Brakes and Traction Control: Testing and Inspection
Diagnosis By Symptom

Brake Noise

SCRAPING OR GRINDING, FRONT DISC BRAKES

Causes
- Front pads/linings worn down to the rivets or metal backing-plate.
- Excessive grooves in rotors.
- Rust or dirt accumulation on the rotor or caliper assembly.
- Damaged or bent pads/linings.

What to Check For
- Inspect linings and replace if;
  - Excessively worn or grooved.
  - Cracked.
  - Bent or warped.
- Inspect the rotor for excessive grooves, resurface or replace as necessary.
- Verify the rotor splash guard is in place and that no debris is dodged in the caliper/rotor area.

SCRAPING OR GRINDING, REAR DRUM BRAKES

Causes
- Rear shoes/linings worn down to the rivets or the metal backing.
- Return springs broken or improperly installed.
- Drum friction surface cracked or excessively grooved.

What to Check For
- Inspect rear shoes/linings and replace if excessively worn or bent.

  NOTE: To check if a brake shoe is bent or distorted, lay the shoe on its side on a flat surface. If the shoe wobbles it is not straight and should be replaced.

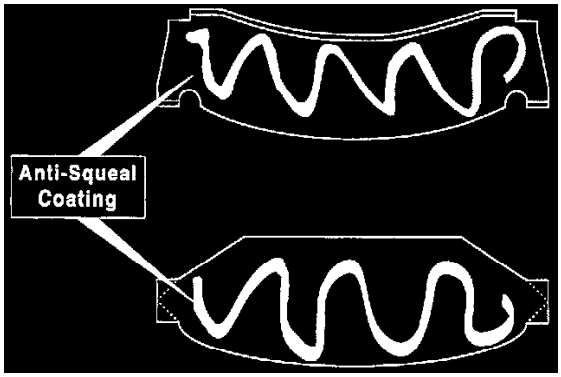
SQUEAL, FRONT DISC BRAKES

Causes
- Pads/linings are worn to minimum thickness, wear indicators are contacting rotors.
- Pads/linings are glazed.
- Pads are loose in the caliper housing.

What to Check For
- Inspect linings for;
  - Minimum thickness, replace if necessary.
  - Glazed appearance, replace if necessary.

    NOTE: Brake linings become glazed as a result of overheating or brake drag. If the linings are glazed, first determine the cause before replacing them.

  - Loose fit in the caliper. Crimp outer pad ears onto caliper housing, or replace missing or damaged anti-vibration clips. (As applicable.)



Anti-squeal Coating

NOTE: Anti-squeal coating or pad insulator shims are very effective in preventing brake squeal on new brakes.

SQUEAL, REAR DRUM BRAKES

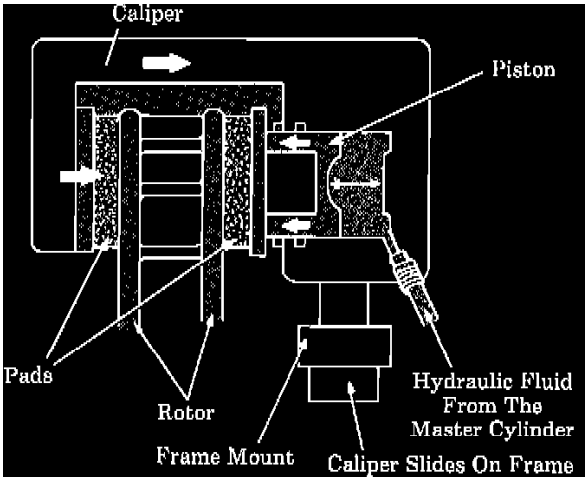
Causes
- Poor shoe to drum contact.
- Drums out of round.
- Shoes/Linings glazed (shiny, possibly black charcoal appearance).
- Weak or broken brake hold-down springs.
- Loose backing-plate, wheel-cylinder, or anchor.
- Excessive brake dust or debris in drum. Clean shoes and drums.

What to Check For
- Inspect drums for size and shape.
  - Turn drums if bellmouthed or tapered.
  - Replace drums if larger than maximum diameter.
- Inspect shoes/linings and adjustment.
  - Readjust shoes if improperly adjusted.
  - Replace shoes if glazed or excessively worn.
- Inspect brake hardware.
  - Verify all return springs are installed properly.
  - Replace all broken or distorted springs.

CLICKING OR RATTLE, FRONT DISC BRAKES

Causes
- Pads/linings loose in the caliper housing.
- Loose wheel bearings or grease cap.
- Loose lug nuts.
- Loose caliper mounting bolts.
- Caliper sticking or binding on the slides.

What to Check For
- Verify that the pads fit snugly in the caliper. If pads are loose, crimp outer pad ears onto caliper housing, or replace missing or damaged anti-vibration clips. (As applicable.)
- Adjust the wheel bearings and check that the axle nut cotter pin is not contacting the dust cap
- Loosen lug nuts and re-torque to the correct specification.
- Inspect and torque mounting bolts. Replace any missing or damaged hardware.
- Clean and lubricate the caliper slides.



Disc Brake Mechanical Force Diagram

NOTE: Floating calipers require free and unrestricted movement on the caliper mounting. Floating or sliding calipers have pistons only on one side of the rotor. The first part of the piston's travel forces the inner pad against the rotor, then further travel forces the movable part of the caliper to pull the outer pad against the rotor.

CLICKING OR RATTLE, REAR DRUM BRAKES

Causes
- Rear shoes/linings binding against backing-plate.
- Rear shoes/linings sticking in grooves worn into Backing-platess.
- Loose backing-plate, wheel-cylinder, or anchor.
- Weak or broken brake shoe hold down springs.
- Cracked drum.
- Drum out of round.
- Shoes/Linings are bent or twisted

What to Check For
- Verify that the brakes shoes slide easily across the backing-plate. Lubricate backing-plate contact pads, remove any burrs or minor nicks.
- Inspect the shoe-backing-plate contact pads for grooves. Replace the backing-plate if any grooves are found.

  NOTE: If you attempt to remove the grooves by grinding or filing, the new shoes/linings will not line up correctly with the drum. This may result in grabby brakes or a more pronounced clicking.

- Check and tighten the hold down bolts for the wheel-cylinder and backing-plate.
- Inspect all rear brake hardware (springs, clips, and pins) and replace if any defects are found.
- Measure the drum inside diameter at several points around the circumference of the drum. If the measurements vary by more than 0.002 inches, resurface or replace the drum.
- Inspect the drum for cracks or grooves, replace if necessary.

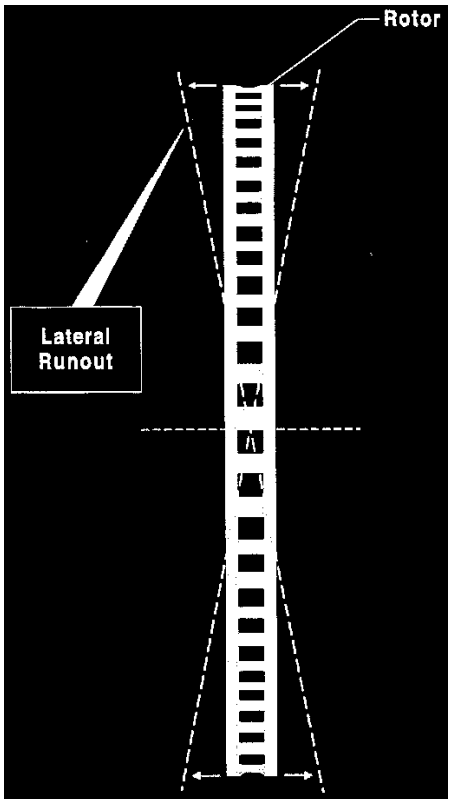
  NOTE: Cracks in drums are often difficult to locate. To quickly determine if a drum is cracked lightly drop the drum (from a height of 4-5 inches) onto a flat hard surface. A cracked drum will make a dull thud sound while a good drum will make a ringing sound.

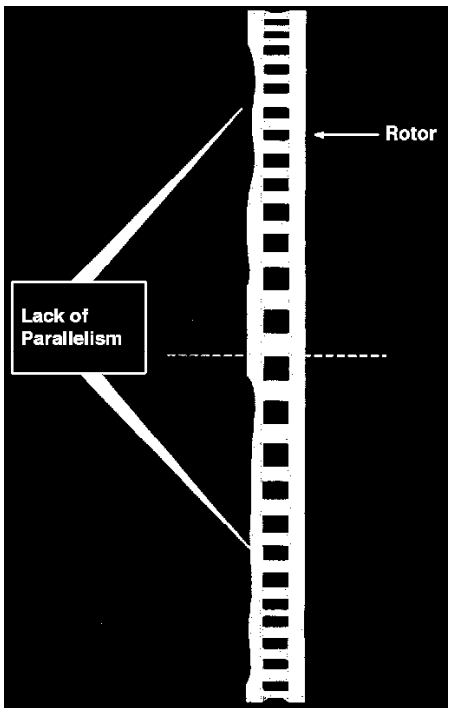
- Lay the shoes/linings on their sides on a flat surface, if the shoes do not lie flat replace them.

Brake Pedal Pulsations

FRONT DISC BRAKES

Causes

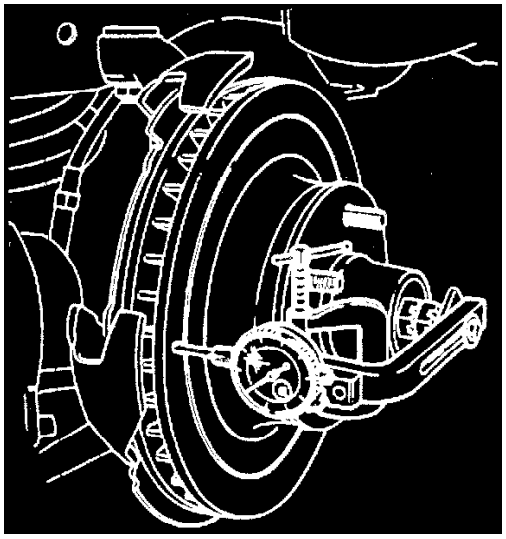


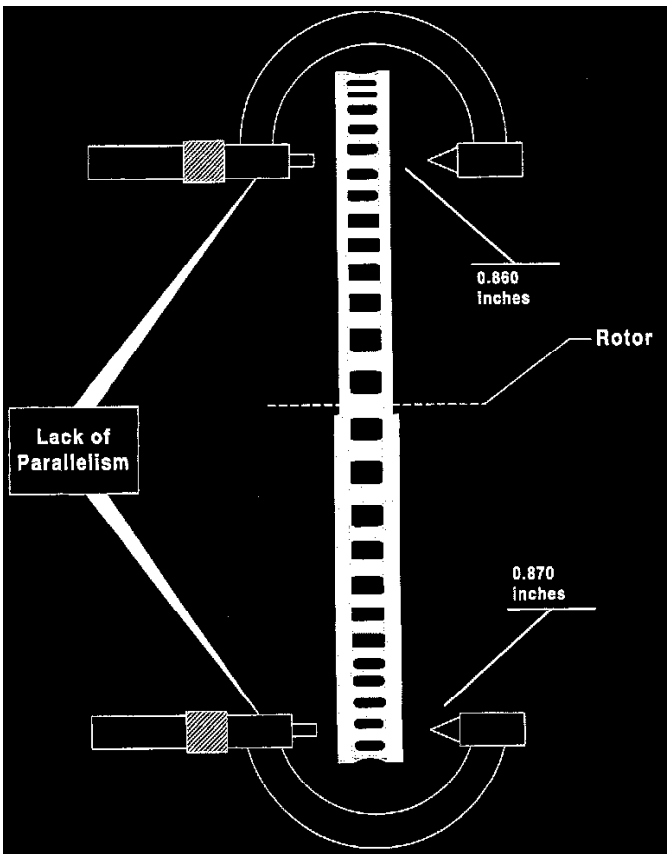


Lack Of Parallelism

- Excessive lateral runout (warpage) or lack of parallelism (rotor thickness variation).
- Loose or worn front suspension components. Worn components which allow lateral movement of the wheel/hub assembly may produce a pulsating pedal or a shimmy in the front end of the vehicle upon braking.
- Loose or worn wheel bearings

What to Check For





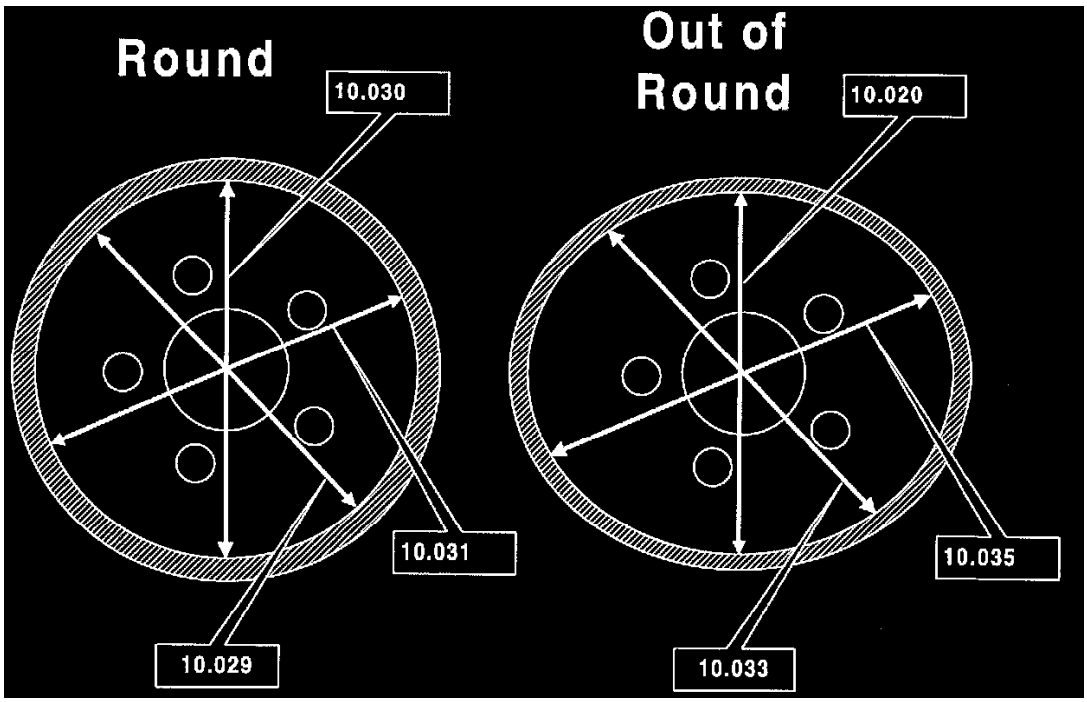
Lack Of Parallelism

- Measure the rotor with a micrometer and a dial indicator. Resurface or replace the rotor if runout exceeds 0.004" or if thickness variation exceeds 0.0005" when measured at several places of equal distance from rotor edge.
  NOTE: Excessive lateral runout may be caused by unevenly torqued lug nuts or loose wheel bearings. Check wheel bearing adjustment and lug nut torque prior to measuring the rotor.
- Check all front suspension components for worn bushings or looseness and replace if necessary.
- Check and adjust front wheel bearings.

REAR DRUM BRAKES

Causes

- Drum out of round.
- Cracked drum.
- Hard spots on the drum friction surface.



What to Check For

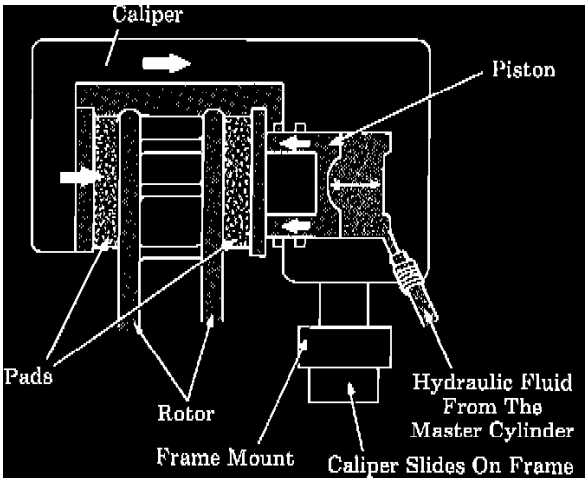
- Measure the drum inside diameter at several points around the circumference of the drum. If the measurements vary by more than 0.002", resurface or replace the drum.
- Inspect the drum for cracks. Lightly drop the drum (from a height of 4-5 inches) onto a flat hard surface. A cracked drum will make a dull thud sound while a good drum will make a ringing sound. If the drum is cracked it must be replaced.
- Inspect the drum friction surface for slightly raised small dark spots (approximately 1/4 in diameter). These hard spots are defects created by localized magnetic fields that built up during the casting process. Resurface or replace the drum (generally these hard spots can not be machined and the drum must be replaced)

Brake Pull

FRONT DISC BRAKES

Causes

- Brake caliper piston seized, or frozen. A seized caliper piston will prevent the brake from being applied at that wheel. The vehicle will pull because one front brake is stopping the wheel, but the other isn't. The pull will be in the direction of the wheel that is stopping.
- Brake caliper sliding hardware seized, or frozen. Caliper slide assemblies which are seized, will prevent the outer pad from being applied, and reduce the braking action at that wheel.



Disc Brake Mechanical Force Diagram

NOTE: Floating calipers require free and unrestricted movement on the caliper mounting. Floating or sliding calipers have pistons only on one side of the rotor. The first part of the piston's travel forces the inner pad against the rotor, then further travel forces the movable part of the caliper to pull the outer pad against the rotor.

- Brake rotors or pads contaminated with oil or brake fluid. Oil and other contaminates fill and block the microscopic pores in the rotor's surface. This prevents the proper bonding of the brake lining to the rotor upon braking and greatly reduces braking performance.
- Worn front suspension components, or steering out of alignment. Braking will amplify these problems.
- Uneven tire pressure or tire size. Tire pressure and width directly affect the braking ability of each wheel. Uneven pressures and widths will result in uneven braking.
- Brake hose restricted or pinched.

What to Check For
- Verify that all four tires are the same size and that they are properly inflated.
- Inspect all brake lines leading from the master-cylinder to the calipers for evidence of pinching or deterioration.

> **NOTE:** Inexperienced mechanics may sometimes clamp the flexible brake hoses with locking pliers while removing calipers. Closely examine the brake hoses for indentations or teeth marks. If any are present the hoses should be replaced. Brake hoses are double walled, damage to the interior pressure wall is not always visible.

- Inspect for free movement of caliper sliding or floating mechanism. Clean and lubricate as necessary.
- Inspect both calipers for uneven pad wear or signs of overheating (discoloration or glazed pad linings). Rebuild or replace both calipers if any defects are found.
- Inspect the linings and rotors for brake fluid or grease contamination. Any brake lining which has been contaminated should be replaced. The brake rotors should be thoroughly cleaned with a commercial brake cleaner.
- Check and adjust the front end alignment as necessary.

REAR DRUM BRAKES

Causes
- Right and left side brakes not evenly adjusted.
- Brake linings contaminated with brake fluid, gear oil or wheel bearing grease.
- Uneven tire pressures or tire size. Tire pressure and width directly affect the braking ability of each wheel. Uneven pressures and widths will result in uneven braking.
- wheel-cylinder seized. A faulty wheel-cylinder can cause uneven braking by failure to apply or to release pressure.
- Brake hose restricted or pinched.

What to Check For

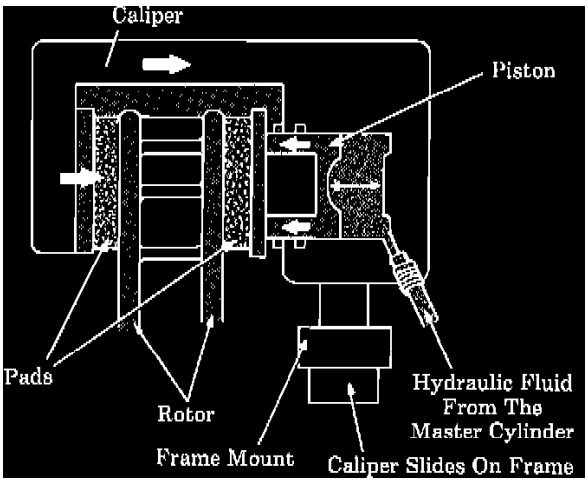
- Verify that all four tires are the same size and that they are properly inflated.
- Inspect all brake lines leading from the master-cylinder to the calipers for evidence of pinching or deterioration.
- Back off the brake shoe adjustment on each side and readjust. After the brake adjustment has been made, firmly depress the brake pedal several times to seat and center the shoes, then recheck the adjustment.
- Inspect the wheel-cylinders for signs of leakage or binding, replace or rebuild as necessary.
- Inspect the axle seals for signs of leakage. Gear oil leaking from the axle seal will usually be indicated by a spray pattern starting at the center of the drum and spreading outwards. If any signs of gear oil leakage are found, the shoes and seal should be replaced.

> **NOTE:** Leakage at the axle seals is often caused by worn wheel bearings. If the vehicle has high mileage it is recommended to replace the wheel bearing along with the axle seal.

Brakes Grab

FRONT DISC BRAKES

Causes
- Brake rotors and pads contaminated with oil or brake fluid.
- Caliper mounting bolts loose.
- Caliper piston sticking. The piston may be sticking or becoming wedged in the caliper bore due to accumulated corrosion deposits or excessive wear. A sudden drop in pedal height followed by wheel lockup indicates a sticking piston.



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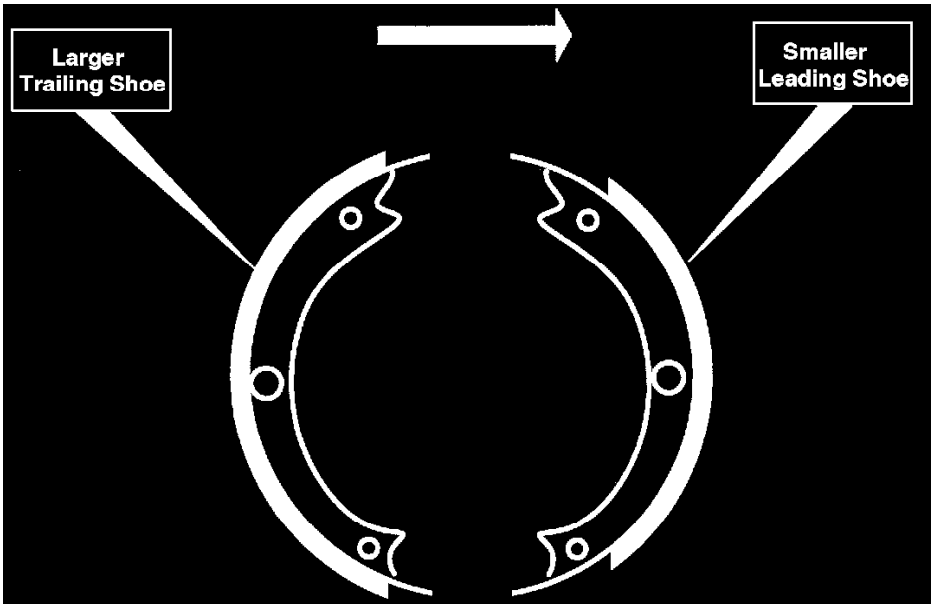
What to Check For

- Inspect the linings and rotors for brake fluid or grease contamination. Any brake lining which has been contaminated should be replaced. The brake rotors should be thoroughly cleaned with a commercial brake cleaner.
- Check the caliper mounting bolts and tighten as necessary.
- Check for free movement of caliper slides and pistons. Inspect piston and slide boots for cuts or tears. Look for signs of moisture contamination of slides or leakage from piston seals. Check for binding of piston when retracting into caliper bore with bleeder open. Rebuild or replace as necessary.

REAR DRUM BRAKES

Causes



- Shoes/Linings incorrectly installed. Each side should have a leading and trailing shoe. The lining surface on the trailing shoe will be slightly larger than the lining surface on the leading shoe. The trailing shoes should be installed in the rear position on each side, while the leading shoes are installed in the front position on each side. If the shoe positions are reversed, the braking performance will be very grabby and prone to wheel lockup.
- Brake linings contaminated with brake fluid or gear oil.
- Incorrect shoe size or type.
- Loose or broken brake lining.
- Brake shoe adjustment too tight or too loose.
- Weak or broken return springs.

What to Check For

- Look for the following common mistakes:
  - Leading and trailing shoes are reversed.
  - Both leading shoes are installed on one side while both trailing shoes are installed on the other side.
- Inspect the wheel-cylinders for signs of leakage or sticking, replace or rebuild as necessary.
- Inspect the axle seals for signs of leakage. Gear oil leaking from the axle seal will usually be indicated by a spray pattern starting at the center of the drum and spreading outwards. If any signs of gear oil leakage are found, the shoes and seal should be replaced.

  NOTE: Leakage at the axle seals is often caused by worn wheel bearings. If the vehicle has high mileage, it is recommended to replace the wheel bearing along with the axle seal.

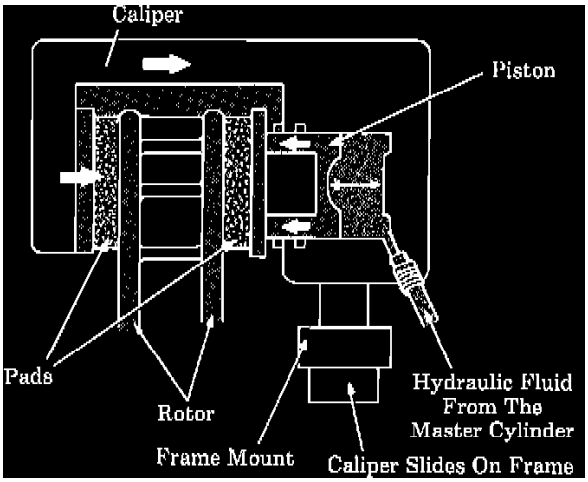
- Inspect all brake springs and replace if any appear worn or distorted.
- Inspect shoes for correct fit with drum and backing-plate.
- Inspect brake lining for cracks, missing pieces or poor bonding to shoes.
- Check for proper adjustment, readjust as necessary.

Dragging Brakes

FRONT DISC BRAKES

Causes

- Corrosion deposits build up inside of the caliper along the piston seal. This prevents the piston from fully releasing, and causes the pads to slightly drag on the rotor.
- Caliper slide joints/pins binding. If the slide joints/pins are binding, the caliper piston will release the inner pad but the outer pad will remain in contact with the rotor. This is often indicated by the outer pad wearing much faster than the inner pad.



Disc Brake Mechanical Force Diagram

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- Pinched or internally collapsed brake hose. Hydraulic pressure from the master-cylinder forces brake fluid through the hose, but residual pressure is then trapped behind the restriction in the hose causing the brakes to drag.
- A blocked compensating port in the master-cylinder. The compensating port allows pressure to quickly equalize upon the release of the brake pedal.
- Lack of clearance between brake master-cylinder and push rod. Lack of clearance will prevent the master-cylinder piston from fully retracting in its bore. This can block the compensating port, and maintain hydraulic pressure in the brake system.
- Oil contamination of the brake fluid. Oil (or any other type of petroleum product) that has contaminated the brake fluid will cause the rubber seals in the master-cylinder and the calipers to swell. This swelling causes the caliper pistons to bind and stick.

What to Check For

1. Inspect the master-cylinder and brake fluid.
   - Inspect the rubber gasket on the inside of the master-cylinder lid. If the gasket is swollen or bloated, the brake fluid is contaminated with oil.
   - Siphon or scoop a small amount of brake fluid out of the master-cylinder and place into a styrofoam cup filled 2/3 of the way with water. Brake fluid will mix with the water while oil contaminants will float on the surface and dissolve the styrofoam.

   NOTE: If any oil contamination is present **ALL** brake components containing rubber seals will need to be replaced or overhauled.

This includes the master-cylinder, both front calipers, both rear wheel-cylinders, and all flexible brake hoses.

- With the master-cylinder lid off, slowly depress and release the brake pedal several times. As you are releasing the pedal a steady stream of brake fluid should be visible bubbling up from the bottom of the master-cylinder. If no stream is visible siphon or remove all brake fluid from the master-cylinder and verify that the compensating port is not blocked.

  WARNING: Wear eye protection and view the master-cylinder from an angle. If the brake pedal is released suddenly, brake fluid may shoot out of the top of the master-cylinder.

- Inspect for clearance between brake pedal pushrod and master-cylinder or power booster. Verify there is a small amount of clearance at pushrod, allowing master-cylinder piston to fully return in its bore, without blocking compensating port.

2. Inspect all brake lines leading from the master-cylinder to the calipers for evidence of pinching or deterioration.

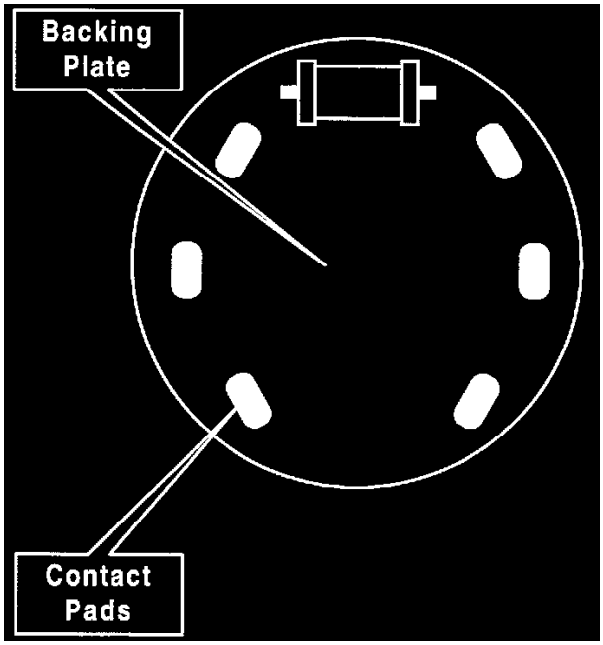
   NOTE: Inexperienced mechanics may sometimes clamp the flexible brake hoses with locking pliers while removing calipers. Closely examine the brake hoses for indentations or teeth marks. If any are present the hoses should be replaced. Brake hoses are double walled, damage to the interior pressure wall is not always visible.

   - If the brake is locked up, opening the bleeder valve will release any residual pressure being held in the line by a faulty hose or master-cylinder. If the brake remains locked up, inspect the caliper piston and slides for seizing or binding.
3. Inspect the caliper slide joints/pins for signs of rust or corrosion, and for proper lubrication. Clean and lubricate with "high temperature" silicone grease as necessary.
4. Inspect calipers.
   - Inspect for damaged or missing mounting hardware.
   - Inspect piston dust boots for cuts, tears or melted appearance.
   - Inspect for brake fluid leakage past piston seal or dust boot.
   - Check for excessive resistance when pistons are retracted with bleeder valve open.
   - Rebuild or replace calipers as necessary, if any problems are found.
5. Inspect pads and rotors for signs of overheating (bluish purple discoloration, cracks, glazed appearance, or a thin brick red oxidation layer evenly covering all brake components), replace as necessary.

REAR DRUM BRAKES

Causes

- Corrosion deposits build up inside of the wheel-cylinder along the seals. This causes the wheel-cylinder pistons to bind and prevents them from withdrawing upon release of the brake pedal.
- Improperly adjusted shoes/linings or emergency brake. If the shoes/linings or emergency brake are adjusted too tightly, the shoes will be in continuous contact with the drum.
- Stuck or frozen emergency brake cable. A corroded or pinched cable or cable housing will not allow the rear brakes to release.
- Weak or broken return springs. Proportioning valves maintain a residual pressure on the drum brake system after the brake pedal has been released. If the return springs are too weak to overcome the residual pressure in the system,the shoes will drag against the drum.



- Contact pads between the backing-plate and shoes/linings are burred, grooved, or lacking lubrication. This prevents the shoes/linings from properly returning to their initial position.

- Pinched or internally collapsed brake hose. Hydraulic pressure from the master-cylinder forces brake fluid through the hose but residual pressure is then trapped behind the restriction in the hose causing the brakes to drag.
- Blocked compensating port in the master-cylinder. The compensating port allows pressure to quickly equalize upon the release of the brake pedal. Can be caused by contaminants in the brake fluid, corrosion of the cylinder or port, or a pushrod which has been adjusted too tightly.
- Oil contamination of the brake fluid. Oil (or any other type of petroleum product) that has contaminated the brake fluid will cause the rubber seals in the master-cylinder, wheel-cylinders, and calipers to swell. This swelling can cause any of these components to bind and stick.

What to Check For

1. Inspect the master-cylinder and brake fluid.
   - Inspect the rubber gasket on the inside of the master-cylinder lid. If the gasket is swollen or bloated, the brake fluid is contaminated with oil.
   - Siphon or scoop a small amount of brake fluid out of the master-cylinder and place into a styrofoam cup filled 2/3 of the way with water. Brake fluid will mix with the water while oil contaminants will float on the surface and dissolve the styrofoam.

     NOTE: If any oil contamination is present **ALL** brake components containing rubber seals will need to be replaced or overhauled. This includes the master-cylinder, both front calipers, both rear wheel-cylinders, and all flexible brake hoses.

   - With the master-cylinder lid off, slowly depress and release the brake pedal several times. As you are releasing the pedal a steady stream of brake fluid should be visible bubbling up from the bottom of the master-cylinder. If no stream is visible siphon or remove all brake fluid from the master-cylinder and verify that the compensating port is not blocked.
     WARNING: Wear eye protection and view the master-cylinder from an angle. If the brake pedal is released suddenly, brake fluid may shoot out of the top of the master-cylinder.
   - Inspect for clearance between brake pedal pushrod and master-cylinder or power booster. Verify there is a small amount of clearance at pushrod, allowing master-cylinder piston to fully return in its bore, without blocking compensating port.
2. Inspect all brake lines leading from the master-cylinder to the wheel-cylinders for evidence of pinching or deterioration.

   NOTE: Inexperienced mechanics may sometimes clamp the flexible brake hoses with locking pliers while removing wheel-cylinders. Closely examine the brake hoses for indentations or teeth marks. If any are present, the hoses should be replaced. Brake hoses are double walled, damage to the interior pressure wall is not always visible.

3. With the emergency brake released, verify that the wheels spin freely. If the wheels drag, re-adjust the shoes/linings and parking brake as necessary.
4. With the drum removed, apply and release the emergency brake several times and verify that the cable and linkage are not sticking.
5. Inspect the contact pads between the shoes and backing-plate. Remove any burrs present. Clean and lubricate with "high temperature" silicone grease.
6. Inspect all return springs. Replace springs as a set if any appear worn, overheated, or distorted.
7. Inspect wheel-cylinders. Check for leakage, build up of rust or corrosion inside dust boots. Check for free movement of pistons in their cylinder bores. Pistons should not bind or stick. Rebuild or replace as necessary.
8. Inspect shoes/linings and drums for signs of overheating (bluish purple discoloration, cracks, or glazed appearance). Replace as necessary.

Fading Pedal

CAUSES

- Severe or prolonged braking. During repeated braking, the amount of pedal effort/travel required to slow the vehicle increases as the ability of the brakes to dissipate heat decreases.
- Heat build up in brake linings. As the linings heat up, their "coefficient of friction" is reduced (they become slicker). As the coefficient of friction is reduced, more hydraulic pressure is required to stop the vehicle. More hydraulic pressure results in more heat which then results in more pedal fade.
- Glazed brake linings (overheated). Brake linings which have been severely overheated (cracked, shiny, charcoal like appearance) have a greatly reduced stopping ability and are highly prone to "pedal fade".
- Worn brake components. As the brake linings, rotors, and drums begin to wear, their ability to absorb and release heat is reduced significantly. This makes worn brakes more prone to "pedal fade".

WHAT TO CHECK FOR

- Inspect all pads/linings and shoes for sufficient lining and signs of overheating. Overheated linings will appear glazed, cracked and have a charcoal like appearance. Replace if linings are worn too thin or show signs of overheating.
- Measure rotor thickness. Replace both rotors if measurements are **less than** the minimum specification.
- Measure the drum inside diameters. Replace both drums if the measurements **exceed** the maximum specification.

  NOTE: Always replace both drums or both rotors on an axle. Replacing only one will result in a different braking ability from side to side. This will produce a steering "pull" when the brakes are applied.

Hard Pedal

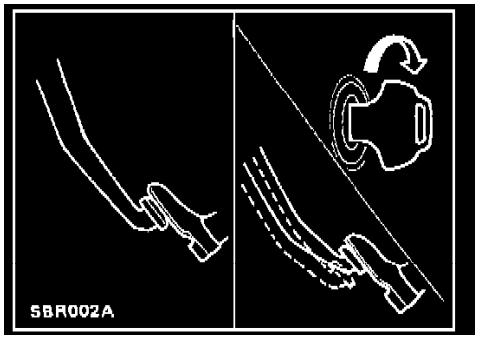
CAUSES

- No assist from the brake booster. The vacuum operated brake booster may be defective or not receiving a sufficient supply of vacuum.
- Brake linings contaminated with brake fluid, oil, or grease. The contamination reduces the stopping ability of the brakes.
- Worn brake linings. Severely worn brake linings have a greatly reduced stopping ability.

- Glazed brake linings (overheated). Brake linings which have been severely overheated (cracked, shiny, charcoal like appearance) have a greatly reduced stopping ability.
- New brake linings not seated. Newly installed brake linings require a break in period of approximately 50 miles. Until the new brake linings are properly seated, overall braking performance will be less than 100%. Braking performance will gradually increase as the new linings are broken in.

Break-In Procedure
- Initially make 8-10 slow and gradual brake applications, slowing from 25 to 10 miles per hour.
- Severe braking or locking up the brakes should be avoided (unless dictated by an emergency or driver safety) for the first 50 miles.

WHAT TO CHECK FOR
- Check for proper brake booster operation.
  - With the engine "OFF", depress and release the brake pedal 4-5 times.

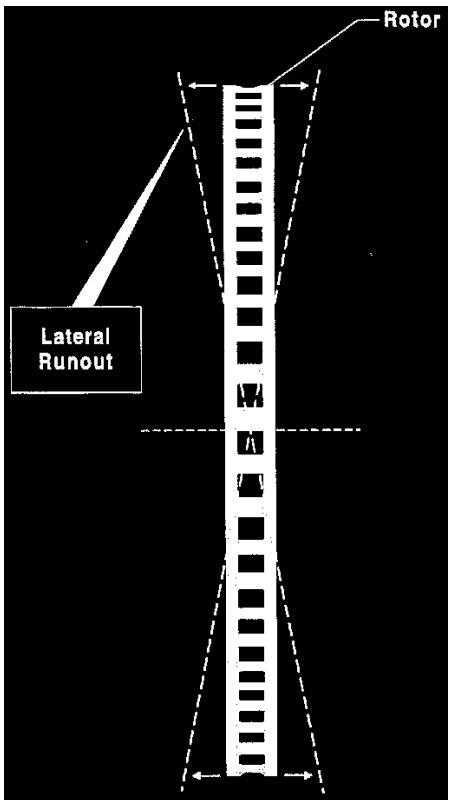


  - Depress the brake pedal firmly and start the engine.
  - If the pedal goes down slightly the brake booster is operating properly.
  - If the pedal does not go down slightly the brake booster is not assisting in brake operation. Verify vacuum supply to the booster.
  - Maintain pressure on brake pedal while turning "OFF" engine. The pedal should remain in the same position. If the pedal slowly slowly rises, the booster or vacuum check valve is leaking. Replace as necessary.
- Verify the brake booster vacuum line is intact and installed properly. Verify that the vacuum check valve allows flow only towards the intake manifold, and not in reverse towards the booster.
- Verify that engine vacuum is at least 17 in hg.
- Inspect brake linings for sufficient thickness, contamination, and evidence of overheating. Replace as necessary.

Low Pedal

CAUSES
- Excessive clearance between shoes/linings and drums. The brake pedal will feel solid and the vehicle will have sufficient braking power, but the pedal travel will be excessive (greater than 1/3 of total travel).

NOTE: If the brake system is operating properly, the amount of pedal travel is proportional to the distance that the brake system has to extend the pads or shoes. This distance is normally controlled by the adjustment of the rear shoes/linings, since the disc brakes readjust themselves with every application. Keep in mind that if the shoes/linings are loose, the emergency brake will also be loose, since it applies the rear brakes.



- Excessive lateral runout (rotor wobble) or loose wheel bearings. The pads/linings can be knocked further back into the calipers than usual by excessive rotor wobble. This requires more brake fluid behind the pistons to extend the pads back into contact with the rotors. This results in longer pedal travel.

WHAT TO CHECK FOR

- Check the adjustment of the rear shoes/linings, and adjust if necessary.

  NOTE: The shoes/linings are normally automatically adjusted. If you have to adjust the brakes more than once, you should inspect the operation of the auto-adjusters. Remove, clean, and lubricate the automatic adjusters as necessary.

- Check the wheel bearing adjustment, and adjust if necessary.
- If a pedal pulsation is also occurring, inspect the rotors for excessive lateral runout. Resurface or replace if necessary.

Pedal Is Low or Feels Spongy

CAUSES

A brake pedal that sinks all the way to the floor is the result of the master-cylinder not developing any hydraulic pressure. This can be caused by a severe fluid leak which has emptied the master-cylinder, or by complete failure of the seals inside the master-cylinder.
A pedal that slowly sinks to the floor is the result of hydraulic pressure leaking off. This may be from an internal leak in the master-cylinder or an external brake fluid leak.

NOTE: Rear brakes which are extremely out of adjustment in conjunction with air in the hydraulic lines can also produce this symptom. Always verify that the shoes/linings are properly adjusted and the brakes have been bled prior to replacing a master-cylinder.

WHAT TO CHECK FOR

- Verify that the fluid reservoir is full.
- Verify that there are no signs of leakage at the area where the master-cylinder bolts onto the brake booster. If any leakage is indicated, the master-cylinder should be replaced.

  NOTE: Minor leakage will often be indicated by "bubbled up" paint on the brake booster just below the master-cylinder. Brake fluid is very corrosive to painted surfaces.

- Inspect the rubber gasket on the inside of the master-cylinder lid. If the gasket is swollen or bloated, the brake fluid is contaminated with oil.
- Siphon or scoop a small amount of brake fluid out of the master-cylinder and place into a styrofoam cup filled 2/3 of the way with water. Brake fluid will mix with the water while oil contaminants will float on the surface and dissolve the styrofoam.

  NOTE: If any oil contamination is present **ALL** brake components containing rubber seals will need to be replaced or overhauled. This includes the master-cylinder, both front calipers, both rear wheel-cylinders, and all flexible brake hoses.

- Trace all brake lines from the master-cylinder to the calipers and wheel-cylinders. Replace any lines that shows evidence of leakage.
- Remove all wheels and inspect the calipers and wheel-cylinders for brake fluid leakage. Replace any component that shows evidence of leakage.
- If no signs of external leakage can be detected, bleed the brakes and verify the shoes/linings and emergency brake are properly adjusted.
- If the pedal still sinks to the floor, replace or rebuild the master-cylinder (Non-Antilock Brake Systems only, For ABS systems see Antilock Brake Systems/Testing and Inspection).

Spongy Pedal

CAUSES

- Air is trapped in the hydraulic lines. The spongy feeling is a result of the air being compressed when the brakes are applied. Clean fresh brake fluid is non-compressible and will produce a firm brake pedal.
- Brake fluid is contaminated with water. During prolonged or severe braking, localized brake fluid temperatures can quickly exceed 220 degrees F. Any water in the brake fluid boils off into steam and creates a spongy pedal. As the brakes cool off the steam condenses back into water and the spongy feeling disappears.
- The rear drums are worn to thin. The spongy feeling is a result of the drums actually flexing into an oval as the brakes are applied.

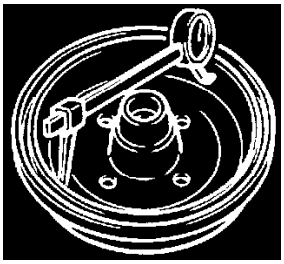
WHAT TO CHECK FOR

- Verify that the master-cylinder reservoir is filled with clean fresh brake fluid.

  NOTE: If at any time the master-cylinder reservoir has been emptied, the master-cylinder will need to be bled.

- Verify that the shoes/linings are properly adjusted, adjust if necessary.
- Bleed the brakes at all four wheels.

  NOTE: Refill the master-cylinder after bleeding at each wheel.



- Remove the rear drums and measure the inside diameter of each. If either drum exceeds the maximum diameter specification, both must be replaced.

  NOTE: Always replace both drums on an axle. Replacing only one drum will result in a different braking ability from side to side. This will produce a steering "pull" when the brakes are applied.

- If the brake pedal is still soft or spongy, flush the hydraulics and replace with clean fresh brake fluid, then bleed the brakes at all four wheels again.