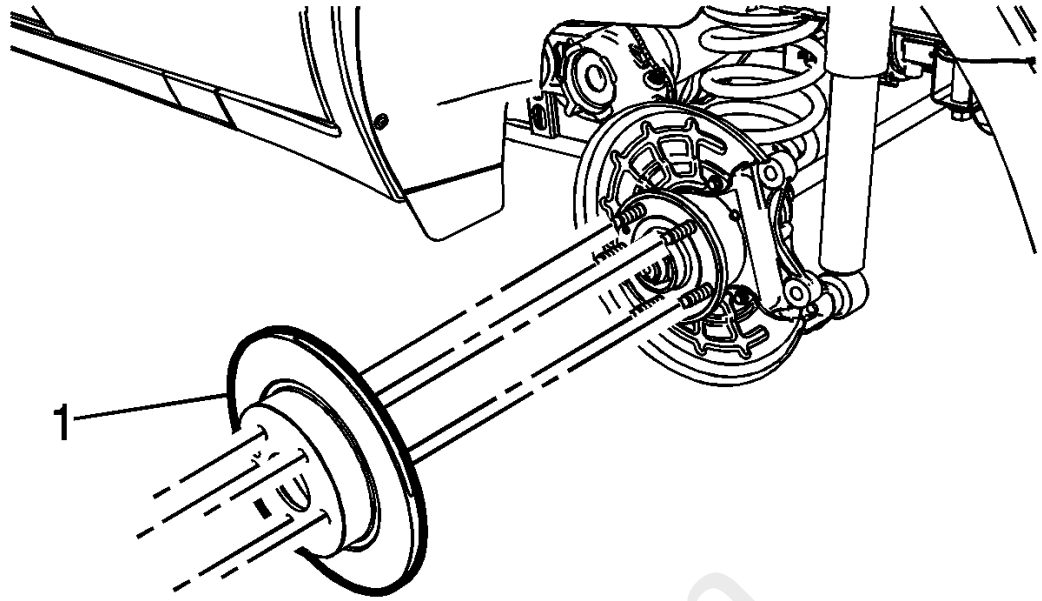


Fig. 70: Brake Rotor

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.

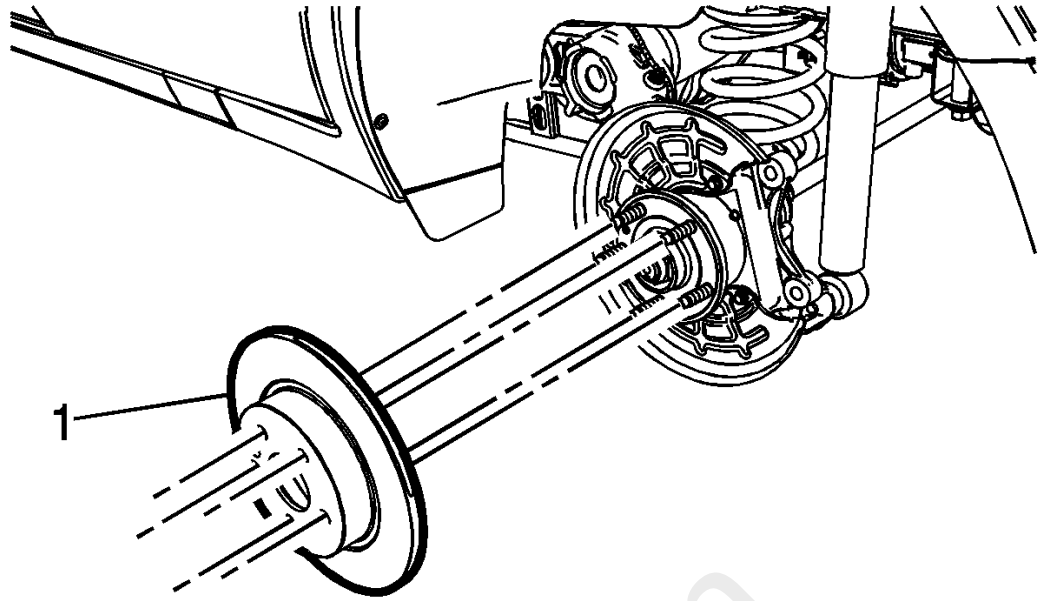


Fig. 71: Brake Rotor

Courtesy of GENERAL MOTORS COMPANY

4. Install the brake rotor (1).

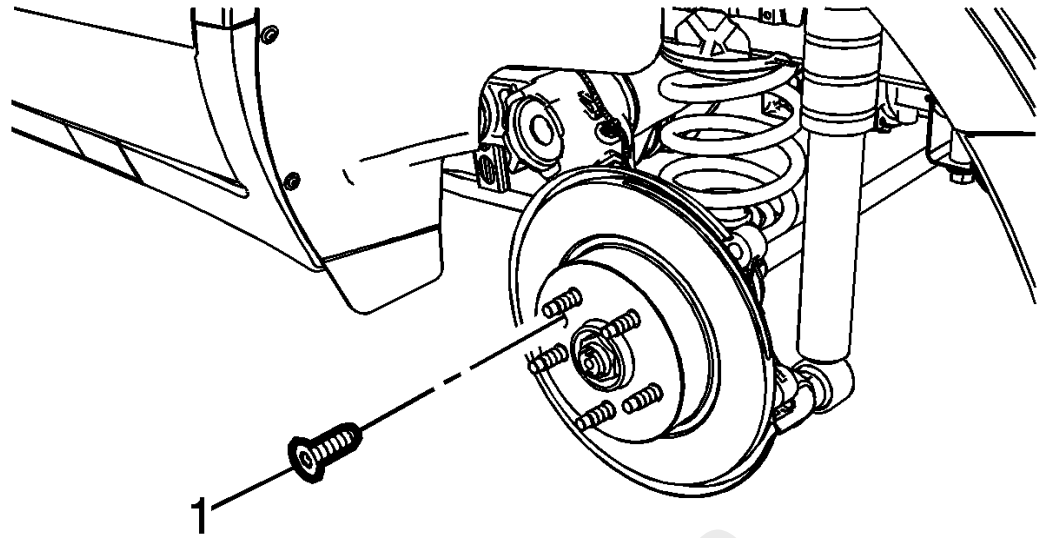


Fig. 72: Brake Rotor Bolt

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to **Fastener Caution** .

5. Install the brake rotor bolt (1) and tighten to 9 N.m (80 lb in).
6. Position the brake caliper and bracket assembly over the brake rotor and to the suspension knuckle.

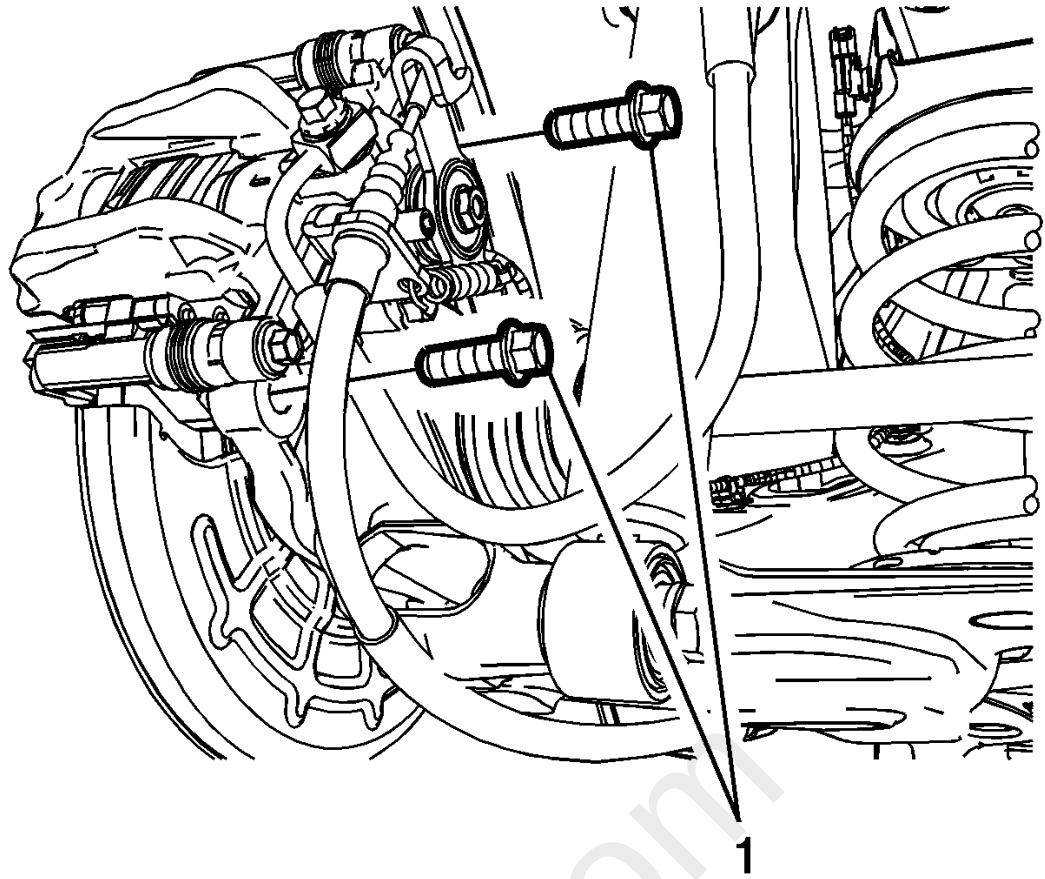


Fig. 73: Brake Caliper Bracket Bolts

Courtesy of GENERAL MOTORS COMPANY

7. Install new brake caliper bracket bolts (1) and tighten to 100 N.m (74 lb ft).
8. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
9. 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 front tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .
3. Remove the front brake rotor. Refer to [Front Brake Rotor Replacement](#).

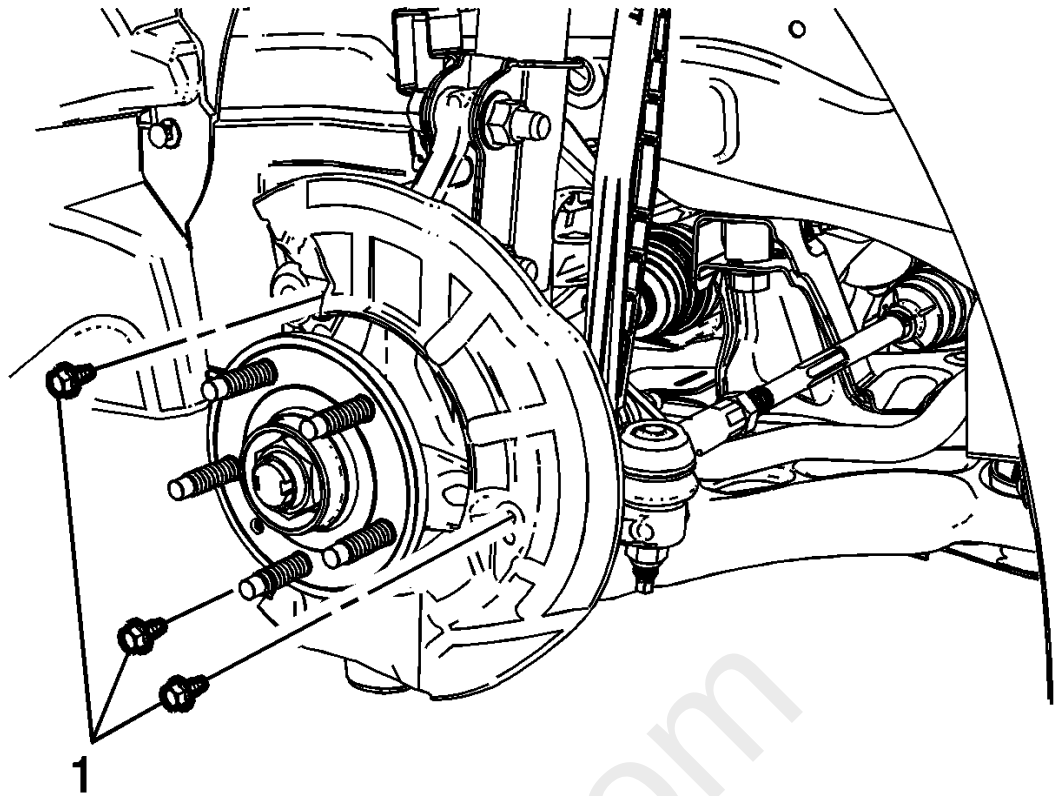


Fig. 74: Front Brake Shield Bolts

Courtesy of GENERAL MOTORS COMPANY

4. Remove the front brake shield bolts (1).

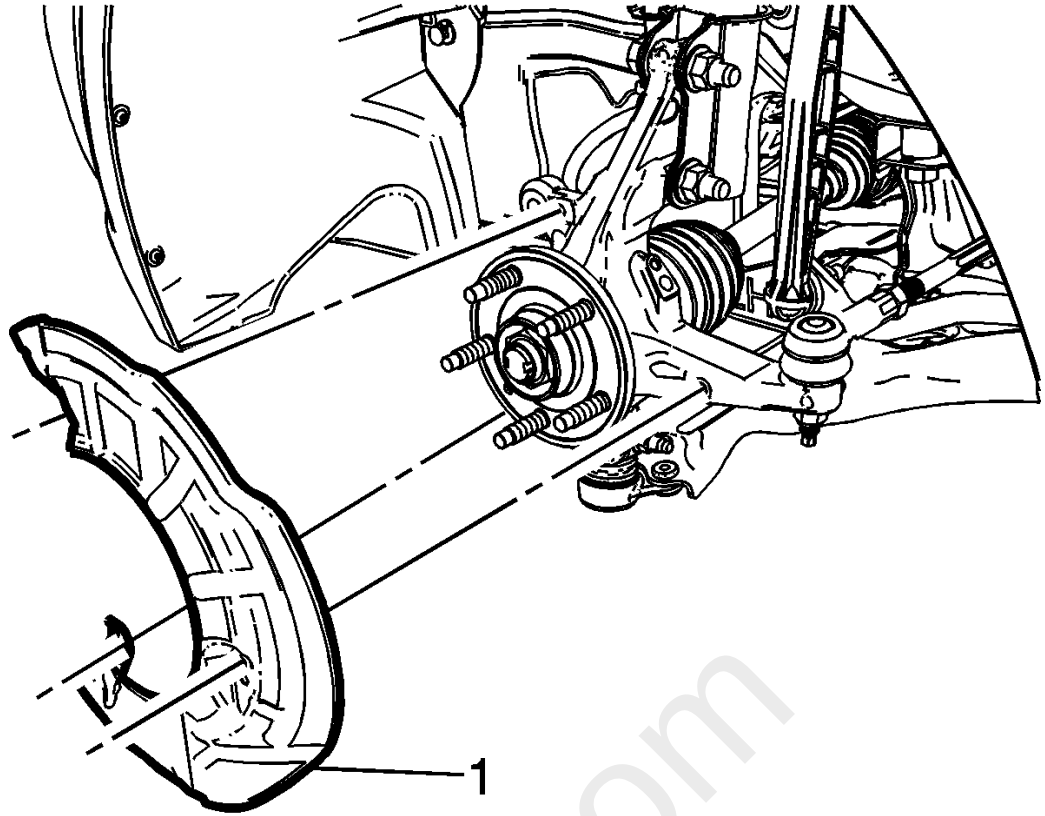


Fig. 75: Front Brake Shield

Courtesy of GENERAL MOTORS COMPANY

5. Remove the front brake shield (1).

Installation Procedure

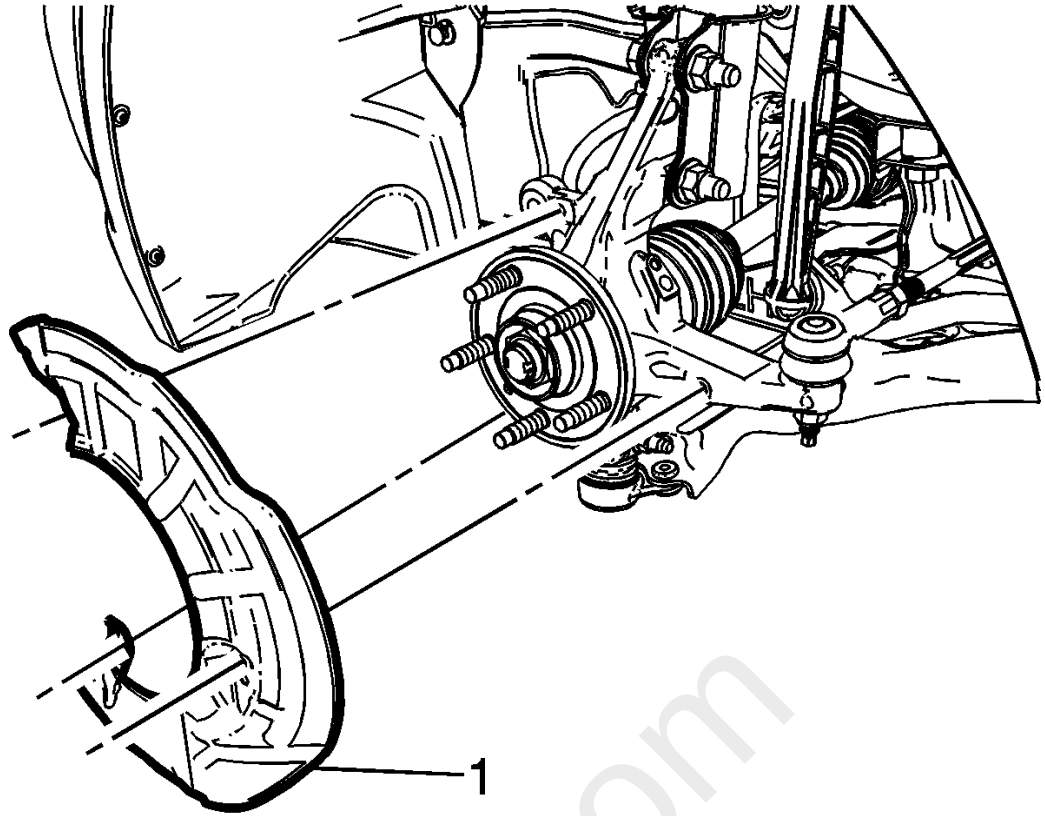


Fig. 76: Front Brake Shield

Courtesy of GENERAL MOTORS COMPANY

1. Install the front brake shield (1).

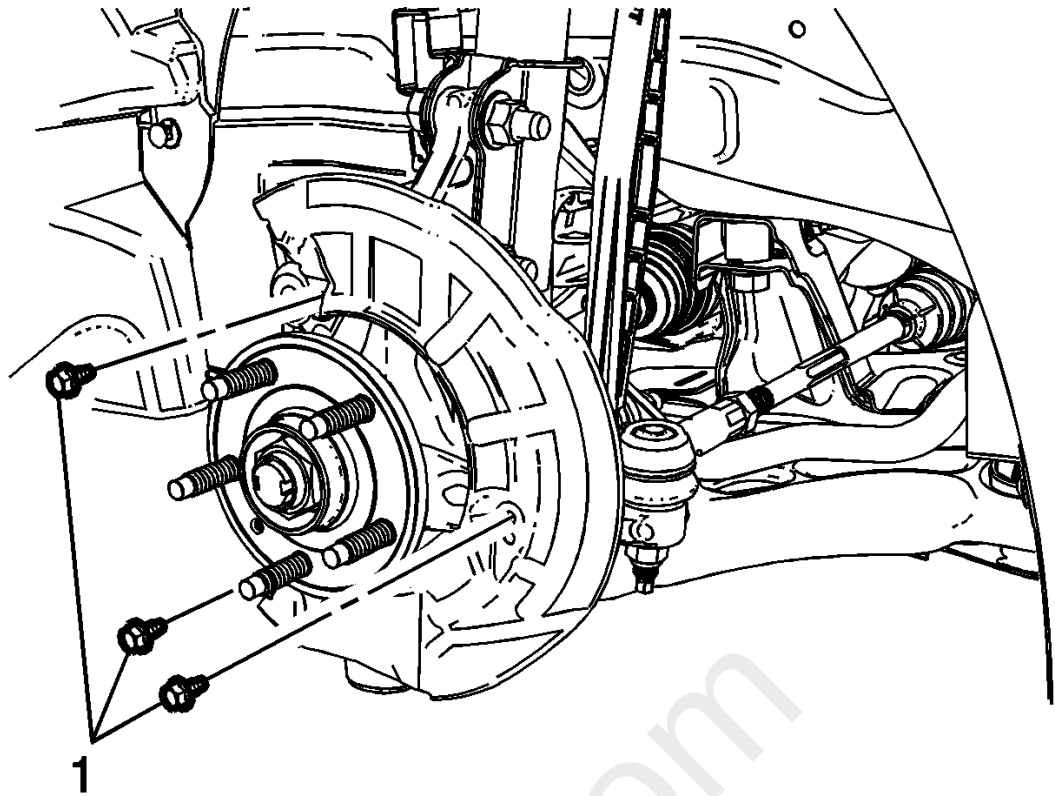


Fig. 77: Front Brake Shield Bolts

Courtesy of GENERAL MOTORS COMPANY

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

2. Install the front brake shield bolts (1) and tighten to 9 N.m (80 lb in).
3. Install the front brake rotor. Refer to [Front Brake Rotor Replacement](#).
4. Install the tire and wheel assembly. Refer to [Tire and Wheel Removal and Installation](#) .

REAR BRAKE SHIELD REPLACEMENT (ALL WHEEL DRIVE)

Removal Procedure

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

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

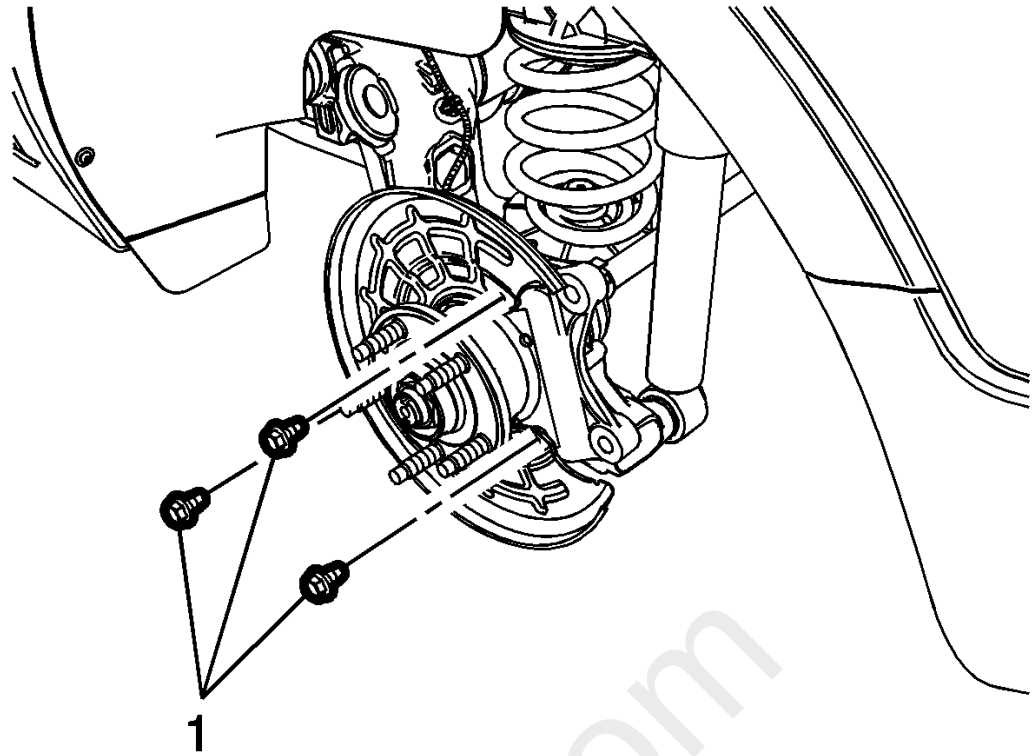


Fig. 78: Rear Brake Shield Bolts
Courtesy of GENERAL MOTORS COMPANY

4. Remove the rear brake shield bolts (1).

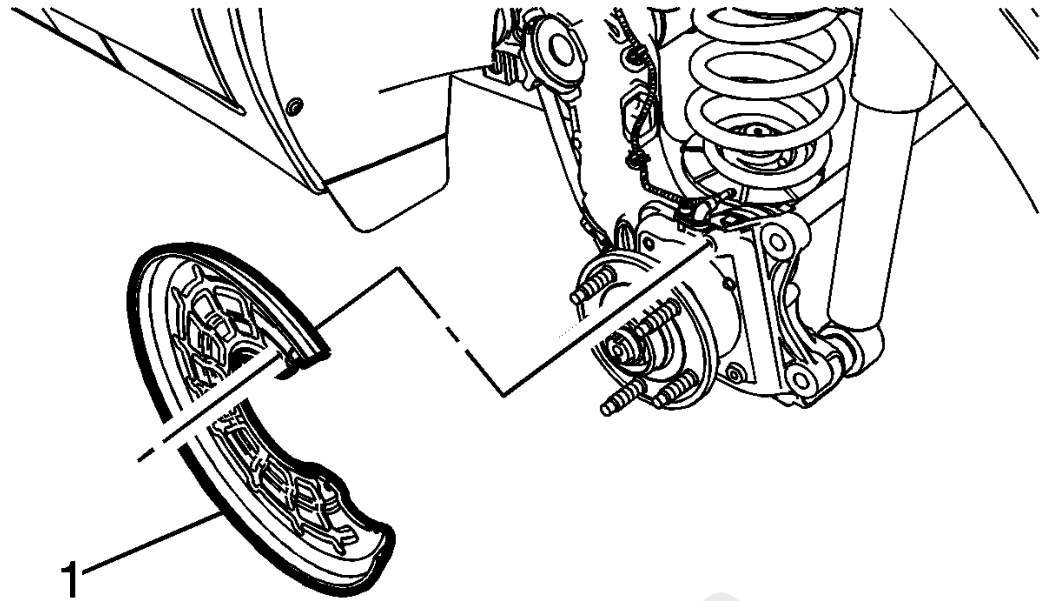


Fig. 79: Rear Brake Shield

Courtesy of GENERAL MOTORS COMPANY

5. Remove the rear brake shield (1).

Installation Procedure

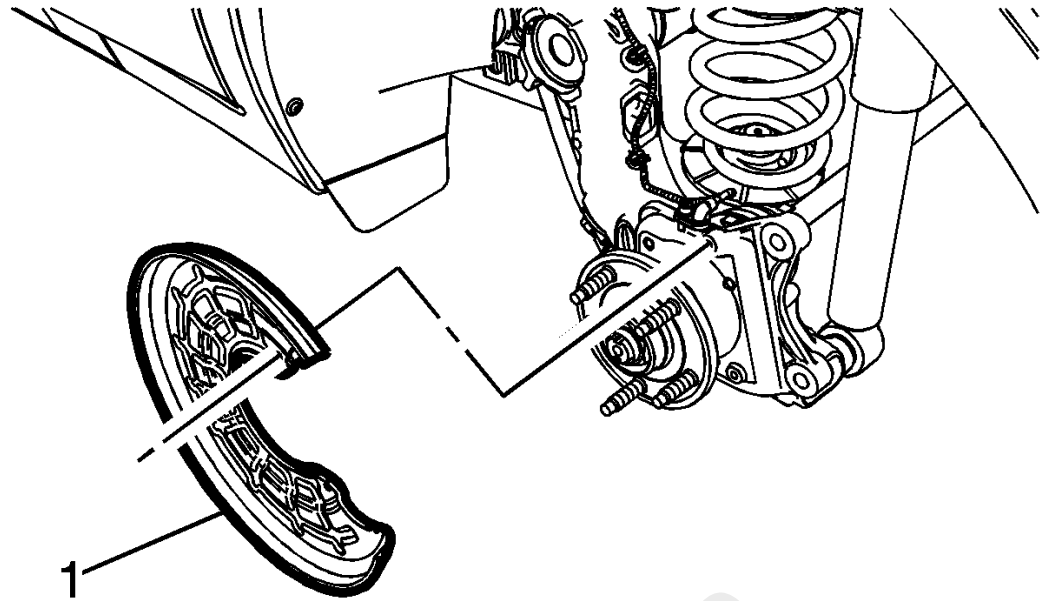


Fig. 80: Rear Brake Shield

Courtesy of GENERAL MOTORS COMPANY

1. Install the rear brake shield (1).

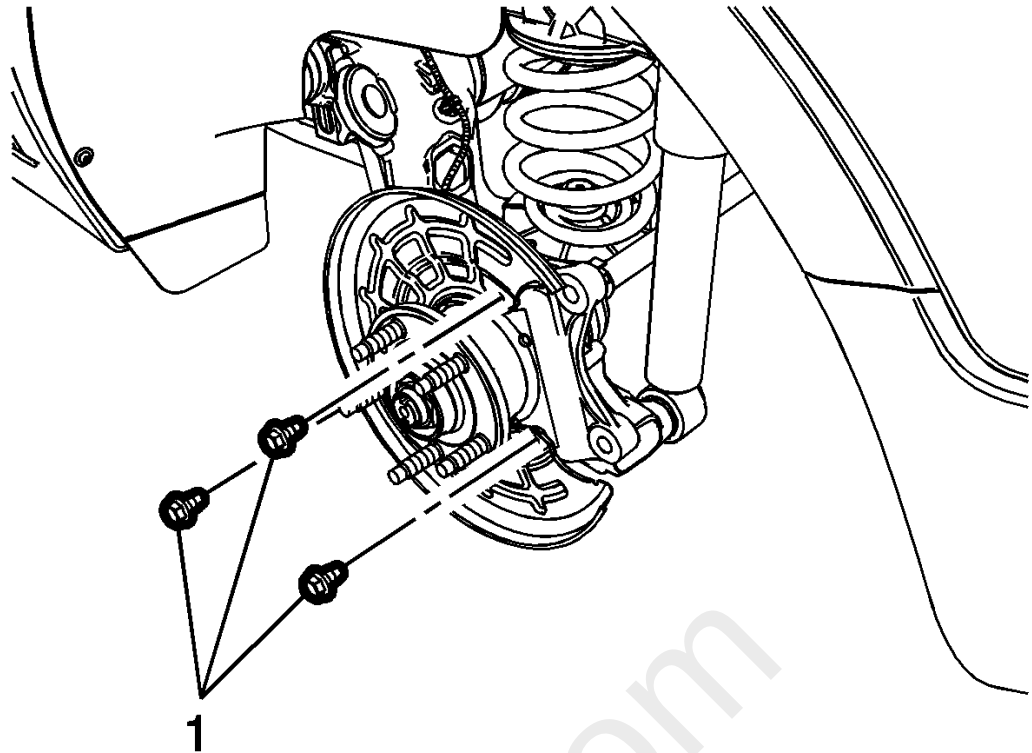


Fig. 81: Rear Brake Shield Bolts

Courtesy of GENERAL MOTORS COMPANY

CAUTION: Refer to Fastener Caution .

2. Install the rear brake shield bolts (1) and tighten to 9 N.m (80 lb in).
3. Install the rear brake rotor. Refer to Rear Brake Rotor Replacement.
4. Install the rear tire and wheel assembly. Refer to Tire and Wheel Removal and Installation .

REAR BRAKE SHIELD REPLACEMENT (FRONT WHEEL DRIVE)

Removal Procedure

WARNING: Brake Dust Warning

1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Remove Rear Brake Rotor - Rear Brake Rotor Replacement

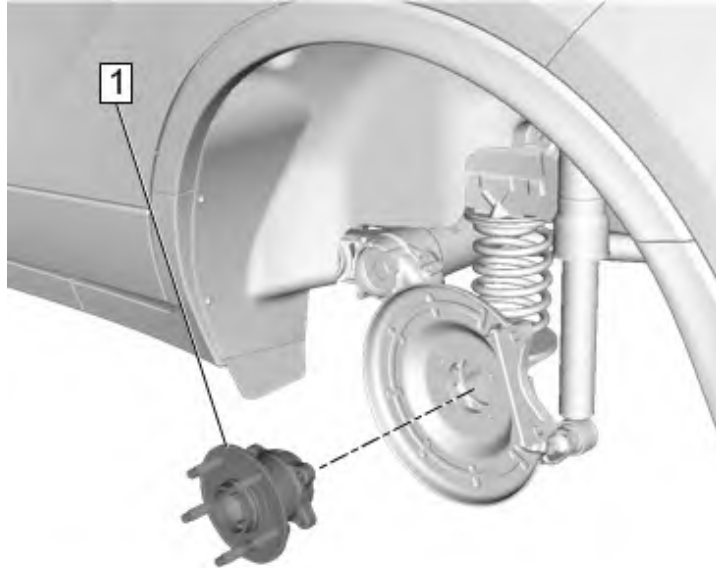


Fig. 82: Wheel Bearing and Hub Assembly
Courtesy of GENERAL MOTORS COMPANY

3. Remove Rear Wheel Bearing and Hub Assembly (1) - **Rear Wheel Bearing and Hub Replacement (With Drum Brakes)** **Rear Wheel Bearing and Hub Replacement (With Disc Brakes)**.

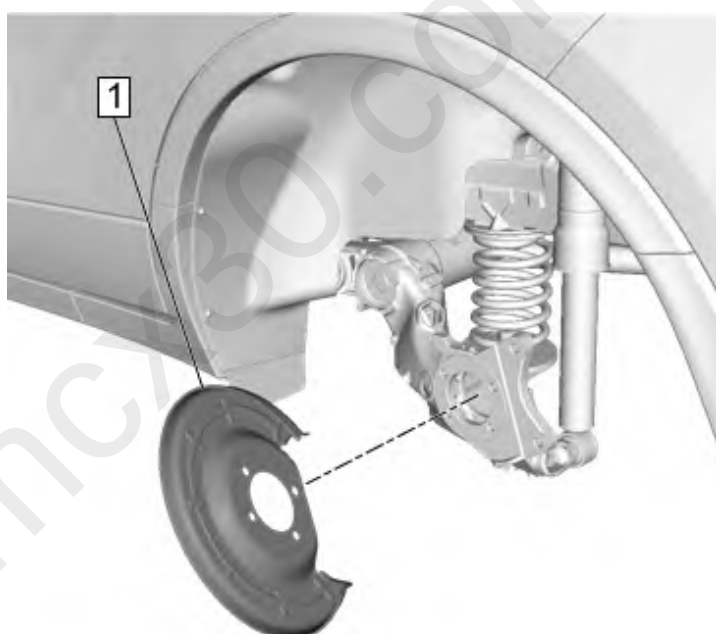


Fig. 83: Rear Brake Shield
Courtesy of GENERAL MOTORS COMPANY

4. Remove Rear Brake Shield (1)

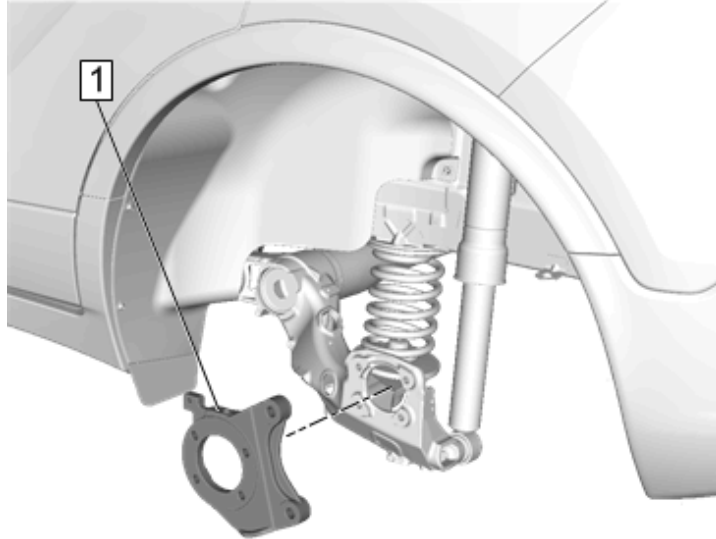


Fig. 84: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

5. Remove Brake Caliper Bracket (1)

Installation Procedure

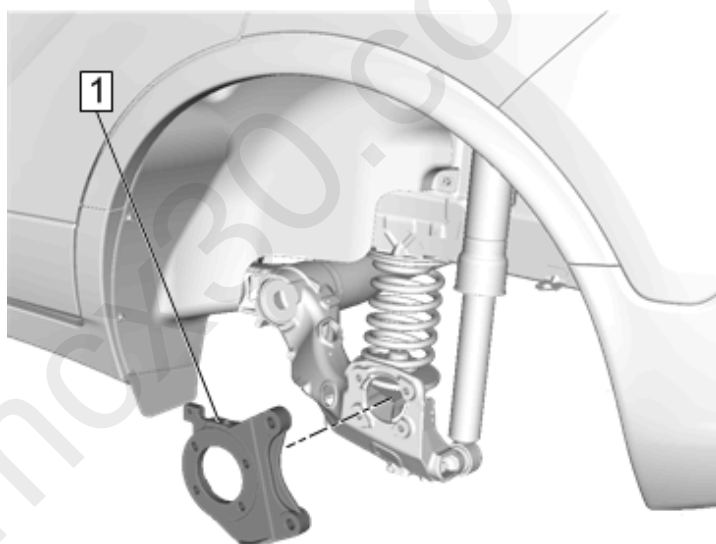


Fig. 85: Brake Caliper Bracket

Courtesy of GENERAL MOTORS COMPANY

1. Install Brake Caliper Bracket (1)

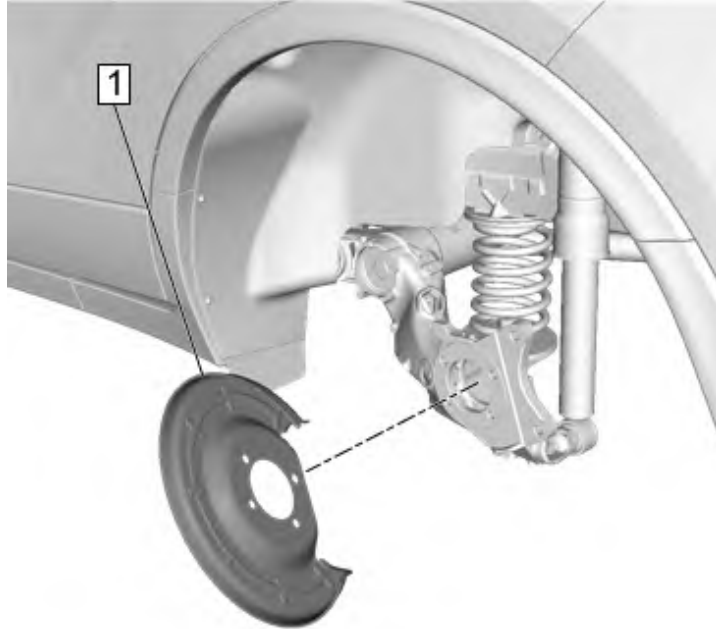


Fig. 86: Rear Brake Shield

Courtesy of GENERAL MOTORS COMPANY

2. Install Rear Brake Shield (1)

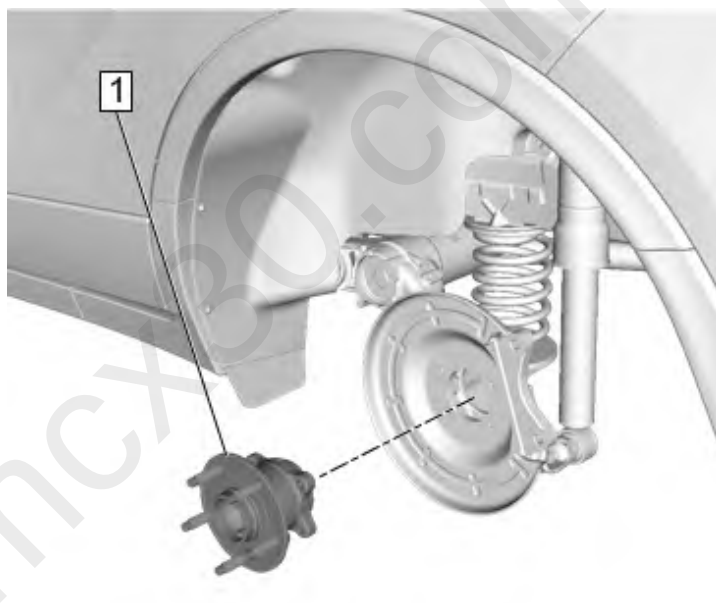


Fig. 87: Wheel Bearing and Hub Assembly

Courtesy of GENERAL MOTORS COMPANY

3. Install Rear Wheel Bearing and Hub Assembly (1)- [Rear Wheel Bearing and Hub Replacement \(With Drum Brakes\)](#) [Rear Wheel Bearing and Hub Replacement \(With Disc Brakes\)](#)
4. Install Rear Brake Rotor- [Rear Brake Rotor Replacement](#)

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. Refer to [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). Refer to [Brake Rotor Assembled Lateral Runout Measurement](#).

Review the following acceptable methods for bringing the brake disc assembled LRO to within specifications. Determine which method to use for the 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. Refer to [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. Refer to [Brake Rotor Assembled Lateral Runout Correction - On Vehicle Lathe](#).

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

Special Tools

CH-45101-100 Conical Brake Rotor Washers

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

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

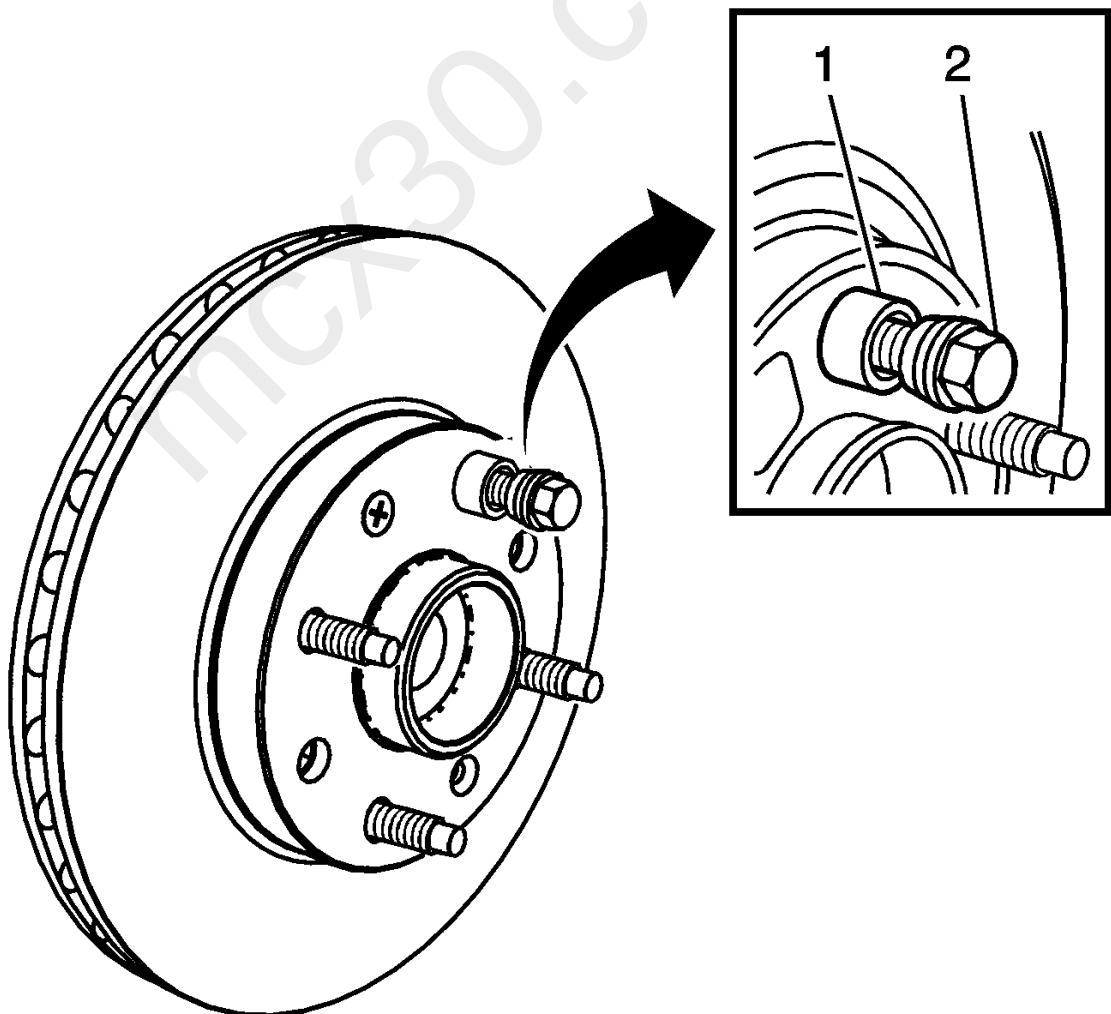


Fig. 88: One Lug Nut & Conical Brake Rotor Washers
Courtesy of GENERAL MOTORS COMPANY

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. Refer to [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). Refer to [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.

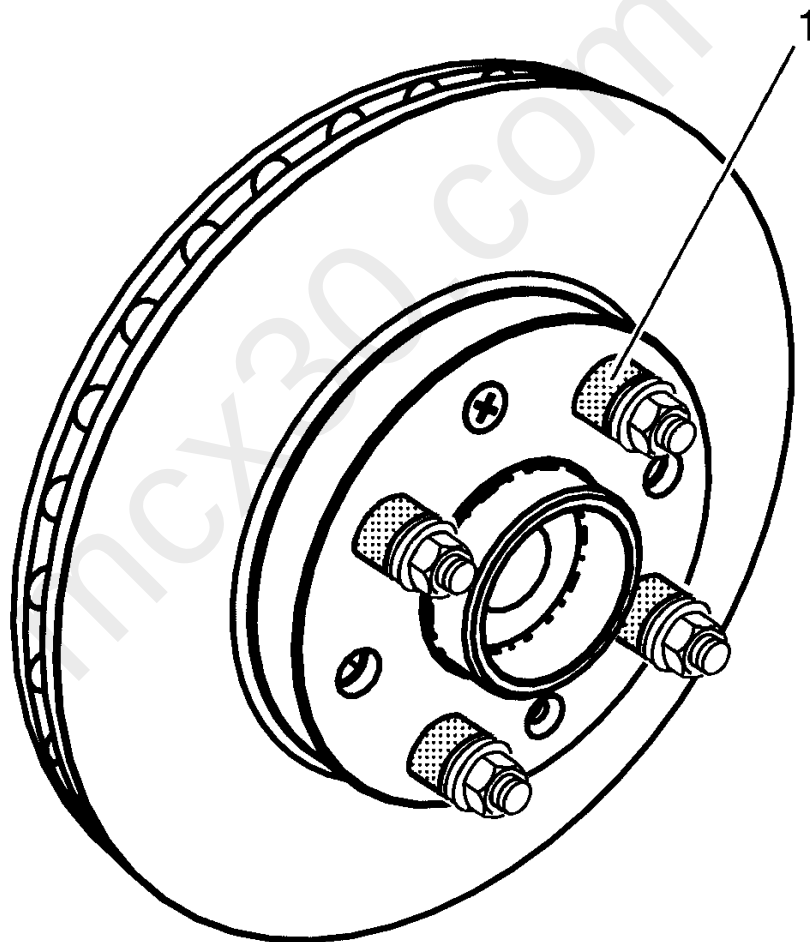


Fig. 89: Lug Nuts And Conical Brake Rotor Washers

Courtesy of GENERAL MOTORS COMPANY

6. Install the remaining **CH-45101-100** conical brake rotor washers and lug nuts onto the wheel studs (1) and tighten the nuts firmly by hand in the tightening sequence.
7. Tighten the lug nuts in sequence, in order to properly secure the rotor. Refer to [Tire and Wheel Removal and Installation](#).
8. Measure the assembled LRO of the brake rotor. Refer to [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 washers and the lug nuts.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - ON VEHICLE LATHE

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. Refer to [**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). Refer to [**Brake Rotor Assembled Lateral Runout Measurement**](#).**

1. Ensure that the brake caliper and brake 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 instructions.
5. Refinish the brake rotor, following the brake lathe manufacturers instructions.
6. After each successive cut, inspect the brake rotor thickness. Refer to [**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 brake 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 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. Refer to [**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 brake 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-metallic 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

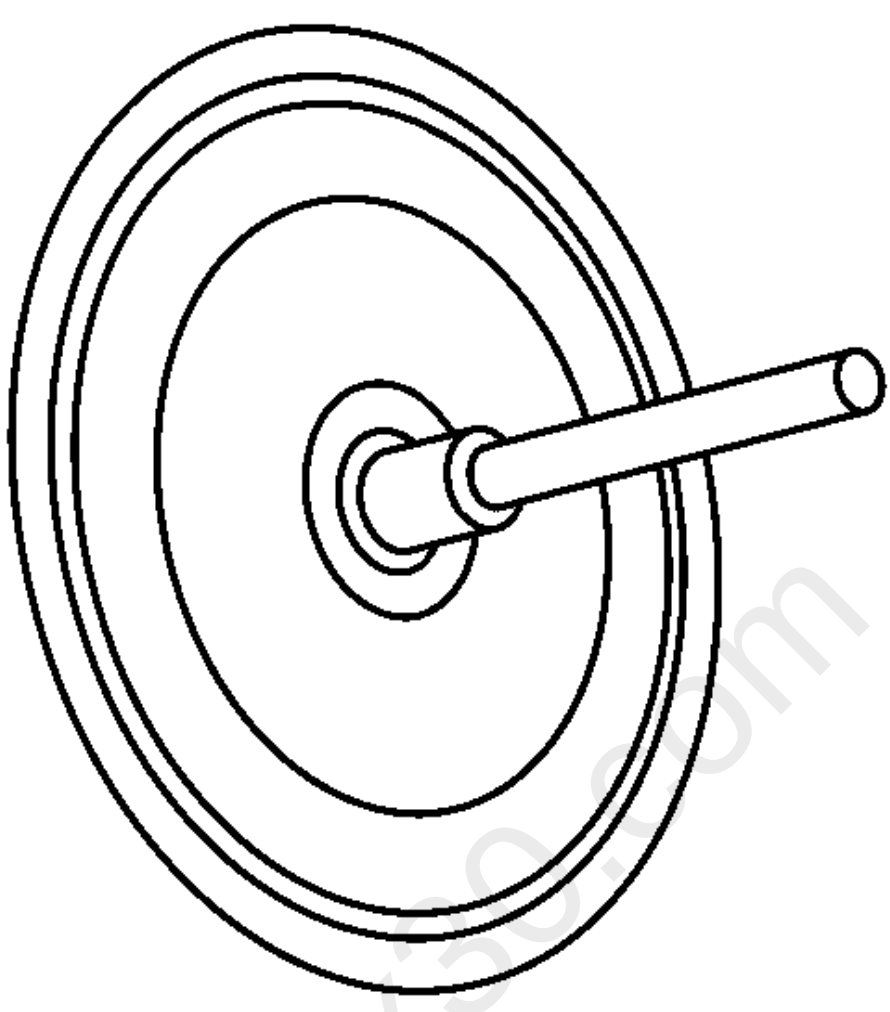
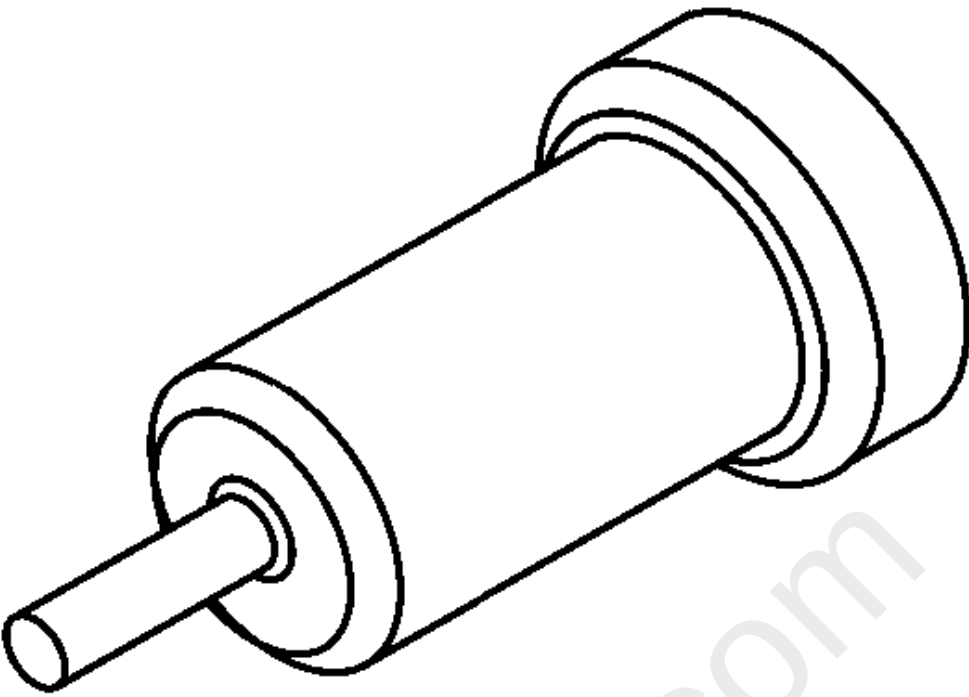
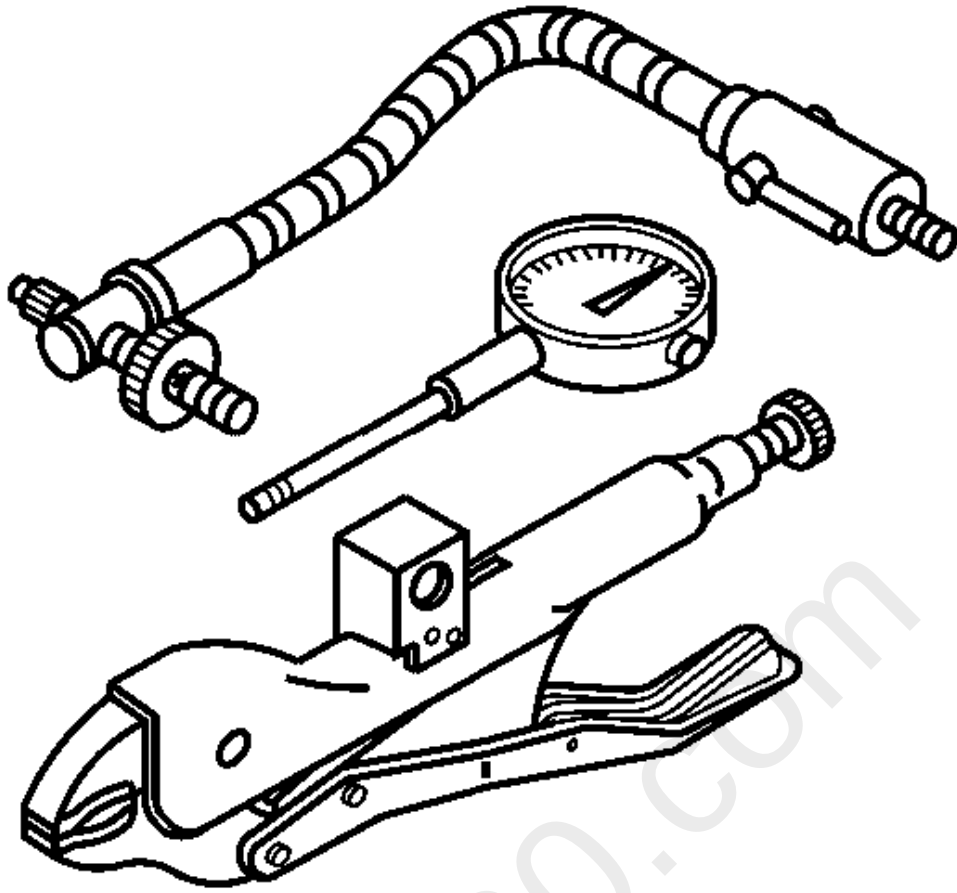
Illustration	Tool Number/Description
	CH-41013 J 41013 Rotor Resurfacing Kit

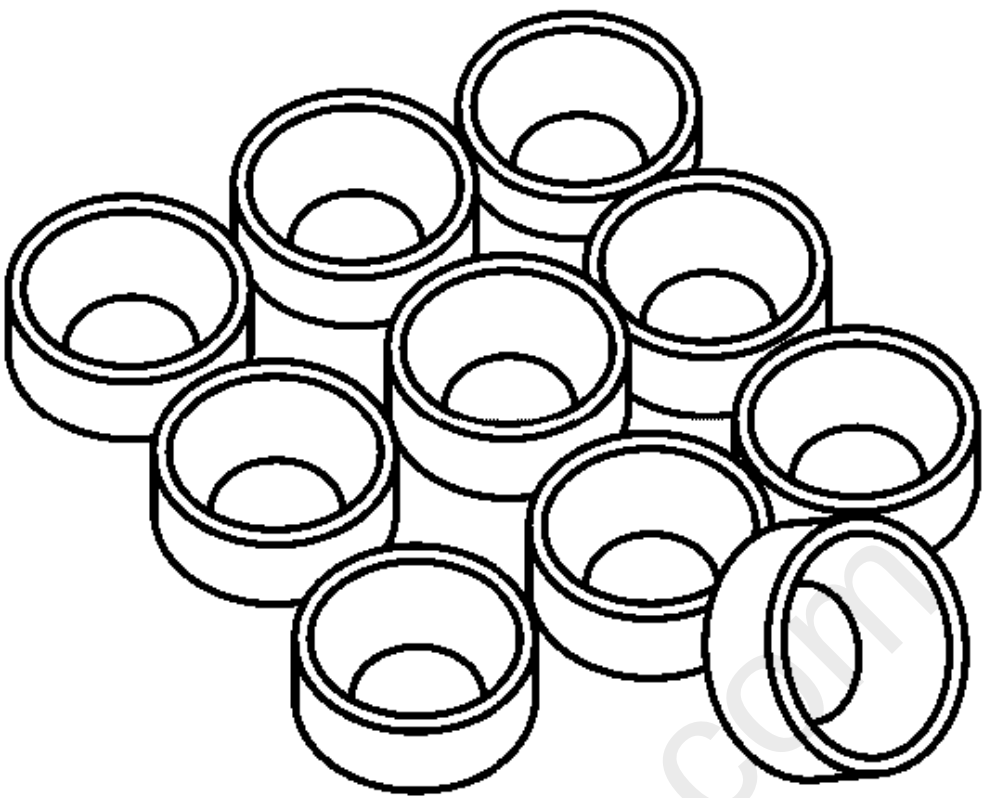
Illustration	Tool Number/Description
 A technical line drawing of a cylindrical wheel hub. It features a central shaft extending from the left. The hub has two flanges: a smaller one on the left and a larger one on the right. The drawing is oriented diagonally. A large, light gray watermark 'mcx30.com' is visible across the lower half of the page.	CH-42450-A J 42450-A Wheel Hub Resurfacing Kit

Illustration

Tool
Number/Description



CH-45101
J 45101
Hub and Wheel
Runout Gauge

Illustration	Tool Number/Description
	CH-45101-100 J 45101-100 Conical Brake Rotor Washers