

2006 Chevrolet HHR LT

2006 BRAKES Disc Brakes - HHR

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Disc Brakes - HHR

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Caliper Bleeder Valve	11 N.m	97 lb in
Brake Caliper Guide Pin Bolt	34 N.m	25 lb ft
Brake Caliper Mounting Bracket Bolt	115 N.m	85 lb ft
Brake Hose-to-Brake Caliper Bolt	48 N.m	35 lb ft

DISC BRAKE COMPONENT SPECIFICATIONS

Disc Brake Component Specifications

Application	Specification	
	Metric	English
Front Brakes J41/JM4		
• Brake Pad Lining Minimum Thickness	1.0 mm	0.039 in
• Brake Pad Lining Thickness - New	12.0 mm	0.472 in
• Brake Rotor Diameter	256.00 mm	10.079 in
• Brake Rotor Discard Thickness*	22.0 mm	0.87 in
• Brake Rotor Maximum Allowable Assembled Lateral Runout	0.06 mm	0.002 in
• Brake Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Brake Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
• Brake Rotor Minimum Allowable Thickness After Refinish	22.75 mm	0.896 in
• Brake Rotor Thickness - New	23.69 mm	0.933 in
Front Brakes JL9		
• Brake Rotor Diameter	296.00 mm	11.653 in
• Brake Rotor Discard Thickness*	22.8 mm	0.898 in
• Brake Rotor Maximum Allowable Assembled Lateral Runout	0.06 mm	0.002 in

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• Brake Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Brake Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
• Brake Rotor Minimum Allowable Thickness After Refinish	23.0 mm	0.906 in
• Brake Rotor Thickness - New	26.0 mm	1.023 in
Rear Brakes JL9		
• Brake Rotor Diameter	270.0 mm	10.630 in
• Brake Rotor Discard Thickness*	11.8 mm	0.465 in
• Brake Rotor Maximum Allowable Assembled Lateral Runout	0.06 mm	0.002 in
• Brake Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Brake Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
• Brake Rotor Minimum Allowable Thickness After Refinish	12.0 mm	0.472 in
• Brake Rotor Thickness - New	14.0 mm	0.551 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 minimum thickness specification.		

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - DISC BRAKES

Begin the disc brake system diagnosis with **Diagnostic Starting Point - Hydraulic Brakes** in Hydraulic Brakes. The use of the Diagnostic Starting Point will lead to the identification of the correct procedure for diagnosing the system and where the procedure is located.

BRAKE ROTOR THICKNESS MEASUREMENT

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

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to **Brake Caliper Replacement**.
2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.

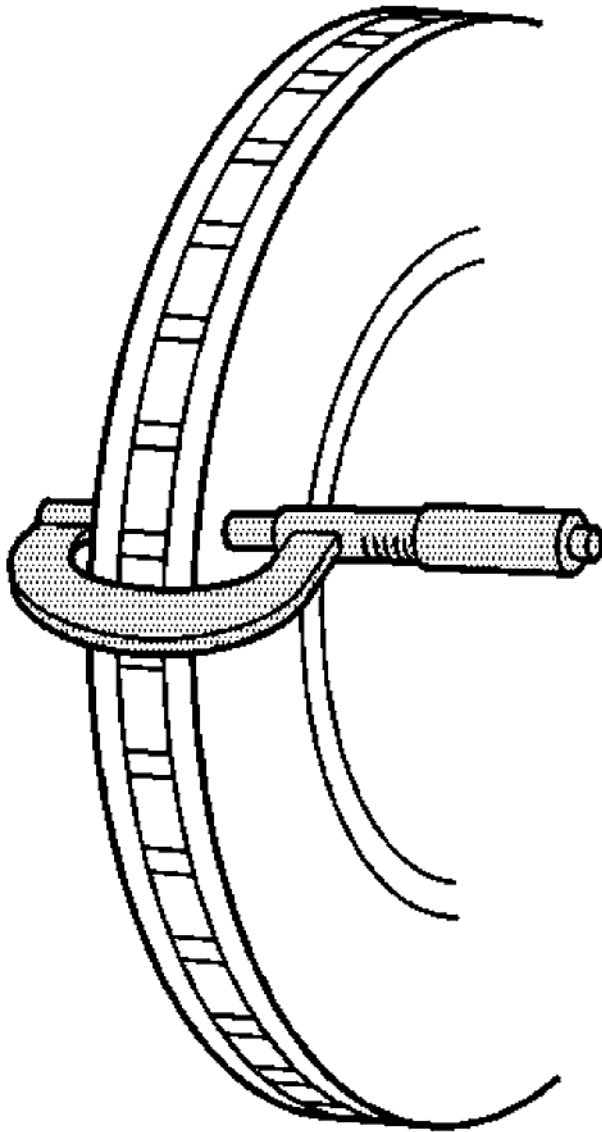


Fig. 1: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

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.

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

Specification - Front J41/JM4

- Brake rotor minimum allowable thickness after refinishing: 22.75 mm (0.896 in)
- Brake rotor discard thickness: 22.0 mm (0.87 in)

Specification - Front JL9

- Brake rotor minimum allowable thickness after refinishing: 23.0 mm (0.906 in)
 - Brake rotor discard thickness: 22.8 mm (0.898 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

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

IMPORTANT: 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 **Brake Pads Replacement**.
2. Clean the friction surfaces of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner.

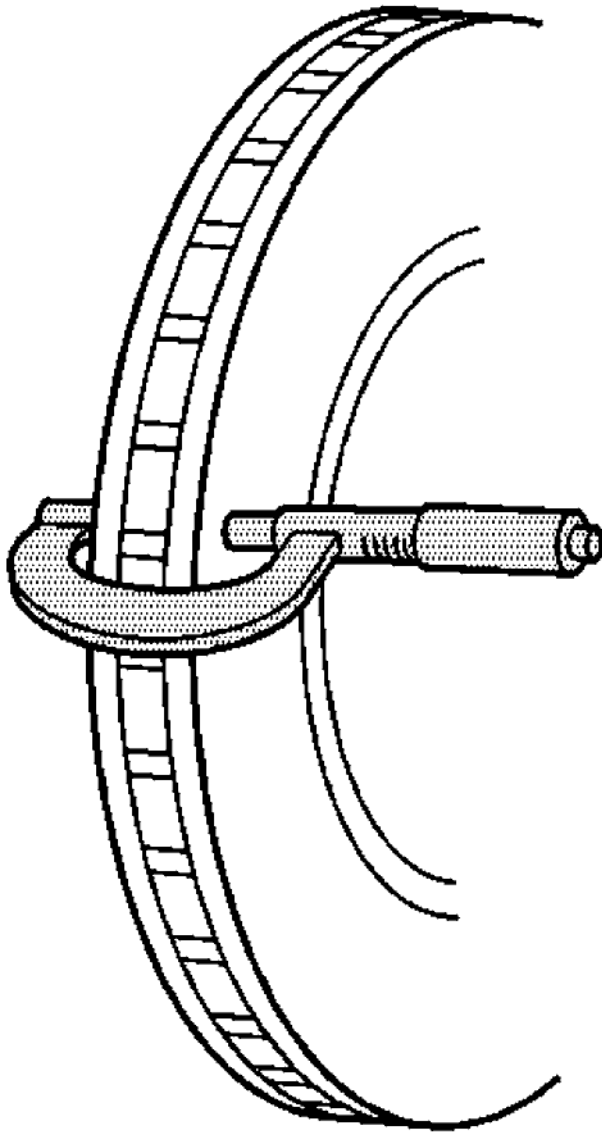


Fig. 2: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

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.

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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: 0.025 mm (0.001 in)

IMPORTANT: 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

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

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to **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 listed, the rotor requires refinishing or replacement.

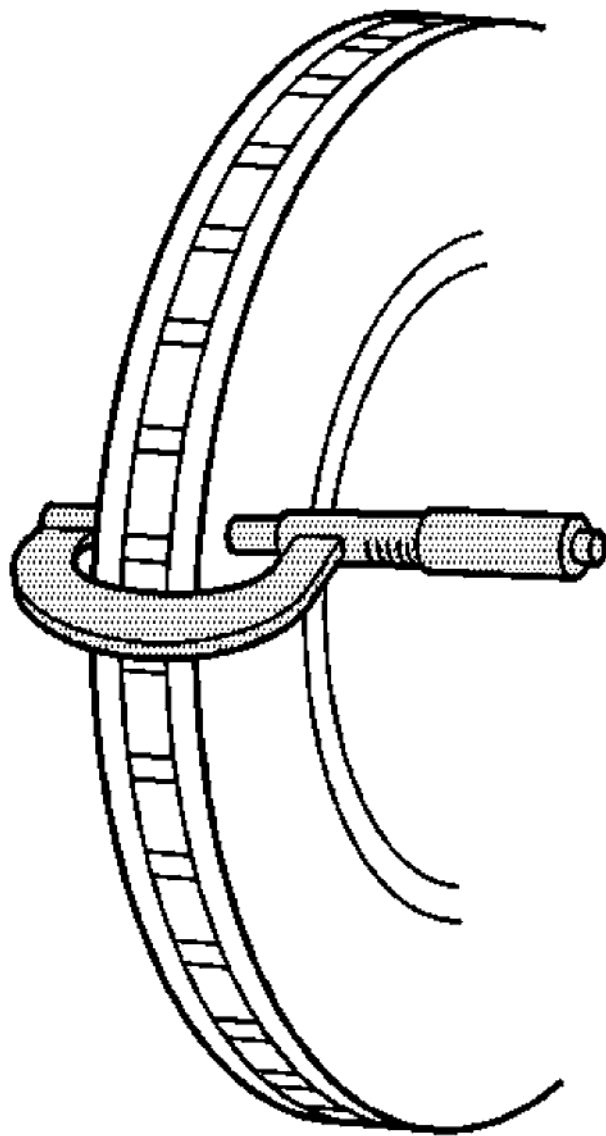


Fig. 3: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

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)

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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 (LRO) MEASUREMENT

Tools Required

- **J 39544-KIT** Torque-Limiting Socket Set, or equivalent. See Special Tools.
- **J 41013** Rotor Resurfacing Kit. See Special Tools.
- **J 42450-A** Wheel Hub Resurfacing Kit. See Special Tools.
- **J 45101** Hub and Wheel Runout Gage, or equivalent. See Special Tools.
- **J 45101-100** Conical Brake Rotor Washers. See Special Tools.

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

IMPORTANT:

- 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 LRO. Thickness variation exceeding the maximum acceptable level can cause brake pulsation. Refer to Brake Rotor Thickness Variation Measurement.

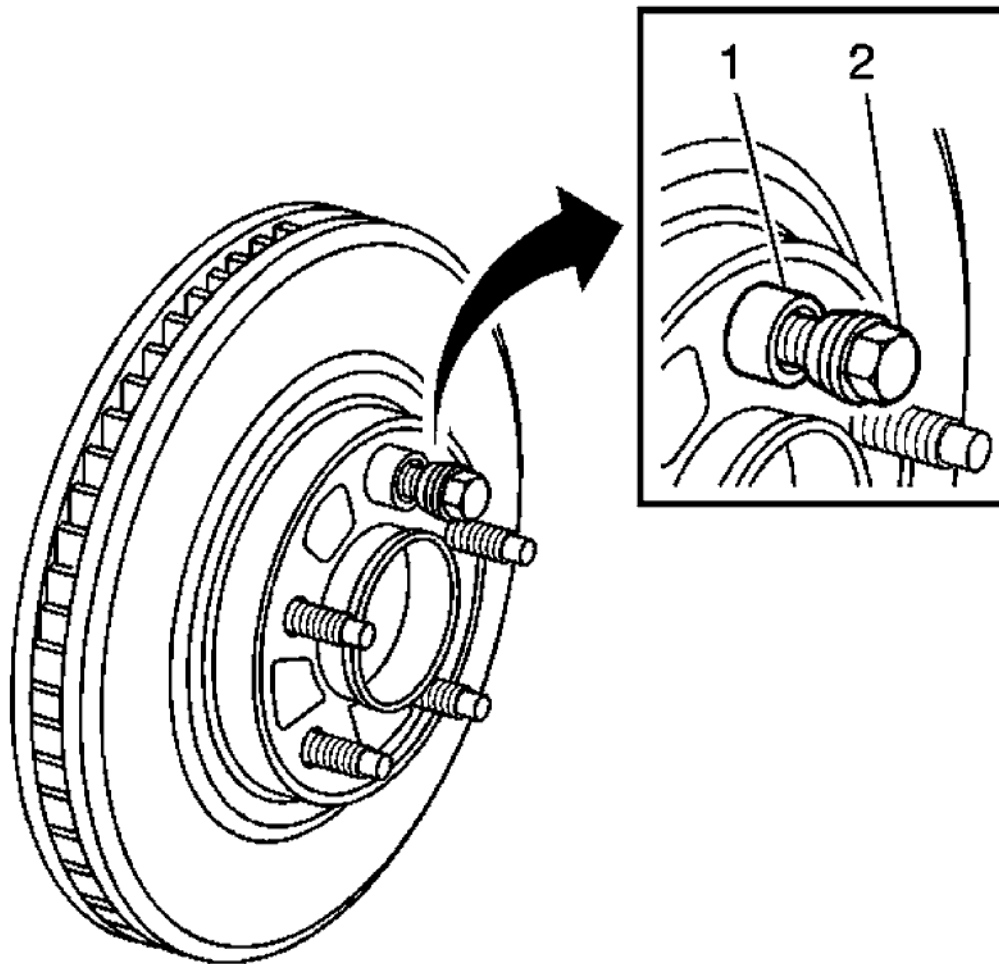


Fig. 4: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: 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 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

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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 **Brake Rotor Replacement**.
2. Using the **J 42450-A**, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange. See **Special Tools**.
3. Using the **J 41013**, thoroughly clean any rust or corrosion from the mating surface of the brake rotor. See **Special Tools**.
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.
4. Hold the rotor firmly in place against the hub/axle flange and install one of the **J 45101-100** (1), and one lug nut (2) onto the upper-most wheel stud. See **Special Tools**.
5. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

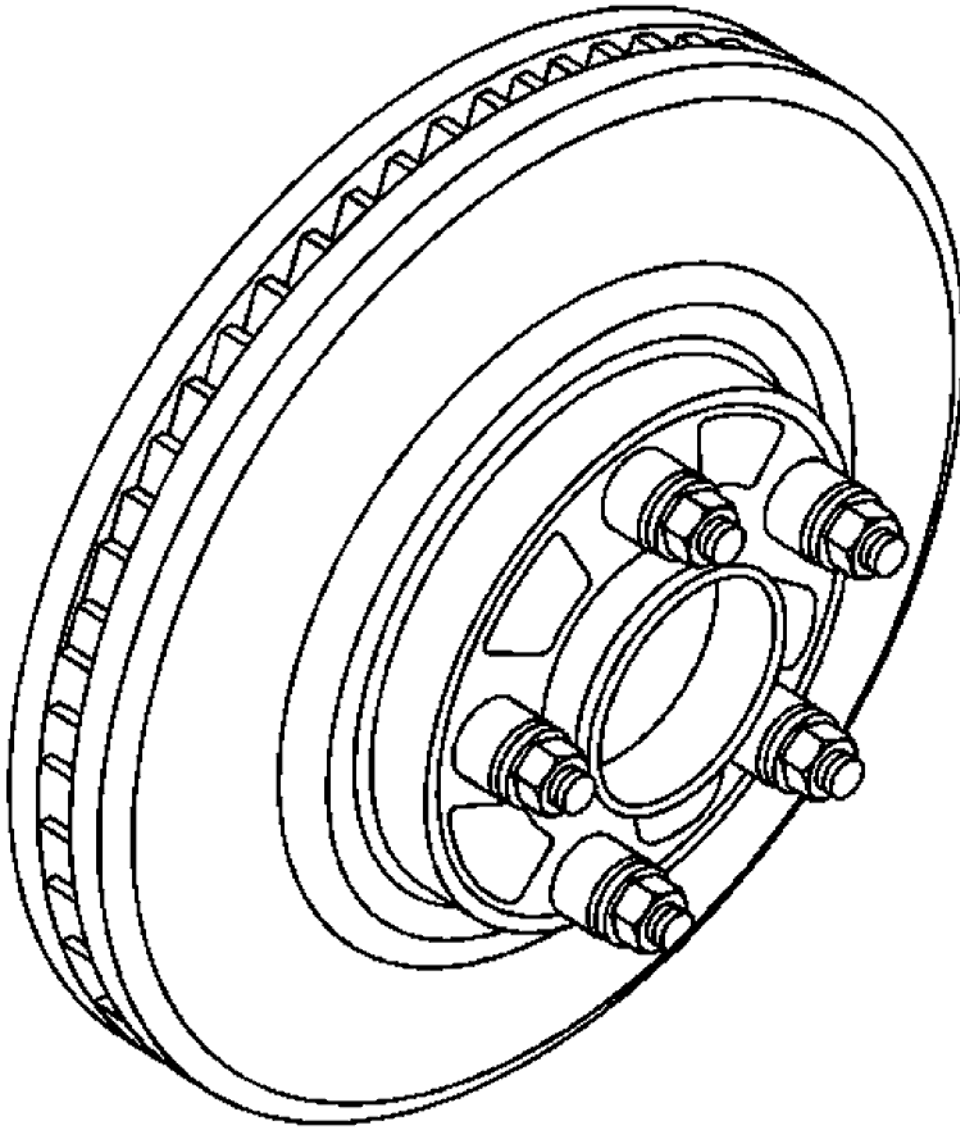


Fig. 5: Installing All J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

6. Install the remaining **J 45101-100** and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern. See **Special Tools**.
7. Using the **J 39544-KIT** , or equivalent, tighten the lug nuts in a star-pattern to specification, in order to properly secure the rotor. See **Special Tools**. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
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.

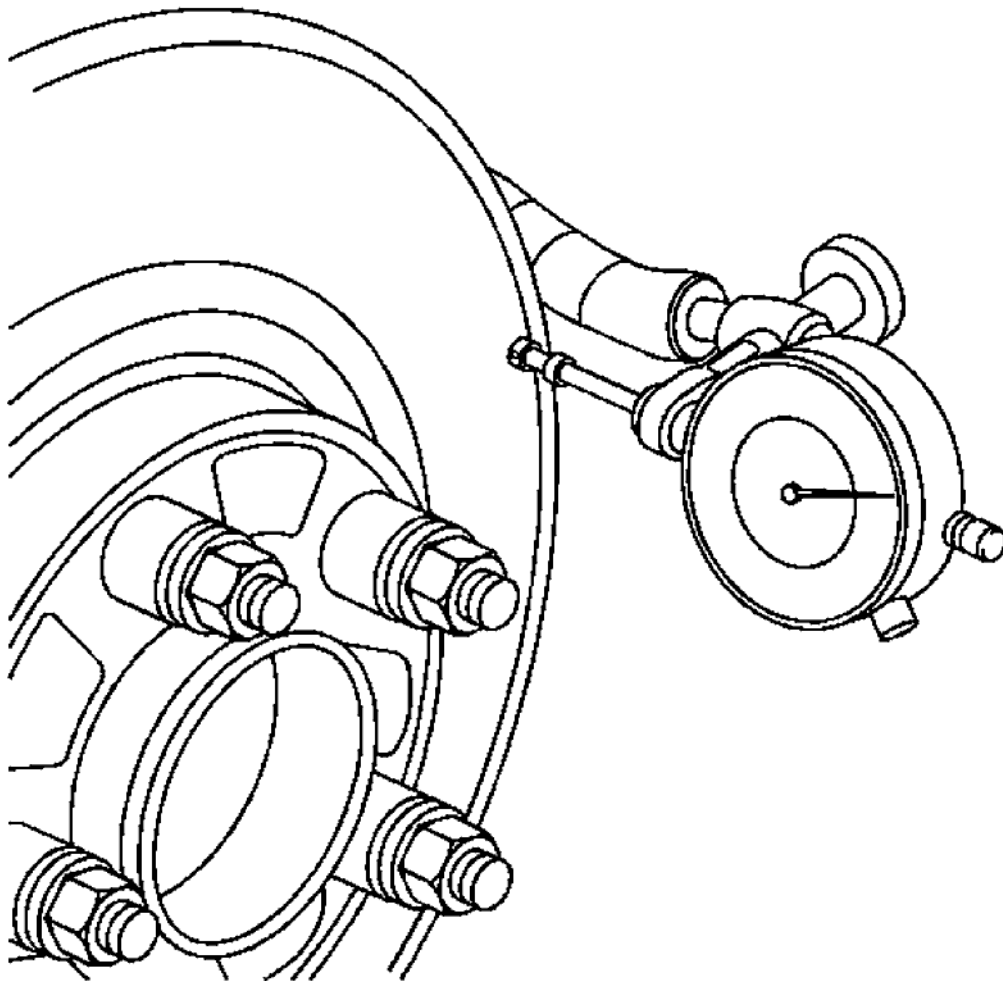


Fig. 6: Mounting Dial Indicator To Measure Lateral Runout
Courtesy of GENERAL MOTORS CORP.

10. Mount a dial indicator, **J 45101** , 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. See **Special Tools**.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: Brake rotor maximum allowable assembled lateral runout: 0.06 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, **J 45101**, 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. See **Special Tools**.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: Brake rotor maximum allowable assembled lateral runout: 0.06 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 (LRO) 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 **J 45101-100** and the lug nuts. See **Special Tools**.

BRAKE PAD INSPECTION

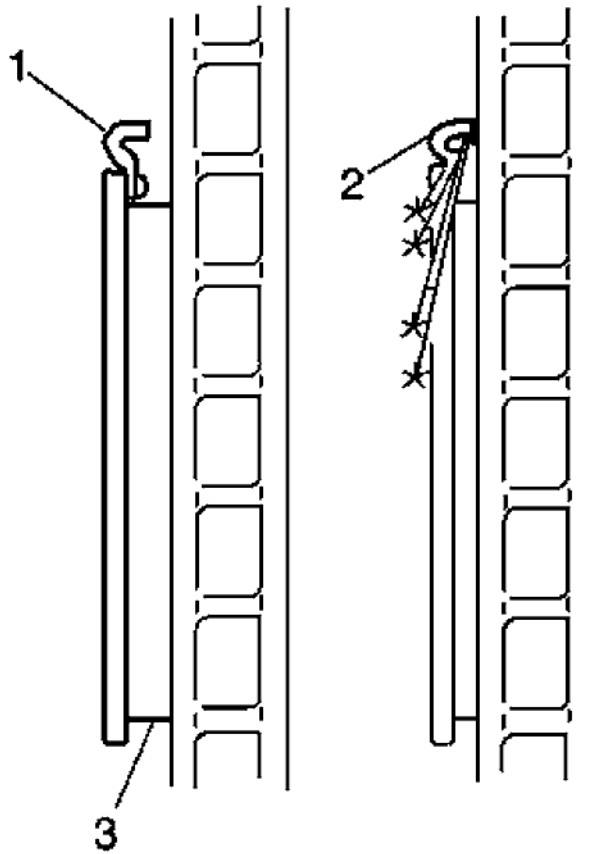


Fig. 7: View Of Brake Pads & Audible Wear Sensors
Courtesy of GENERAL MOTORS CORP.

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

- Inspect the disc brake pads at regular intervals, or whenever the tire and wheel assemblies are removed from the vehicle.
- If replacement is necessary, always replace disc brake pads in axle sets.
- 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.
- Inspect the thickness of the disc brake pads (3) in order to ensure that they have not worn excessively. The disc brake pad wear should be approximately even per axle set.
- 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

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the disc brake rotor (2). The wear indicator will then produce an audible, high-pitched warning noise during wheel rotation.

- Replace the disc brake pads when the friction surface (3) is worn to within 1 mm (0.039 in) of the mounting plates.
- 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 0.5 mm (0.020 in) gap exists midway between the length of the disc brake pads, replace the disc brake pads.
- Verify that any disc brake pad shims that may be required are in place and not damaged or excessively corroded. Replace any missing or damaged shims in order to preserve proper disc brake performance.
- Replace the disc brake pads if any have separated from the mounting plates.
- Inspect the disc brake pads friction surfaces for cracks, fractures, or damage which may cause noise or otherwise impair disc brake performance.
- Inspect the noise insulators on the brake pad mounting plate. Replace the brake pads if the noise insulators have separated from the brake pad mounting plate.

BRAKE CALIPER INSPECTION

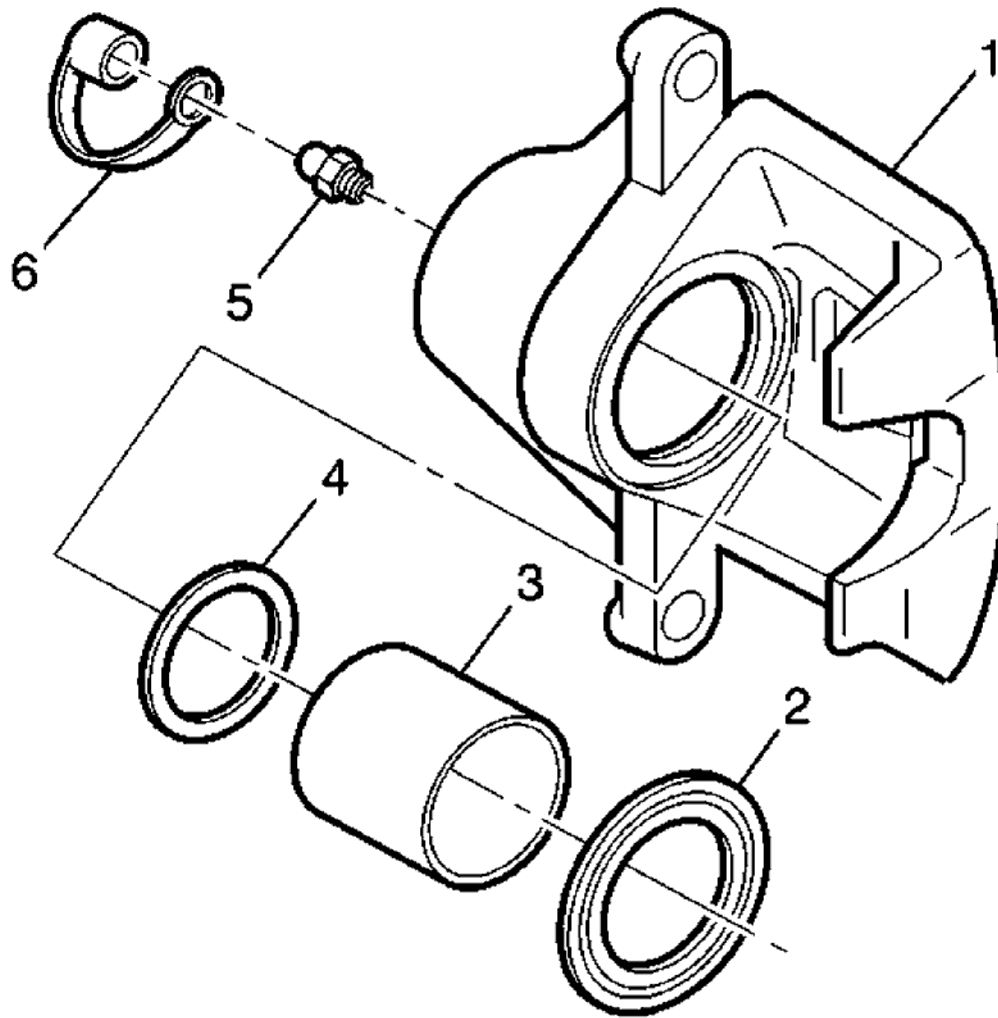


Fig. 8: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS CORP.

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

CAUTION: Refer to Brake Fluid Irritant Caution in Cautions and Notices.

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.

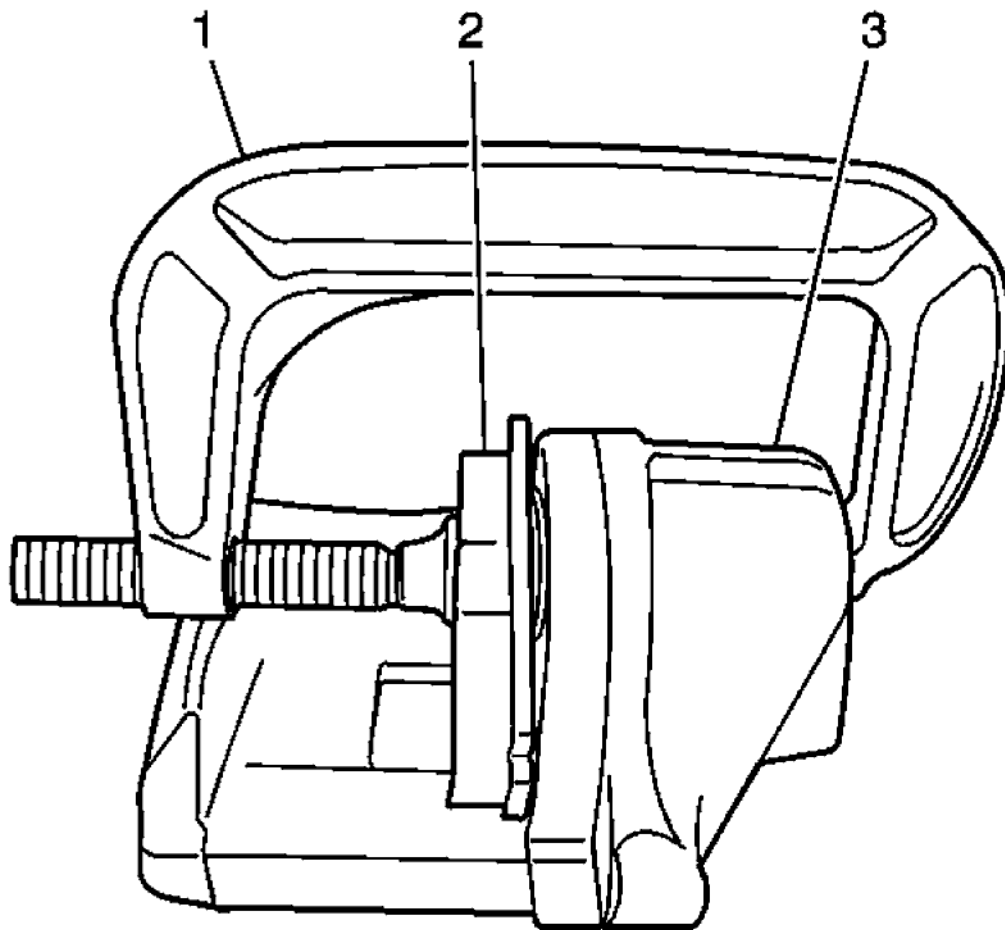


Fig. 9: Compressing Caliper Piston
Courtesy of GENERAL MOTORS CORP.

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.

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- 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

CAUTION: Refer to Brake Dust Caution .

CAUTION: Refer to Brake Fluid Irritant Caution .

1. Inspect the fluid level in the brake master cylinder auxiliary 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 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, remove brake fluid to the midway point before proceeding.

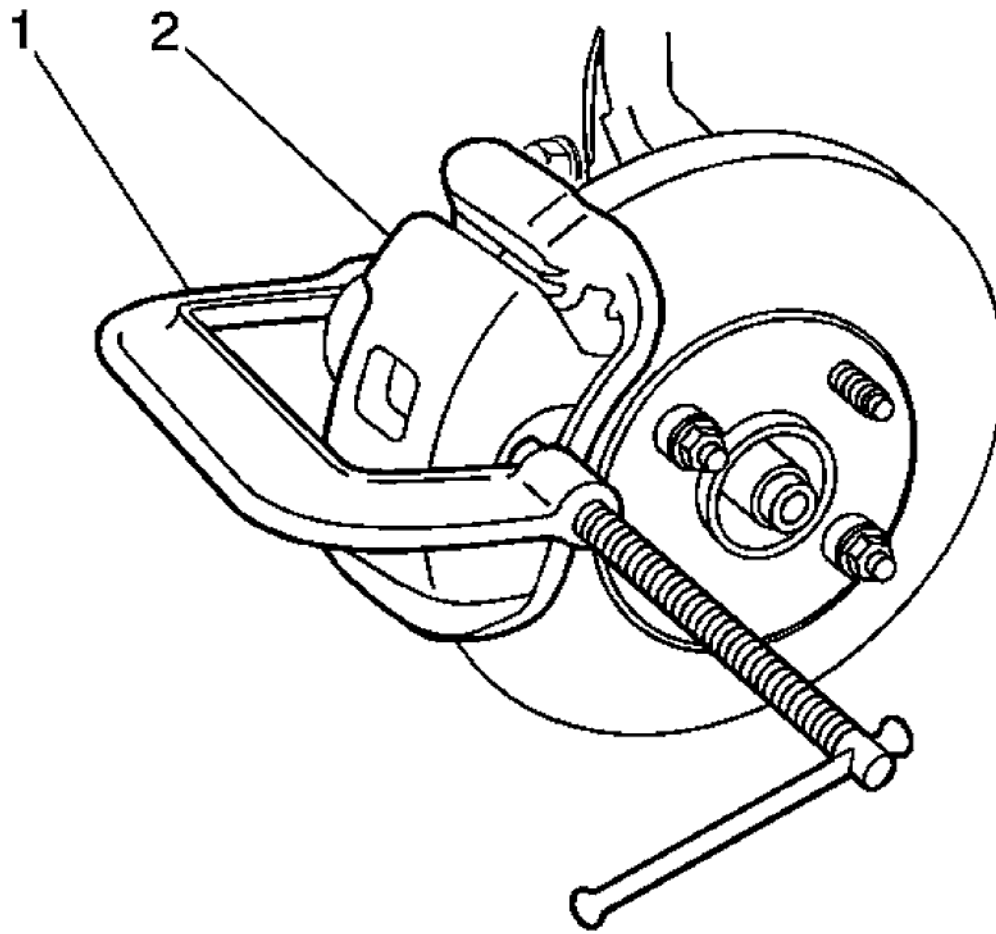


Fig. 10: View Of C-Clamp & Brake Caliper
Courtesy of GENERAL MOTORS CORP.

4. Install a large C-clamp (1), over the body of the brake caliper (2) with the C-clamp ends against the rear of the caliper body and against the outer brake pad.
5. Tighten the C-clamp (1) until the caliper piston is compressed into the caliper bore leaving a gap of approximately 10 mm (0.38 in) between the disc brake pads and the brake rotor.
6. Remove the C-clamp (1) from the caliper (2).
7. Grasp the brake caliper and attempt to move the brake caliper vertically. The brake caliper should not exhibit excessive looseness.
8. Grasp the brake caliper and move the brake caliper inboard and outboard. The brake caliper should slide smoothly with minimal force.

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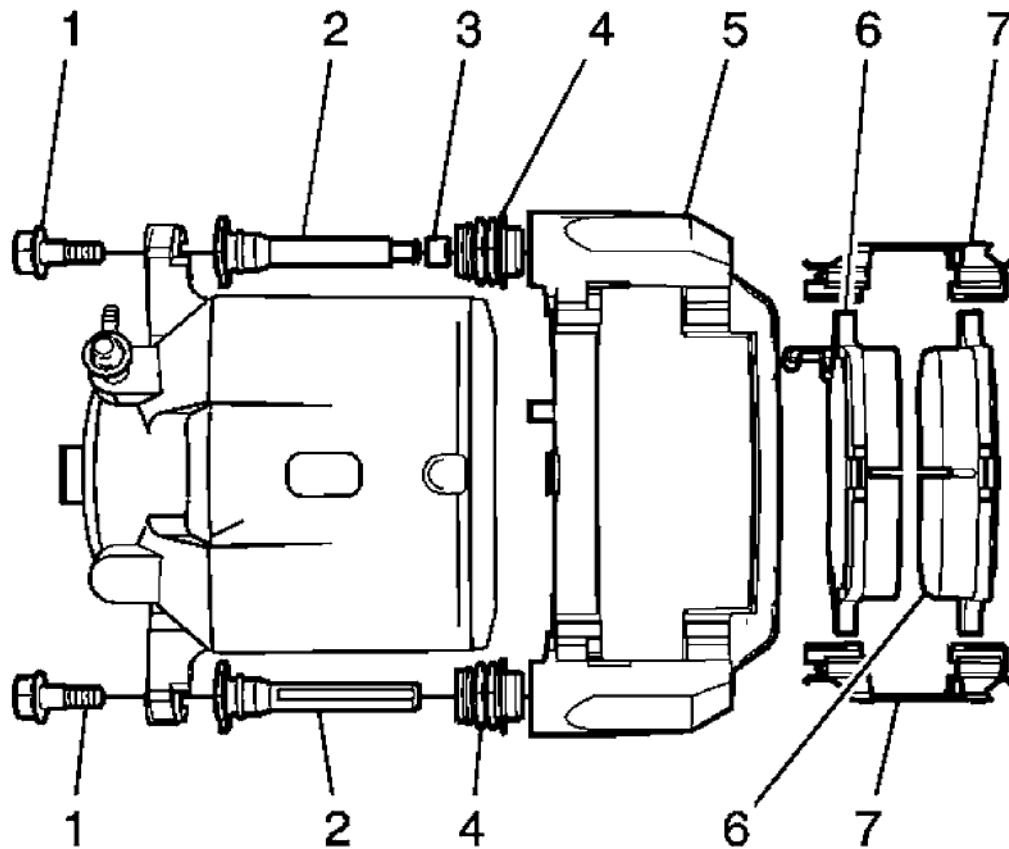


Fig. 11: Exploded View Of Caliper Assembly
Courtesy of GENERAL MOTORS CORP.

9. Ensure the disc brake pads are held firmly in place on the brake caliper mounting bracket (5), yet slide easily on the mounting hardware without binding.
10. Inspect the disc brake pad mounting hardware, pad retainers (7), for the following:
 - Bent mounting tabs
 - Excessive corrosion
 - Looseness at the brake caliper mounting bracket
 - Excessive wear and/or looseness at the disc brake pads
 - Missing mounting hardware
11. If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.
12. Inspect the brake caliper guide pins (2) by gently pushing inward, without disengaging the slides from the boots, then pull outward, and observe for the following:

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- Bent or damaged brake caliper bolts (1)
 - Restricted caliper guide pin movement
 - Corrosion
 - Split or torn boots (4)
 - Missing boots
 - Looseness in the brake caliper mounting bracket
 - Seized or binding caliper guide pins
13. If any of the conditions listed are found, the brake caliper mounting hardware requires replacement.
14. Inspect the brake caliper mounting bracket (5) for being bent, cracked, or damaged.
15. If any of the conditions listed are found, the brake caliper mounting bracket requires replacement.

REPAIR INSTRUCTIONS

BRAKE PADS REPLACEMENT

CAUTION: Refer to Brake Dust Caution .

CAUTION: Refer to Brake Fluid Irritant Caution .

Removal Procedure

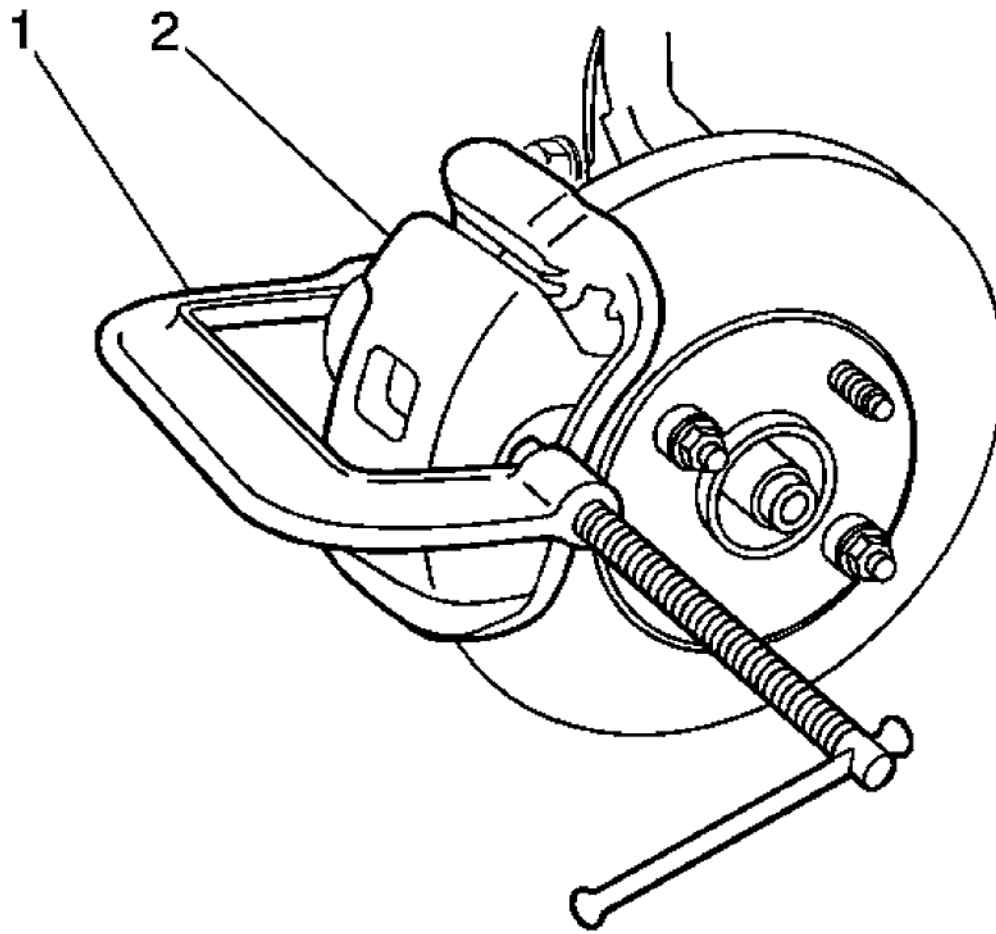


Fig. 12: View Of C-Clamp & Brake Caliper
Courtesy of GENERAL MOTORS CORP.

1. Inspect the fluid level in the brake master cylinder auxiliary 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 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, 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. Install and firmly hand tighten 2 wheel nuts to opposite wheel studs in order to retain the rotor to the hub.

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7. Install a large C-clamp (1) over the body of the brake caliper (2) with the C-clamp ends against the rear of the caliper body and against the outboard brake pad.
8. Tighten the C-clamp evenly until the caliper piston is compressed into the caliper bore enough to allow the caliper to slide past the brake rotor.
9. Remove the C-clamp from the caliper.

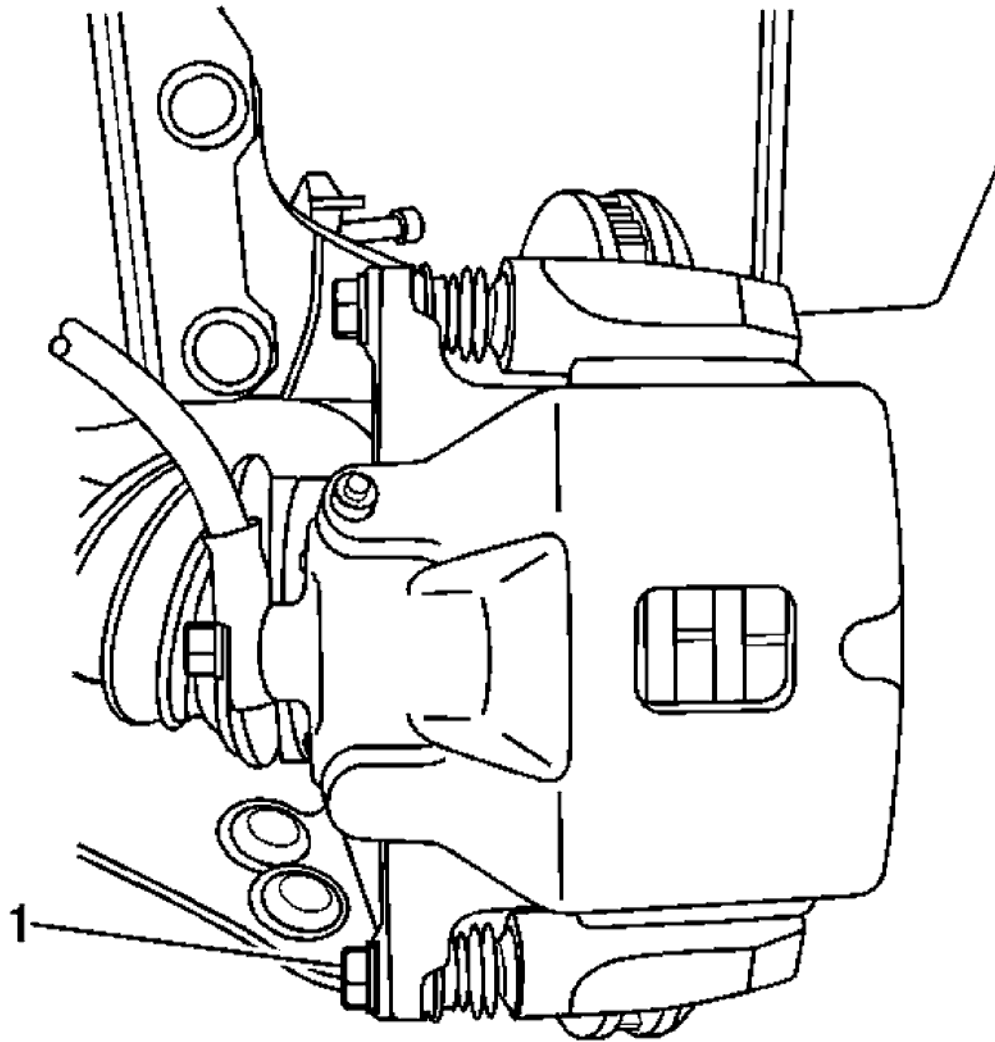


Fig. 13: Locating Brake Caliper Lower Guide Pin Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the brake caliper lower guide pin bolt (1).

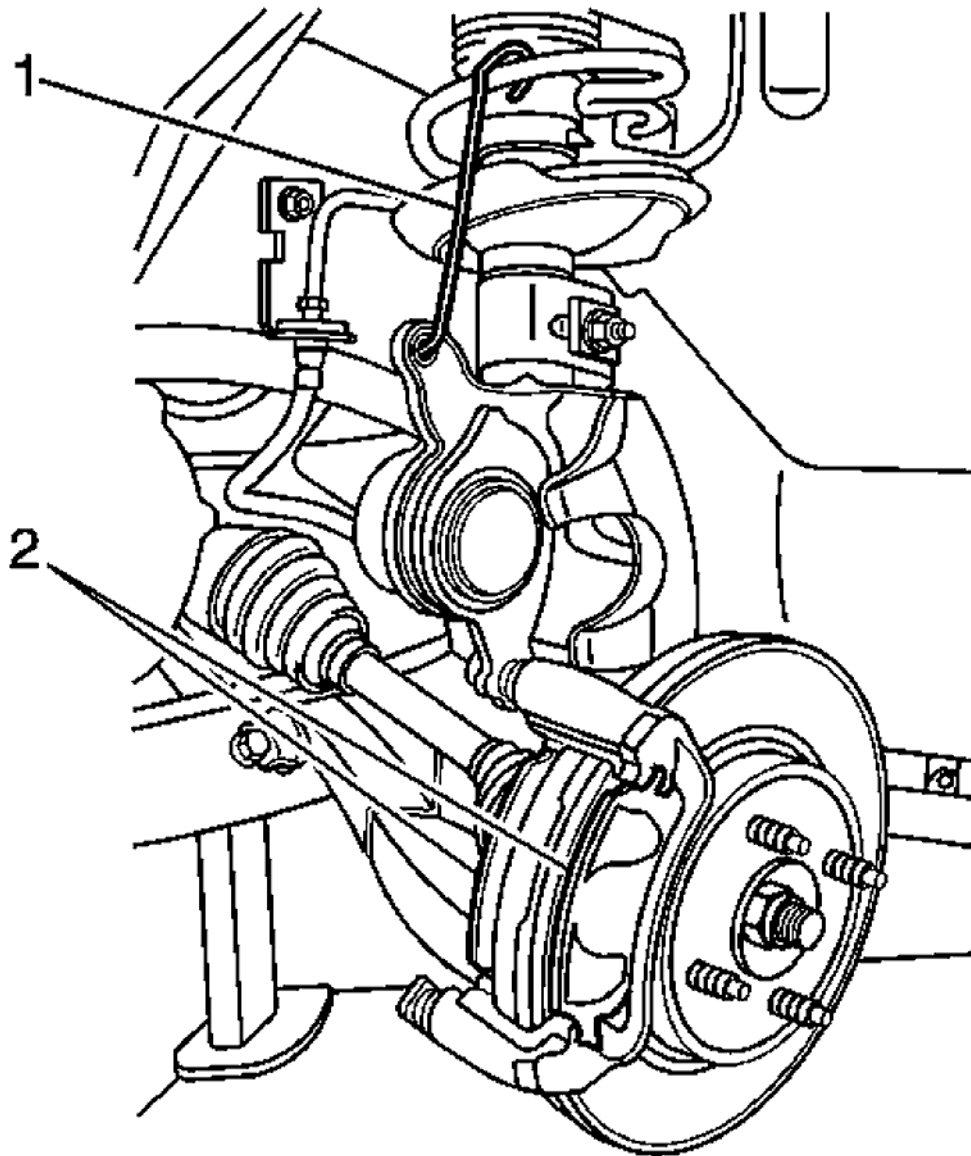


Fig. 14: Identifying Heavy Mechanics Wire
Courtesy of GENERAL MOTORS CORP.

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

brake fluid leak.

11. Without disconnecting the hydraulic brake flexible hose, pivot the caliper upward and secure the caliper with heavy mechanics wire (1), or equivalent.

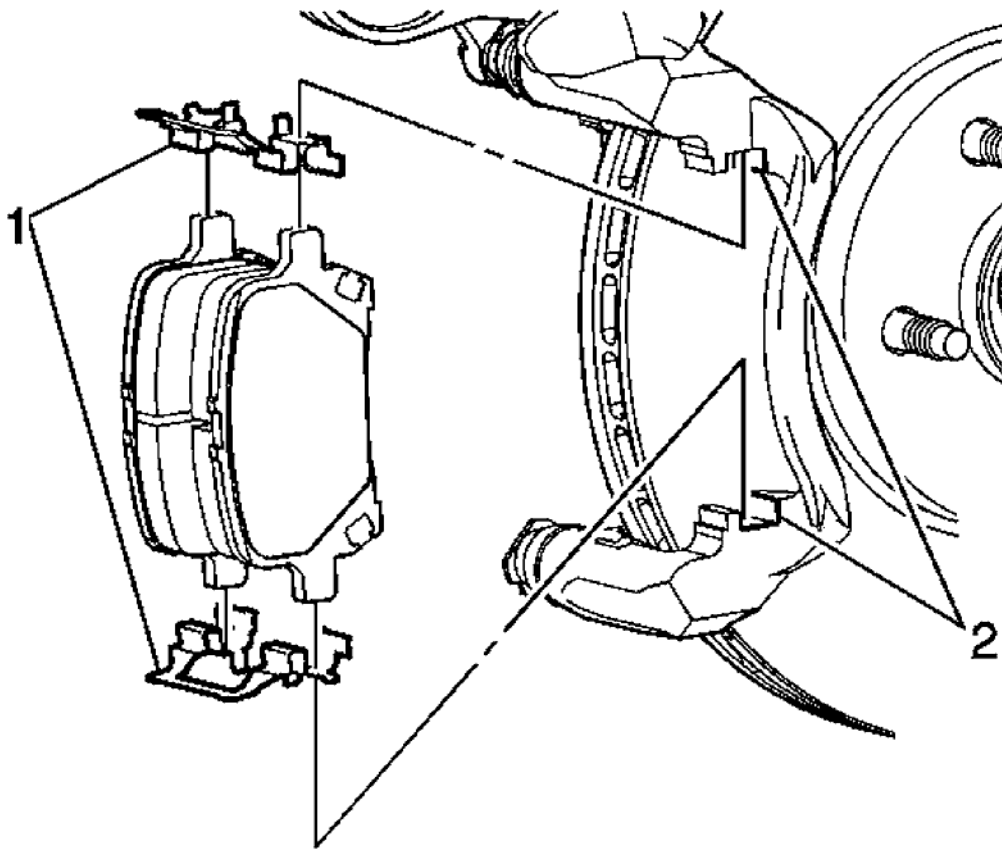


Fig. 15: Identifying Brake Pad Retainers & Caliper Bracket - Front
Courtesy of GENERAL MOTORS CORP.

12. Remove the brake pads from the caliper mounting bracket.
13. Remove the brake pad retainers (1) from the caliper bracket.
14. Thoroughly clean the brake pad hardware mating surfaces of the caliper bracket (2), of any debris and corrosion.
15. Inspect the brake caliper guide pins for freedom of movement, and inspect the condition of the guide pin boots. Move the guide pins inboard and outboard within the bracket bores, without disengaging the slides from the boots, and observe for the following:

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- Restricted caliper guide pin movement
- Looseness in the brake caliper mounting bracket
- Seized or binding caliper guide pins
- Split or torn boots

16. If any of the conditions listed are found, the brake caliper guide pins and/or boots require replacement.

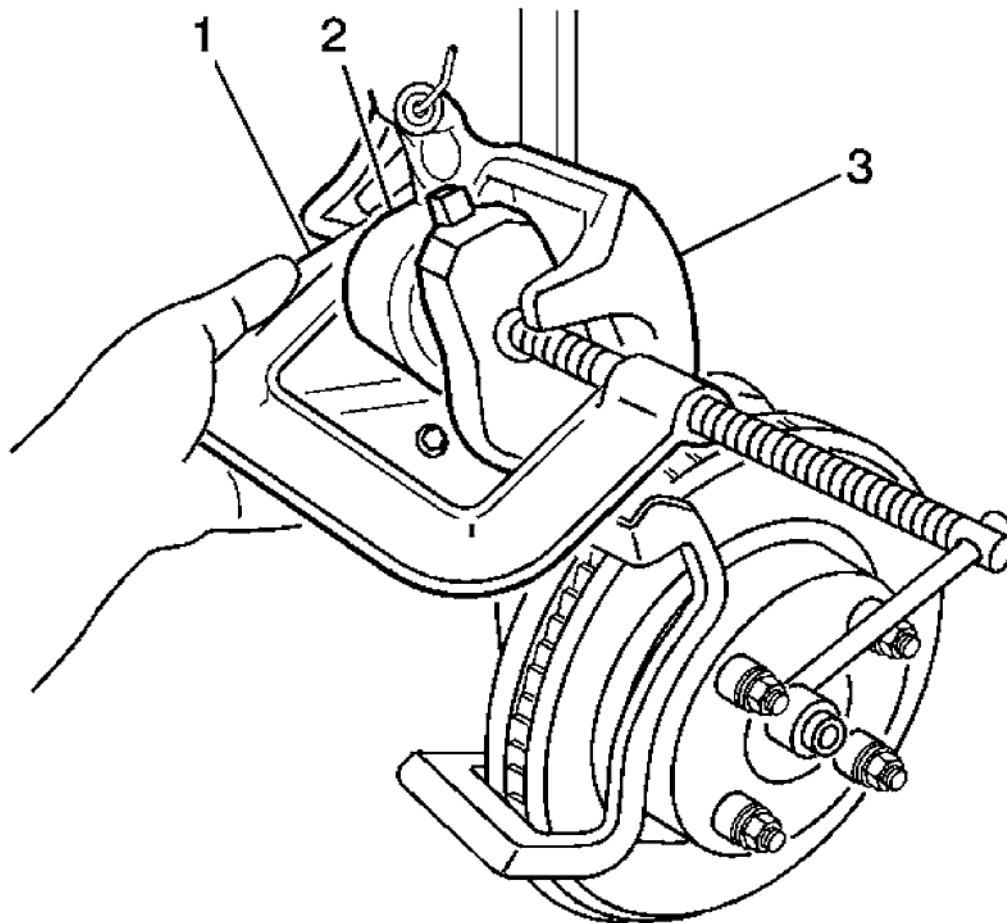


Fig. 16: Compressing Caliper Piston
Courtesy of GENERAL MOTORS CORP.

17. Install a large C-clamp (1) over the body of the brake caliper (3), with the C-clamp ends against the rear of the caliper body and against an old inboard brake pad (2) or a wood block installed against the caliper piston.
18. Tighten the C-clamp (1) evenly until the caliper piston is compressed completely into

the caliper bore.

19. Remove the C-clamp and the old brake pad or wood block from the caliper.

Installation Procedure

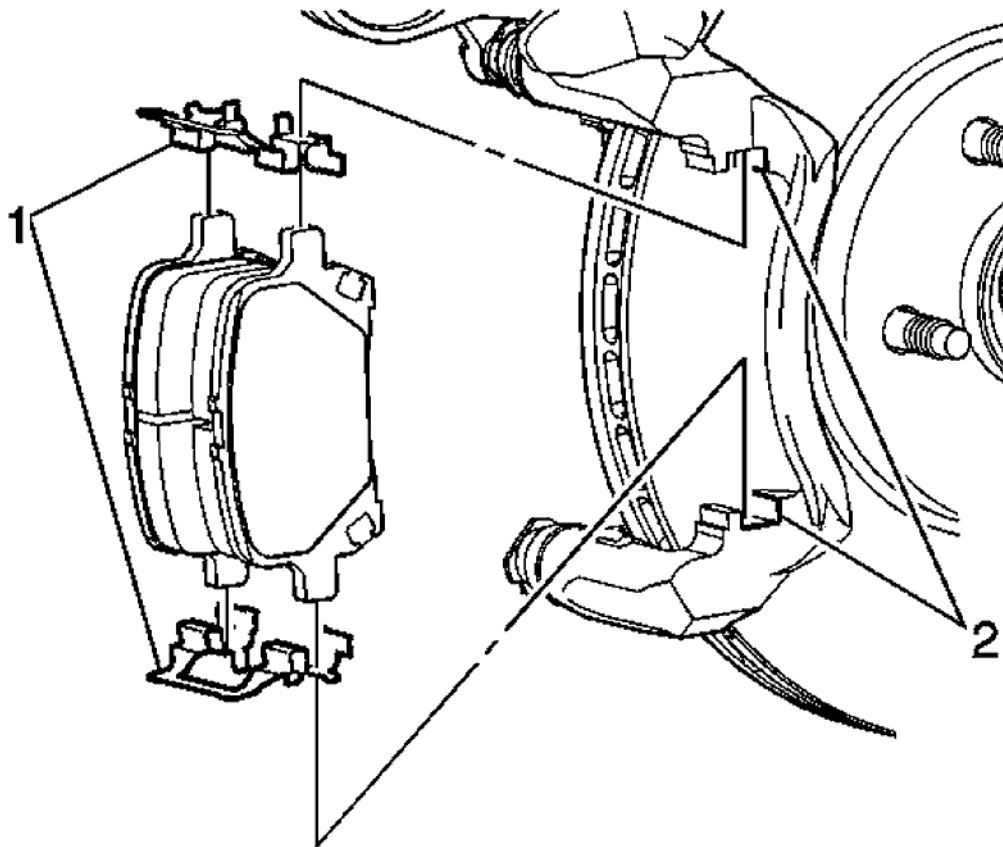


Fig. 17: Identifying Brake Pad Retainers & Caliper Bracket - Front
Courtesy of GENERAL MOTORS CORP.

1. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket (2) only.
2. Install the brake pad retainers (1) to the brake caliper bracket.

IMPORTANT: The wear sensor equipped disc brake pad must be mounted inboard of the rotor with the leading edge of the sensor facing the brake rotor during forward wheel rotation, or at the top of the pad when installed in vehicle position.

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3. Install the brake pads to the caliper bracket.
4. Remove the support, and rotate the brake caliper into position over the disc brake pads and to the caliper mounting bracket.

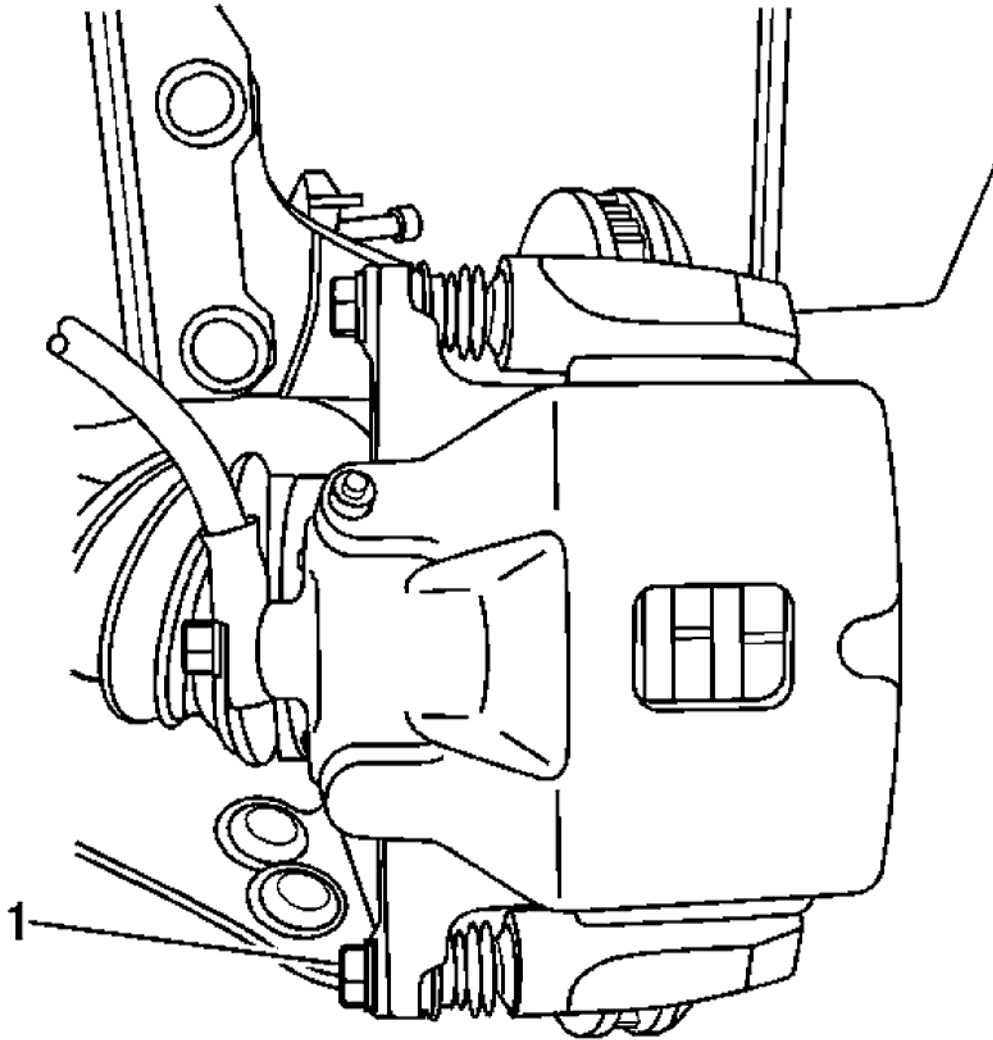


Fig. 18: Locating Brake Caliper Lower Guide Pin Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

5. Install the lower brake caliper guide pin bolt (1).

Tighten: Tighten the bolt to 34 N.m (25 lb ft).

6. Remove the wheel nuts retaining the brake rotor to the hub.
7. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation**.
8. Lower the vehicle.
9. With the engine OFF, gradually apply the brake pedal approximately 2/3 of its travel distance.
10. Slowly release the brake pedal.
11. Wait 15 seconds, then gradually apply the brake pedal approximately 2/3 of its travel distance again until a firm brake pedal apply is obtained. This will properly seat the brake caliper pistons and brake pads.
12. Fill the master cylinder auxiliary reservoir to the proper level. Refer to **Master Cylinder Reservoir Filling**.
13. Burnish the pads and rotors. Refer to **Burnishing Pads and Rotors**.

BURNISHING PADS AND ROTORS

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

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

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).

IMPORTANT: 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

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sufficient cooling periods between stops in order to properly burnish the brake pads and rotors.

BRAKE CALIPER REPLACEMENT

CAUTION: Refer to Brake Dust Caution .

CAUTION: Refer to Brake Fluid Irritant Caution .

Removal Procedure

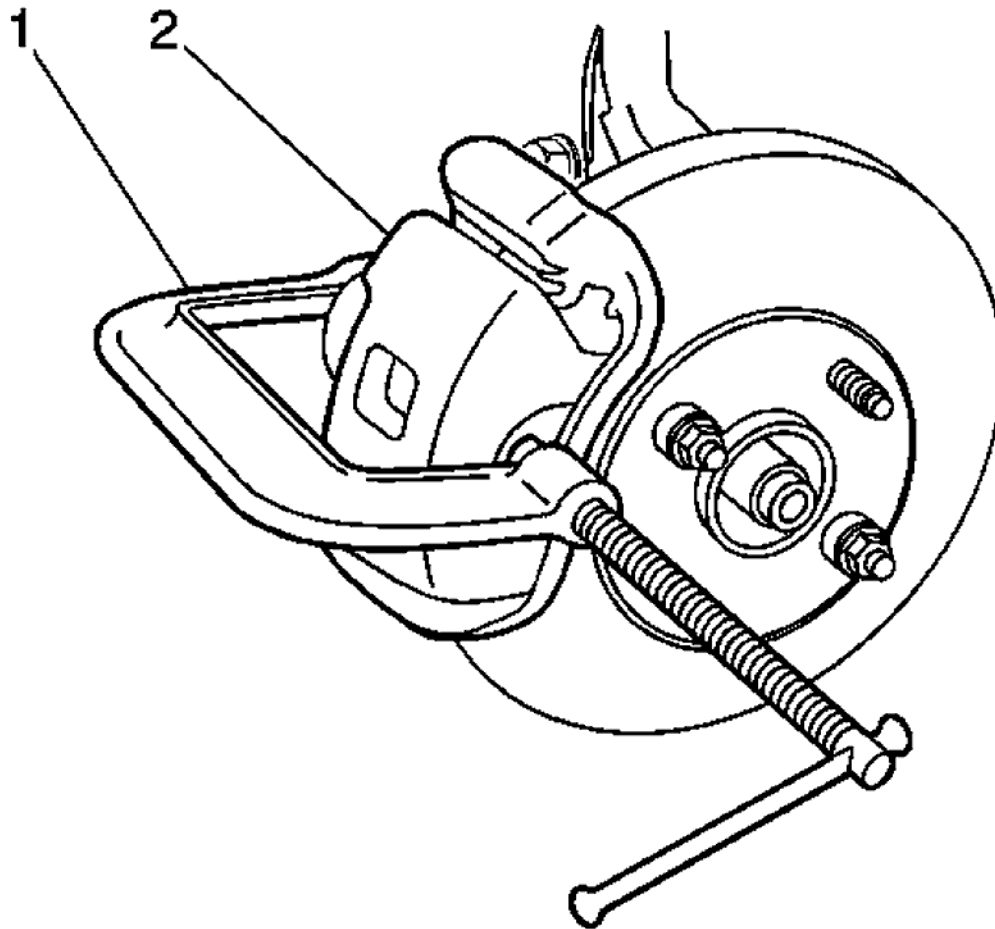


Fig. 19: View Of C-Clamp & Brake Caliper
Courtesy of GENERAL MOTORS CORP.

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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 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, 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. Install and firmly hand tighten 2 wheel nuts to opposite wheel studs in order to retain the rotor to the hub.
7. Install a large C-clamp (1) over the body of the brake caliper (2) with the C-clamp ends against the rear of the caliper body and against the outer brake pad.
8. Tighten the C-clamp until the caliper piston is compressed into the caliper bore enough to allow the caliper to slide past the brake rotor.
9. Remove the C-clamp from the caliper.

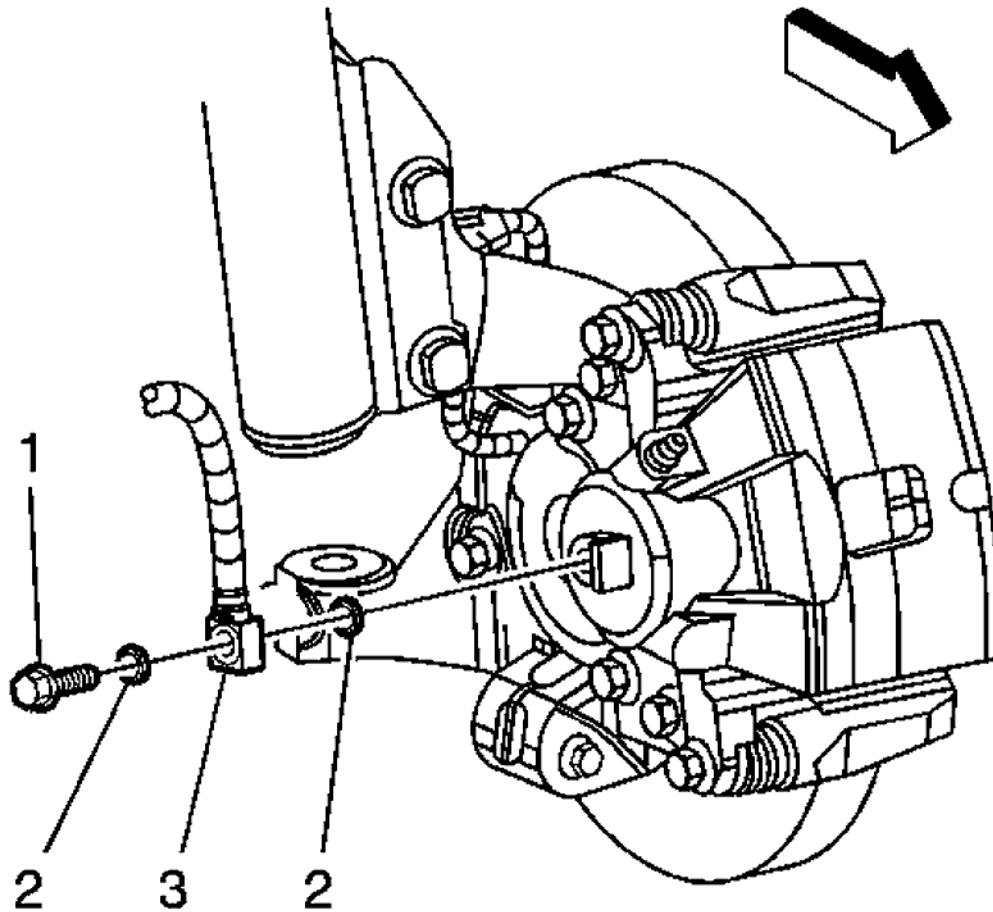


Fig. 20: View Of Front Brake Hose
Courtesy of GENERAL MOTORS CORP.

10. Remove the brake hose-to-caliper bolt (1) from the brake caliper.
11. Remove the brake hose (3) from the brake caliper.
12. Remove and discard the 2 copper brake hose gaskets (2). These gaskets may be stuck to the brake caliper and/or the brake hose end (3).
13. Cap or plug the opening in the brake caliper and the brake hose to prevent fluid loss and contamination.

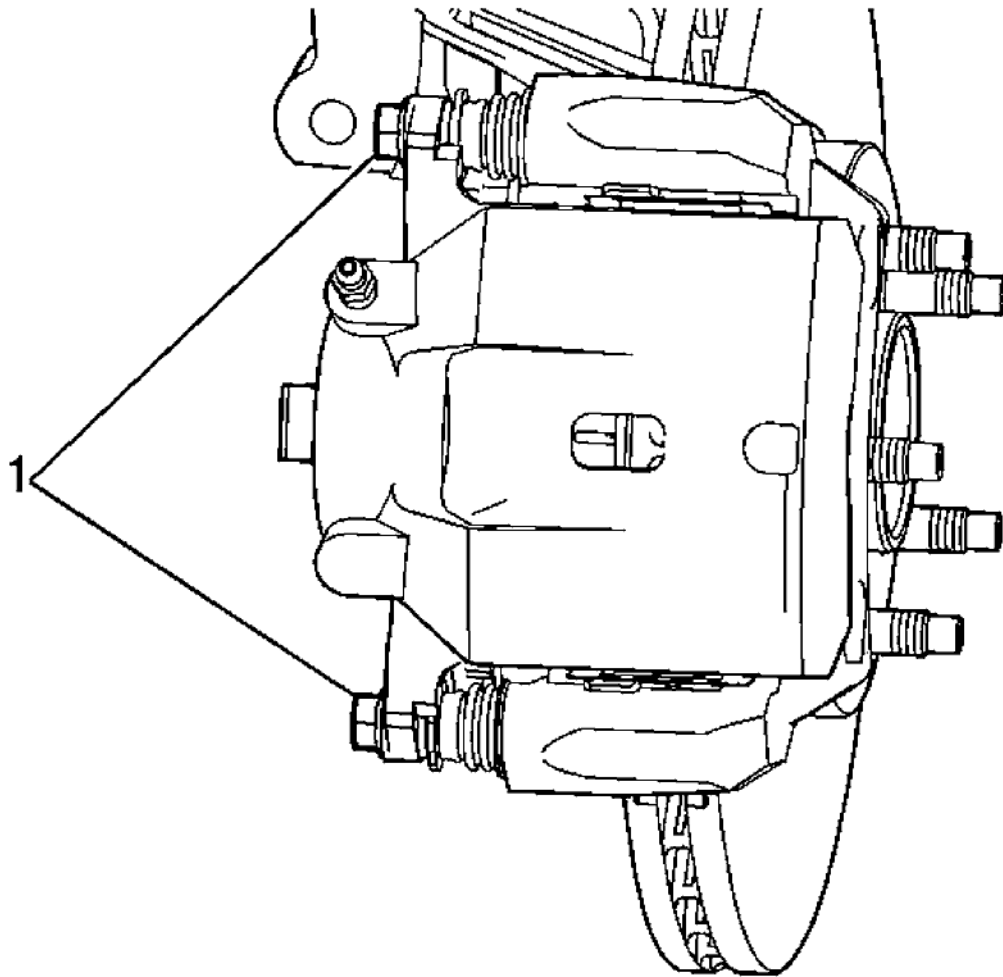


Fig. 21: Locating Brake Caliper Guide Pin Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the brake caliper guide pin bolts (1).
15. Remove the brake caliper from the caliper bracket.
16. Inspect the brake caliper guide pins for freedom of movement, and inspect the condition of the guide pin boots. Move the guide pins inboard and outboard within the bracket bores, without disengaging the slides from the boots, and observe for the following:
 - Restricted caliper guide pin movement
 - Looseness in the brake caliper mounting bracket
 - Seized or binding caliper guide pins
 - Split or torn boots

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17. If any of the conditions listed are found, the brake caliper guide pins and/or boots require replacement.

Installation Procedure

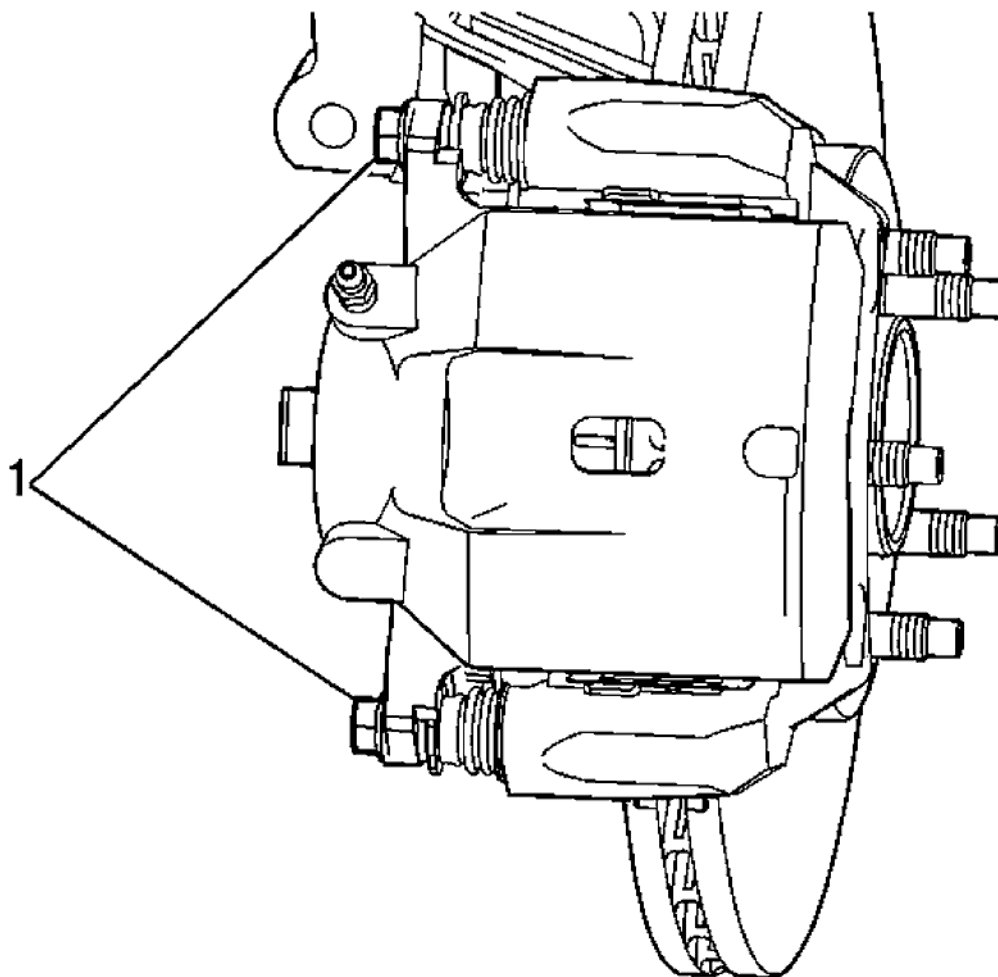


Fig. 22: Locating Brake Caliper Guide Pin Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the brake caliper to the brake caliper bracket.

NOTE: **Refer to Fastener**
 Notice .

2. Install the brake caliper guide pin bolts (1).

Tighten: Tighten the bolts to 34 N.m (25 lb ft).

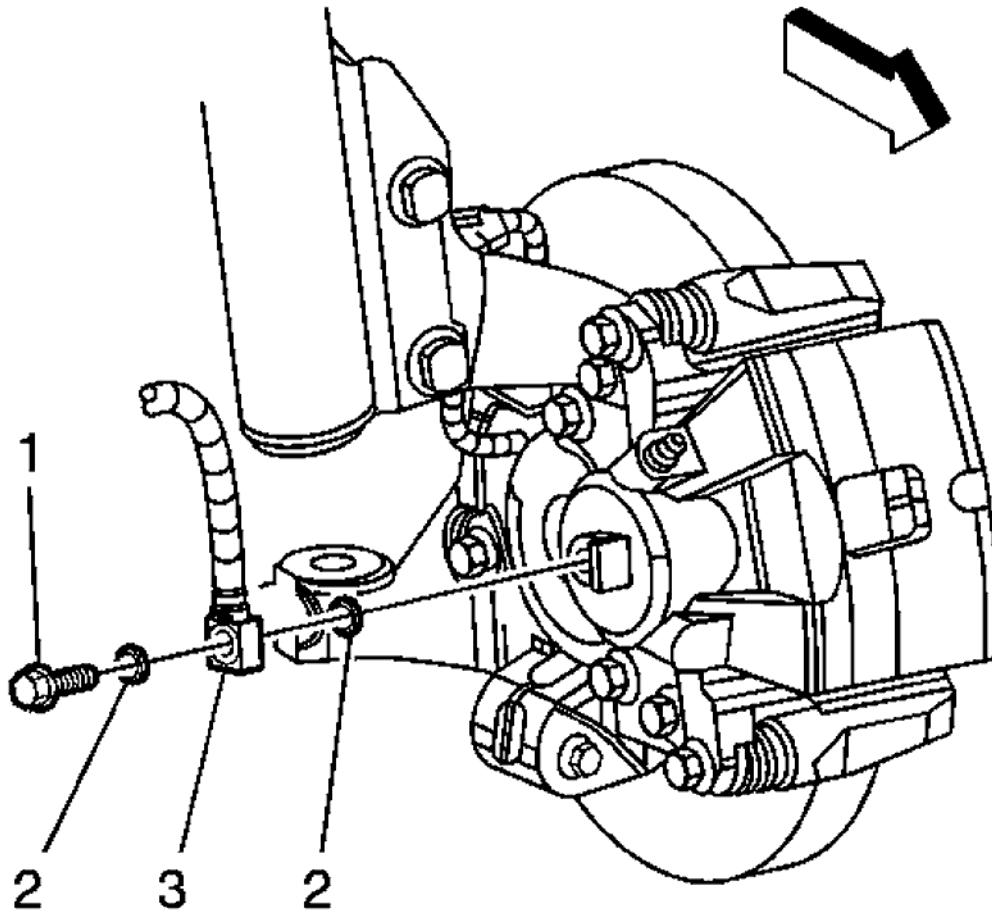


Fig. 23: View Of Front Brake Hose
Courtesy of GENERAL MOTORS CORP.

3. Remove the caps or plugs from the brake caliper opening and the brake hose (3).

IMPORTANT: Do not reuse the copper brake hose gaskets.

4. Install NEW copper brake hose gaskets (2) to the brake hose-to-caliper bolt (1) and to the brake hose (3).
5. Install the brake hose and the brake hose-to-brake caliper bolt to the brake caliper.

Tighten: Tighten the bolt to 48 N.m (35 lb ft).

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6. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Pressure)** or **Hydraulic Brake System Bleeding (Manual)** .
7. Remove the wheel nuts retaining the brake rotor to the wheel hub.
8. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .
9. Lower the vehicle.
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 gradually apply the brake pedal approximately 2/3 of its travel distance again until a firm brake pedal apply is obtained. This will properly seat the brake caliper pistons and brake pads.

BRAKE CALIPER OVERHAUL

CAUTION: Refer to **Brake Dust Caution** .

CAUTION: Refer to **Brake Fluid Irritant Caution** .

NOTE: Refer to **Brake Fluid Effects on Paint and Electrical Components Notice** .

Disassembly Procedure

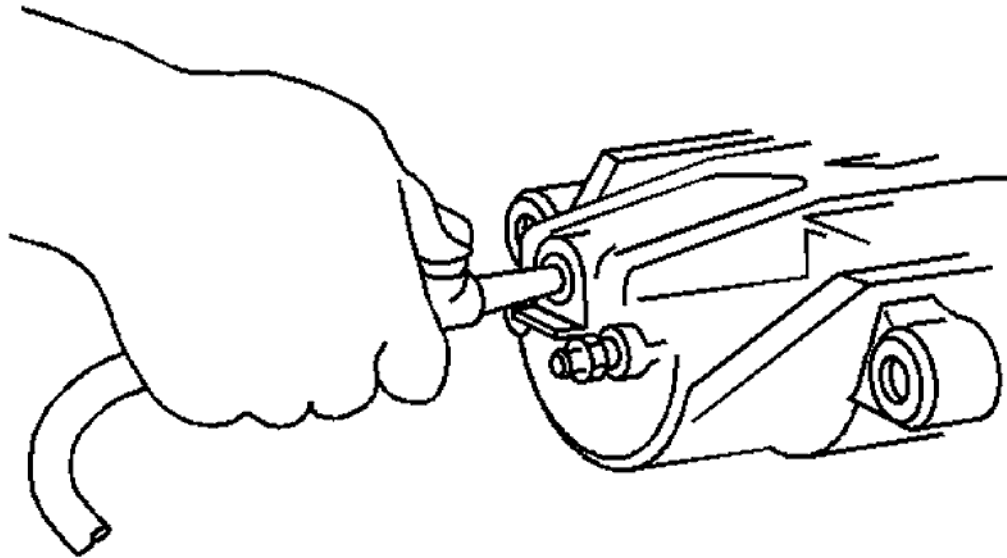


Fig. 24: Removing Brake Caliper Piston Using Compressed Air
Courtesy of GENERAL MOTORS CORP.

1. Remove the brake caliper from the vehicle. Refer to Brake Caliper Replacement.

CAUTION: 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: 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.

2. Remove the brake caliper piston from the caliper bore by directing low pressure compressed air into the caliper bore through the fluid inlet hole.

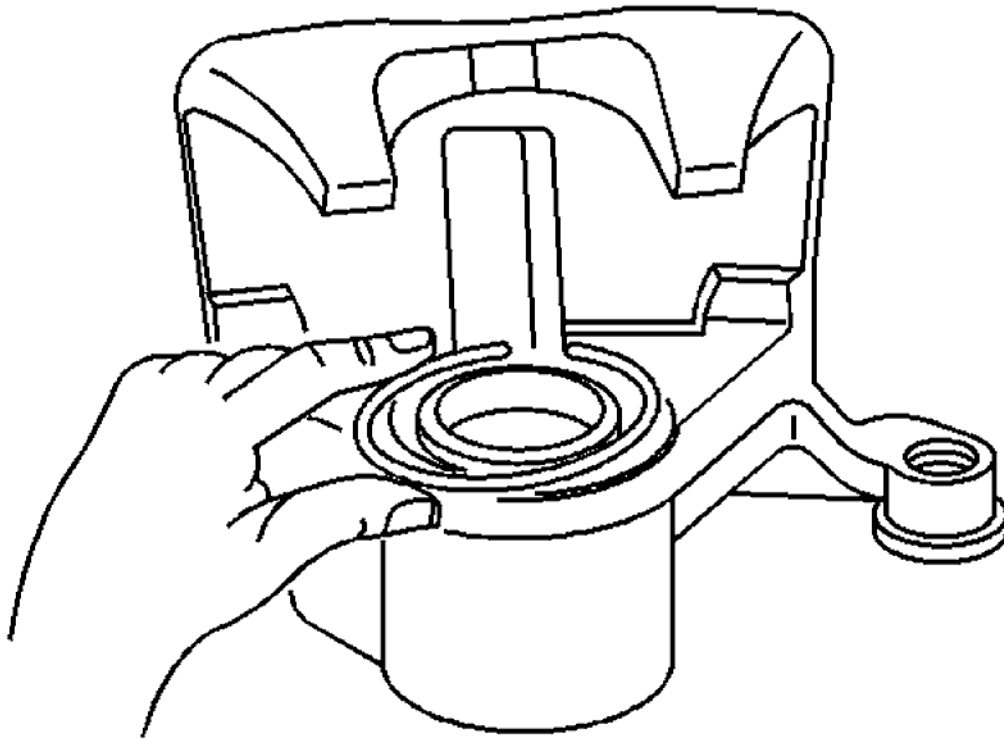


Fig. 25: View Of Dust Boot Retaining Ring
Courtesy of GENERAL MOTORS CORP.

3. Remove the retaining ring that secures the dust boot to the caliper housing.

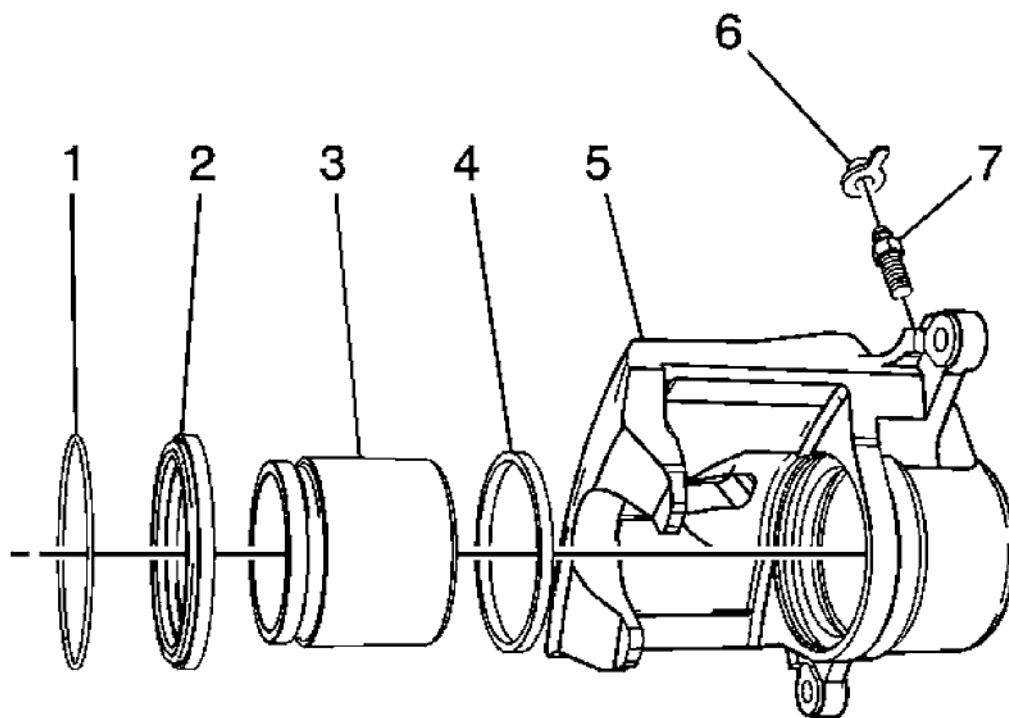


Fig. 26: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS CORP.

4. Remove the piston dust boot seal (2) from the seal counterbore in the caliper (5). Discard the boot seal.
5. Using a small wooden or plastic tool, remove the piston seal (4) from the caliper bore. Discard the piston seal.
6. Remove the bleeder valve cap (6).
7. Remove the bleeder valve (7).

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

8. Inspect the caliper bore for cracks, scoring, pitting, excessive rust, and/or excessive corrosion.
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.

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11. 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.
12. If cracks, scoring, pitting, excessive rust, and/or excessive corrosion are present in the caliper bore, replace the caliper assembly.
13. Inspect the caliper piston for cracks, scoring, and/or damage to the plating. Replace the caliper piston if any of these conditions exist.

Assembly Procedure

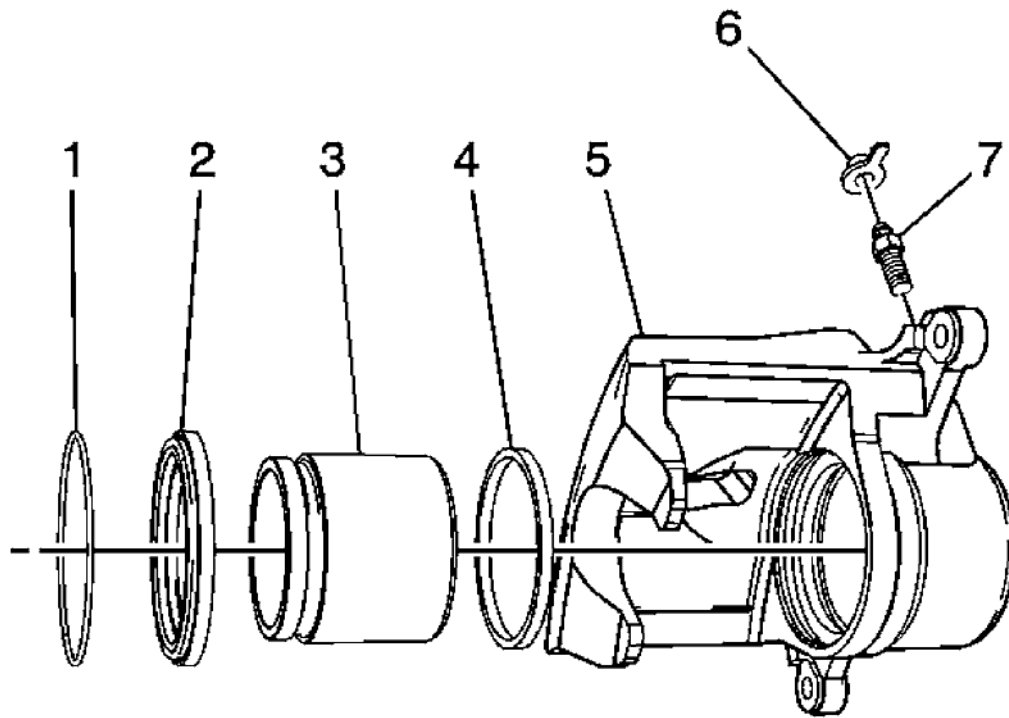


Fig. 27: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the new piston seal (4) with Saturn P/N 21013073, or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
2. Install the lubricated, new piston seal (4) into the caliper bore.
3. Apply a thin coat of Saturn P/N 21013073, or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container onto the outer surface area of the caliper piston (3).

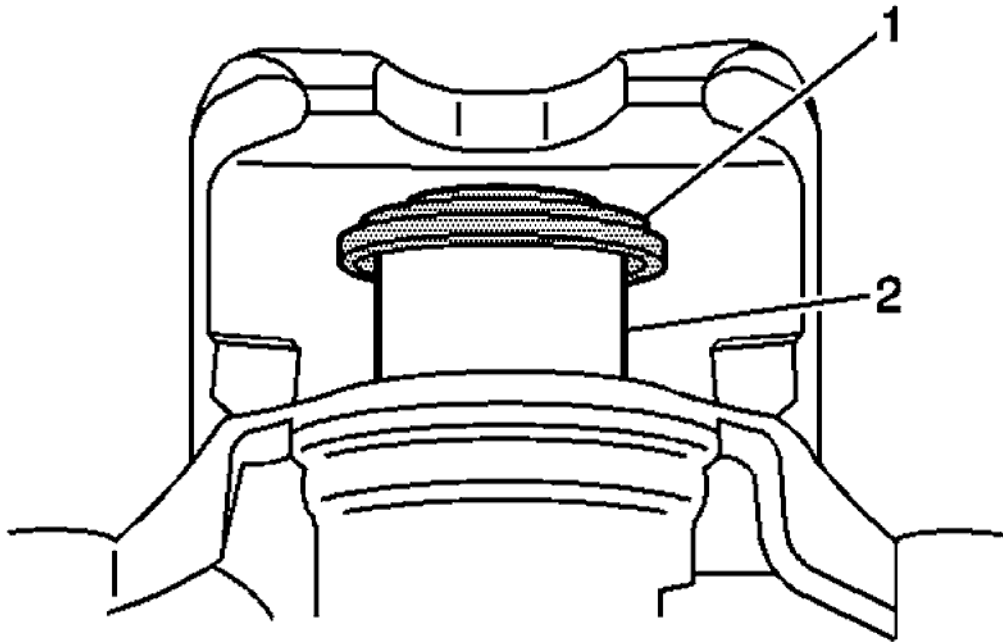


Fig. 28: Identifying Caliper Piston & Piston Dust Boot Seal
Courtesy of GENERAL MOTORS CORP.

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

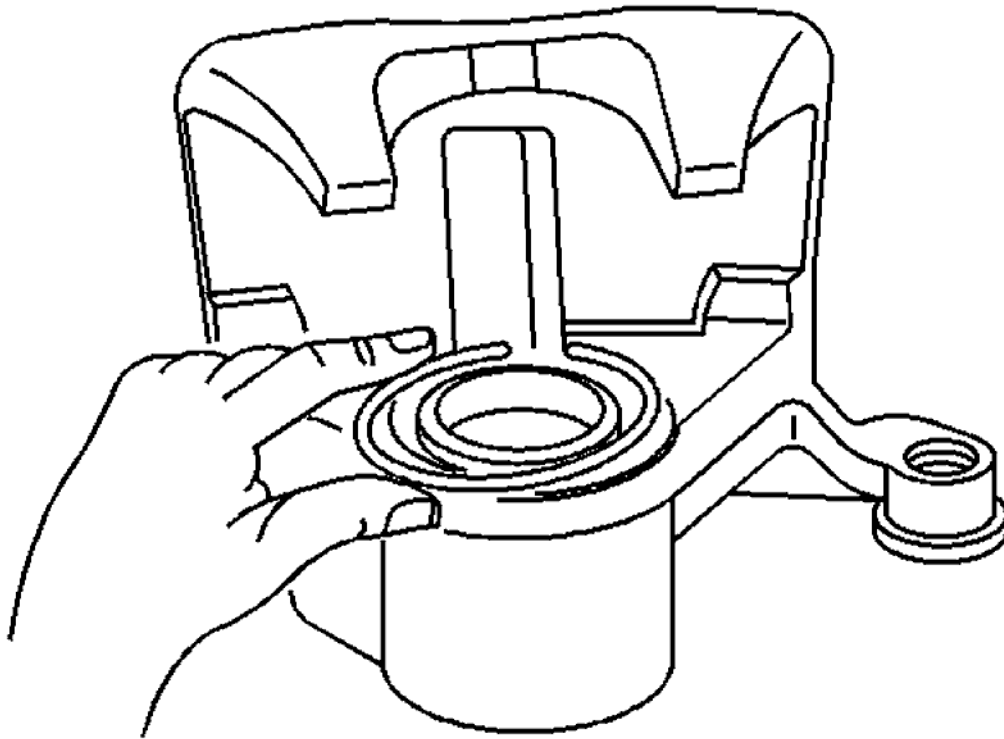


Fig. 29: View Of Dust Boot Retaining Ring
Courtesy of GENERAL MOTORS CORP.

8. Install the retaining ring that secures the dust boot to the caliper housing.

NOTE: Refer to Fastener Notice .

9. Install the bleeder valve to the caliper.

Tighten: Tighten the brake bleeder valve to 11 N.m (97 lb in).

10. Install the bleeder valve cap.
11. Install the brake caliper to the vehicle. Refer to Brake Caliper Replacement.

DISC BRAKE HARDWARE REPLACEMENT

CAUTION: Refer to Brake Dust Caution .

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Removal Procedure

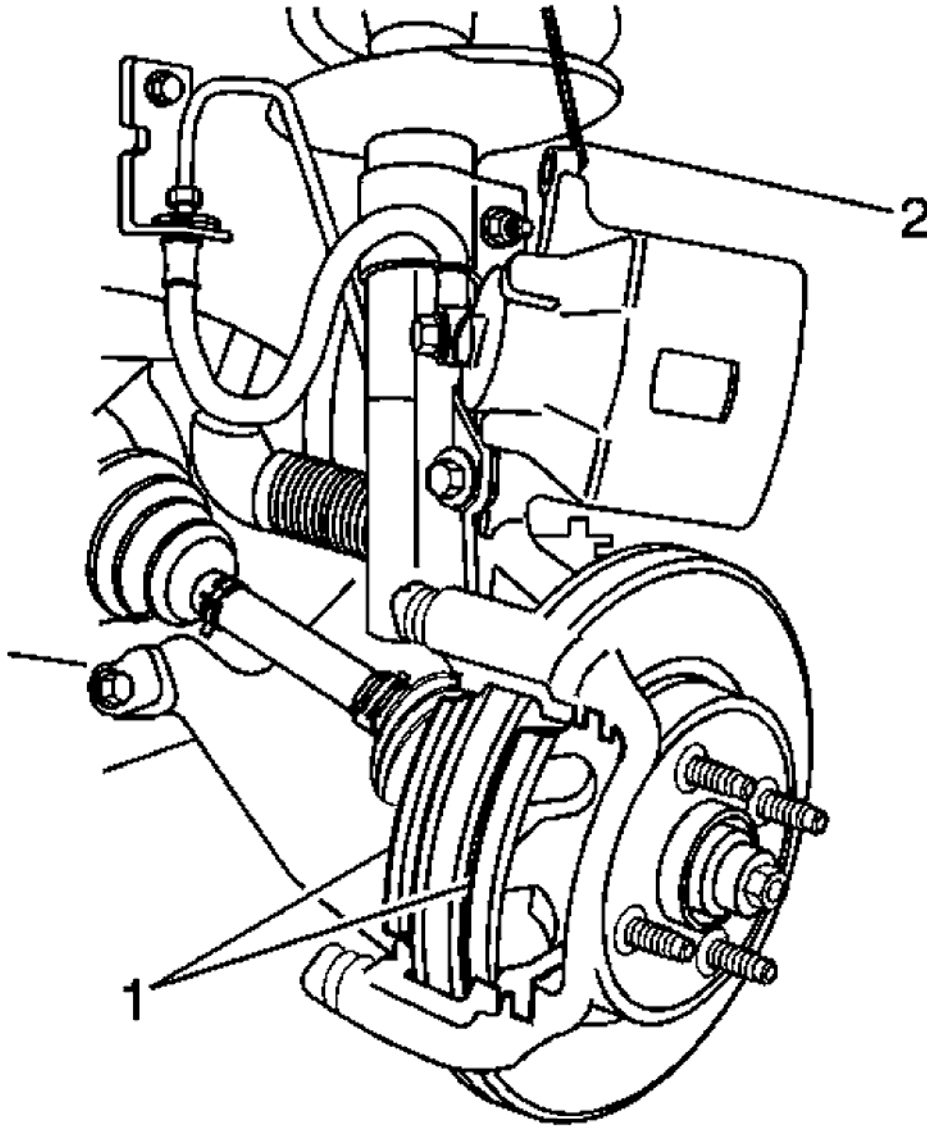


Fig. 30: View Of Brake Pads & Heavy Mechanic's Wire
Courtesy of GENERAL MOTORS CORP.

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

cause damage to the brake hose and in turn may cause a brake fluid leak.

1. Remove the brake caliper from the brake caliper mounting bracket and support the brake caliper with heavy mechanic's wire (2), or equivalent. Do NOT disconnect the hydraulic brake flexible hose from the caliper. Refer to **Brake Caliper Replacement**.
2. Remove the brake pads (1) from the brake caliper bracket.

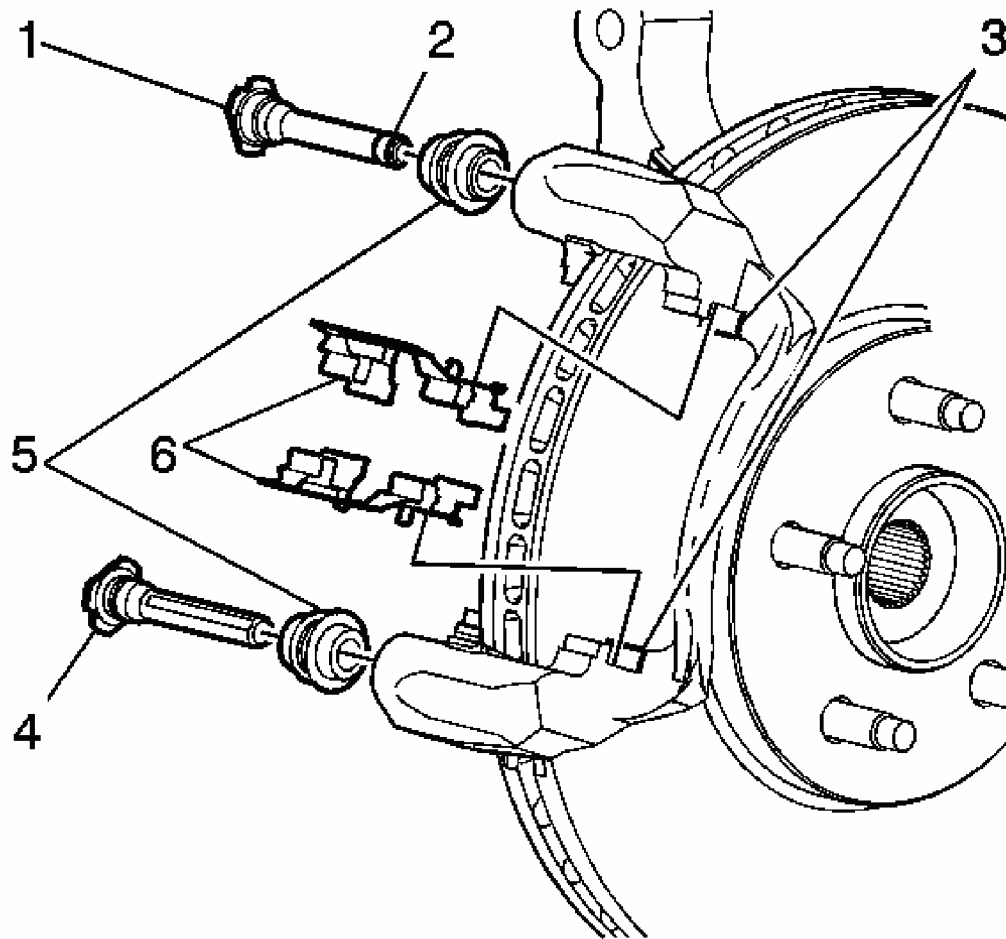


Fig. 31: Exploded View Of Front Disc Brake Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the disc brake pad retainers (6) from the brake caliper bracket.
4. Thoroughly clean the brake pad hardware mating surfaces of the caliper bracket (3), of any debris and corrosion.

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5. Inspect the disc brake pad retainers (6) for the following:
 - Bent mounting tabs
 - Excessive corrosion
 - Looseness at the brake caliper mounting bracket
 - Looseness at the disc brake pads
6. If any of the conditions listed are found, the disc brake pad retainers require replacement.
7. Remove the brake caliper guide pins (1, 4) from the brake caliper bracket.
8. Remove the caliper guide pin boots (5) from the caliper bracket.
9. Inspect the caliper guide pin bores in the caliper bracket. Carefully remove any debris or corrosion from the bores.
10. Inspect the guide pin boots (5). If the boots are damaged, they require replacement.
11. Inspect the guide pins (1, 4) and the bushing (2) on the upper guide pin. If either of the guide pin assemblies is damaged or corroded, or if the bushing is damaged, the guide pins require replacement.

Installation Procedure

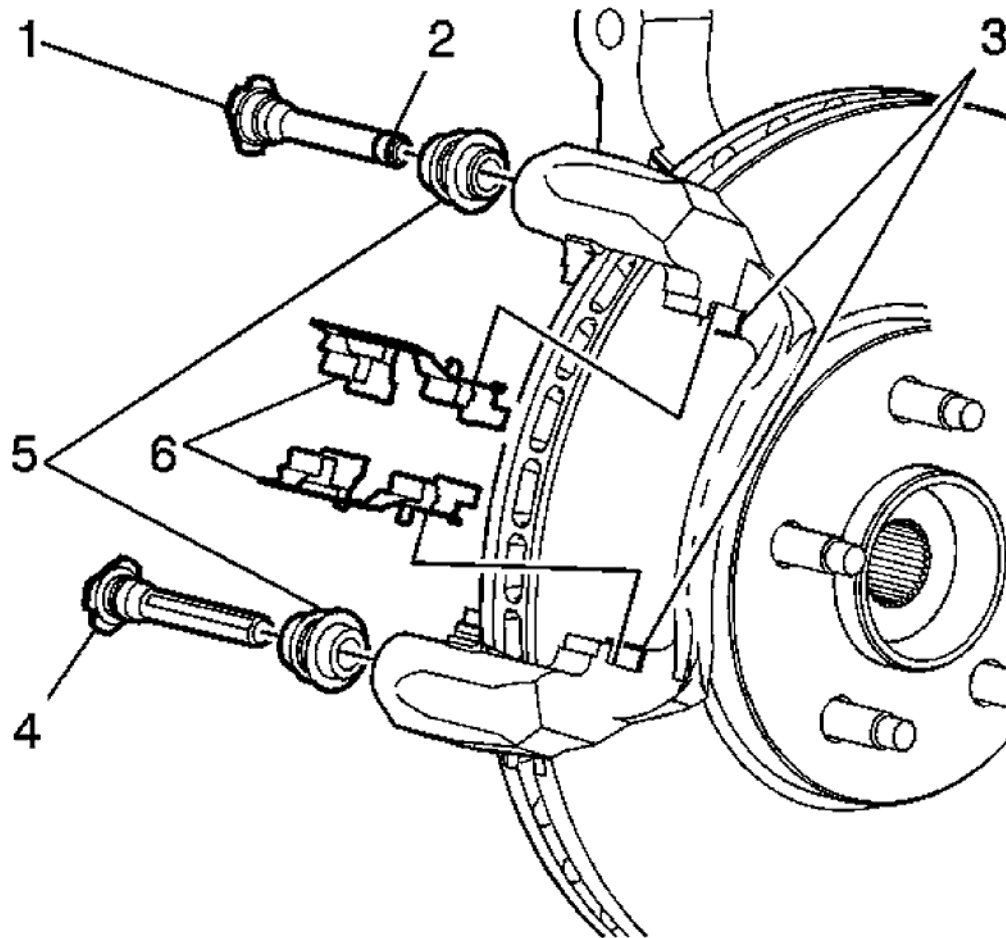


Fig. 32: Exploded View Of Front Disc Brake Assembly
Courtesy of GENERAL MOTORS CORP.

1. Apply a thin, light coating of high temperature silicone brake lubricant to the inside of the brake caliper guide pin boots (5).
2. Fully install the guide pin boots (5) to the brake caliper mounting bracket.

IMPORTANT: Ensure that there is not a build up of lubricant at the end of the upper guide pin, ahead of the bushing (2).

3. Apply a light coating of high temperature silicone brake lubricant to the brake caliper guide pins (1, 4), including the bushing (2) on the upper guide pin. Apply very little lubricant to the end of the upper guide pin, ahead of the bushing (2).
4. Install the brake caliper guide pins (1, 4) to the caliper mounting bracket. Ensure that

the rim of the guide pin boots is fully seated in the groove on the guide pins.

5. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket (3) only.
6. If reusing the brake pad retainers, clean the brake pad mating surfaces of the brake pad retainers (6).
7. Install the brake pad retainers (6) to the brake caliper bracket.

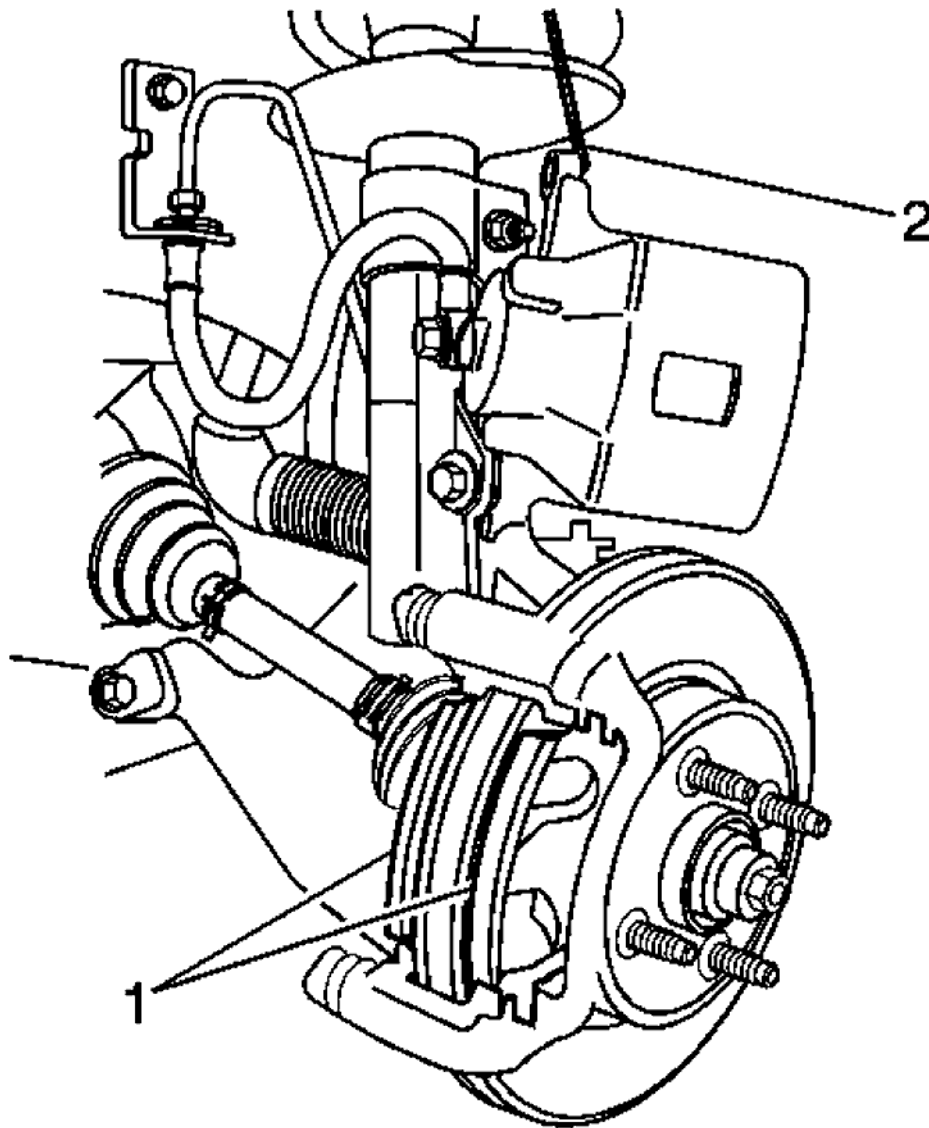


Fig. 33: View Of Brake Pads & Heavy Mechanic's Wire
Courtesy of GENERAL MOTORS CORP.

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IMPORTANT: The wear sensor equipped disc brake pad must be mounted inboard of the rotor with the leading edge of the sensor facing the brake rotor during forward wheel rotation, or at the top of the pad when installed in vehicle position.

8. Install the brake pads (1) to the brake caliper bracket.
9. Remove the support (2) and reposition the brake caliper over the brake pads and to the mounting bracket. Refer to **Brake Caliper Replacement**.

BRAKE CALIPER BRACKET REPLACEMENT

CAUTION: Refer to **Brake Dust Caution** .

Removal Procedure

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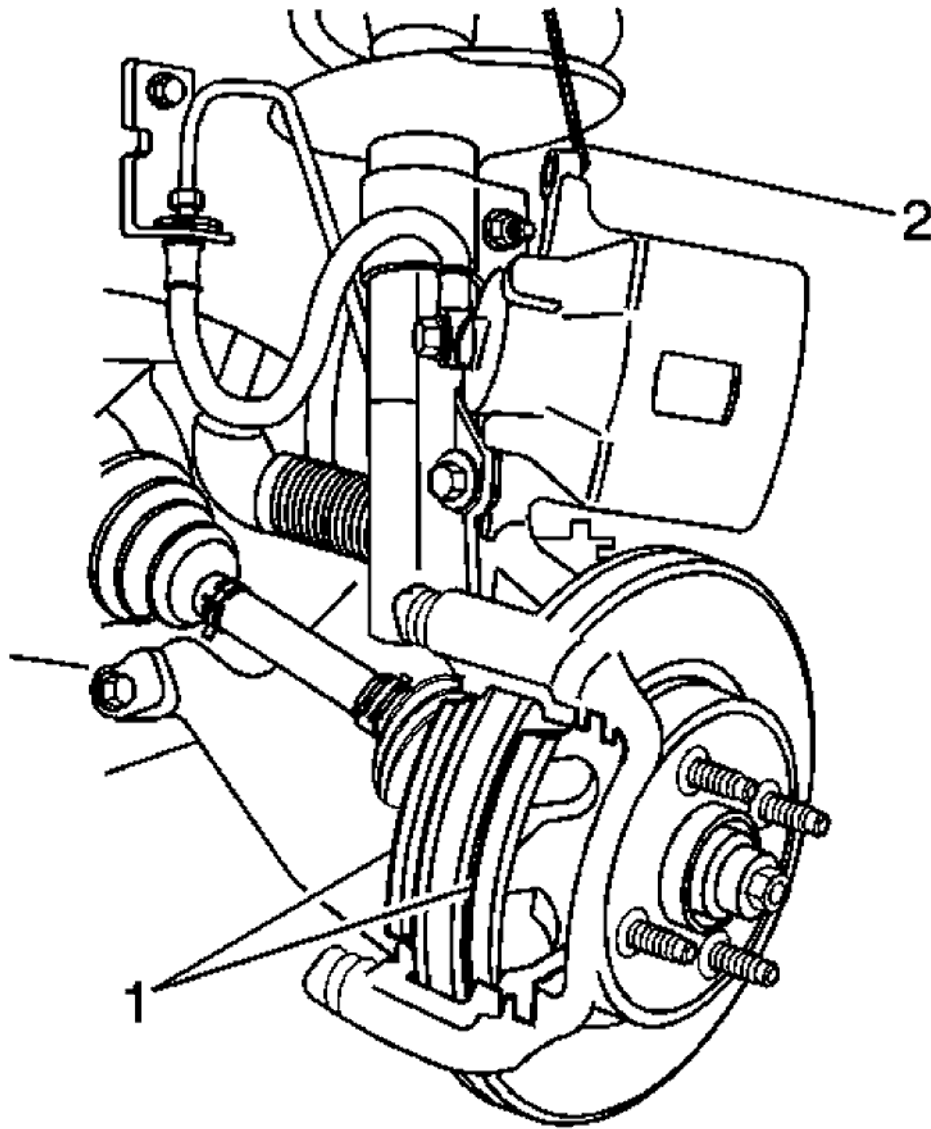


Fig. 34: View Of Brake Pads & Heavy Mechanic's Wire
Courtesy of GENERAL MOTORS CORP.

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

brake fluid leak.

1. Remove the brake caliper from the brake caliper mounting bracket and support the brake caliper with heavy mechanic's wire (2), or equivalent. Do NOT disconnect the hydraulic brake flexible hose from the caliper. Refer to **Brake Caliper Replacement**.

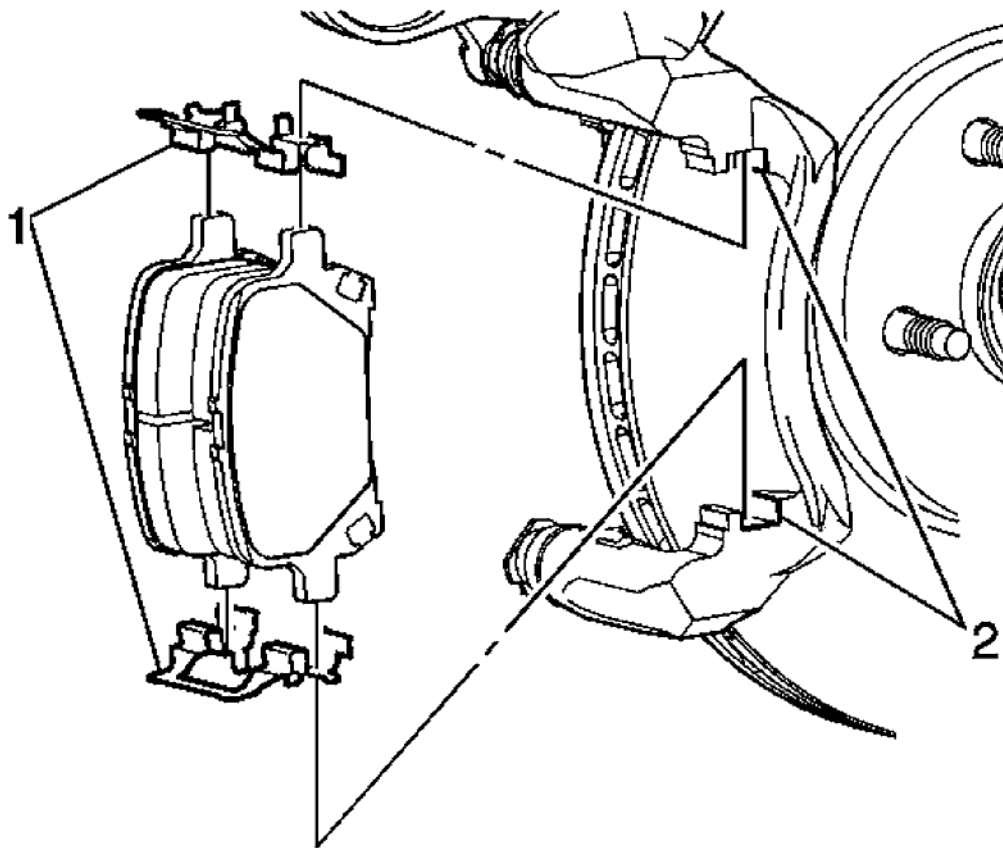


Fig. 35: Identifying Brake Pad Retainers & Caliper Bracket - Front
Courtesy of GENERAL MOTORS CORP.

2. Remove the brake pads from the brake caliper bracket.
3. Remove the brake pad retainers (1) from the brake caliper bracket.
4. If reusing the bracket, thoroughly clean the pad hardware mating surfaces of the caliper bracket (2), of any debris and corrosion.
5. Inspect the disc brake pad retainers (1) for the following:
 - Bent mounting tabs
 - Excessive corrosion

- Looseness at the brake caliper mounting bracket
 - Looseness at the disc brake pads
6. If any of the conditions listed are found, the disc brake pad retainers require replacement.

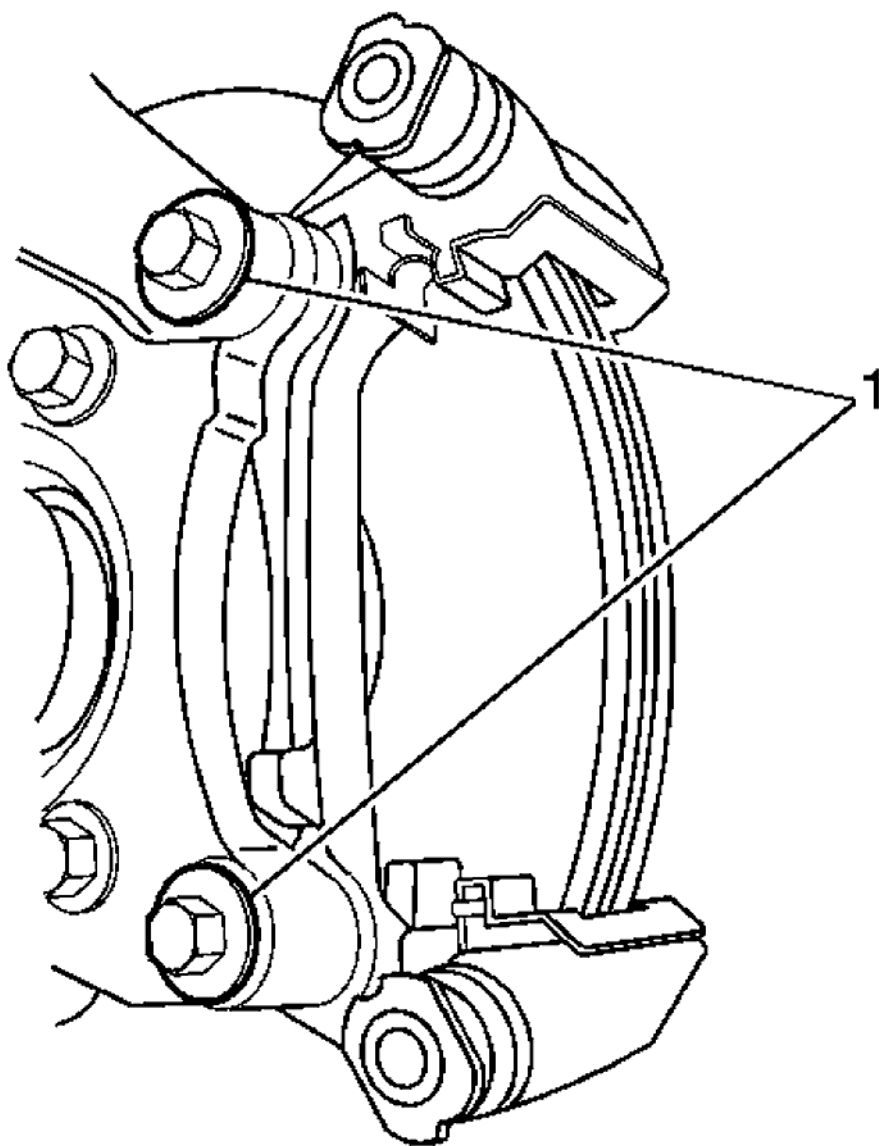


Fig. 36: Locating Front Brake Caliper Mounting Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

7. Remove the brake caliper mounting bracket bolts (1).

8. Remove the brake caliper bracket from the steering knuckle.

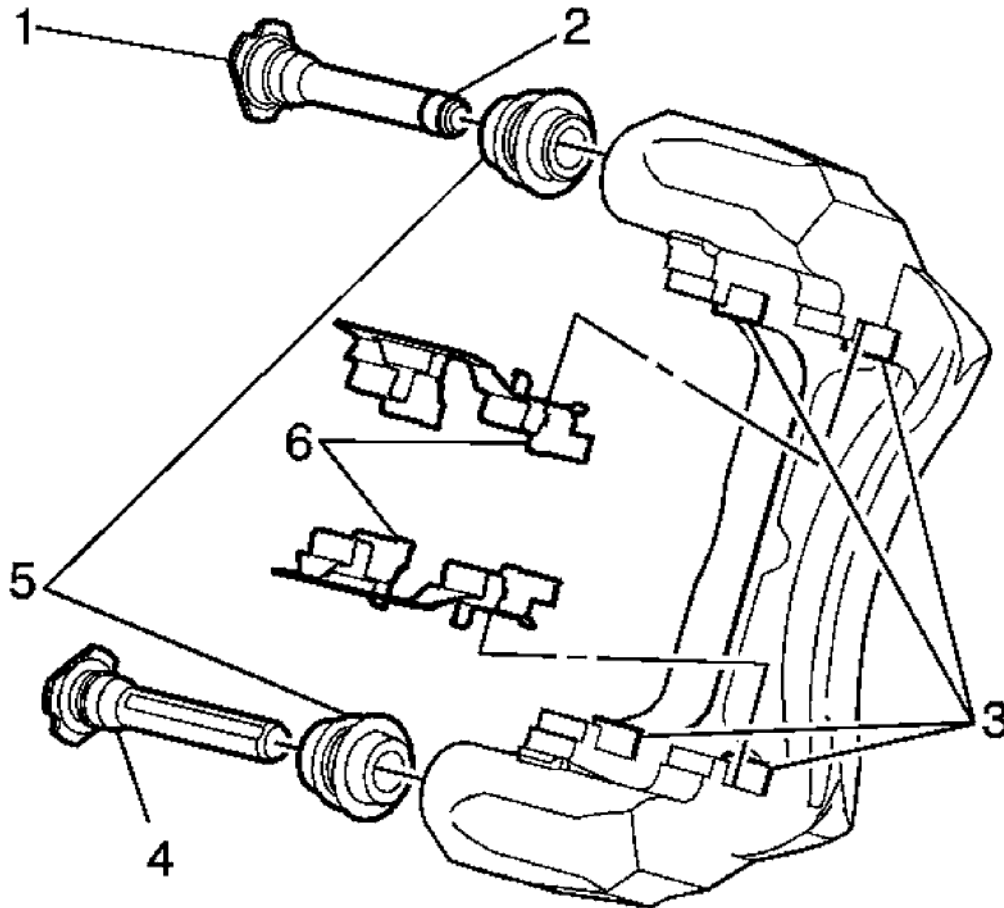


Fig. 37: Exploded View Of Front Brake Caliper Bracket
Courtesy of GENERAL MOTORS CORP.

9. Inspect the caliper bracket. If the brake caliper bracket is bent, cracked, or damaged, it requires replacement.
10. Inspect the brake caliper guide pins (1, 4) for freedom of movement, and inspect the condition of the guide pin boots (5). Move the guide pins inboard and outboard within the bracket bores, without disengaging the slides from the boots, and observe for the following:
 - Restricted caliper guide pin movement
 - Looseness in the brake caliper mounting bracket
 - Seized or binding caliper guide pins

- Split or torn boots

11. If any of the conditions listed are found, the brake caliper guide pins and/or boots require replacement.

Installation Procedure

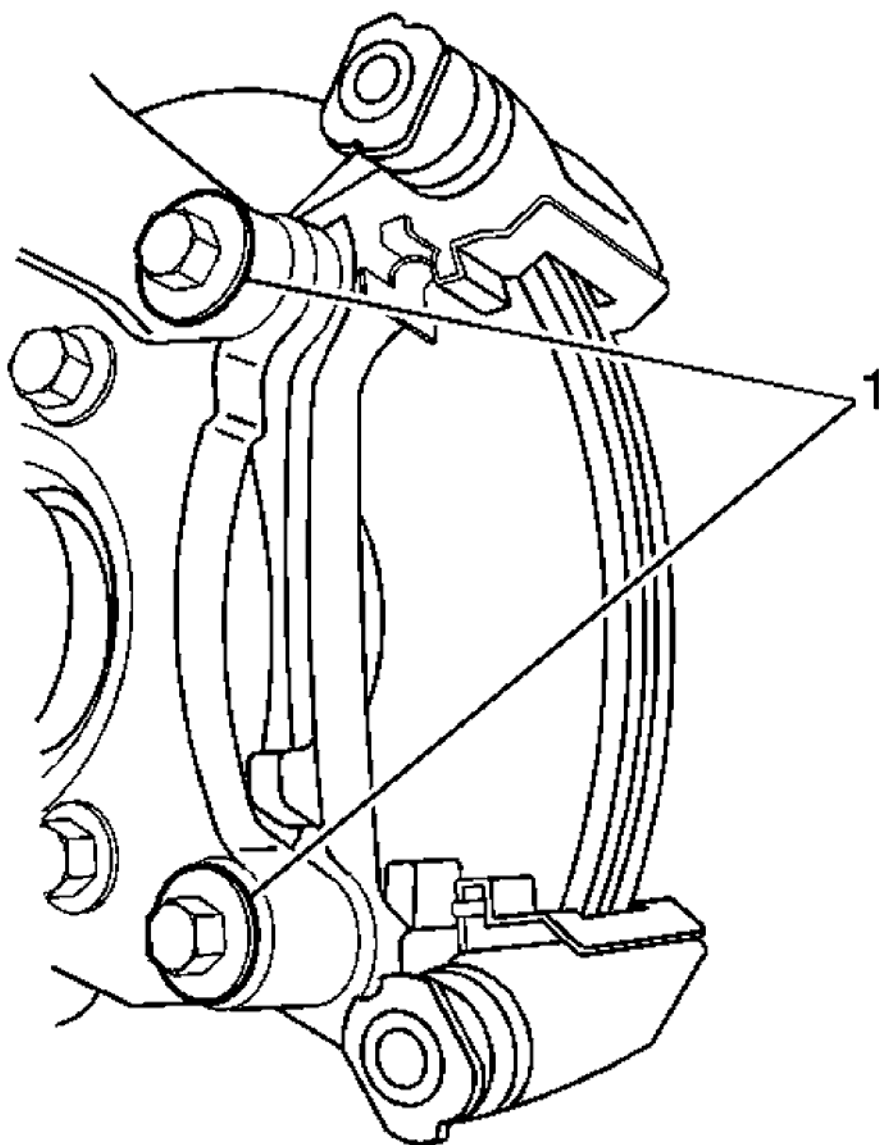


Fig. 38: Locating Front Brake Caliper Mounting Bracket Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the brake caliper mounting bracket to the steering knuckle.

NOTE: This is a self-retaining fastener joint that does not require thread locking compounds. Do not attempt to clean the threads with a standard tap. If a standard tap is used, damage to the joint threads will occur.

NOTE: Refer to Fastener Notice .

2. Install the brake caliper mounting bracket bolts (1).

Tighten: Tighten the bolts to 115 N.m (85 lb ft).

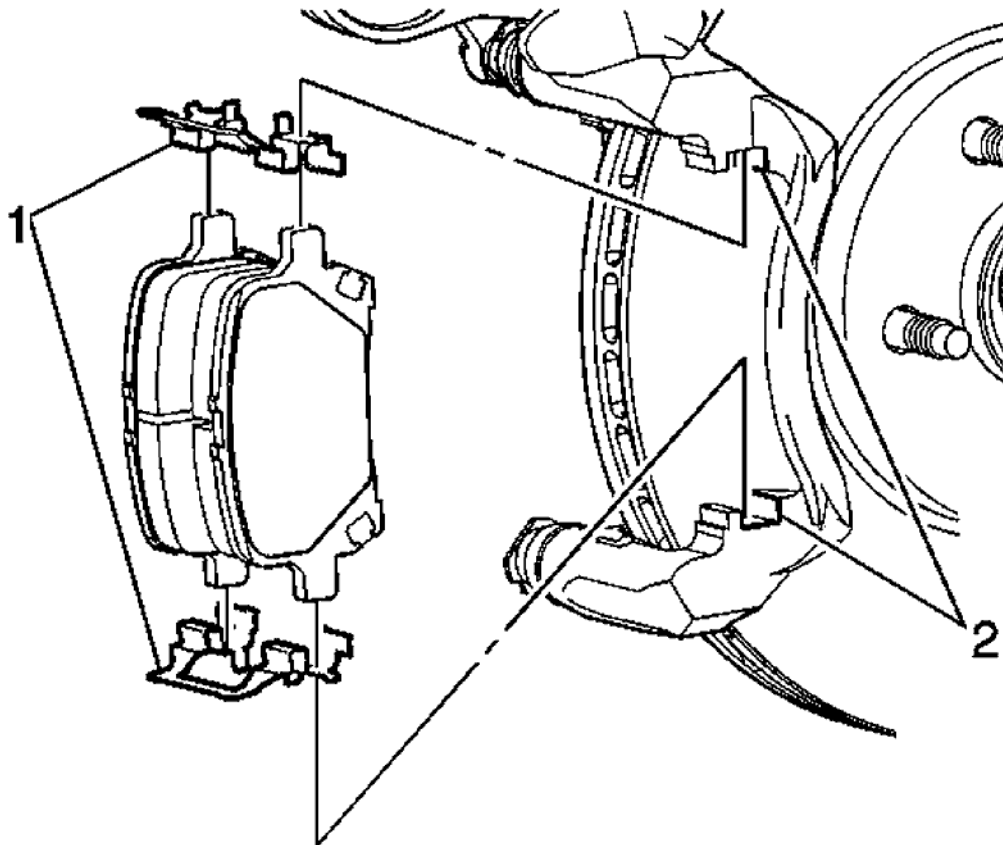


Fig. 39: Identifying Brake Pad Retainers & Caliper Bracket - Front
Courtesy of GENERAL MOTORS CORP.

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3. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket (2) only.
4. Clean the brake pad mating surfaces of the brake pad retainers (1).
5. Install the brake pad retainers (1) to the brake caliper bracket.

IMPORTANT: The wear sensor equipped disc brake pad must be mounted inboard of the rotor with the leading edge of the sensor facing the brake rotor during forward wheel rotation, or at the top of the pad when installed in vehicle position.

6. Install the brake pads to the brake caliper bracket.
7. Remove the support and reposition the brake caliper over the brake pads and to the mounting bracket. Refer to **Brake Caliper Replacement**.

BRAKE ROTOR REPLACEMENT

Tools Required

- J 41013 Rotor Resurfacing Kit. See **Special Tools**.
- J 42450-A Wheel Hub Resurfacing Kit. See **Special Tools**.

CAUTION: Refer to **Brake Dust Caution** .

Removal Procedure

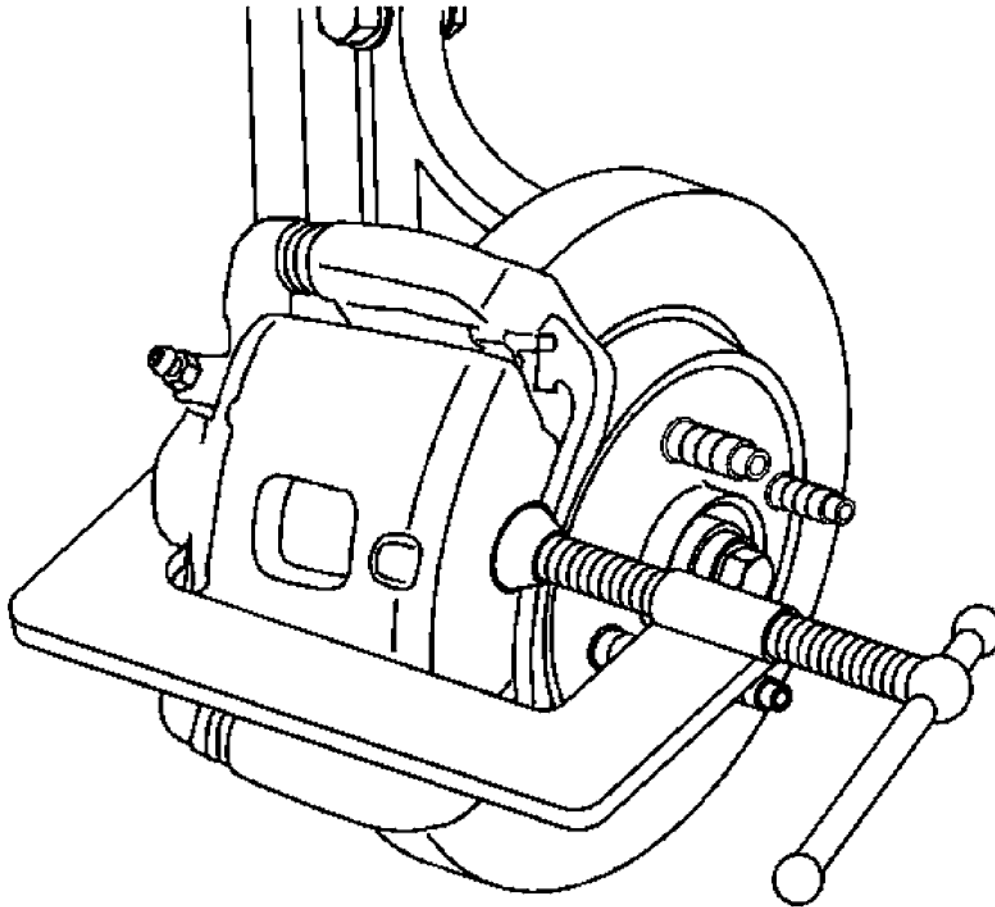


Fig. 40: Installing C-Clamp To Front Brake Caliper
Courtesy of GENERAL MOTORS CORP.

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. Install a C-clamp over the body of the brake caliper, with the C-clamp ends against the rear of the caliper body and the outboard disc brake pad.
4. Tighten the C-clamp until the caliper piston is compressed into the caliper bore enough to allow the caliper to slide past the brake rotor.
5. Remove the C-clamp.

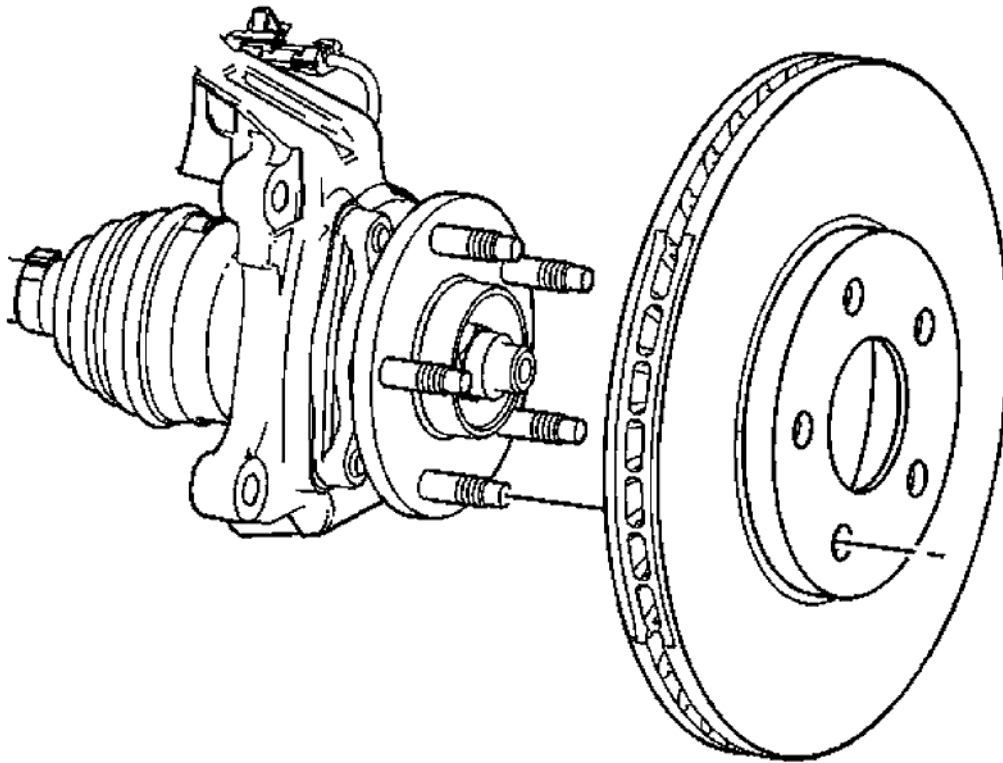


Fig. 41: View Of Front Brake Rotor
Courtesy of GENERAL MOTORS CORP.

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

IMPORTANT: Do NOT disconnect the hydraulic brake flexible hose from the caliper.

6. Remove the brake caliper and the caliper mounting bracket as an assembly from the steering knuckle and support the assembly with heavy mechanic's wire, or equivalent. Ensure that there is no tension on the hydraulic brake flexible hose. Refer to **Brake Caliper Bracket Replacement**.
7. Matchmark the position of the brake rotor to the wheel studs.

8. Remove the brake rotor.

Installation Procedure

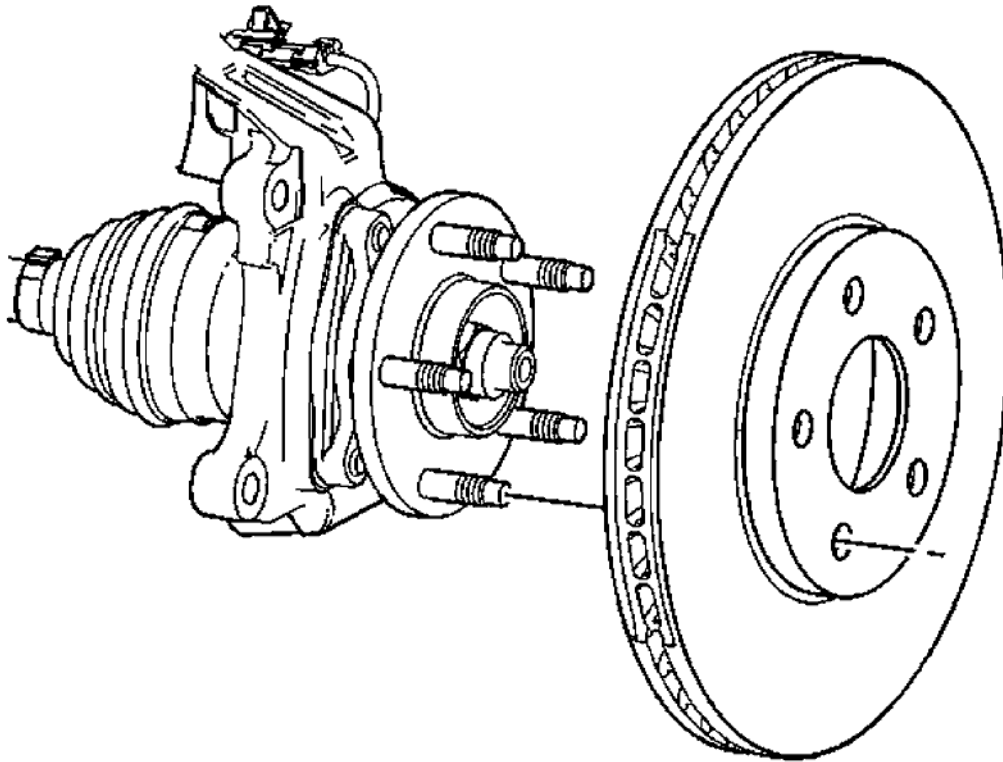


Fig. 42: View Of Front Brake Rotor
Courtesy of GENERAL MOTORS CORP.

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

1. Using the **J 42450-A** , thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange. See **Special Tools**.
2. Using the **J 41013** , thoroughly clean any rust or corrosion from the mating surface and mounting surface of the brake rotor. See **Special Tools**.
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. Install the brake rotor to the hub/axle flange. Use the matchmark made prior to removal for proper orientation to the flange.
5. If the brake rotor was removed and installed as part of a brake system repair, measure the assembled LRO of the brake rotor to ensure optimum performance of the disc brakes. Refer to **Brake Rotor Assembled Lateral Runout (LRO) Measurement**.
6. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. Refer to **Brake Rotor Assembled Lateral Runout (LRO) Correction**.
7. Remove the support, and install the brake caliper and the brake caliper bracket as an assembly to the steering knuckle. Refer to **Brake Caliper Bracket Replacement**.
8. Install the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation**.
9. Lower the vehicle.
10. If the brake rotor was refinished or replaced, or if new brake pads were installed, burnish the pads and rotors. Refer to **Burnishing Pads and Rotors**.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT (LRO) CORRECTION

IMPORTANT:

- **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 (LRO) 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. Refer to **Brake Rotor Assembled Lateral Runout (LRO) Correction - Indexing**.
- The correction plate method of correcting assembled LRO involves the addition of a tapered plate between the brake rotor and the hub/axle flange. The correction plate method can be used to correct LRO that exceeds the specification by up to 0.23 mm (0.009 in). Refer to **Brake Rotor Assembled Lateral Runout (LRO) Correction -**

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Correction Plates.

- 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 (LRO) 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 (LRO) CORRECTION - INDEXING

Tools Required

- J 39544-KIT Torque-Limiting Socket Set, or equivalent. See **Special Tools.**
- J 45101-100 Conical Brake Rotor Washers. See **Special Tools.**

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

- IMPORTANT:**
- 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 (LRO) Measurement.**

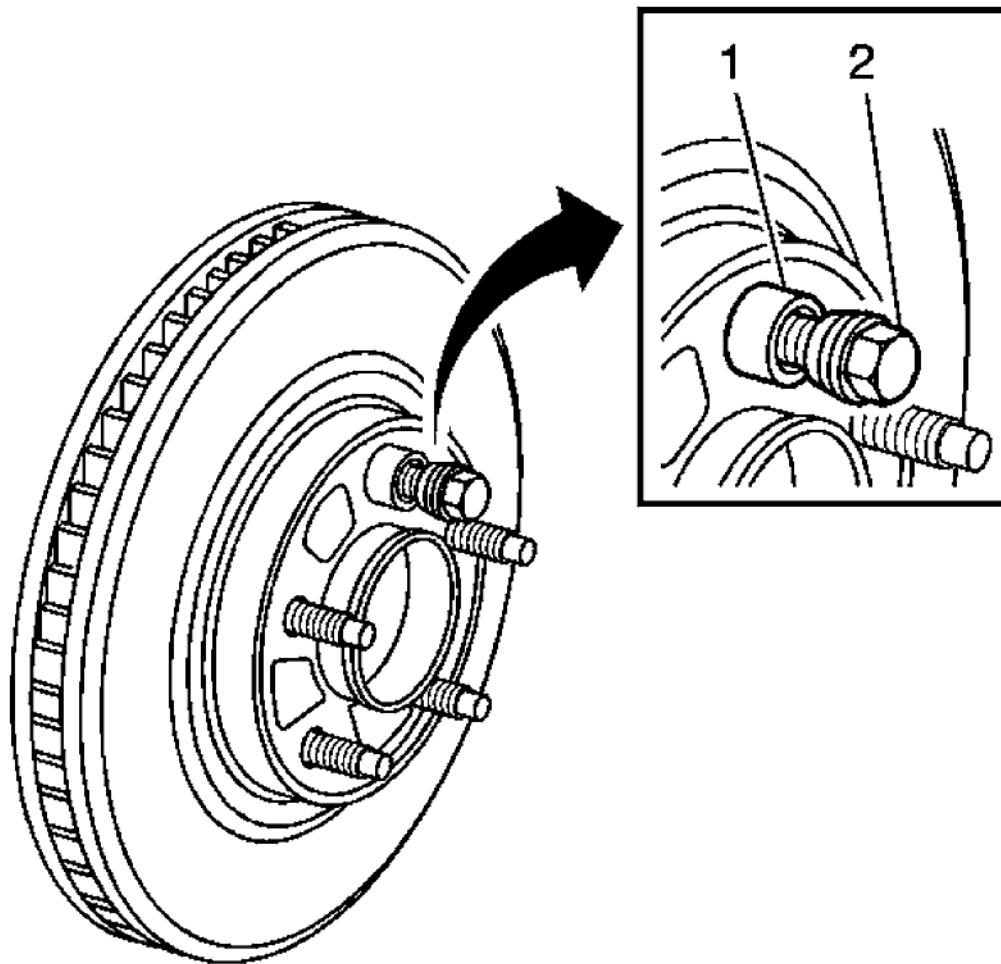


Fig. 43: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

1. Remove the **J 45101-100** and the lug nuts that were installed during the assembled LRO measurement procedure. See **Special Tools**.
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 **J 45101-100** (1) and one lug nut (2) onto the upper-most wheel stud. See **Special Tools**.
5. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

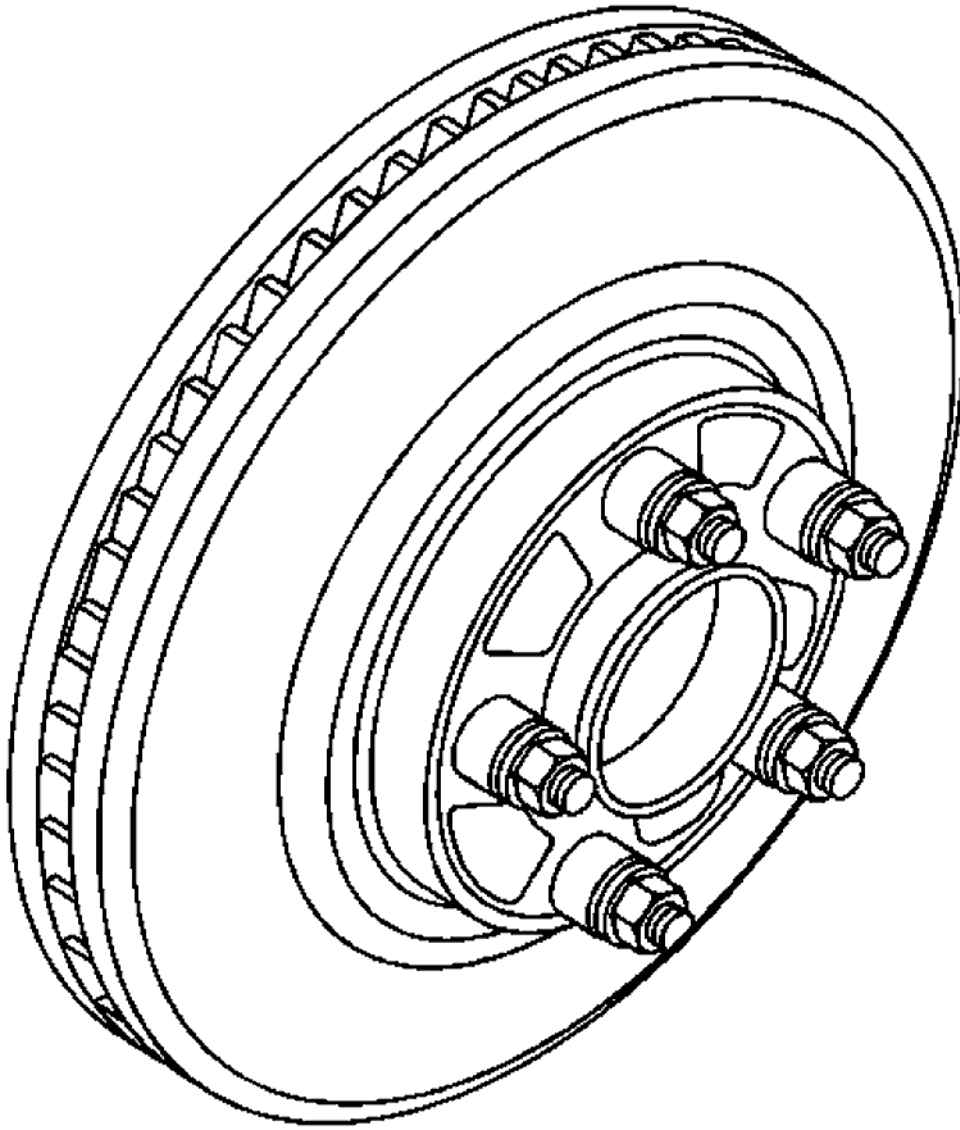


Fig. 44: Installing All J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

6. Install the remaining **J 45101-100** and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern. See **Special Tools**.
7. Using the **J 39544-KIT** , or equivalent, tighten the lug nuts in a star-pattern to specification, in order to properly secure the rotor. See **Special Tools**. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
8. Measure the assembled LRO of the brake rotor. Refer to **Brake Rotor Assembled**

Lateral Runout (LRO) 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 (LRO) 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 **J 45101-100** and the lug nuts. See **Special Tools.**

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT (LRO) CORRECTION - CORRECTION PLATES

Tools Required

- **J 39544-KIT** Torque-Limiting Socket Set, or equivalent. See **Special Tools.**
- **J 45101-100** Conical Brake Rotor Washers. See **Special Tools.**

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

- IMPORTANT:**
- 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 (LRO) Measurement.**

2006 Chevrolet HHR LT

2006 BRAKES Disc Brakes - HHR

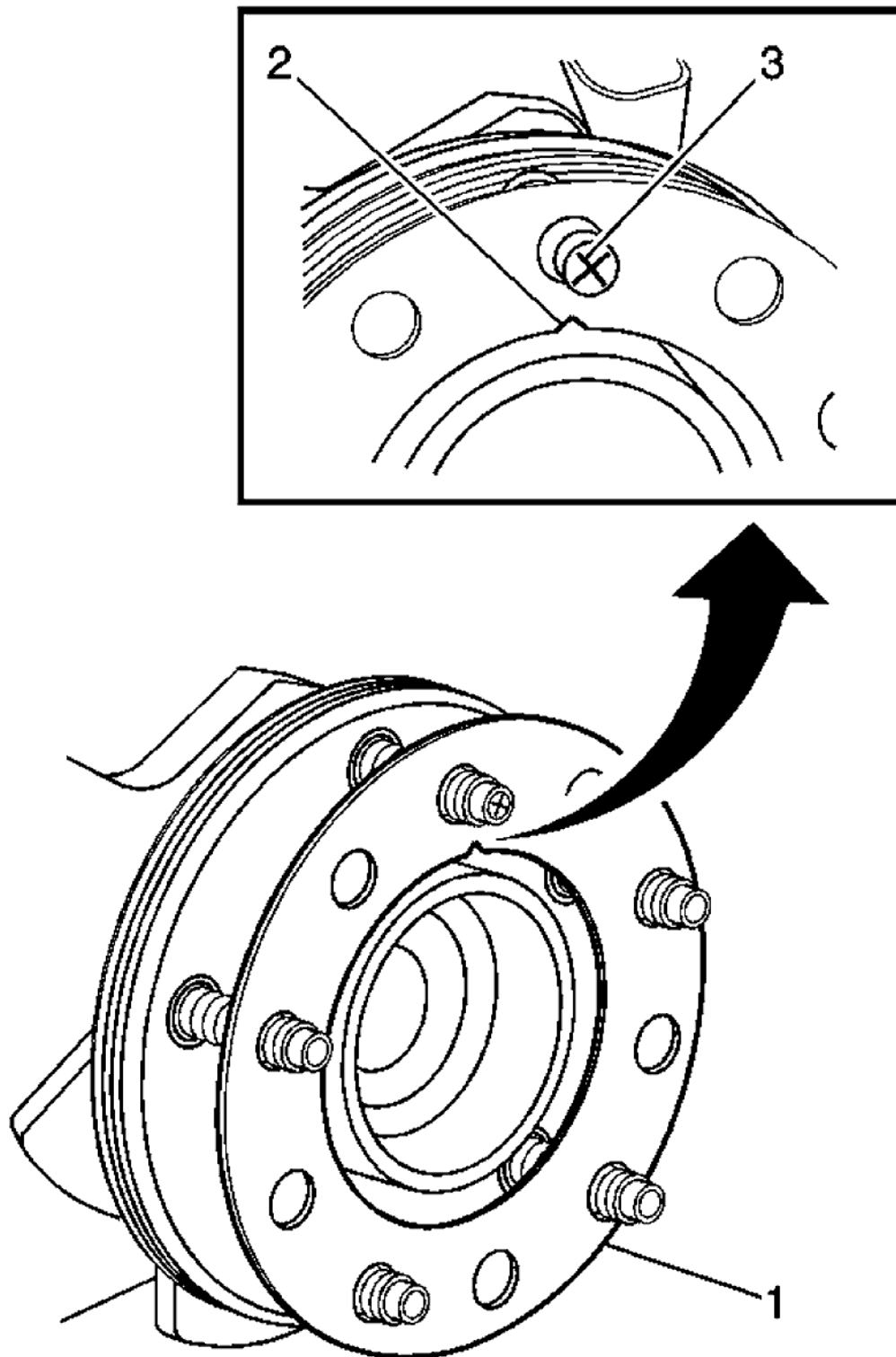


Fig. 45: Identifying Correction Plate, High Spot Mark & V-Shaped Notch

Courtesy of GENERAL MOTORS CORP.

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 **J 45101-100** and the lug nuts that were installed during the assembled LRO measurement procedure and/or the indexing correction procedure. See **Special Tools**.
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.

IMPORTANT:

- **Do NOT install used correction plates in an attempt to correct brake rotor assembled lateral runout (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.

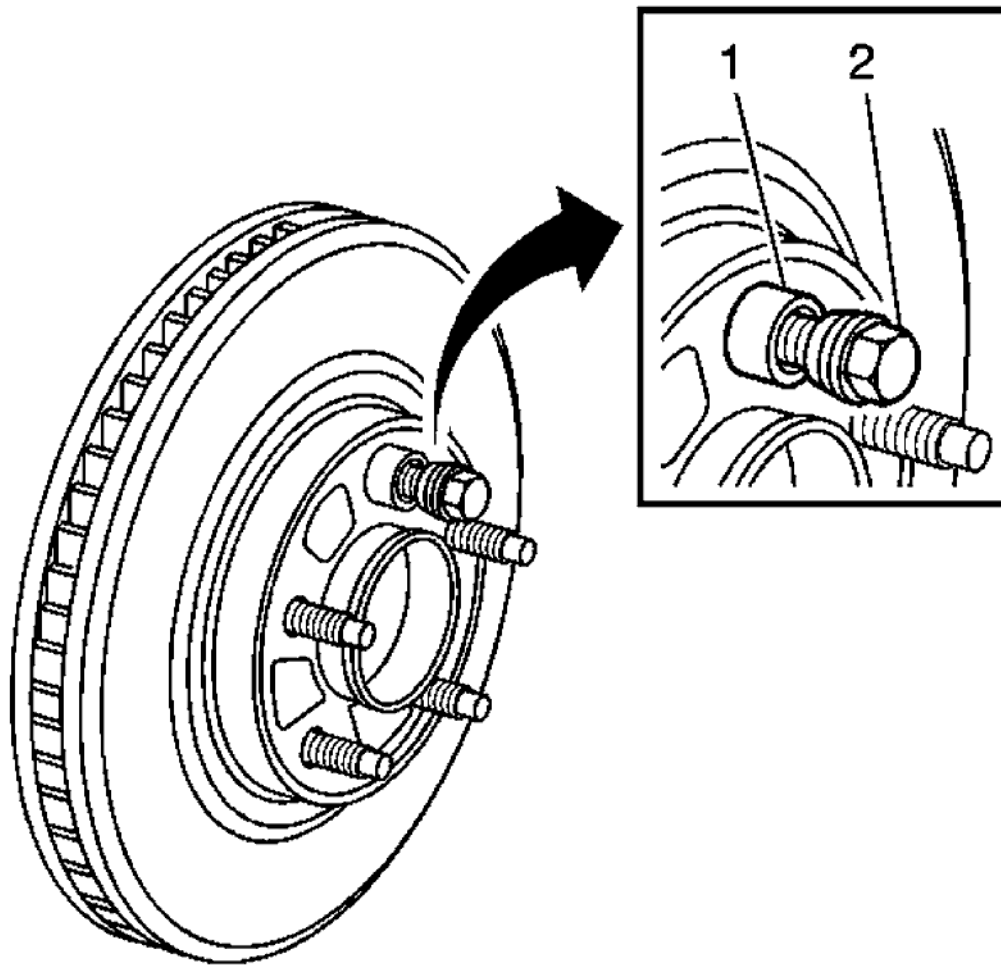


Fig. 46: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

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 **J 45101-100** (1) and one lug nut (2) onto the upper-most wheel stud. See **Special Tools**.
9. Continue to hold the rotor secure and tighten the lug nut firmly by hand.

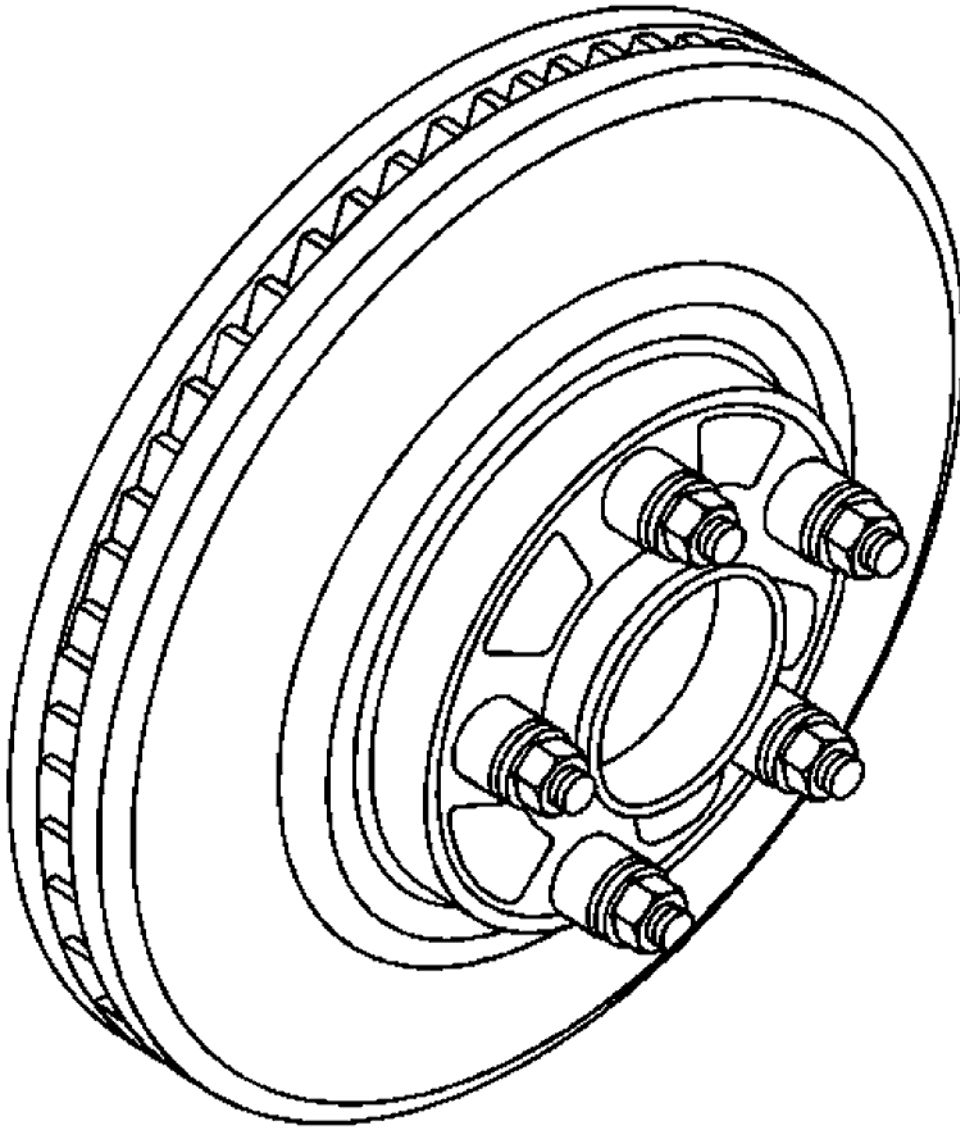


Fig. 47: Installing All J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

10. Install the remaining **J 45101-100** and lug nuts onto the wheel studs and tighten the nuts firmly by hand in a star-pattern. See **Special Tools**.
11. Using the **J 39544-KIT** , or equivalent, tighten the lug nuts in a star-pattern to specification, in order to properly secure the rotor. See **Special Tools**. Refer to **Tire and Wheel Removal and Installation** in Tires and Wheels.
12. Measure the assembled LRO of the brake rotor. Refer to **Brake Rotor Assembled**

Lateral Runout (LRO) Measurement.

13. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to **Brake Rotor Assembled Lateral Runout (LRO) 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 **J 45101-100** and the lug nuts. See **Special Tools.**

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT (LRO) CORRECTION - ON-VEHICLE LATHE**Tools Required**

J 45101-100 Conical Brake Rotor Washers. See **Special Tools.**

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

IMPORTANT:

- 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 (LRO) 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 **J 45101-100** and the lug nuts that were installed during the assembled LRO measurement procedure and/or the indexing correction procedure. See **Special Tools.**
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. 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 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. Refer to **Brake Rotor Assembled Lateral Runout (LRO) Measurement**.
11. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to **Brake Rotor Assembled Lateral Runout (LRO) 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 **J 45101-100** and the lug nuts. See **Special Tools**.

BRAKE ROTOR REFINISHING

Tools Required

- **J 41013** Rotor Resurfacing Kit. See **Special Tools**.
- **J 42450-A** Wheel Hub Resurfacing Kit. See **Special Tools**.

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

- IMPORTANT:**
- 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. Refer to 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.

IMPORTANT: 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 **J 42450-A**, thoroughly clean any rust or corrosion from the mating surface of the hub/axle flange. See Special Tools.
2. Using the **J 41013**, thoroughly clean any rust or corrosion from the mating surface and mounting surface of the brake rotor. See Special Tools.
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. Refer to **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
 3. After applying a non-directional finish, clean each friction surface of the brake rotor with denatured alcohol, or an equivalent approved brake cleaner
13. Remove the brake rotor from the brake lathe.
14. Measure the assembled lateral runout (LRO) of the brake rotor to ensure optimum performance of the disc brakes. Refer to **Brake Rotor Assembled Lateral Runout (LRO) Measurement**.
15. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. Refer to **Brake Rotor Assembled Lateral Runout (LRO) 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

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.

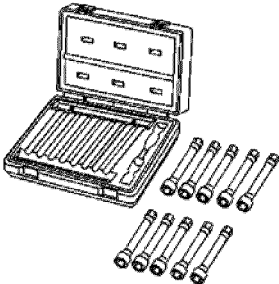
System Operation

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.

SPECIAL TOOLS AND EQUIPMENT

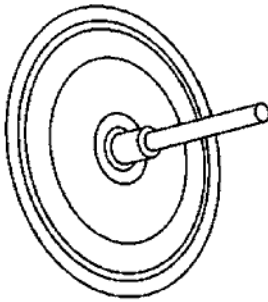
SPECIAL TOOLS

Special Tools

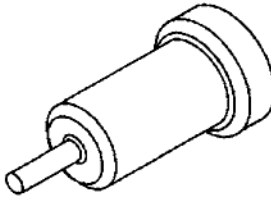
Illustration	Tool Number/Description
	J 39544-KIT Complete Torque Socket Set-10 PCS

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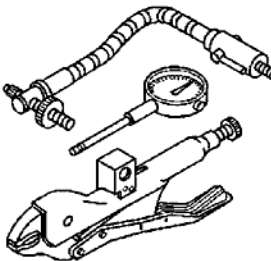
2006 BRAKES Disc Brakes - HHR



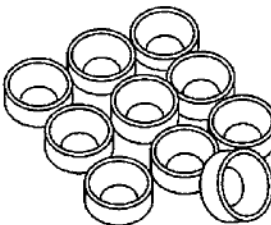
J 41013
Rotor Resurfacing Kit



J 42450-A
Wheel Hub Resurfacing Kit



J 45101
Hub and Wheel Runout Gage



J 45101-100
Conical Brake Rotor Washers