

INTRODUCTION

Drum brakes were the first type of brakes used on motor vehicles. Drum brakes are still used on the rear of many vehicles. Figure 1.

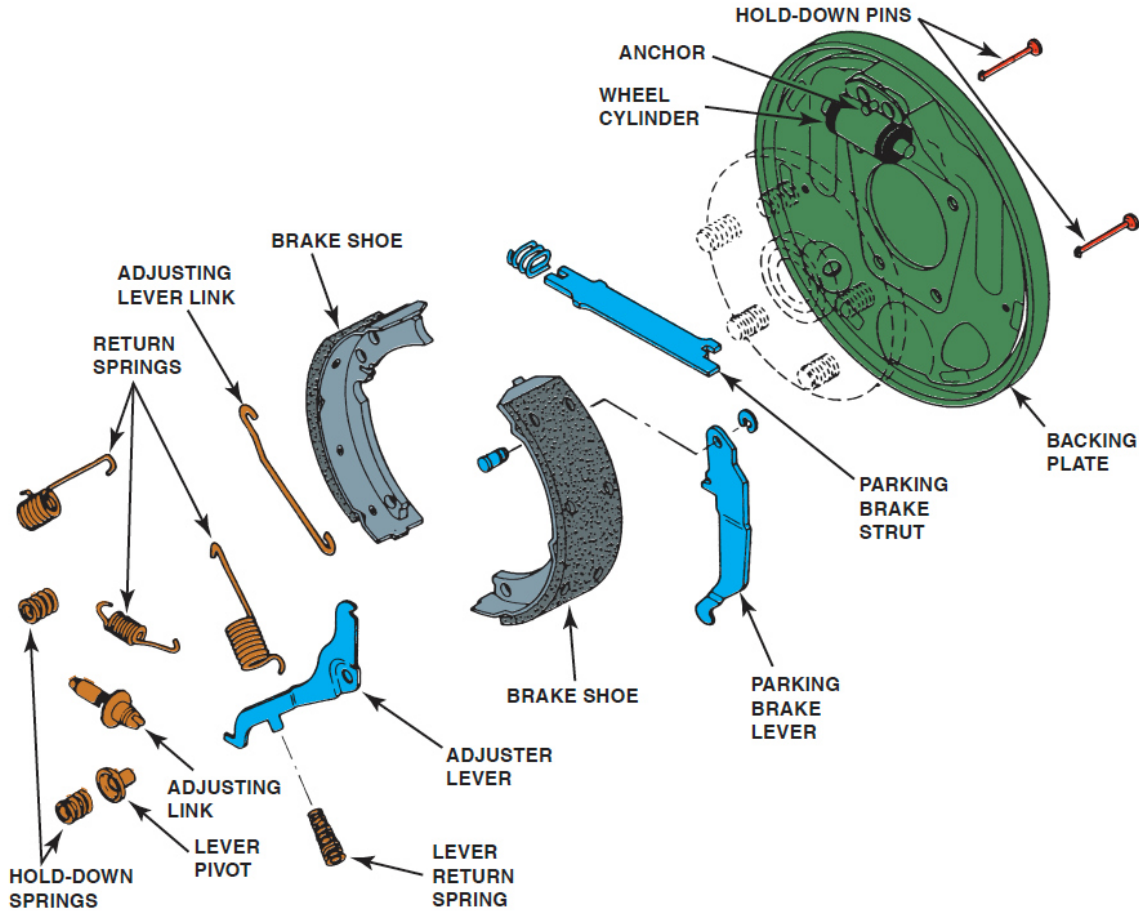


Figure 1. A typical drum brake assembly.

The backing plate is the foundation of every drum brake. There are normally six pads where the brake shoes contact the backing plate. Shoe anchors prevent the brake shoes from rotating with the drum when the brakes are applied. Figure 2.

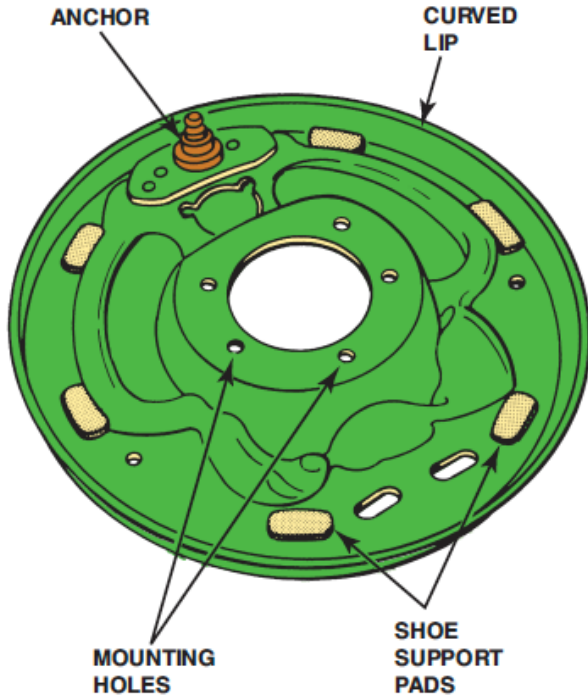


Figure 2. Backing plate.

Hydraulic pressure is transferred from the master cylinder to each wheel cylinder through brake fluid. The force exerted on the brake fluid by the driver forces the piston inside the wheel cylinder to move outward. Through pushrods or links, this movement acts on the brake shoes, forcing them outward against the brake drum. Figures 3 and 4.

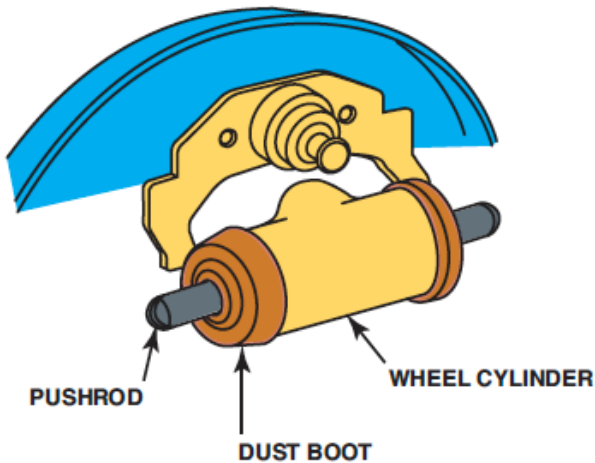


Figure 3. Wheel cylinder and pushrods.

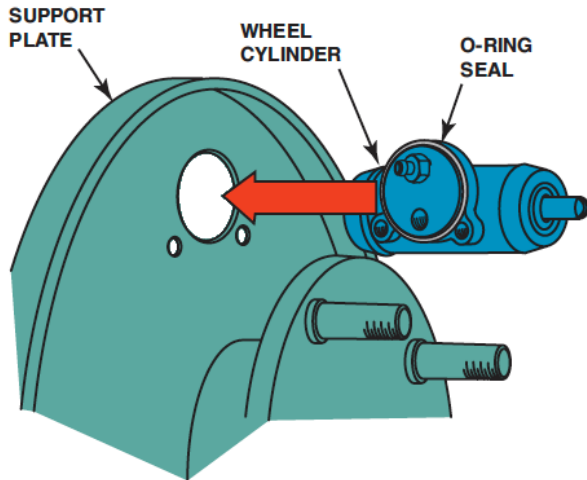


Figure 4. This wheel cylinder mounts to the backing plate with bolts.

The linings of drum brakes are attached to curved metal assemblies called brake shoes. Most shoes are made of two pieces of sheet steel welded together in a T-shaped cross section. The outer surface is lined with a friction material that contacts the brake drum to generate the actual stopping power. Figure 5.

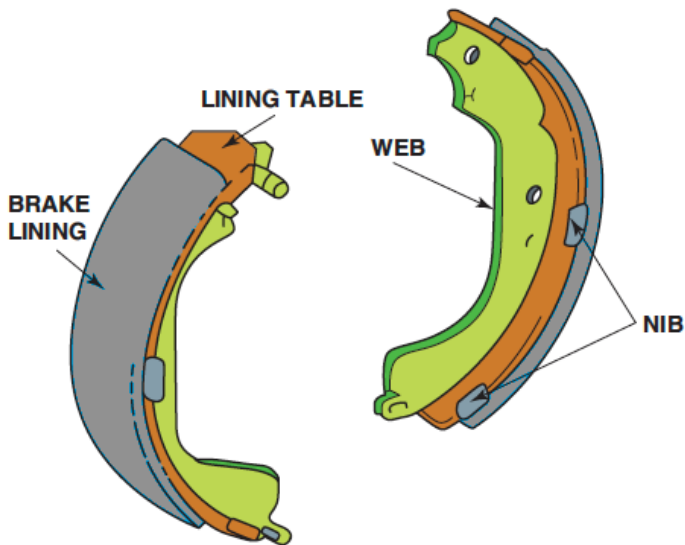


Figure 5. Brake shoes.

The brake shoe return springs retract the shoes to their unapplied positions when the brake pedal is released. Brake shoe hold-downs keep the shoes securely against the support pads on the backing plate. Figure 6.

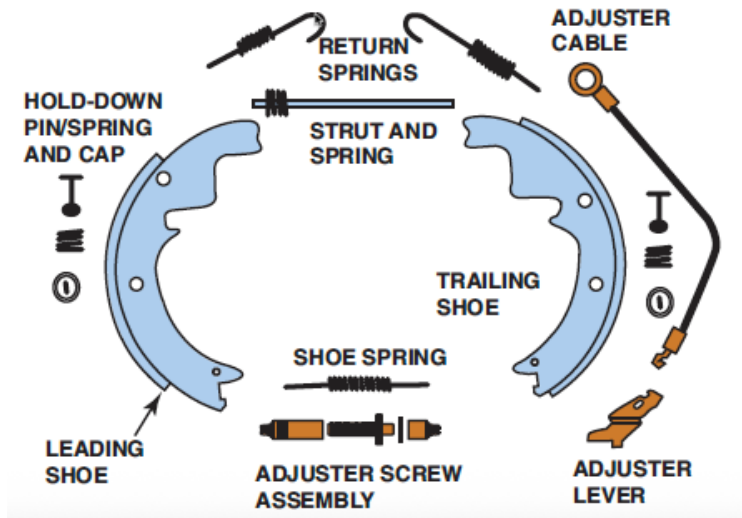


Figure 6. Return springs and shoe hold-down springs.

The brake drum is not connected to the backing plate but turns with the wheel. The drum mounts on the hub or axle and covers the rest of the brake assembly. Figure 7.



Figure 7. Brake drum.

ASE TEST TOPICS

1. Diagnose poor stopping, pulling, dragging or incorrect pedal travel caused by drum brake hydraulic problems; determine needed repairs.

Some possible symptoms and causes of drum brake hydraulic problems are:

- **LOW PEDAL.** Leaking wheel cylinder; air in the system
- **EXCESSIVE PEDAL PRESSURE REQUIRED TO STOP THE VEHICLE.** Frozen wheel cylinder pistons
- **ONE WHEEL DRAGS.** Wheel cylinder piston cups swollen and distorted; pistons sticking in the wheel cylinder

2. Diagnose poor stopping, noise, pulling, grabbing, dragging, pedal pulsation or incorrect pedal travel caused by drum brake mechanical problems; determine needed repairs.

Some possible symptoms and causes of drum brake mechanical problems are:

- **LOW PEDAL.** Excessive clearance between the linings and drum; automatic adjusters not working
- **EXCESSIVE PEDAL PRESSURE REQUIRED TO STOP THE VEHICLE.** Grease or fluid-soaked linings
- **ONE WHEEL DRAGS.** Weak or broken shoe retracting springs; brake-shoe-to-drum clearance too tight—brake shoes not adjusted properly; brake assembled improperly
- **BRAKES TOO SENSITIVE.** Incorrect brake adjustment; lining loose on the shoe; excessive dust and dirt in the drums
- **PULSATING BRAKE PEDAL.** Drums out-of-round
- **SHOE CLICK NOISE.** Shoes lift off the backing plate and snap back; hold-down springs weak; shoe bent; grooves in the backing plate support pads
- **THUMPING NOISE WHEN BRAKES ARE APPLIED.** Cracked drum; hard spots in the drum
- **GRINDING NOISE.** Shoe hits the drum; bent shoe web; brake improperly assembled
- **BRAKES CHATTER.** Incorrect lining-to-drum clearance; weak or broken retractor spring; drums out-of-round; tapered or barrel-shaped drums

3. Remove, clean, inspect and measure brake drums; follow manufacturers' recommendations in determining need to machine or replace.

The drum has to be removed before inspection or repair of a drum brake can begin. It is usually recommended that the drums be marked with an “L” for left or an “R” for right so that they can be replaced in the same location.

Two situations that can prevent the drum from being removed include the following:

- The drum is rusted to the hub. Striking the area inside the wheel studs will usually break the drum loose from the hub.
- The brake shoes are worn into the drum. The brake drums cannot be removed because the inner edge of the brake drum catches on the lining. Remove the adjuster plug from the backing plate or drum and back off the adjuster. Figure 8.

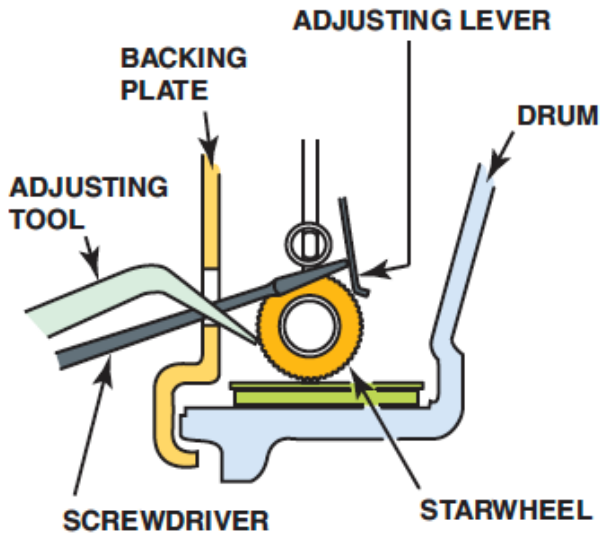


Figure 8. Release the self-adjuster lever and back off the adjuster.

Drums are inspected for damage and wear.

- Scoring is caused by brake linings that have worn to the point where a rivet, lining table, or pad backing plate contacts the drum or rotor. Figure 9.



Figure 9. The drum should be machined or replaced.

- A lesser form of drum and rotor cracking is called heat checking, which consists of many small, interlaced cracks on the friction surface. Figure 10.

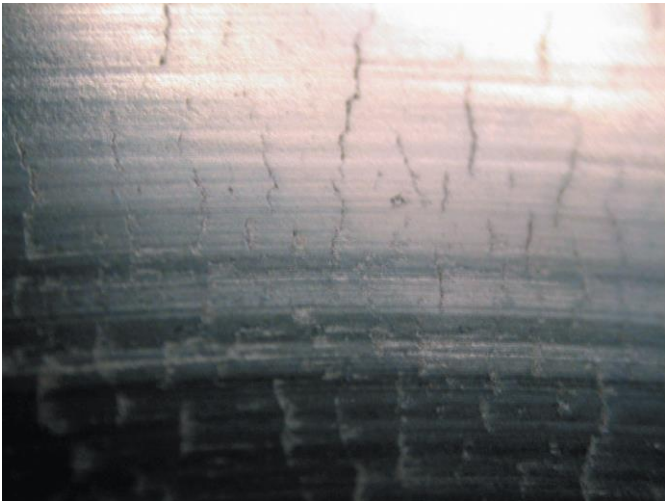


Figure 10. A drum with heat checking must be replaced.

- Hard spots are roughly circular, bluish gold, glassy-appearing areas on the friction surface. Most vehicle manufacturers recommend that the drum or rotor should be replaced if hard spots are found. Figure 11.

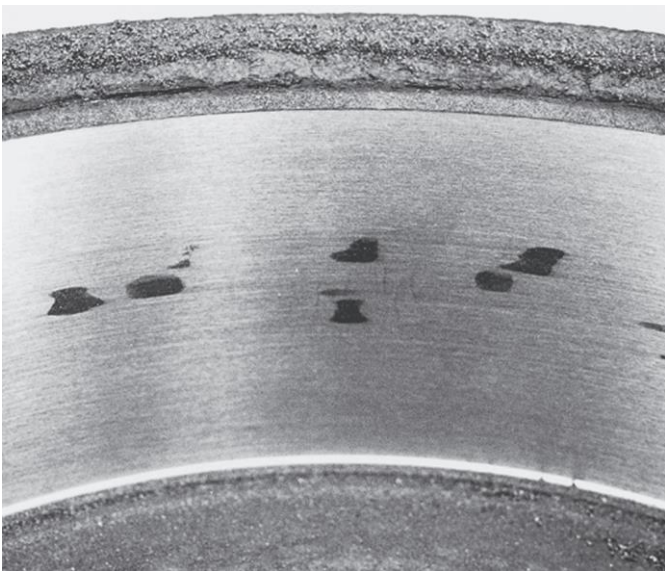


Figure 11. Hard spots require the replacement of the drum.

- The inside diameter of the drum should be measured and compared to the maximum diameter marked on the face of the drum. Brake drums can usually be machined a maximum of 0.060 inch (1.5 mm) oversize (e.g., a 9.500 in. drum could wear or be machined to a maximum inside diameter of 9.560 in.). Many manufacturers recommend that 0.030 inch (0.8 mm) be left for wear. Figures 12 and 13.



Figure 12. This drum can be machined to a maximum diameter of 9.064 in., leaving 0.030 in. for wear.



Figure 13. Accurate measurements are made with a brake drum micrometer.

4. Machine drums according to manufacturers' procedures and specifications.

Typical drum brake machining steps include the following:

STEP 1 Mount the drum on the lathe and install the silencer band. Figure 14.

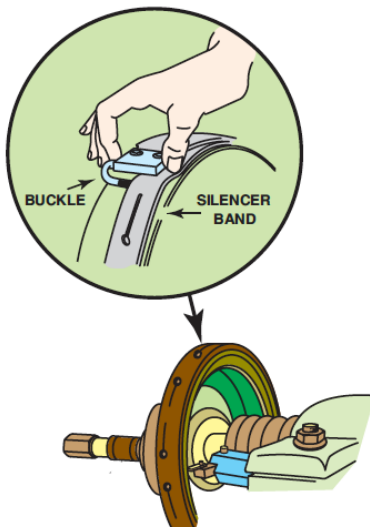


Figure 14. The silencer band keeps the tool bit from chattering.

A5-B. Drum Brake Diagnosis and Repair

STEP 2 Turn on the lathe and advance the tool bit manually until it just contacts the drum. This is called a scratch cut.

STEP 3 Stop the lathe and back off the tool bit. Loosen the arbor nut, rotate the drum one-half turn (180°) on the arbor, and retighten the arbor nut. Turn the lathe on and make a second scratch cut.

- a. If the scratch cuts are side-by-side, the lathe is okay, and machining can begin.
- b. If the scratch cuts are opposite, remove the drum and check for nicks, burrs, or chips on the mounting surfaces.

STEP 4 Start the lathe and adjust the tool bit fully into the drum. Adjust the depth of the cut and lock it in position.

STEP 5 Set the feed rate and engage the automatic feed to make the cut. Figure 15.

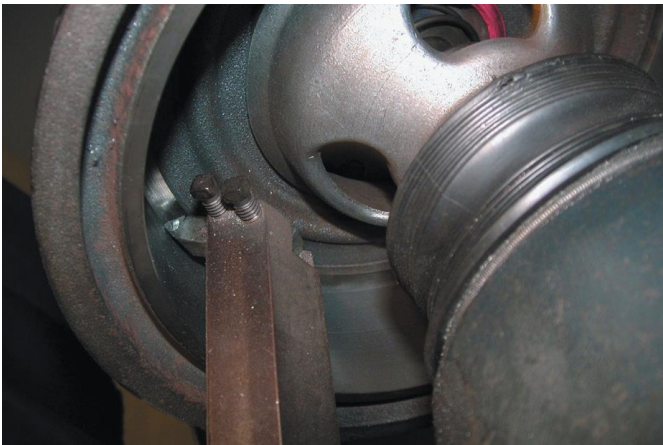


Figure 15. The drum will automatically move as the tool remains stationary to make the cut.

5. Using proper safety procedures, remove, clean and inspect mechanical brake components, such as: shoes/linings, springs, pins, self-adjusters, levers, clips, brake backing (support) plates and other related brake hardware; determine needed repairs.

After removal of the brake drum, the brake shoes and other brake hardware should be wetted down with a solvent or enclosed in an approved evacuation system to prevent possible asbestos release into the air. Figure 15.



Figure 15. Wet down the assembly to trap any dust that may contain asbestos.

A5-B. Drum Brake Diagnosis and Repair

Usually, the first step in the disassembly of a drum brake system is removal of the return (retracting) springs. After the return springs have been removed, the hold-down springs and other brake hardware can be removed. Figure 16 and 17.

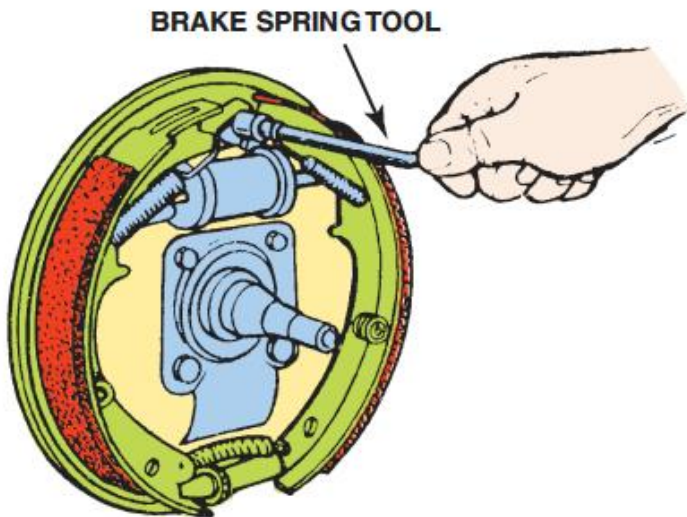


Figure 16. Removing the return springs.

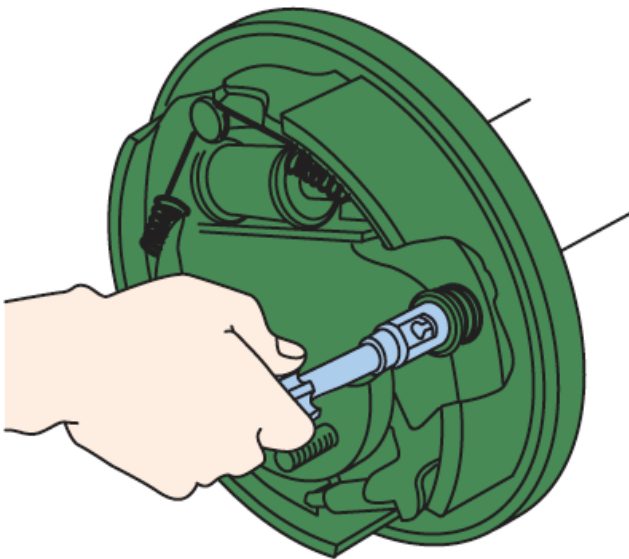


Figure 17. Press and rotate the retainer to remove the hold downs.

Inspect the following for possible replacement:

- Backing plate. The six raised contact surfaces of the backing plate should be inspected. If the pads are worn more than 1/16 inch (1.5 mm), the backing plate should be replaced. Figure 18.



Figure 18. Rusty and worn backing plate.

- Return springs. Return springs can get weak due to heat and time and can cause the linings to stay in contact with the drum when the brakes are released. Figure 19.



Figure 19. Damaged spring.

- Adjuster components. A lack of proper lubrication can cause the starwheel to become frozen in one place and not adjust properly. Figure 20.



Figure 20. A worn out adjuster starwheel.

If any spring is found to be defective many brake suppliers sell drum brake hardware kits. These kits usually include the items listed below for two drum brakes (axle set):

1. Primary and secondary return springs
2. Connecting spring

A5-B. Drum Brake Diagnosis and Repair

3. Hold-down springs
4. Hold-down spring retainers
5. Hold-down spring pins (nails)

Self-adjuster kits are available in left- and right-handed threads for the left and right side of the vehicle.

6. Lubricate brake shoe support pads on backing (support) plate, self-adjuster mechanisms and other brake hardware.

For proper operation, the following points should be lubricated with approved brake lubricant such as molybdenum disulfide (moly) grease, synthetic grease, or lithium-based brake grease.

1. The starwheel adjuster threads and under end caps
2. The backing plate contact areas (pads or ledges) Figure 21.
3. Anchor pins



Figure 21. Lubricate the backing plate.

7. Inspect wheel cylinder(s) for leakage, operation and mounting; remove and replace wheel cylinder(s); bleed system.

Dust boots are installed on the ends of the wheel cylinder to keep dirt out of the cylinder bore. Between both piston seals, there is a spring with piston seal expanders to keep the seals from collapsing toward each other and to keep pressure exerted on the lips of both seals to ensure proper sealing. Figure 22.

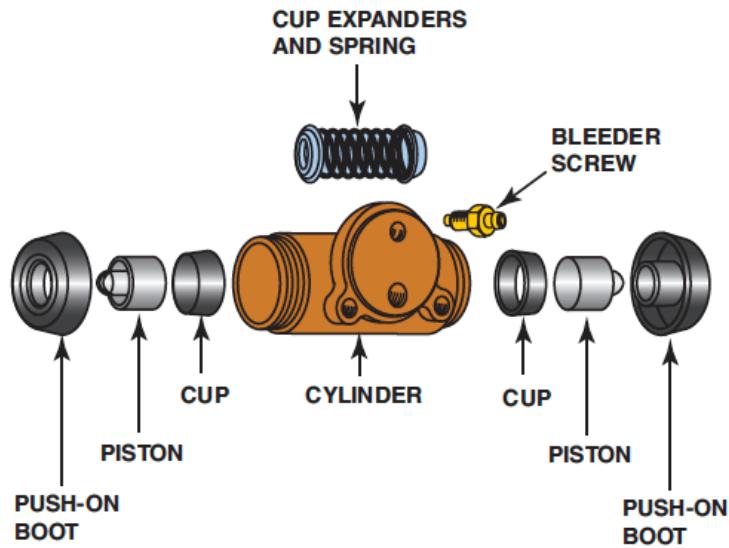


Figure 22. Typical wheel cylinder and components.

If defective or leaking The wheel cylinder is normally replaced as an assembly. To remove the wheel cylinder:

- The brake line must first be removed from the wheel cylinder. Be careful not to twist the brake line when removing the line from the wheel cylinder or the brake line will also require replacement.
- Unbolt or remove the wheel cylinder retainer clip. Figure 23.

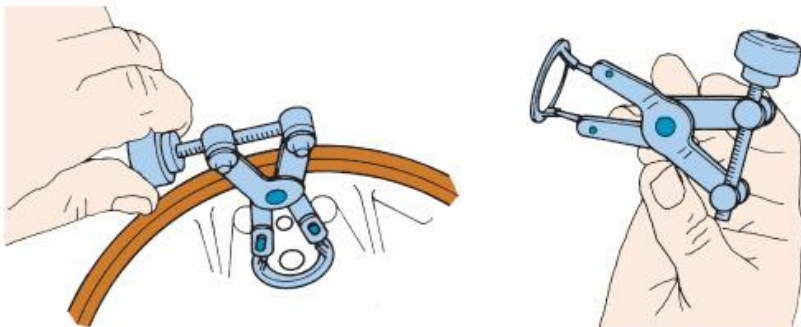


Figure 23. Many wheel cylinders are mounted using a special clip.

8. Following manufacturers' specifications, install brake shoes and related hardware.

Reassembling the drum brake includes the following steps:

- STEP 1. Carefully clean the backing plate.
- STEP 2. Check the anchor pin for looseness.
- STEP 3. Lubricate the shoe contact surfaces (shoe pads) with brake grease, or synthetic grease.
- STEP 4. Reassemble the primary and secondary shoes and brake strut, along with all springs.
- STEP 5. Finish assembling the drum brake, being careful to note the correct location of all springs and parts.

A5-B. Drum Brake Diagnosis and Repair

- Most self-adjusters operate off the rear (secondary) shoe and should therefore be assembled toward the rear of the vehicle.
- Be sure that the star wheel adjuster is used on the correct side of the vehicle as the threads are different.

9. Preadjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.

Use a brake shoe clearance gauge to adjust the brake shoes before installing the drum. Figures 24 and 25.

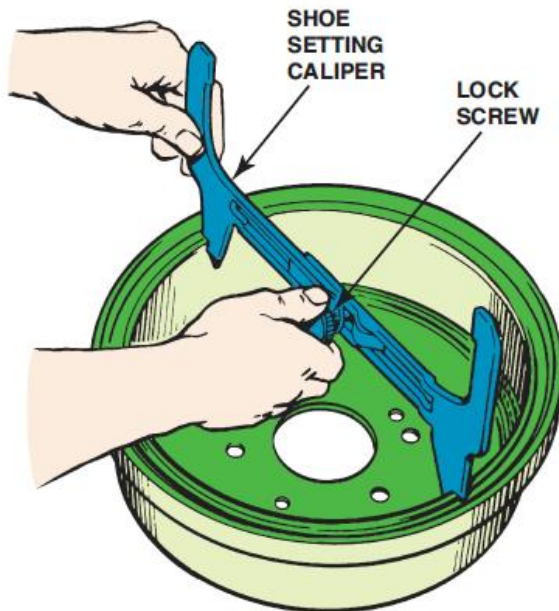


Figure 24. Using a brake shoe clearance gauge, first adjust it to the drum inside diameter and tighten the lock screw.

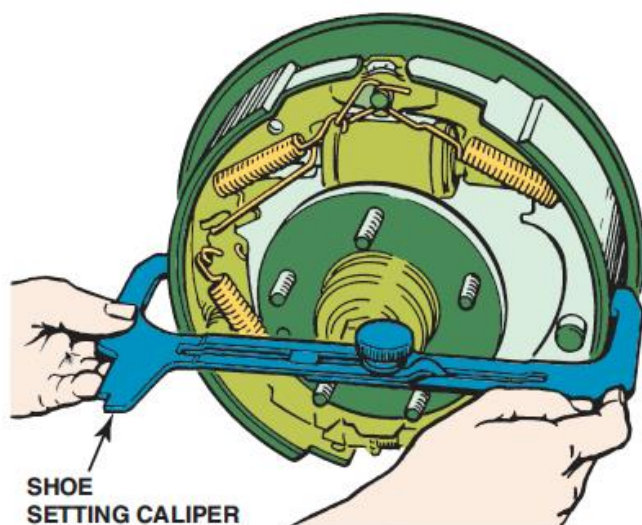


Figure 25. Place the gauge over the shoes and adjust the brakes until they contact the inside of the gauge.

10. Reinstall wheel, torque lug nuts, and make final checks and adjustments.

For wheel mounting torque, make certain that the wheel studs are clean and dry, and torqued to the manufacturer's specifications. Most manufacturers warn that the wheel studs should not be oiled or lubricated with grease.

All vehicle manufacturers recommend that the lug nuts be tightened to factory specifications using a torque wrench. Check service information for the specified torque for the lug nuts on the vehicle being serviced. For most passenger vehicles, this torque is usually 80 to 100 lb-ft. Torque the lug nuts in a star pattern. This method helps insure that the wheel is installed straight onto the hub. Figure 26.

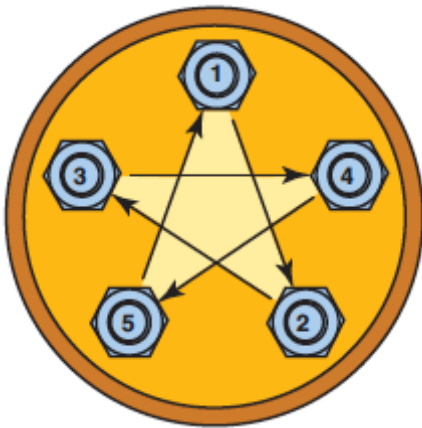


Figure 26. Lug nut torque sequence example.

After completing the brake service, be sure to cover the brake adjustment opening to prevent water from getting into the brake. Figure 27.

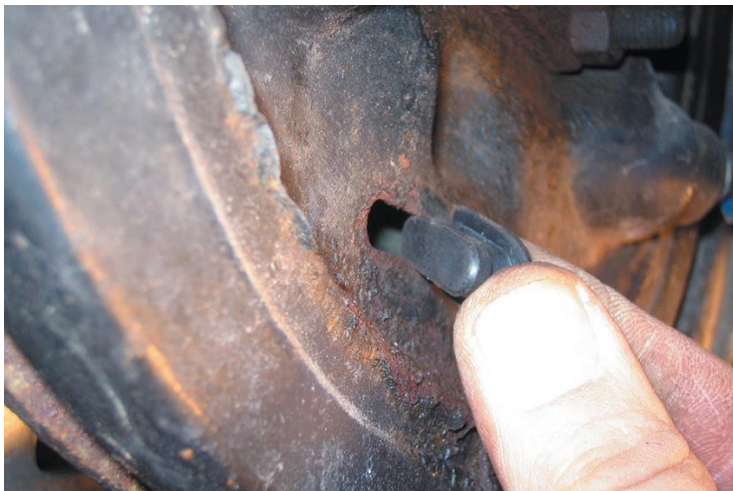


Figure 27. Insert the rubber plug in the backing plate.

11. Diagnose wheel bearing noises and vibration problems; determine needed repairs.

Symptoms of defective wheel bearings include the following:

- A hum, rumbling, or growling noise that increases with vehicle speed

A5-B. Drum Brake Diagnosis and Repair

- Roughness felt in the steering wheel that changes with the vehicle speed or cornering
- Looseness or excessive play in the steering wheel, especially while driving over rough road surfaces
- A loud grinding noise in severe cases, indicating a defective front wheel bearing

12. Remove, clean, inspect, repack wheel bearings or replace wheel bearings and races; replace seals; replace hub and bearing assemblies; adjust wheel/hub bearings according to manufacturers' specifications.

A two-piece wheel bearing (inner and outer) is serviced by removing the bearings, washing out the old grease, cleaning the bearings, and then repacking with new grease. Figure 28.



Figure 28. Cleaning the wheel bearing.

During installation, the bearings require careful adjustment. When the wheel bearing is properly adjusted, the wheel will have about 0.001 to 0.005 inch (0.03 to 0.13 mm) end play. Figure 29.

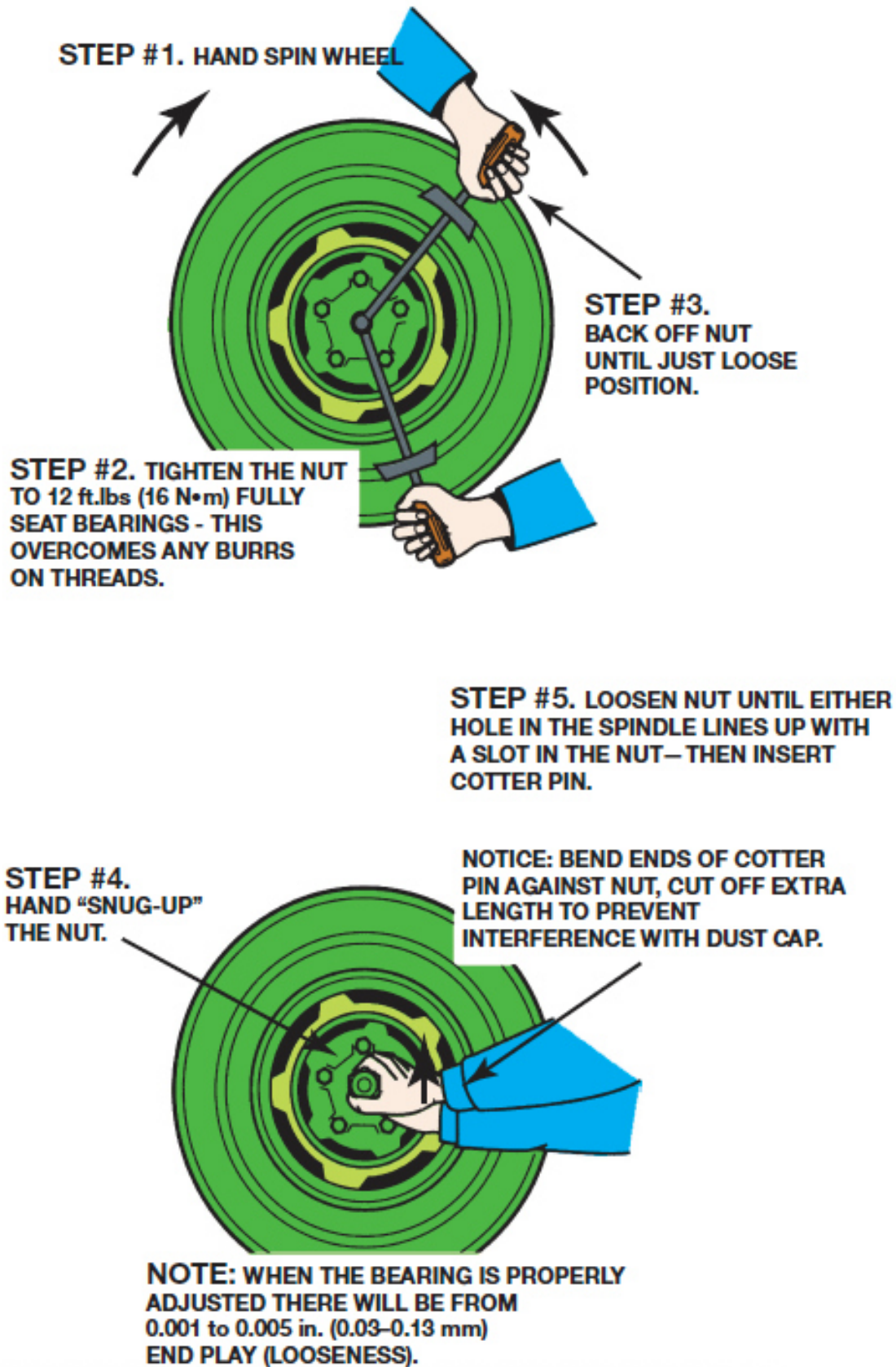


Figure 29. Wheel bearing adjustment.

A5-B. Drum Brake Diagnosis and Repair

Most front-wheel-drive vehicles use a sealed bearing assembly that is bolted to the steering knuckle. A sealed bearing/hub assembly may also be used on the rear wheels or a FWD vehicle. The bearing/hub assembly is replaced as a unit after removing the caliper, rotor, and mounting bolts. Figure 30.

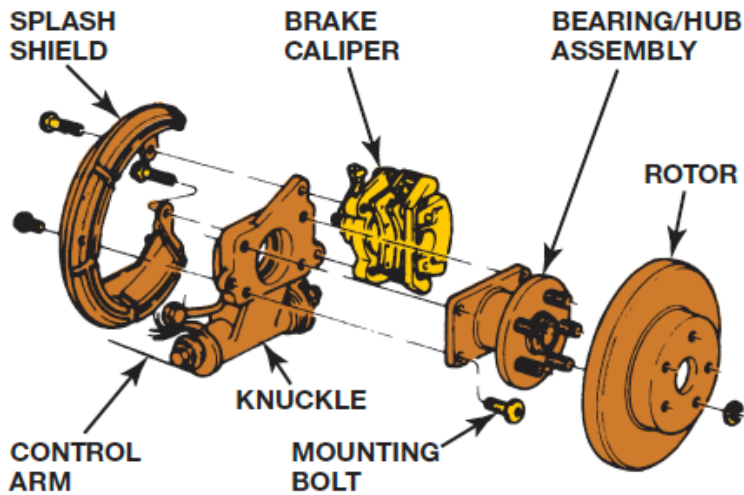


Figure 30. Rear wheel sealed bearing/hub assembly replacement.