2007 BRAKES

Disc Brakes - Outlook

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Caliper Bleed Valve - Front	13 N.m	115 lb in
Brake Caliper Bleed Valve - Rear	7 N.m	62 lb in
Brake Caliper Bracket Bolts - Front	175 N.m	129 lb ft
Brake Caliper Bracket Bolts - Rear	200 N.m	148 lb ft
Brake Caliper Guide Pin Bolts - Front Tighten the guide pin bolt closest to the bleed valve first.	64 N.m	47 lb ft
Brake Caliper Guide Pin Bolts - Rear Tighten the guide pin bolt closest to the bleed valve first.	22 N.m	16 lb ft
Brake Hose Fitting Bolts - Front and Rear	40 N.m	30 lb ft
Brake Pipe Fittings - Front and Rear at Brake Hose	17 N.m	13 lb ft
Brake Pipe Fittings - Rear Crossover Brake Pipe Union	18 N.m	13 lb ft
Brake Rotor Retention Screw - Front	12 N.m	106 lb in
Brake Rotor Retention Screw - Rear	6 N.m	53 lb in

DISC BRAKE COMPONENT SPECIFICATIONS

General Specifications

Application	Specification	
	Metric	English
Front Brakes		
• Rotor Minimum Thickness *	27.5 mm	1.08 in
• Rotor Thickness (new)	29.0 mm	1.14 in
• Rotor Maximum Allowable Assembled Lateral	0.06 mm	0.002 in

Runout		
• Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 in
Rear Brakes		
• Rotor Minimum Thickness *	18.4 mm	0.72 in
• Rotor Thickness (new)	20 mm	0.79 in
• Rotor Maximum Allowable Assembled Lateral Runout	0.06 mm	0.002 in
• Rotor Maximum Allowable Scoring	1.50 mm	0.059 in
• Rotor Maximum Allowable Thickness Variation	0.025 mm	0.001 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

DIAGNOSTIC STARTING POINT - DISC BRAKES

Begin the disc brake system diagnosis with **Diagnostic Starting Point - 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 .

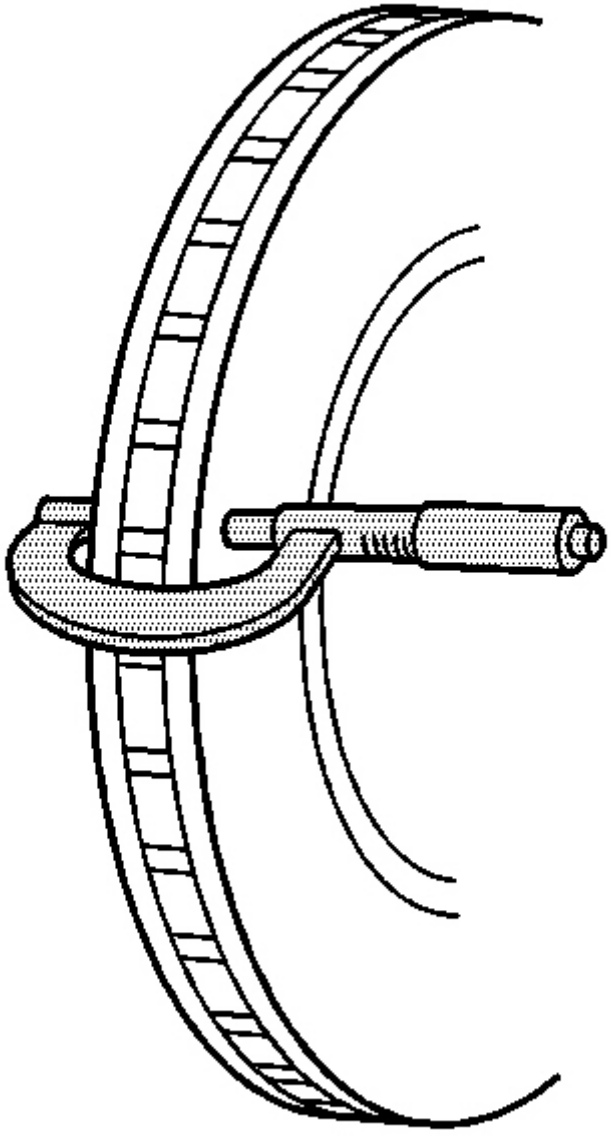


Fig. 1: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

1. Clean the brake pad lining contact surface of the brake rotor with denatured alcohol or an equivalent brake cleaner.
2. Using a micrometer calibrated in ten-thousands of an inch, measure and record the lowest

thickness of the brake rotor at four or more points, equally spaced around the rotor.

Ensure that the measurements are only taken within the brake pad lining contact area and that the micrometer is positioned the same distance from the outside edge of the rotor for each measurement.

3. Compare the lowest thickness measurement recorded to the specifications. Refer to **Disc Brake Component Specifications**.
4. If the lowest thickness measurement of the brake rotor is above the brake rotor minimum thickness specification; the rotor may be refinished, depending upon the surface and wear conditions which may be present.
5. If the lowest thickness measurement of the brake rotor is below the minimum thickness specification; the rotor requires replacement.

BRAKE ROTOR THICKNESS VARIATION MEASUREMENT

CAUTION: Refer to Brake Dust Caution .

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 **Front Disc Brake Pads Replacement** and/or **Rear Disc Brake Pads Replacement**.
2. Clean the friction surfaces of the brake rotor with denatured alcohol or an equivalent approved brake cleaner.

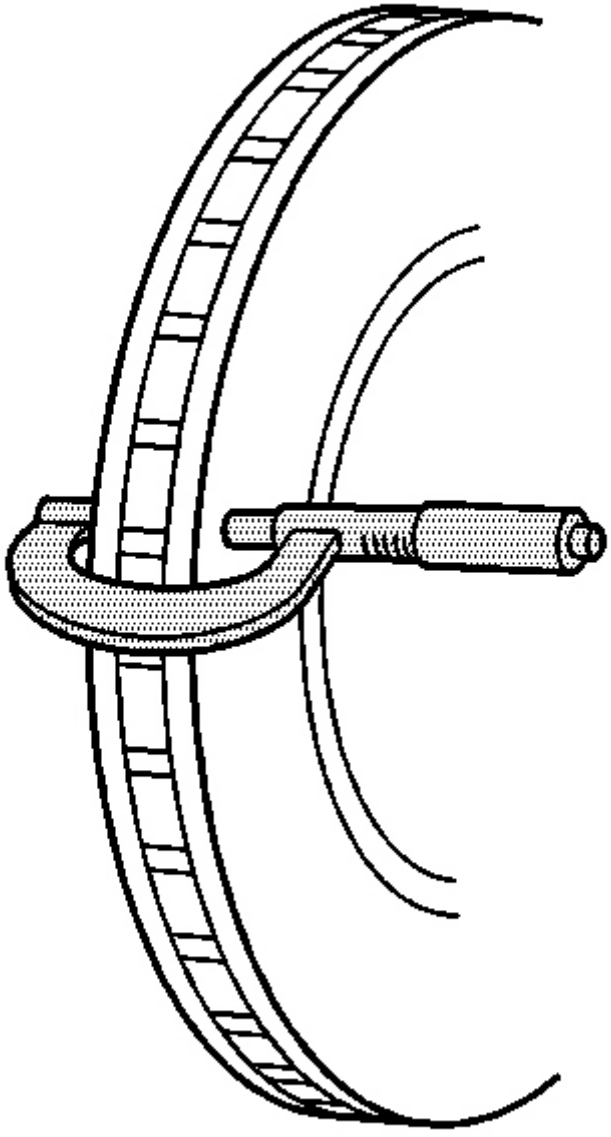


Fig. 2: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

3. Using a micrometer calibrated in thousanths-of-a-millimeter or ten-thousanths-of-an-inch, measure and record the thickness of the brake rotor at four or more points, evenly spaced around the rotor.

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

4. 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 .

1. If the inboard friction surface of the brake rotor is not accessible, reposition and support the caliper with the brake pads. Refer to **Front Disc Brake Pads Replacement** and/or **Rear Disc Brake Pads Replacement**.
2. Clean the friction surfaces of the brake rotor with denatured alcohol or an equivalent approved brake cleaner.
3. Inspect the friction surfaces of the brake rotor for the following Braking Surface Conditions:
   - Heavy rust and/or pitting

     Light surface rust can be removed with an abrasive disc. Heavy surface rust and/or pitting must be removed by refinishing the rotor.

   - Cracks and/or heat spots
   - Excessive blueing discoloration
4. If the friction surfaces of the brake rotor exhibit one or more of the Braking Surface Conditions, the rotor requires refinishing or replacement.

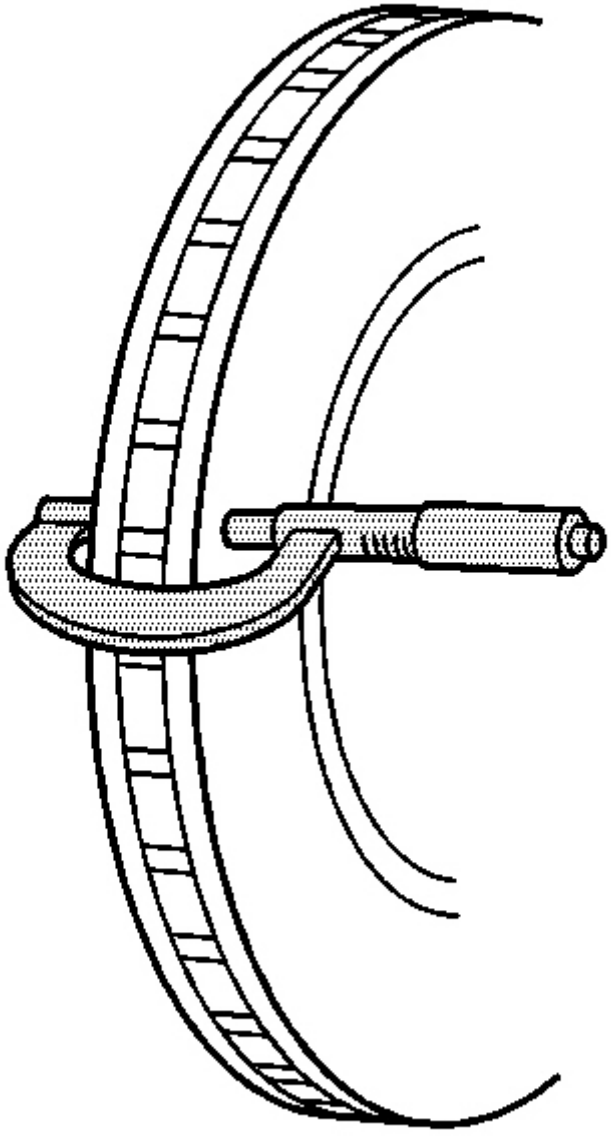


Fig. 3: Measuring Brake Rotor Thickness
Courtesy of GENERAL MOTORS CORP.

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

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

7. If the brake rotor scoring depth exceeds the specification or if an excessive amount of scoring is present, the rotor requires refinishing or replacement.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT MEASUREMENT

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

CAUTION: Refer to Brake Dust Caution .

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 lateral runout (LRO). Thickness variation exceeding the maximum acceptable level can cause brake pulsation. Refer to Brake Rotor Thickness Variation Measurement.**

Measurement Procedure

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 lateral runout (LRO) of the brake rotor, which could lead to brake pulsation.

2. Inspect the mating surface of the hub/axle flange and the brake rotor to ensure that there are no foreign particles, corrosion, rust or debris remaining. If the wheel hub/axle flange and/or if the brake rotor mating surfaces exhibit these conditions, perform the following steps:
    1. Remove the brake rotor from the vehicle. Refer to **Front Brake Rotor Replacement** and/or **Rear Brake Rotor Replacement**.
    2. Using the **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.

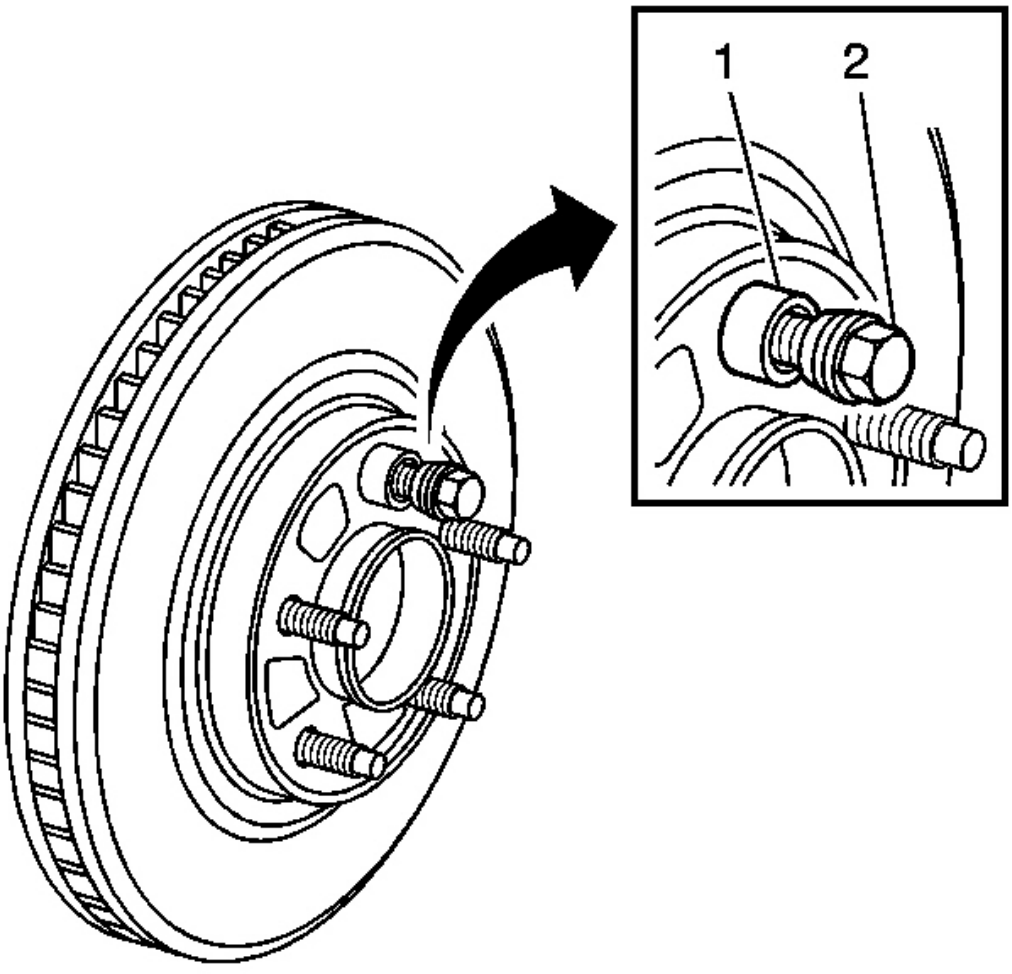


Fig. 4: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

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.

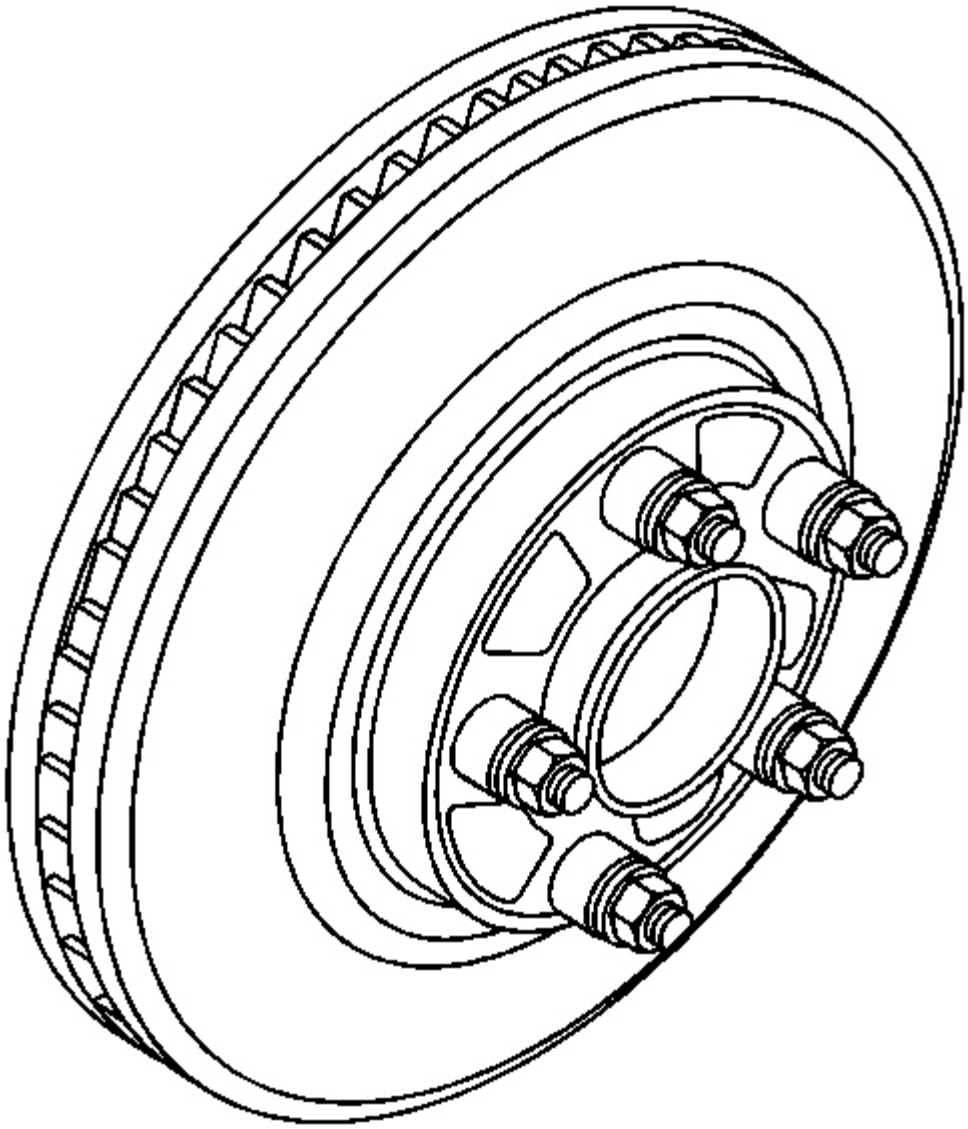


Fig. 5: Identifying J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

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** .

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

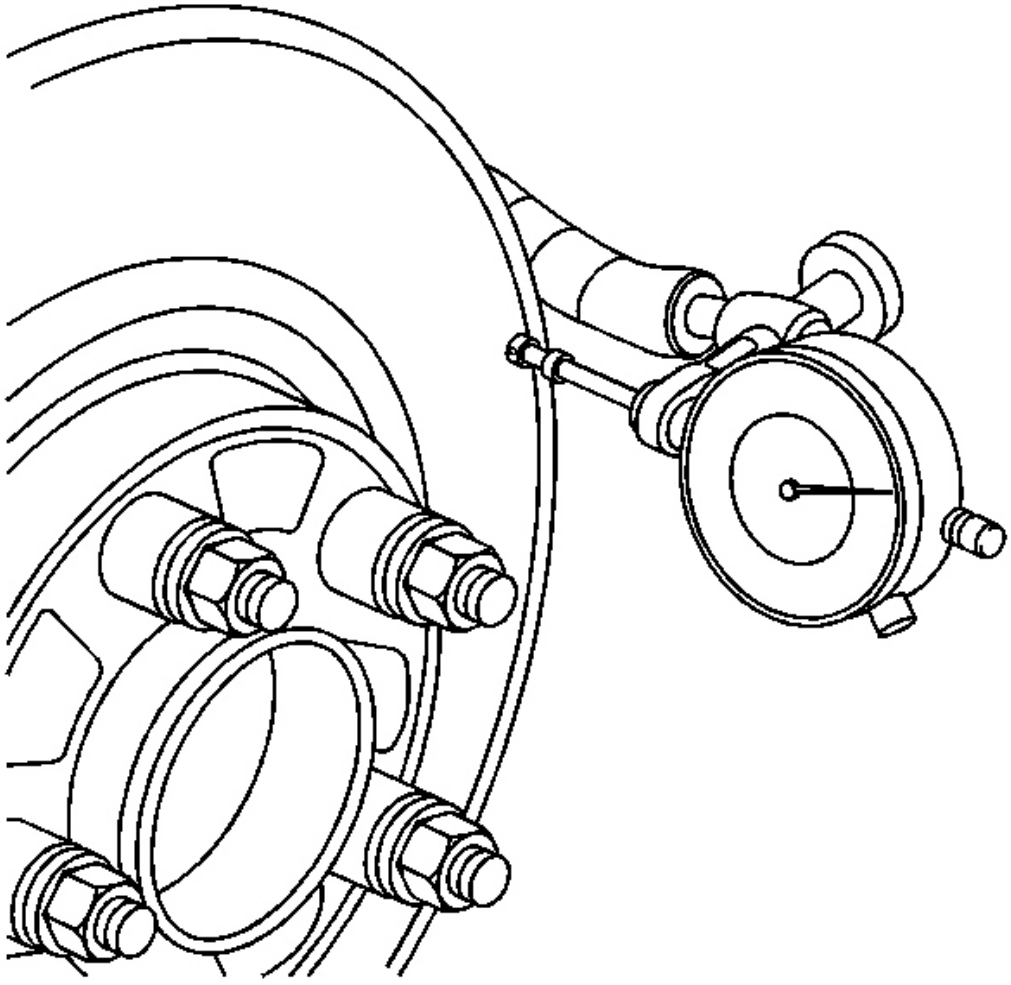


Fig. 6: Identifying Dial Indicator To Measure Lateral Runout
Courtesy of GENERAL MOTORS CORP.

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 (0.5 in) from the outer edge of the rotor.
11. Measure and record the assembled LRO of the brake rotor.
    1. Rotate the rotor until the lowest reading is displayed on the indicator dial, then set the dial to zero.
    2. Rotate the rotor until the highest reading is displayed on the dial.
    3. Mark the location of the high spot relative to the nearest wheel stud or studs.
    4. Measure and record the amount of LRO.
12. Compare the brake rotor assembled LRO to the following specification:

    Specification:
    - Front brake rotor maximum allowable assembled lateral runout: 0.13 mm (0.005 in)
    - Rear brake rotor maximum allowable assembled lateral runout: 0.13 mm (0.005 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 (0.5 in) from the outer edge of the rotor.
15. Measure and record the assembled LRO of the brake rotor.
    1. Rotate the rotor until the lowest reading is displayed on the indicator dial, then set the dial to zero.
    2. Rotate the rotor until the highest reading is displayed on the dial.
    3. Mark the location of the high spot relative to the nearest wheel stud or studs.
    4. Measure and record the amount of LRO.
16. Compare the brake rotor assembled LRO to the following specification:

    Specification:
    - Front brake rotor maximum allowable assembled lateral runout: 0.13 mm (0.005 in)

- Rear brake rotor maximum allowable assembled lateral runout: 0.13 mm (0.005 in)

17. If the brake rotor assembled LRO measurement exceeds the specification, bring the LRO to within specifications. Refer to **Brake Rotor Assembled Lateral Runout Correction**.
18. If the brake rotor assembled LRO measurement is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **J 45101-100** and the lug nuts. See **Special Tools**.

BRAKE PAD INSPECTION

CAUTION: Refer to Brake Dust Caution .

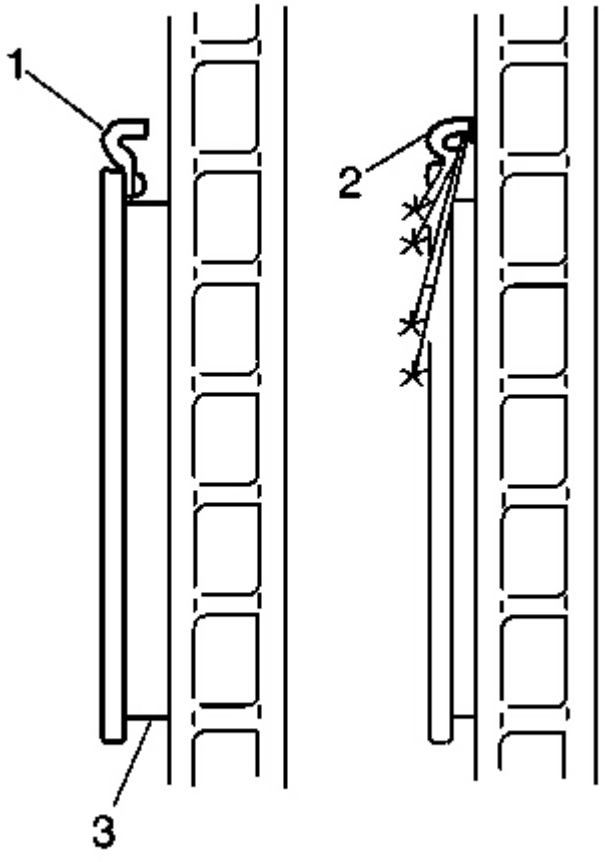


Fig. 7: View Of Brake Pads & Audible Wear Sensors
Courtesy of GENERAL MOTORS CORP.

- 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 prematurely. The disc brake pad wear should be approximately even per axle set.
- Both front and rear disc brake pads have integral, audible wear sensors (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.
- Replace the disc brake pads when the friction surface (3) is worn to within 0.76 mm (0.030 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 0.13 mm (0.005 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.

BRAKE CALIPER INSPECTION

CAUTION: Refer to Brake Dust Caution .

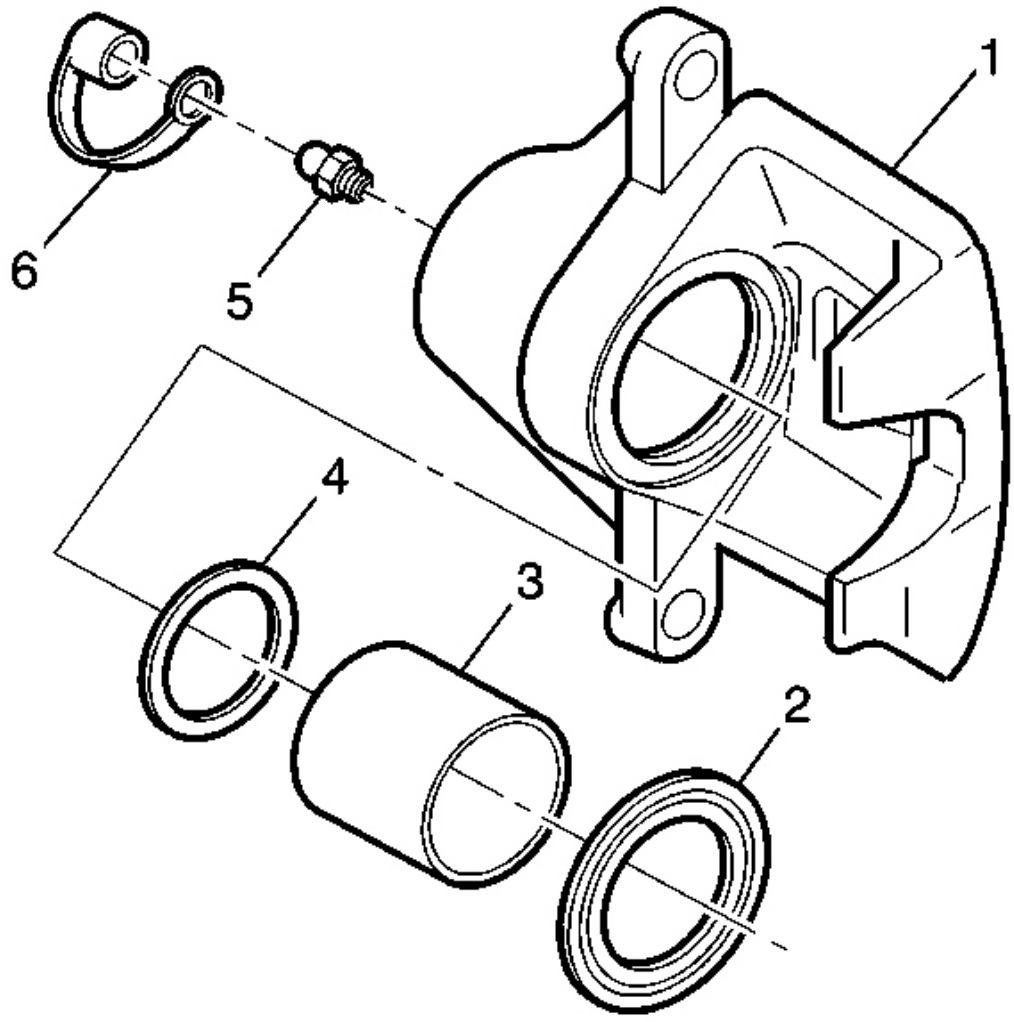


Fig. 8: Exploded View Of Brake Caliper
Courtesy of GENERAL MOTORS CORP.

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.

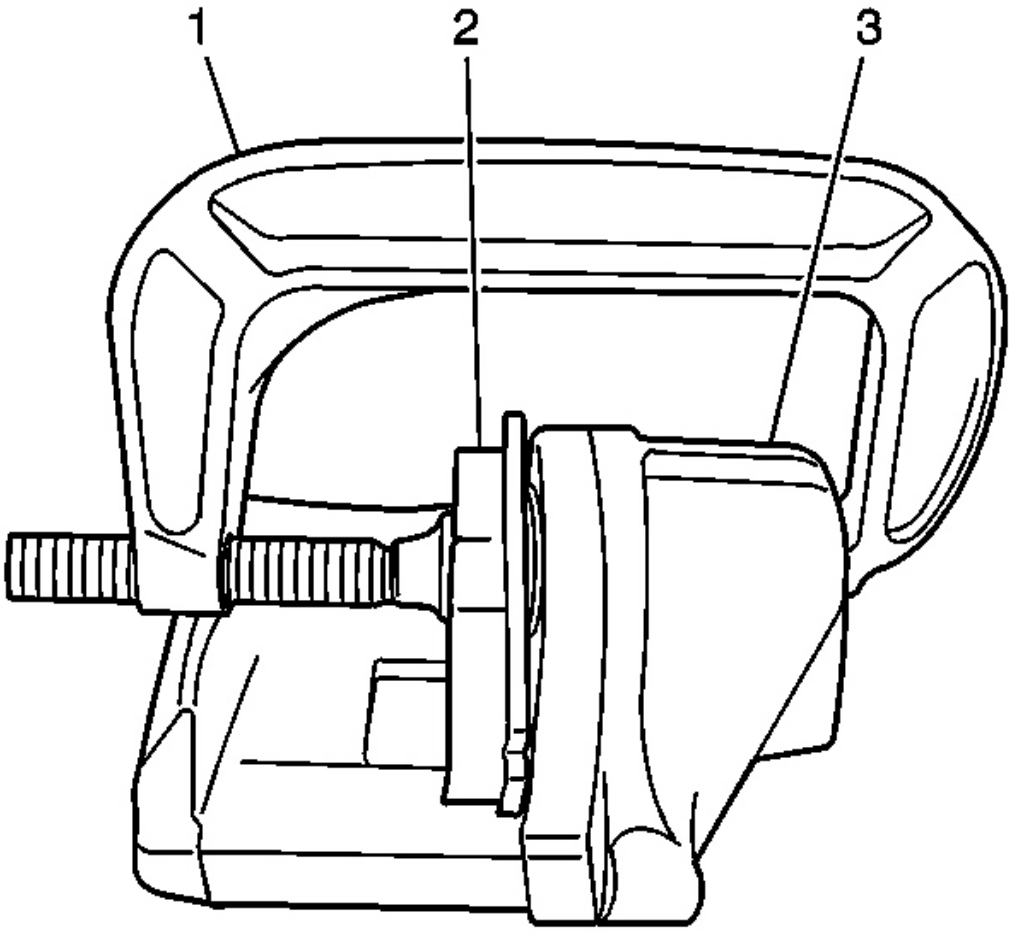


Fig. 9: View Of Caliper Piston
Courtesy of GENERAL MOTORS CORP.

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.

   - 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.

FRONT DISC BRAKE MOUNTING AND HARDWARE INSPECTION

CAUTION: Refer to Brake Dust Caution .

1. Inspect the fluid level in the brake master cylinder reservoir.
2. If the brake fluid level is midway between the maximum-full point and the minimum allowable level then no brake fluid needs to be removed from the reservoir before proceeding.
3. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level then remove brake fluid to the midway point before proceeding.
4. Raise and support the vehicle. Refer **Lifting and Jacking the Vehicle** .
5. Remove the tire and wheel assembly. Refer to **Tire and Wheel Removal and Installation** .

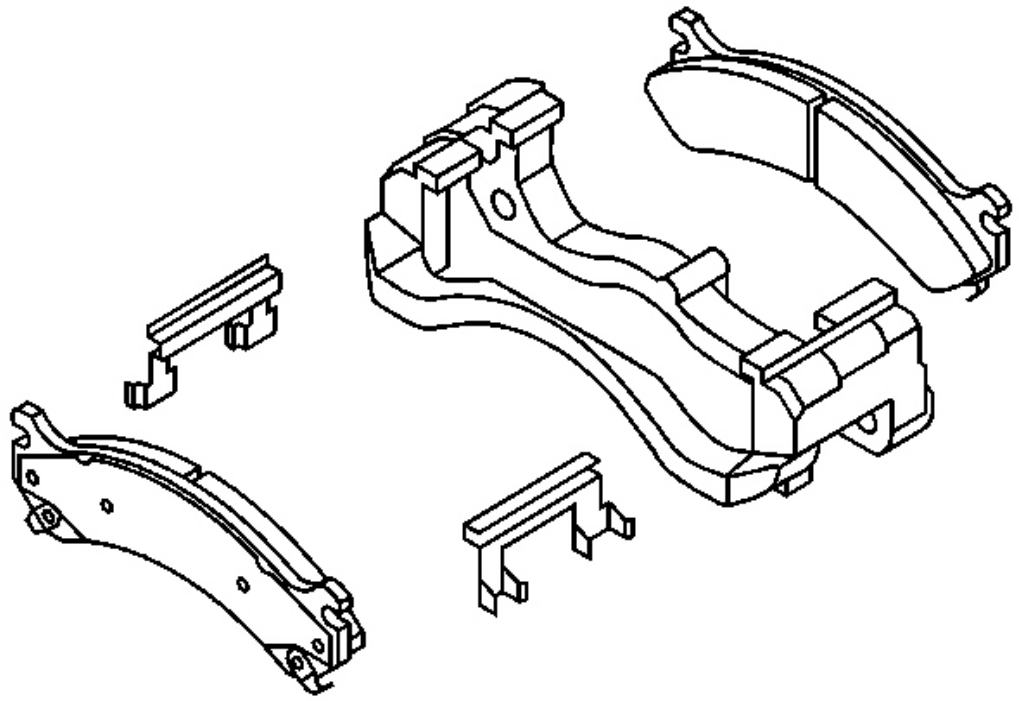


Fig. 10: View Of Disc Brake Pads & Brake Caliper Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

6. Grasp the brake caliper housing and try to move the brake caliper housing up/down and forward/reverse in relation to the brake caliper mounting bracket. If excessive looseness is observed the brake caliper bracket bushings and/or the brake caliper mounting bolts may need to be replaced.
7. Compress the front caliper pistons.
   - Install a large C-clamp over the top of the caliper housing and against the back of the outboard pad.
   - Slowly tighten the C-clamp until the pistons are pushed completely into the caliper bores.
   - 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 from the brake caliper mounting bracket.
11. Inspect the disc brake pad mounting hardware for the following:
    - Missing mounting hardware
    - Excessive corrosion
    - Bent mounting tabs
    - Looseness at the brake caliper mounting bracket
    - Looseness at the disc brake pads
    - Excessive contaminants in the brake caliper mounting bracket surface and threads.
12. If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.
13. Ensure the disc brake pads are held firmly in place on the brake caliper mounting bracket, yet slide easily on the mounting hardware without binding.

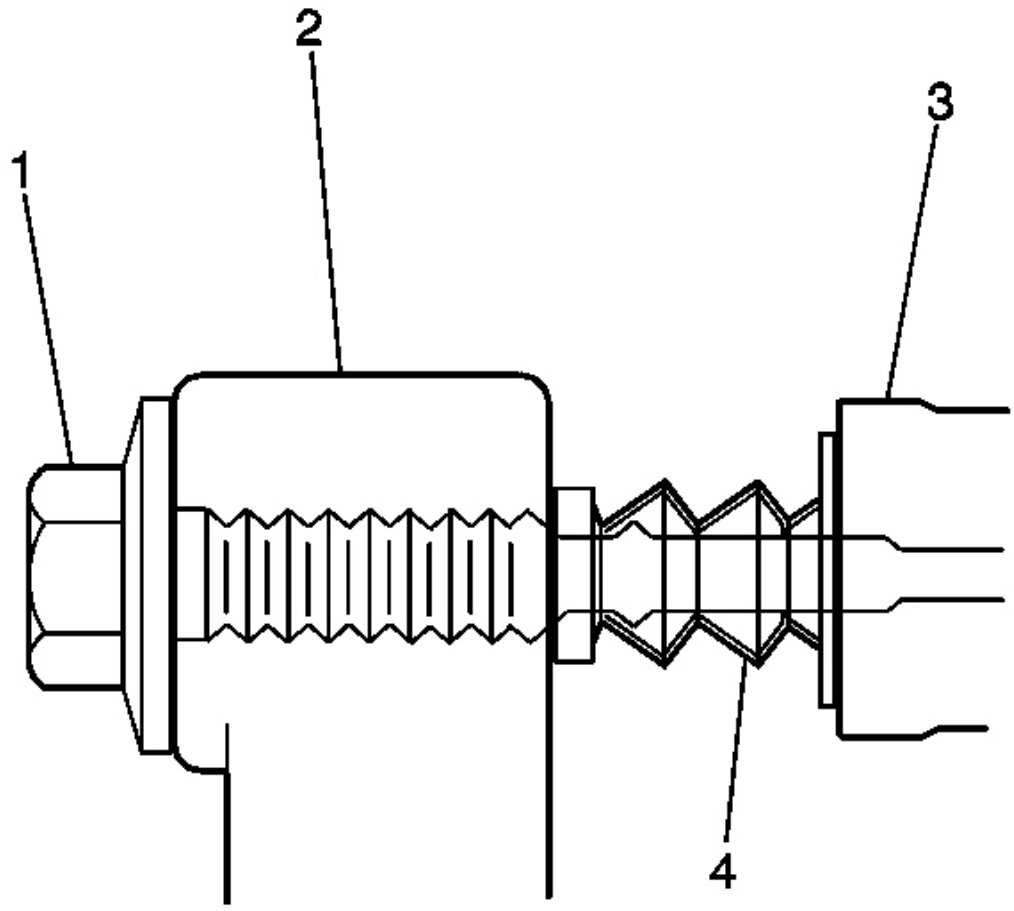


Fig. 11: View Of Caliper, Pin, Boots & Caliper Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

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
    - Cracked or torn boots (4)
    - Missing boots
    - Bent or damaged brake caliper mounting bracket (3)

15. If any of the conditions listed are found then the brake caliper mounting hardware requires replacement.
16. Install the disc brake pads to the brake caliper mounting bracket.
17. Install the disc brake caliper to the brake caliper mounting bracket. Refer to **Front Brake Caliper Replacement**.

REAR DISC BRAKE MOUNTING AND HARDWARE INSPECTION

CAUTION: Refer to Brake Dust Caution .

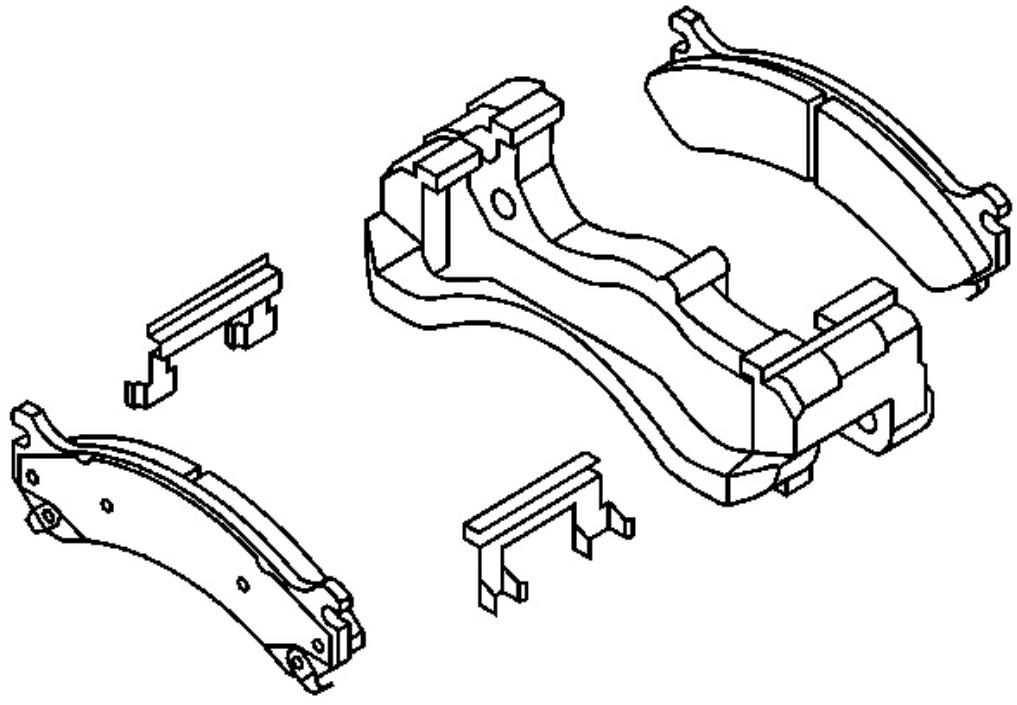


Fig. 12: View Of Disc Brake Pads & Brake Caliper Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

1. Remove the disc brake caliper from the caliper mounting bracket.
2. Remove the disc brake pads from the caliper mounting bracket.

3. Inspect the disc brake pad mounting hardware for the following:
   - Missing mounting hardware
   - Excessive corrosion
   - Bent mounting tabs
   - Looseness at the caliper mounting bracket
   - Looseness at the disc brake pads
4. If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.
5. Ensure the disc brake pads are held firmly in place on the caliper mounting bracket, yet slide easily on the mounting hardware without binding.
6. Install the disc brake pads to the caliper mounting bracket.
7. Install the disc brake caliper to the mounting bracket.

REPAIR INSTRUCTIONS

FRONT DISC BRAKE PADS REPLACEMENT

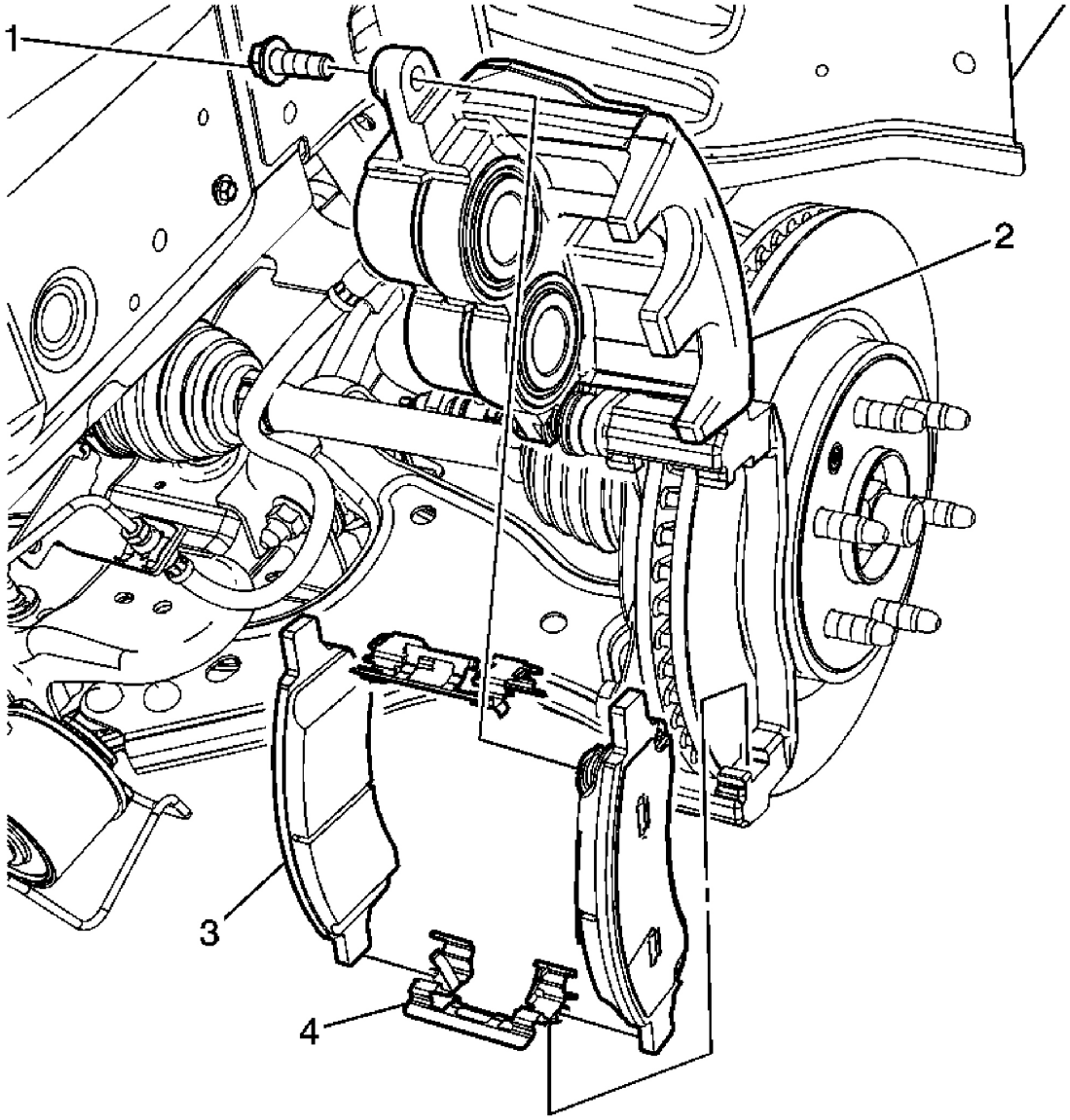


Fig. 13: View Of Front Disc Brake Pads
Courtesy of GENERAL MOTORS CORP.

Front Disc Brake Pads Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:** **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.

Preliminary Procedures

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** .

1	Brake Caliper Guide Pin Bolt **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in caliper bracket bore. **Tighten:** 64 N.m (47 lb ft)
2	Brake Caliper **Procedure** 1. Install 2 large C-clamps over the top of the caliper housing and against the back of the outboard brake pad. 2. Slowly and evenly tighten the C-clamps until the caliper pistons are

	completely retracted into the brake caliper bores. 3. Remove the C-clamps. 4. Without disconnecting the brake hose, pivot the brake caliper upward. 5. Support the brake caliper with heavy mechanics wire or equivalent.
3	Disc Brake Pad (Qty: 2) **Tip:** Note the location of the inner and outer brake pads to aid installation.
4	Brake Pad Shim (Qty: 2) **Procedure** 1. Discard the brake pad shims. 2. Thoroughly clean the brake pad hardware mating surfaces of the caliper bracket of any debris and corrosion. 3. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket only. 4. After the installation is complete and with the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. 5. Slowly release the brake pedal. 6. Wait 15 seconds, then repeat steps 4-5 until a firm brake pedal is obtained. This will properly seat the brake caliper pistons and brake pads. 7. Fill the master cylinder to the proper level. Refer to **Master Cylinder Reservoir Filling** . 8. Burnish the brake pads and rotors. Refer to **Brake Pad and Rotor Burnishing**.

REAR DISC BRAKE PADS REPLACEMENT

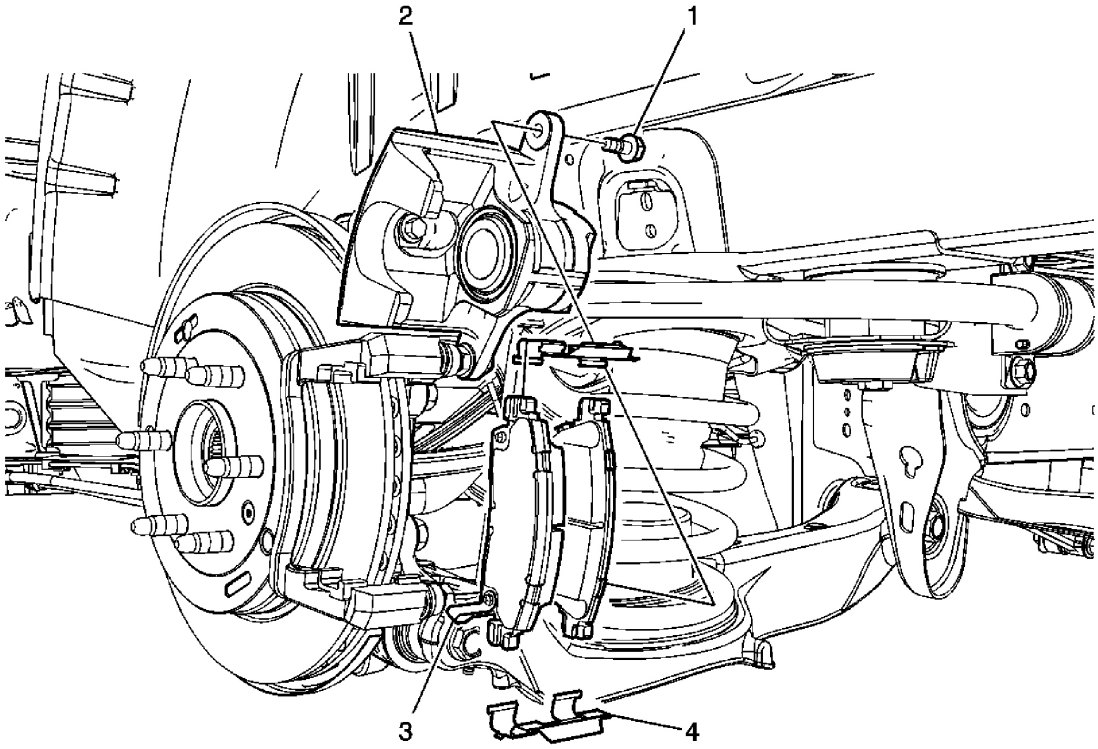


Fig. 14: Identifying Rear Disc Brake Pads
Courtesy of GENERAL MOTORS CORP.

Rear Disc Brake Pads Replacement

Callout	Component Name

CAUTION:
Refer to Brake Dust Caution .

NOTE:
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.

Preliminary Procedures

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** .

1	Brake Caliper Guide Pin Bolt **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in caliper bracket bore. **Tighten:** 22 N.m (16 lb ft)
2	Brake Caliper **Procedure** 1. Without disconnecting the brake hose, pivot the brake caliper upward. 2. Support the brake caliper with heavy mechanics wire or equivalent. 3. Using a suitable tool, retract the brake caliper piston into the brake caliper bore.
3	Disc Brake Pad (Qty: 2) **Tip:** Note the location of the inner and outer brake pads to aid installation.
	Brake Pad Shim (Qty: 2) **Procedure** 1. Thoroughly clean the brake pad hardware mating surfaces of the caliper

4	bracket of any debris and corrosion. 2. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket only. 3. After the installation is complete and with the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. 4. Slowly release the brake pedal. 5. Wait 15 seconds, then repeat steps 3-5 until a firm brake pedal is obtained. This will properly seat the brake caliper pistons and brake pads. 6. Fill the master cylinder to the proper level. Refer to **Master Cylinder Reservoir Filling** . 7. Burnish the brake pads and rotors. Refer to **Brake Pad and Rotor Burnishing**.

BRAKE PAD AND ROTOR BURNISHING

CAUTION: Refer to ROAD TEST CAUTION .

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

FRONT BRAKE CALIPER REPLACEMENT

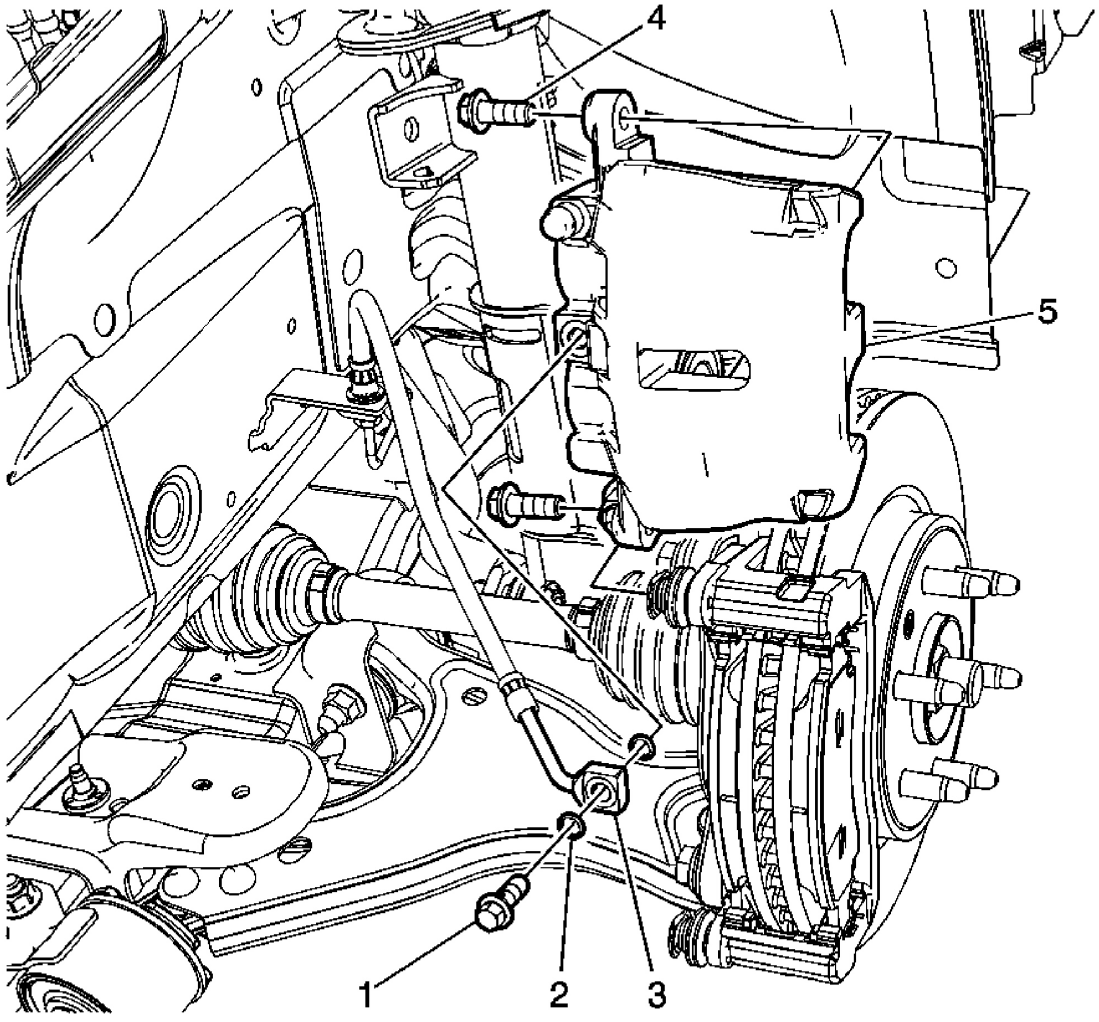


Fig. 15: View Of Front Brake Caliper
Courtesy of GENERAL MOTORS CORP.

Front Brake Caliper Replacement

Callout	Component Name

CAUTION:
Refer to Brake Dust Caution .

CAUTION:
Refer to Brake Fluid Irritant Caution .

Preliminary Procedures

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** .

1	Brake Hose Fitting Bolt **NOTE:** **Refer to Fastener Notice .** **Tighten:** 40 N.m (30 lb ft)
2	Brake Hose Fitting Gasket (Qty: 2) **Procedure:** Discard the brake hose fitting gaskets and install new gaskets.
3	Brake Hose Fitting **Tip:** Plug the brake hose fitting to prevent brake fluid loss and contamination.
4	Brake Caliper Guide Pin Bolt (Qty: 2) **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in caliper bracket bore. 4. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first. **Tighten:** 64 N.m (47 lb ft)
	Brake Caliper **Procedure** 1. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** .

5	2. After the installation is complete and with the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. 3. Slowly release the brake pedal. 4. Wait 15 seconds, then repeat steps 2-3 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and the brake pads. 5. Fill the master cylinder to the proper level. Refer to **Master Cylinder Reservoir Filling** .

REAR BRAKE CALIPER REPLACEMENT

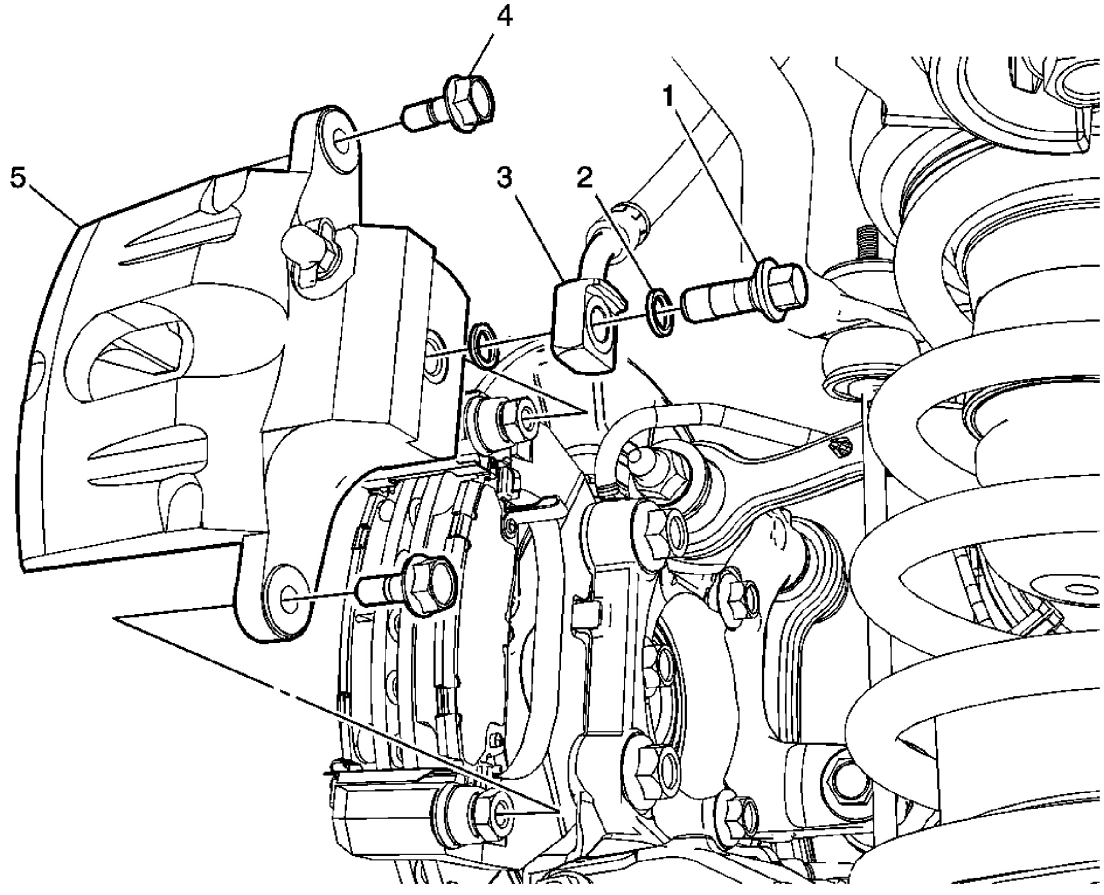


Fig. 16: Identifying Rear Brake Caliper
Courtesy of GENERAL MOTORS CORP.

Rear Brake Caliper Replacement

Callout	Component Name

CAUTION:
Refer to Brake Dust Caution .

CAUTION:
Refer to Brake Fluid Irritant Caution .

Preliminary Procedures

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** .

1	Brake Hose Fitting Bolt **NOTE:** **Refer to Fastener Notice .** **Tighten:** 40 N.m (30 lb ft)
2	Brake Hose Fitting Gasket (Qty: 2) **Procedure:** Discard the brake hose fitting gaskets and install new gaskets.
3	Brake Hose Fitting **Tip:** Plug the brake hose fitting to prevent brake fluid loss and contamination.
4	Brake Caliper Guide Pin Bolt (Qty: 2) **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in caliper bracket bore. 4. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first.

	Tighten: 22 N.m (16 lb ft)
5	Brake Caliper **Procedure** 1. Bleed the hydraulic brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** . 2. After the installation is complete and with the engine OFF, gradually apply the brake pedal to approximately 2/3 of its travel distance. 3. Slowly release the brake pedal. 4. Wait 15 seconds, then repeat steps 2-3 until a firm brake pedal is obtained. This will properly seat the brake caliper piston and the brake pads. 5. Fill the master cylinder to the proper level. Refer to **Master Cylinder Reservoir Filling** .

FRONT DISC BRAKE HARDWARE REPLACEMENT

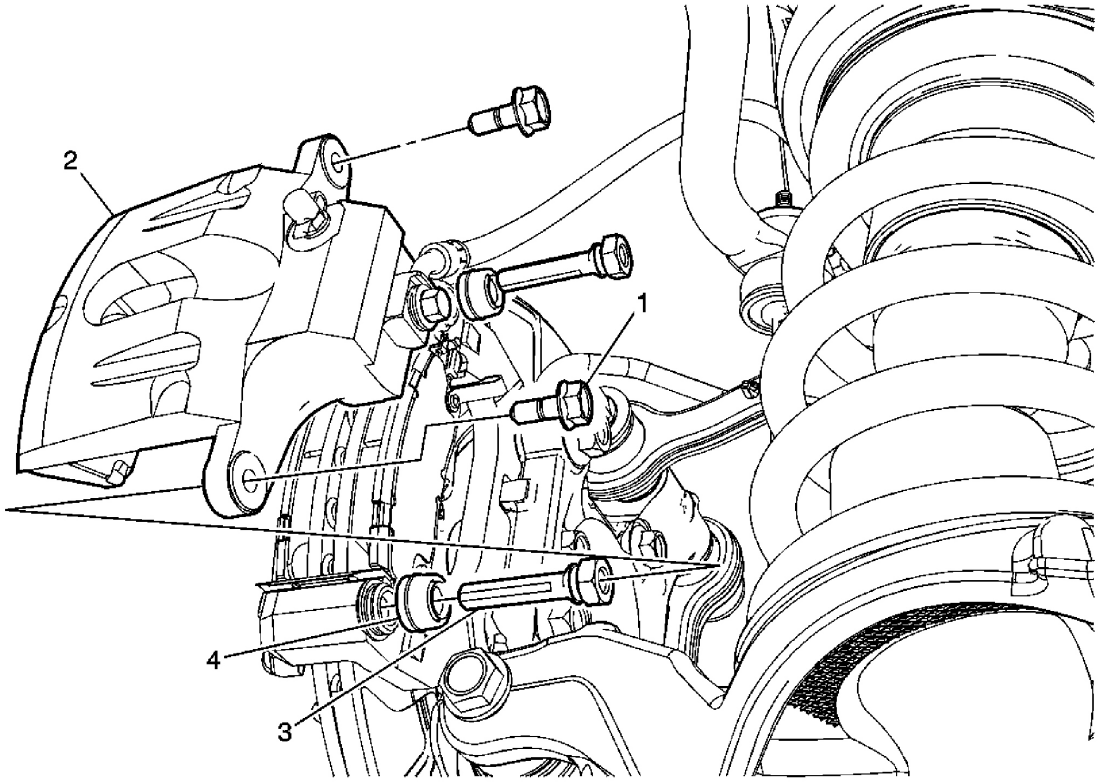


Fig. 17: View Of Rear Disc Brake Hardware
Courtesy of GENERAL MOTORS CORP.

Front Disc Brake Hardware Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:** **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.** **Preliminary Procedures** 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** .	
	Brake Caliper Guide Pin Bolt (Qty: 2)

1	**NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools only. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first. **Tighten:** 64 N.m (47 lb ft)
2	Brake Caliper **Procedure:** Without disconnecting the brake caliper hose, support the brake caliper with heavy mechanics wire or equivalent.
3	Brake Caliper Guide Pin (Qty: 2) **Procedure** 1. Note the location of the brake caliper guide pins. The brake caliper guide pin with the bushing must be installed in the lower brake caliper bracket bore. 2. Apply a thin coating of high temperature silicone brake lubricant to the brake caliper guide pins and the guide pin bores of the brake caliper bracket.
4	Brake Caliper Guide Pin Seal (Qty: 2) **Procedure** 1. Apply a thin coating of high temperature silicone brake lubricant to the brake caliper guide pin seals. 2. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in the brake

	caliper bracket bore.

REAR DISC BRAKE HARDWARE REPLACEMENT

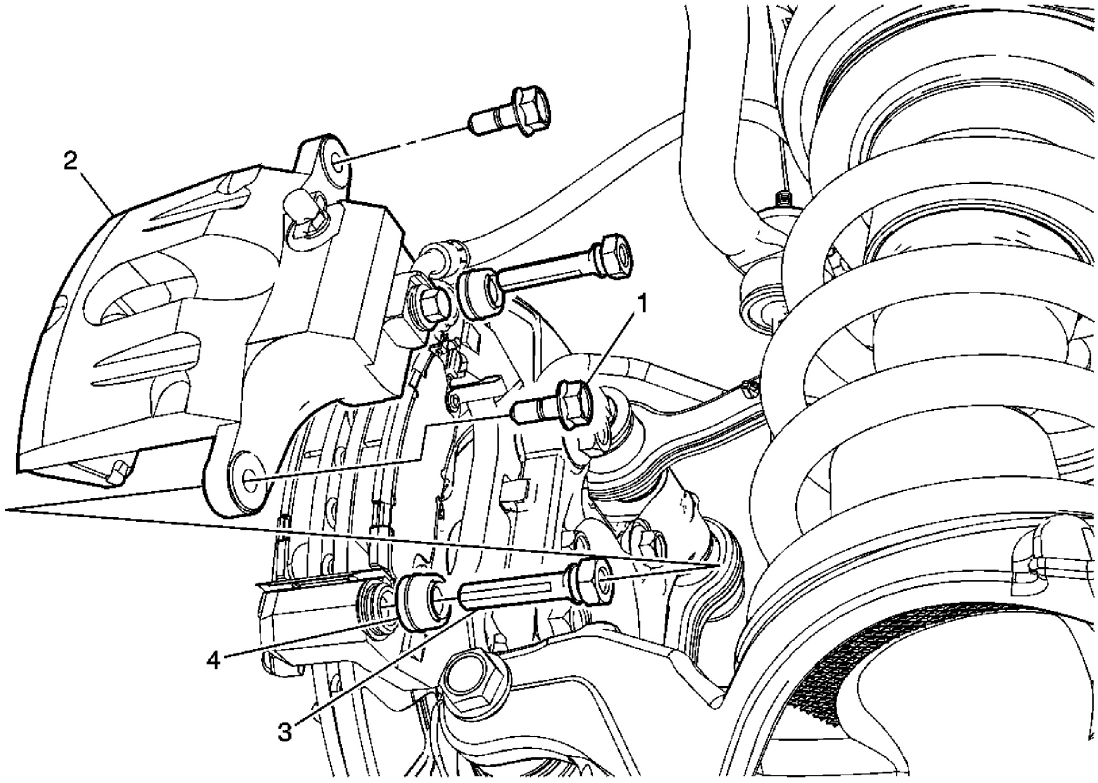


Fig. 18: View Of Rear Disc Brake Hardware
Courtesy of GENERAL MOTORS CORP.

Rear Disc Brake Hardware Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:** **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.**	
Preliminary Procedures	

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** .

1	Brake Caliper Guide Pin Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools only. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first. **Tighten:** 22 N.m (16 lb ft)
2	Brake Caliper **Procedure:** Without disconnecting the brake caliper hose, support the brake caliper with heavy mechanics wire or equivalent.
3	Brake Caliper Guide Pin (Qty: 2) **Procedure:** Apply a thin coating of high temperature silicone brake lubricant to the brake caliper guide pins and the guide pin bores of the brake caliper bracket.
4	Brake Caliper Guide Pin Seal (Qty: 2) **Procedure** 1. Apply a thin coating of high temperature silicone brake lubricant to the brake caliper guide pin seals. 2. Ensure the brake caliper guide pin seal is fully seated in the groove of the brake caliper guide pin and the guide pin slides freely in the brake

	caliper bracket bore.

FRONT BRAKE CALIPER BRACKET REPLACEMENT

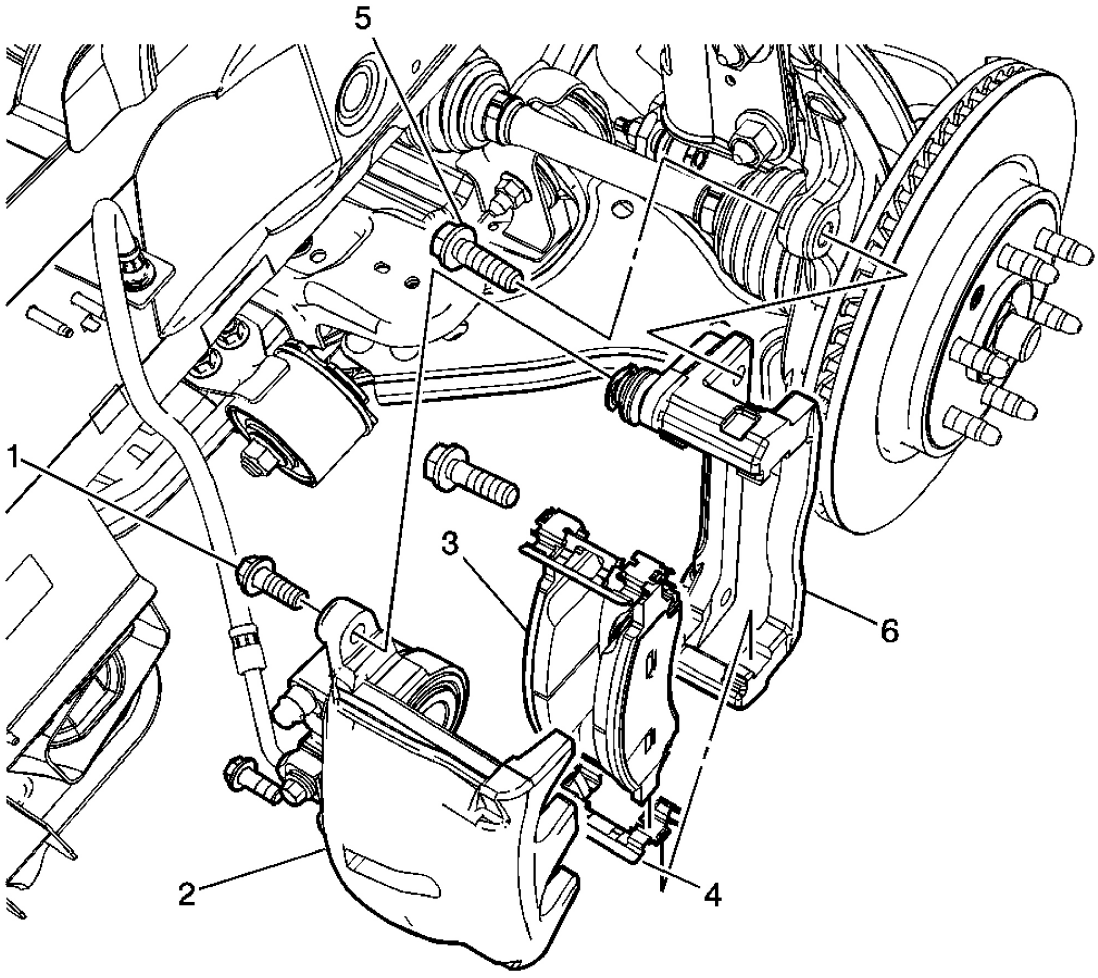


Fig. 19: View Of Front Brake Caliper Bracket
Courtesy of GENERAL MOTORS CORP.

Front Brake Caliper Bracket Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:** **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.

Preliminary Procedures

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** .

1	Brake Caliper Guide Pin Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first. **Tighten:** 64 N.m (47 lb ft)
2	Disc Brake Caliper **Procedure:** Without disconnecting the brake caliper hose, remove and support the brake caliper with heavy mechanics wire or equivalent.
3	Disc Brake Pad (Qty: 2) **Tip:** Note the location of the inner and outer brake pads to aid installation.
4	Brake Pad Shim (Qty: 2) **Procedure** 1. Thoroughly clean the brake pad hardware mating surfaces of the caliper bracket of any debris and corrosion. 2. Apply a very thin coating of high temperature silicone brake lubricant

	to the pad hardware mating surfaces of the caliper bracket only.
5	Brake Caliper Bracket Bolt (Qty: 2) **Procedure** 1. Remove all traces of the adhesive patch on the brake caliper bracket bolts and threaded holes of the brake caliper bracket. 2. Clean the brake caliper bracket bolt threads and the threaded holes of the brake caliper bracket with denatured alcohol or equivalent and allow to dry. 3. Apply threadlocker G/M P/N 12345493 (Canadian P/N 10953488) to 2/3 of the threaded portion of the brake caliper bolts. **Tighten:** 175 N.m (129 lb ft)
6	Brake Caliper Bracket

REAR BRAKE CALIPER BRACKET REPLACEMENT

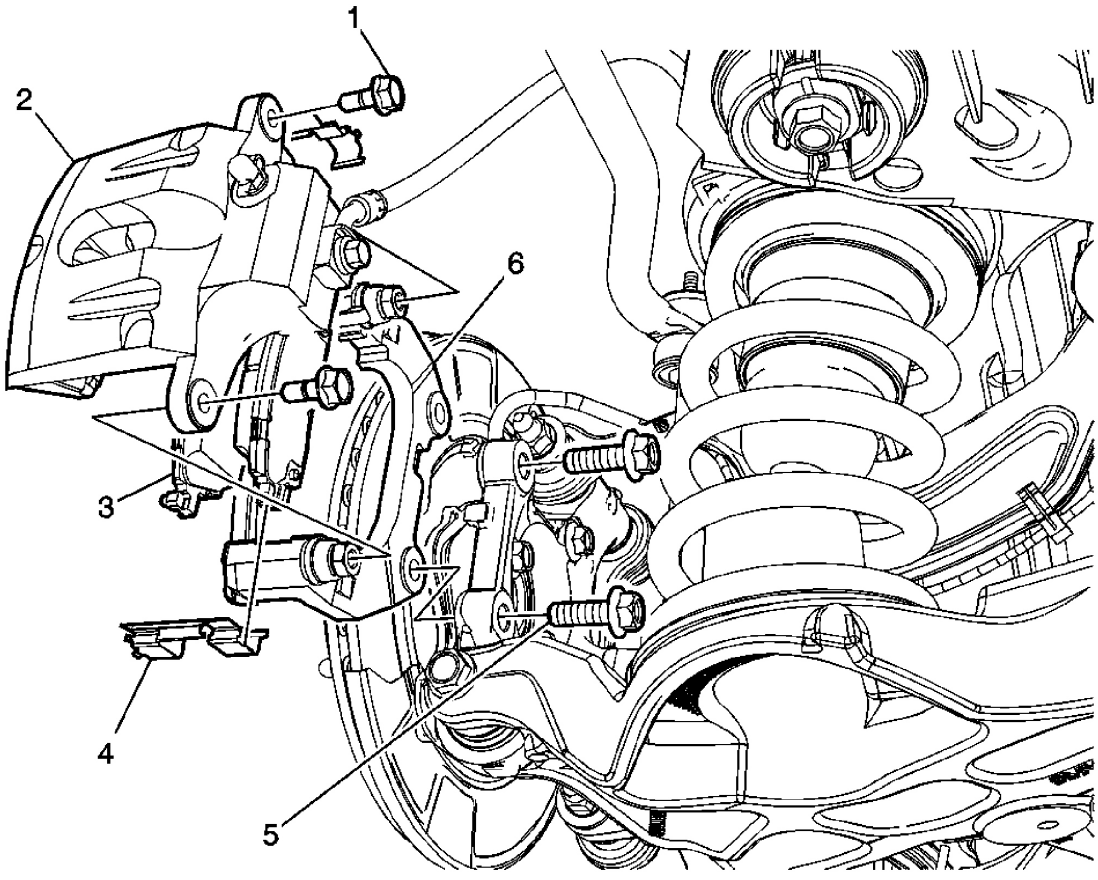


Fig. 20: View Of Rear Brake Caliper Bracket
Courtesy of GENERAL MOTORS CORP.

Rear Brake Caliper Bracket Replacement

Callout	Component Name

CAUTION:
Refer to Brake Dust Caution .

NOTE:
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.

Preliminary Procedures

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 .

1	Brake Caliper Guide Pin Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. DO NOT use any air tools to remove or install the brake caliper guide pin bolts. Use hand tools ONLY. 2. 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 bolts. DO NOT allow the open end wrench to contact the brake caliper. Allowing the open end wrench to contact the brake caliper will cause a pulsation when the brakes are applied. 3. When installing the brake caliper guide pin bolts, tighten the guide pin bolt closest to the bleed valve first. **Tighten:** 22 N.m (16 lb ft)
2	Disc Brake Caliper **Procedure:** Without disconnecting the brake caliper hose, remove and support the brake caliper with heavy mechanics wire or equivalent.
3	Disc Brake Pad (Qty: 2) **Tip:** Note the location of the inner and outer brake pads to aid installation.
4	Brake Pad Shim (Qty: 2) **Procedure** 1. Thoroughly clean the brake pad hardware mating surfaces of the caliper bracket of any debris and corrosion. 2. Apply a very thin coating of high temperature silicone brake lubricant to the pad hardware mating surfaces of the caliper bracket only.
	Brake Caliper Bracket Bolt (Qty: 2) **Procedure** 1. Remove all traces of the adhesive patch on the brake caliper bracket bolts and threaded holes of the brake caliper bracket.

5	2. Clean the brake caliper bracket bolt threads and the threaded holes of the brake caliper bracket with denatured alcohol or equivalent and allow to dry. 3. Apply threadlocker G/M P/N 12345493 (Canadian P/N 10953488) to 2/3 of the threaded portion of the brake caliper bolts. **Tighten:** 200 N.m (148 lb ft)
6	Brake Caliper Bracket

FRONT BRAKE ROTOR REPLACEMENT

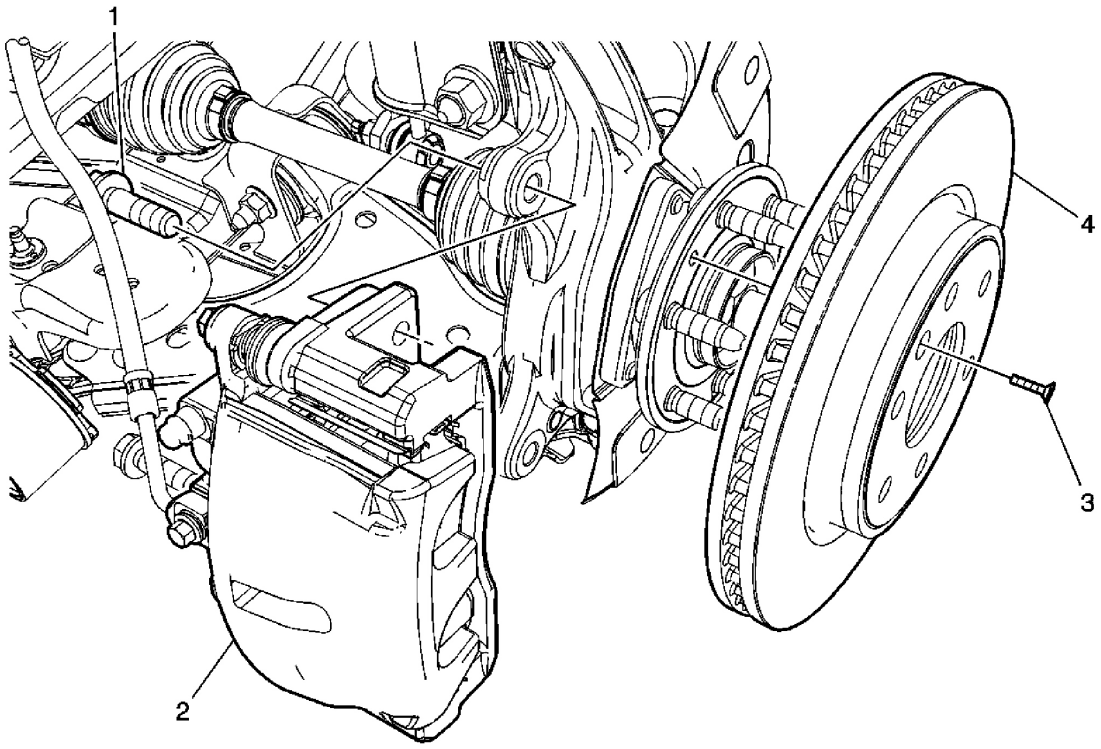


Fig. 21: View Of Front Brake Rotor
Courtesy of GENERAL MOTORS CORP.

Front Brake Rotor Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:**	

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.

Preliminary Procedures

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** .

1	Brake Caliper Bracket Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. Remove all traces of the adhesive patch on the brake caliper bracket bolts and threaded holes of the brake caliper bracket. 2. Clean the brake caliper bracket bolt threads and the threaded holes of the brake caliper bracket with denatured alcohol or equivalent and allow to dry. 3. Apply threadlocker G/M P/N 12345493 (Canadian P/N 10953488) to 2/3 of the threaded portion of the brake caliper bolts. **Tighten:** 175 N.m (129 lb ft)
2	Brake Caliper and Bracket Assembly **Procedure:** Without disconnecting the brake hose from the brake caliper, remove the brake caliper and bracket as an assembly and support with heavy mechanics wire or equivalent.
3	Brake Rotor Retention Screw **Tighten:** 12 N.m (106 lb in)
	Brake Rotor **Procedure** 1. If reinstalling the original brake rotor, mark the position of the brake rotor to the wheel stud.

4	2. Using the **J 42450-A** , clean any rust or corrosion from the mating surface of the hub/axle flange. See **Special Tools**. 3. Using the **J 41013** , clean any rust or corrosion from the mating surface the brake rotor. See **Special Tools**. 4. After installing the brake rotor, measure the assembled lateral runout (LRO). Refer to **Brake Rotor Assembled Lateral Runout Measurement**. 5. If the brake rotor was refinished or replaced, burnish the brake pads and rotors. Refer to **Brake Pad and Rotor Burnishing**. **Special Tools** • **J 41013** Rotor Resurfacing Kit. See **Special Tools**. • **J 42450-A** Wheel Hub Resurfacing Kit. See **Special Tools**.

REAR BRAKE ROTOR REPLACEMENT

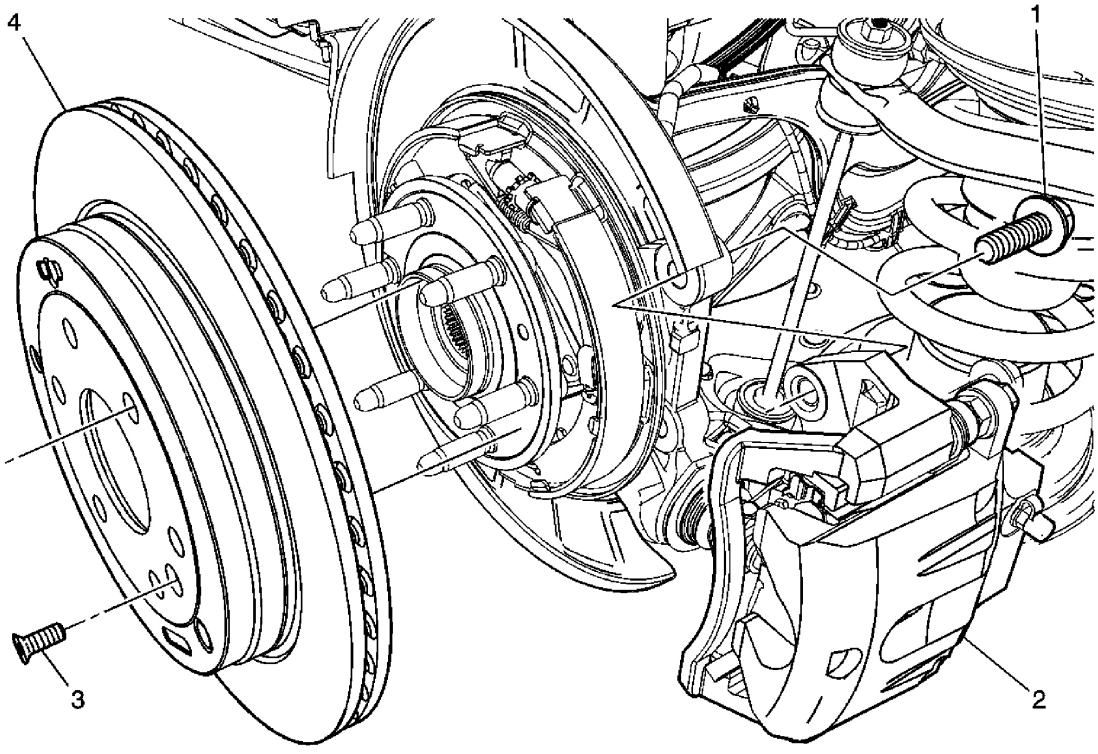


Fig. 22: Identifying Rear Brake Rotor
Courtesy of GENERAL MOTORS CORP.

Rear Brake Rotor Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **NOTE:** **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.** **Preliminary Procedures** 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** .	
1	Brake Caliper Bracket Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. Remove all traces of the adhesive patch on the brake caliper bracket bolts and threaded holes of the brake caliper bracket. 2. Clean the brake caliper bracket bolt threads and the threaded holes of the brake caliper bracket with denatured alcohol or equivalent and allow to dry. 3. Apply threadlocker G/M P/N 12345493 (Canadian P/N 10953488) to 2/3 of the threaded portion of the brake caliper bolts. **Tighten:** 200 N.m (148 lb ft)
2	Brake Caliper and Bracket Assembly **Procedure:** Without disconnecting the brake hose from the brake caliper, remove the brake caliper and bracket as an assembly and support with heavy mechanics wire or equivalent.
3	Brake Rotor Retention Screw **Tighten:** 6 N.m (53 lb in)

4	Brake Rotor **Procedure** 1. If reinstalling the original brake rotor, mark the position of the brake rotor to the wheel stud. 2. Using the **J 42450-A** , clean any rust or corrosion from the mating surface of the hub/axle flange. See **Special Tools**. 3. Using the **J 41013** , clean any rust or corrosion from the mating surface the brake rotor. See **Special Tools**. 4. After installing the brake rotor, measure the assembled lateral runout (LRO). Refer to **Brake Rotor Assembled Lateral Runout Measurement**. 5. If the brake rotor was refinished or replaced, burnish the brake pads and rotors. Refer to **Brake Pad and Rotor Burnishing**. **Special Tools** • **J 41013** Rotor Resurfacing Kit. See **Special Tools**. • **J 42450-A** Wheel Hub Resurfacing Kit. See **Special Tools**.

FRONT BRAKE SHIELD REPLACEMENT

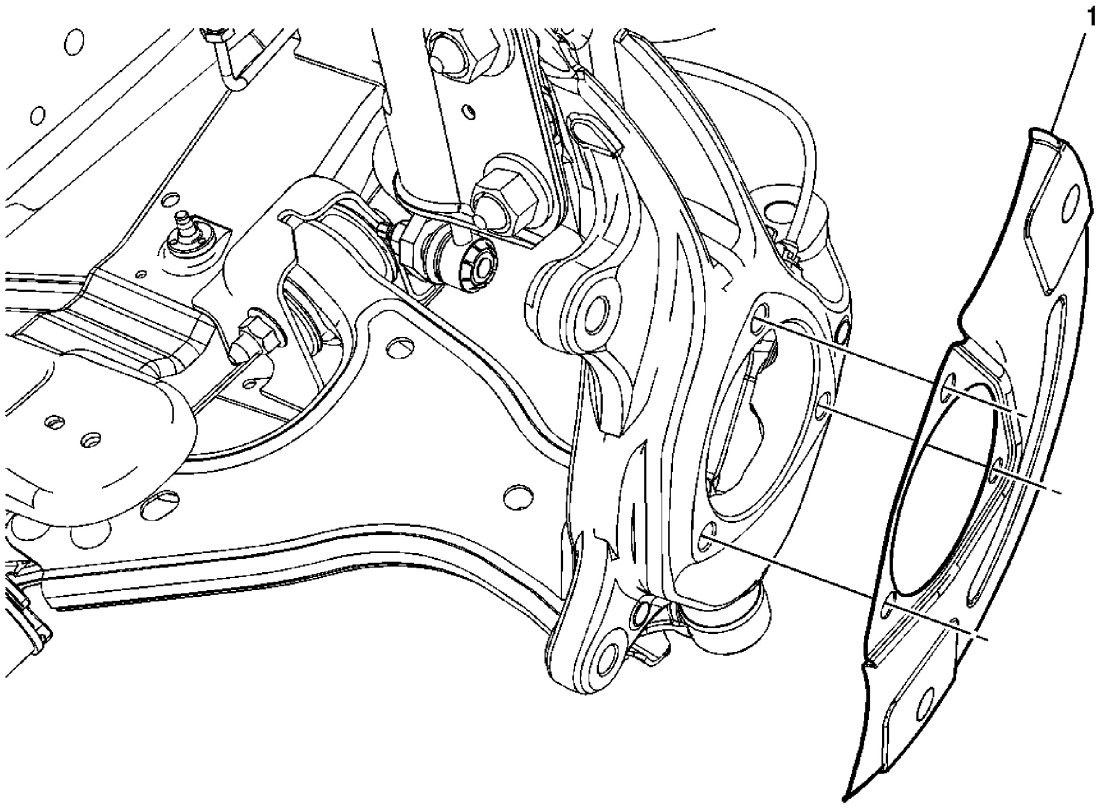


Fig. 23: View Of Front Brake Shield
Courtesy of GENERAL MOTORS CORP.

Front Brake Shield Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .** **Preliminary Procedures** 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 disc brake rotor. Refer to **Front Brake Rotor Replacement**. 4. Remove the wheel hub and bearing assembly. Refer to **Front Wheel Bearing and Hub Replacement** .	
1	Disc Brake Shield

REAR DISC BRAKE BACKING PLATE REPLACEMENT

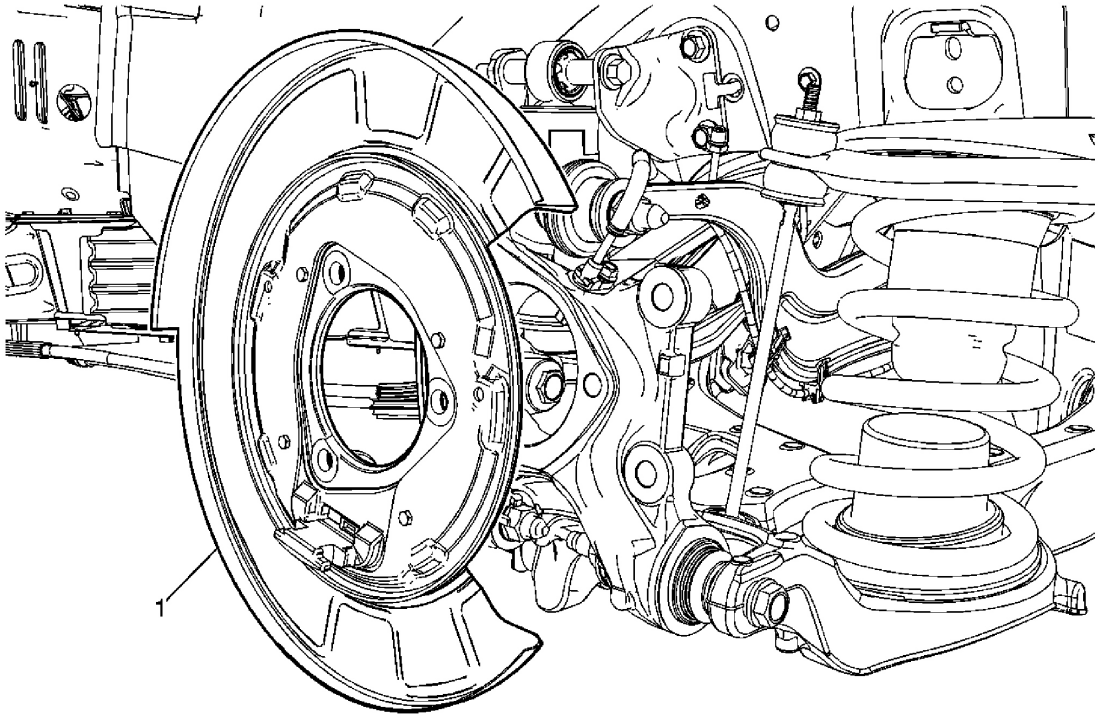


Fig. 24: View Of Rear Disc Brake Backing Plate
Courtesy of GENERAL MOTORS CORP.

Rear Disc Brake Backing Plate Replacement

Callout	Component Name
CAUTION: **Refer to Brake Dust Caution .**	
Preliminary Procedures 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 park brake shoes. Refer to **Park Brake Shoe Replacement** . 4. Remove the park brake actuator. Refer to **Parking Brake Actuator Replacement** . 5. Remove the wheel hub and bearing assembly. Refer to **Rear Wheel Bearing and Hub Replacement (AWD)** or **Rear Wheel Bearing and Hub Replacement (FWD)** .	

1	Disc Brake Backing Plate

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT 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 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 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 Correction - 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 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

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 .

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 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.**

Indexing Procedure

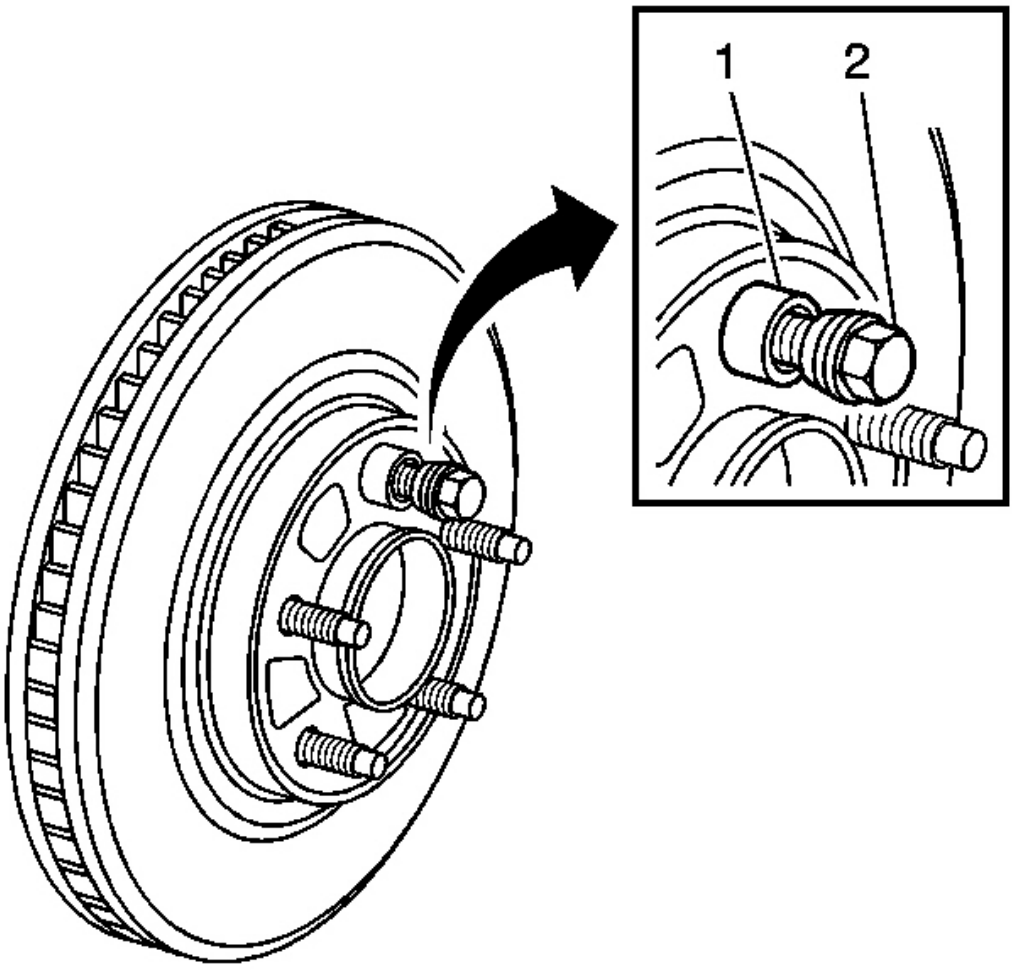


Fig. 25: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

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.

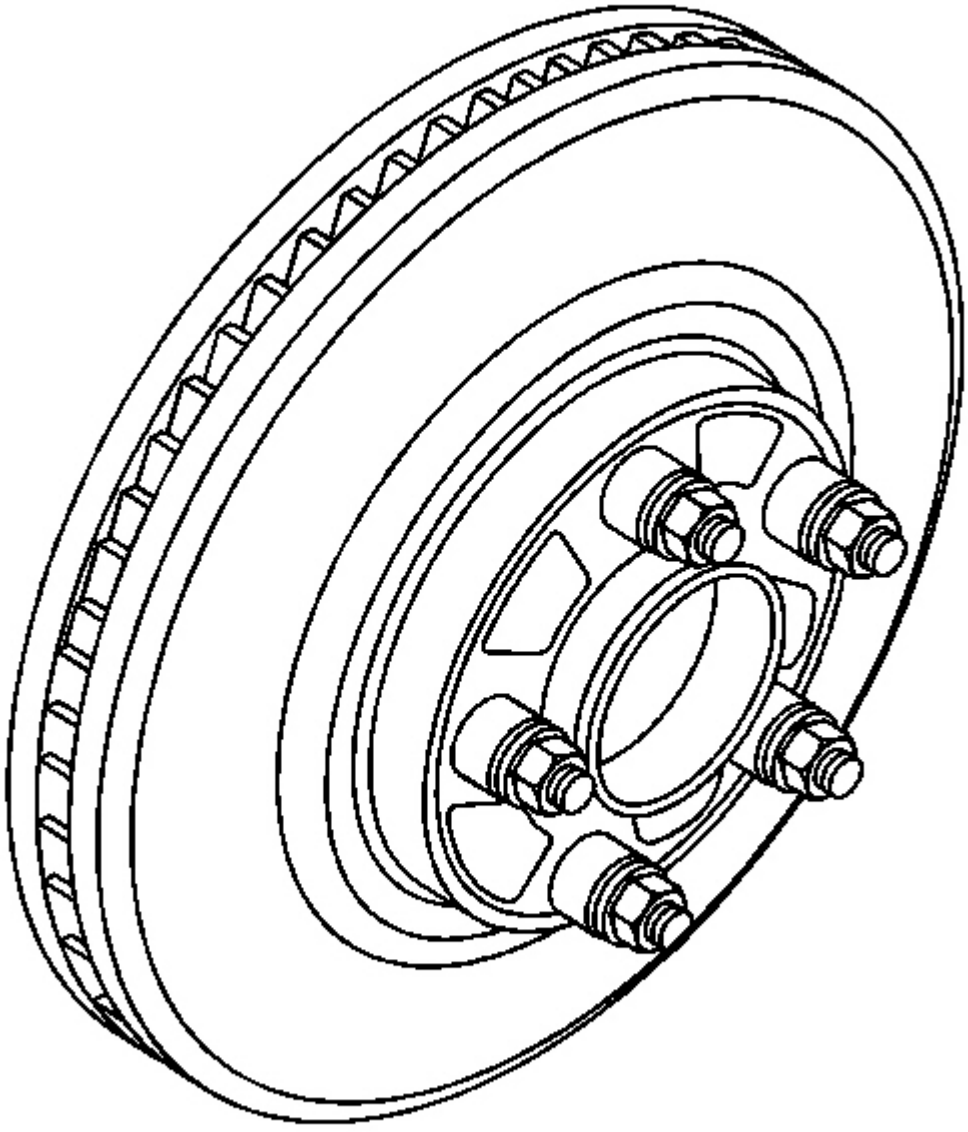


Fig. 26: Identifying J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

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** .
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 **J 45101-100** and the lug nuts. See **Special Tools**.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - CORRECTION PLATES

Tools Required

- **J 39544-KIT** Complete Torque Socket Set-10 Pieces or equivalent. See **Special Tools**.
- **J 45101-100** Conical Brake Rotor Washers. See **Special Tools**.

CAUTION: Refer to Brake Dust Caution .

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 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.

Correction Procedure

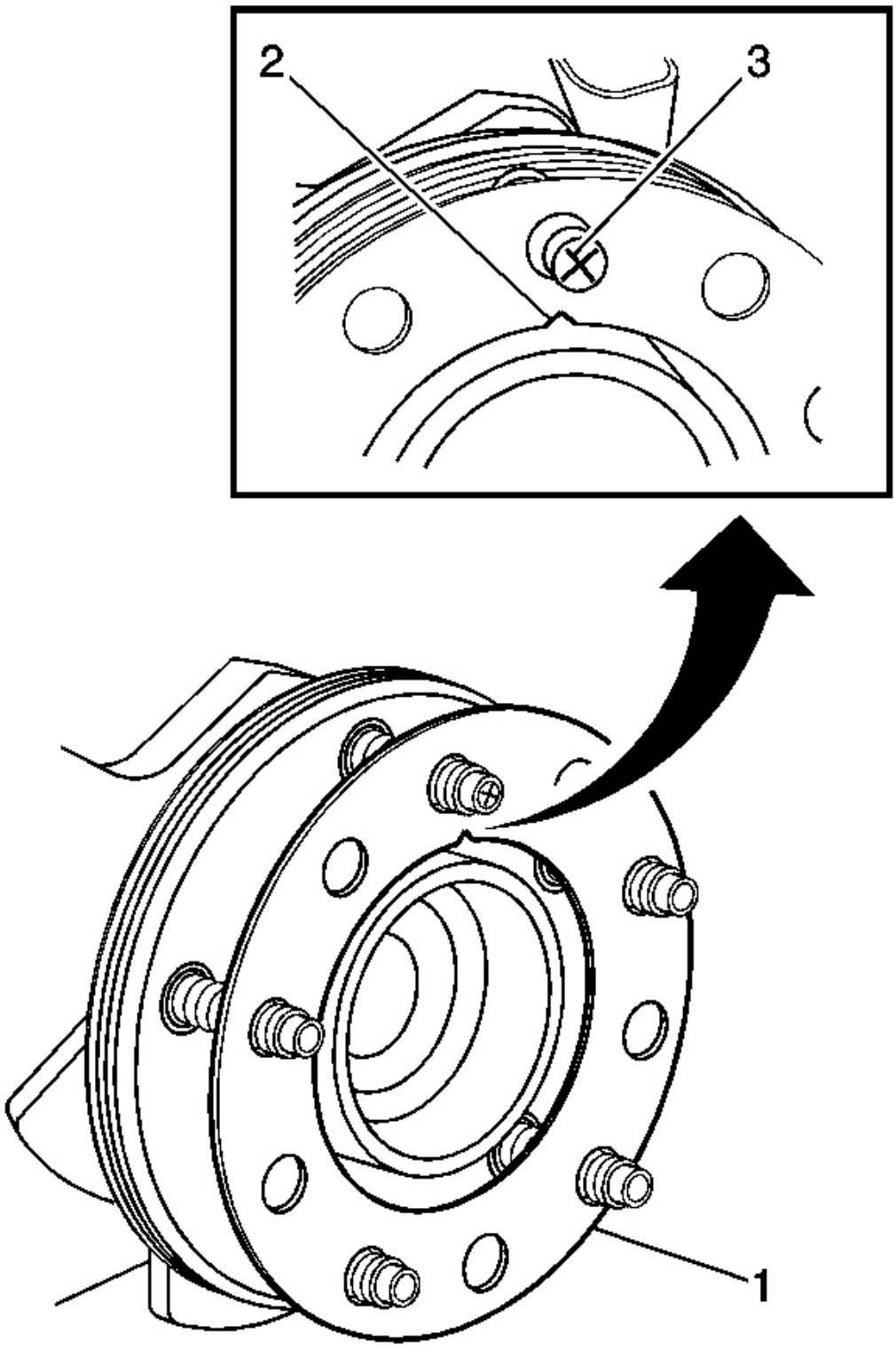

2
3
1

Fig. 27: 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 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.

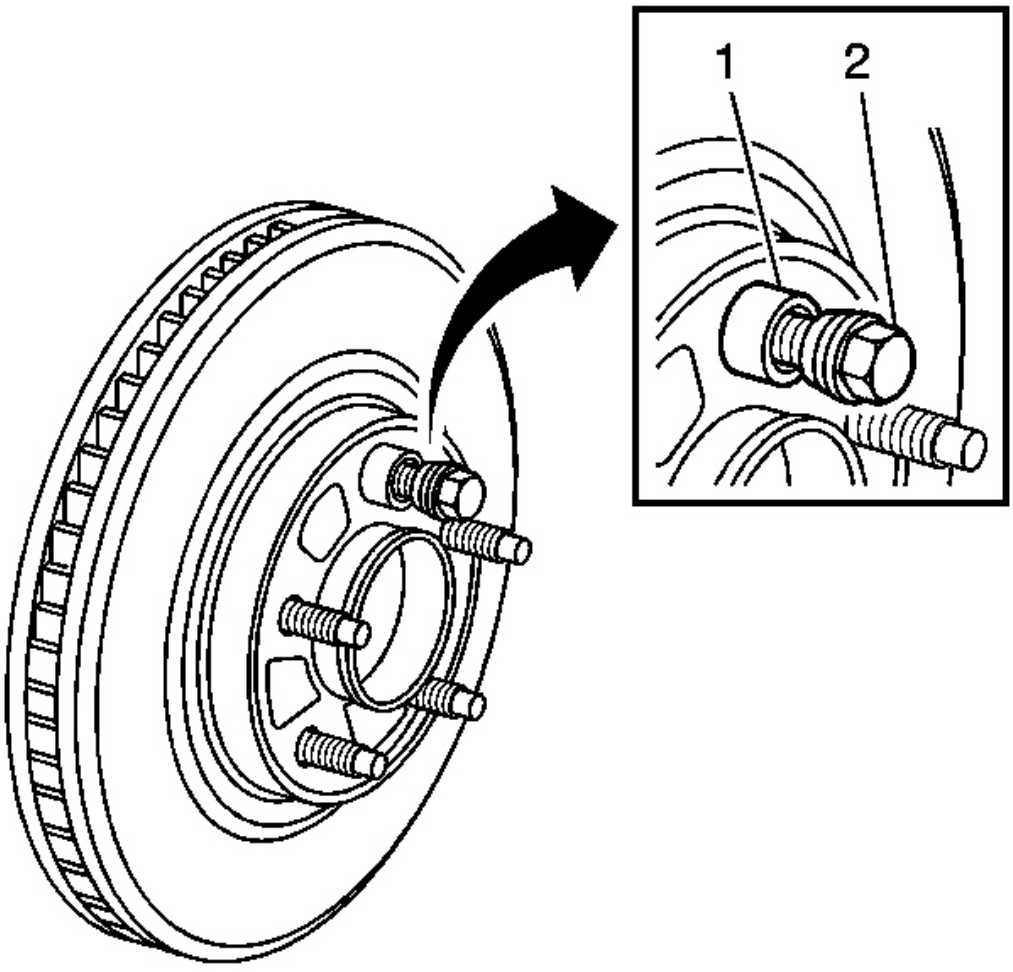


Fig. 28: Identifying J 45101-100 & Lug Nut
Courtesy of GENERAL MOTORS CORP.

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.

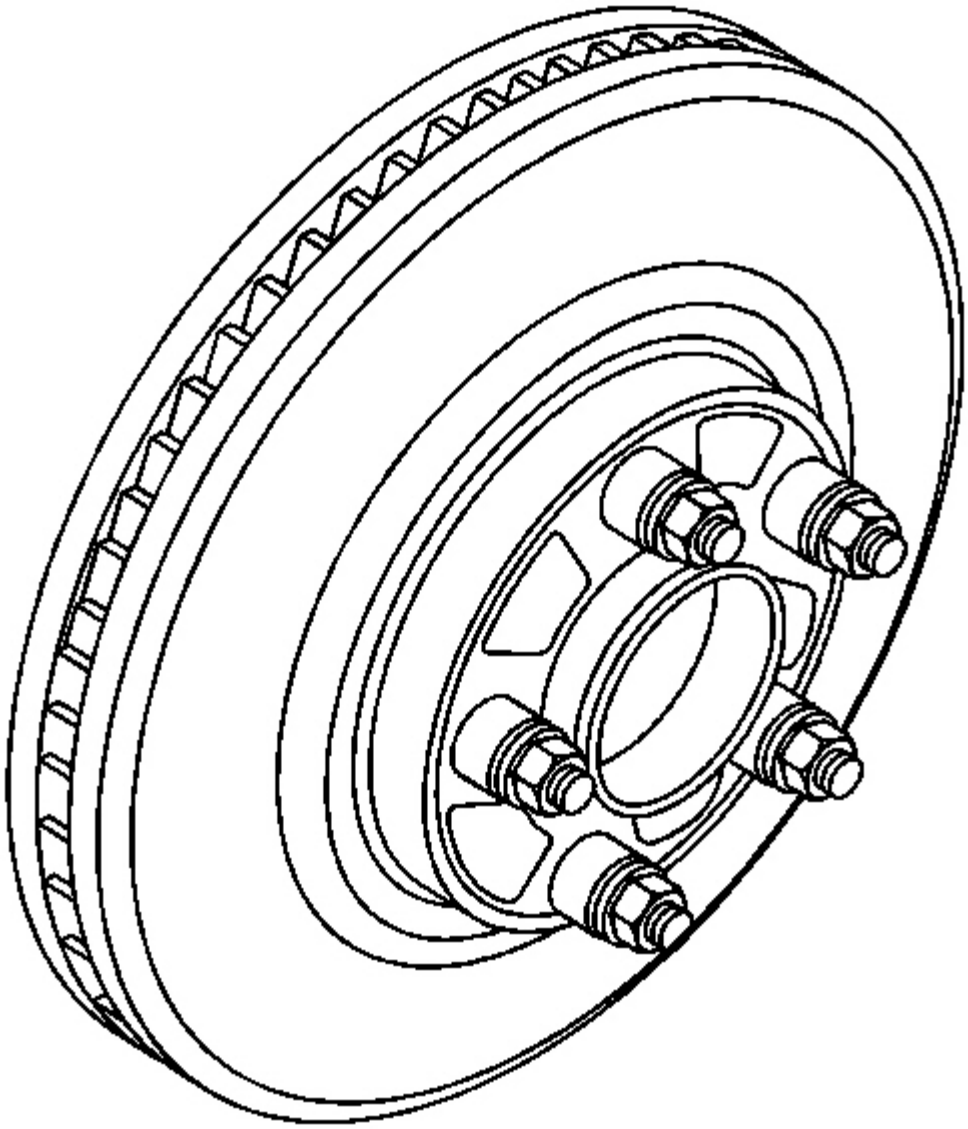


Fig. 29: Identifying J 45101-100s & Lug Nuts
Courtesy of GENERAL MOTORS CORP.

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** .

12. Measure the assembled LRO of the brake rotor. Refer to **Brake Rotor Assembled Lateral Runout Measurement**.
13. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to **Brake Rotor Assembled Lateral Runout Correction**.
14. If the brake rotor assembled LRO measurement is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **J 45101-100** and the lug nuts. See **Special Tools**.

BRAKE ROTOR ASSEMBLED LATERAL RUNOUT CORRECTION - ON VEHICLE LATHE

Tools Required

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

CAUTION: Refer to Brake Dust Caution .

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 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.**

Correction Procedure

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 Measurement**.
11. If the brake rotor assembled LRO measurement still exceeds the maximum allowable specification, refer to **Brake Rotor Assembled Lateral Runout Correction**.
12. If the brake rotor assembled LRO is within specification, install the brake caliper and depress the brake pedal several times to secure the rotor in place before removing the **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 .

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: 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.

Refinishing Procedure

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 LRO of the brake rotor to ensure optimum performance of the disc brakes. Refer to **Brake Rotor Assembled Lateral Runout 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 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.

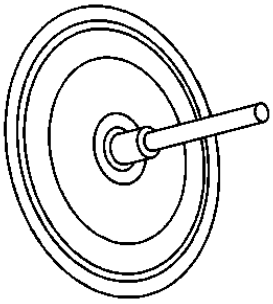
System Operation

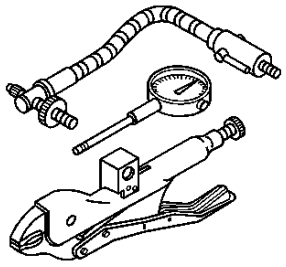
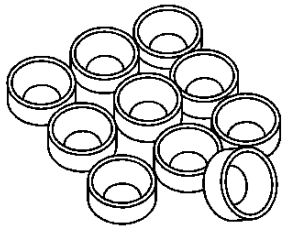
Mechanical output force is applied from the hydraulic brake caliper pistons to the inner brake pads. As the pistons press the inner brake pads outward, the caliper housings draw the outer brake pads inward. This allows the output force to be equally distributed. The brake pads apply the output force 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 Pieces
	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