



1. Description

This procedure describes repair, replacement, and inspection requirements for collision-damaged brake systems.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality repair of brake systems. This procedure is intended for use by professionals who are qualified through training and experience.



3. Referenced Documents

The following documents are considered part of this procedure by reference.

3.1 Procedures

- BR51 Brakes, Anti-Lock And Traction Control
- HM01 Hazardous Materials
- PS01 Personnel Safety

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Equipment

The use of this equipment is included in this procedure:

- pressure bleeding equipment with adapters, if necessary
- vacuum bleeding equipment
- ISO or double-flare flaring tools
- HEPA-filter vacuum system
- drum and rotor resurfacing equipment
- dial indicator or runout gauge
- micrometer
- flare-nut wrench set
- caliper piston retractor
- adjusting tool
- brake spring pliers



5. Damage Analysis

5.1 General Damage

Inspect a brake system for these conditions:

- damage to the hoses, lines, connections, master cylinder, and booster
- leaks
- contaminated brake fluid
- discolored brake fluid -
- improper pedal feel and operation
- improper operation of the parking brake system

5.2 Drums Or Rotors

Inspect brake drums and rotors for these conditions:

- cracks or scoring
- glazing, contamination, or corrosion
- improper diameter of drums, or thickness of rotors
- radial runout of drums, or lateral runout of rotors
- parallel surfaces of drums or rotors

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5. Damage Analysis (cont'd)

5.3 Wheel Cylinders And Backing Plates, Or Calipers And Splash Shields

Inspect wheel cylinders and backing plates, or calipers and splash shields, for these conditions:

- visible damage
- damage to mounting fasteners or hardware
- leaks
- internal corrosion or scoring
- damaged parking brake hardware

5.4 Shoes Or Pads

Inspect shoes or pads for these conditions:

- visible damage
- contamination
- excessive or uneven lining wear
- glazing



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Brake Fluid Safety

To prevent injury when working with brake fluid:

- Wear rubber gloves.
- Immediately clean up spilled brake fluid.
- Do not expose brake fluid to open flame.
- Wear eye protection.
- Avoid skin contact with brake fluid.

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6. Personnel Safety (cont'd)

6.3 Brake Dust Safety

To prevent exposure to brake dust, which may contain asbestos fibers:

- Wear a HEPA-type respirator.
- Use a HEPA-filter vacuum system to clean dust from brake parts. Do not clean brake parts by dry brushing, or with an air nozzle.
- Use water or brake cleaning solvent for cleaning dust.

6.4 High-Pressure Safety

If the vehicle is equipped with an anti-lock brake system (ABS), follow the depressurizing methods described in **BR51**.



7. Environmental Safety

7.1 Brake Fluid And Asbestos

To protect the environment during brake system repairs:

- Do not mix brake fluid with other waste materials.
- Collect and properly dispose of used brake fluid.
- Collect and properly dispose of asbestos waste. Follow local regulations for asbestos disposal.

Hazardous material safety information is in **HM01**.



8. Vehicle Protection

8.1 Brake System

To protect the brake system from damage:

- Immediately plug any open lines or hoses.
- Do not press the brake pedal when a drum or caliper is removed.
- Do not press the brake pedal when a hose or line is disconnected or open.
- Do not allow grease, oil, or brake fluid to contact the drums, rotors, or linings.
- Use only products designed for cleaning brake parts. Do not use petroleum-based cleaners.
- Do not dry parts with lubricated shop air.
- Use only new brake fluid.
- Use only brake fluid recommended by the vehicle maker, listed on the master cylinder cover or in the service or owner's manual.
- Do not leave the caliper suspended by the fluid hose.

8.2 Adjacent Areas

Protect adjacent plastic and painted surfaces from exposure to brake fluid, brake dust, and cleaning solvents. Immediately rinse off any spilled fluid with water and clean the surface.



9. Repair Procedure

Damaged parts must be replaced. Replacement of worn parts may also be necessary to restore proper brake system performance. If the lining thickness is less than the minimum allowable, the drum diameter exceeds the maximum allowable, or the rotor thickness is less than the allowable minimum, they must be replaced. Resurfacing or replacement is necessary if the drums or rotors are warped, scored, glazed, contaminated, or corroded. Always repair or replace parts on both sides of the vehicle (in axle sets) to restore proper brake performance.

9.1 Brake Line Replacement

To replace a steel brake line:

1. Bend and route new brake lines to follow the original factory routing. Replacement brake lines must be the same size, type, and material used by the vehicle maker.
2. Flare the brake lines using only a double flare or ISO flare, duplicating the original flare used by the vehicle maker.
3. Thread the brake line nuts into the connection by hand, to prevent cross-threading or stripping.
4. Properly torque the connections using a line wrench.
5. Install all retaining clips and fasteners to duplicate original mounting methods.

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9. Repair Procedure (cont'd)

- 6. Torque all fasteners to the vehicle maker's recommendations.
- 7. Bleed the system, following the vehicle maker's recommendations.

9.2 Brake Hose Replacement

To replace a brake hose:

- 1. Disconnect the steel brake line from the brake hose.
- 2. Remove the mounting bracket clips or nuts on the end of the brake hose.
- 3. Disconnect any springs or brackets holding the hose.
- 4. Disconnect the brake hose from the wheel cylinder or caliper. Remove the copper gasket.
- 5. Trial-fit the replacement hose. Replacement brake hoses must be exact replacements for the original in size, type, and material.
- 6. Install a new copper gasket on the wheel cylinder side of the hose. Thread the brake hose into the wheel cylinder or caliper by hand, to prevent cross-threading or stripping.
- 7. Use a line or flare-nut wrench to properly torque the connections.
- 8. Install the mounting brackets. Torque all fasteners to the vehicle maker's recommendations.
- 9. Install the brake hose to the mounting brackets and support springs. Make sure the hose does not rub against any other parts. Do not twist the hose. The colored reference line on the hose must be kept straight.
- 10. Thread the brake line to the hose by hand, to prevent cross-threading or stripping.
- 11. Use a line or flare-nut wrench to properly torque the connections.
- 12. Bleed the system, following the vehicle maker's recommendations.

9.3 Drum And Shoes Removal

To remove the drum and shoes:

- 1. Restrain the vehicle and release the parking brake (rear wheels only).
- 2. Raise the wheel, axle, or vehicle and remove the wheel and tire assembly.
- 3. Remove the drum. Loosen the shoe adjustment if necessary. If the drum is part of a hub assembly, protect the bearings and grease from contamination.
- 4. Use a HEPA-filter vacuum system to remove and collect all brake dust.
- 5. Note the locations of the springs, adjuster parts, and retaining hardware.
- 6. Remove the retracting springs and adjuster assembly.
- 7. Remove the shoe hold-down springs and other retaining hardware.
- 8. Remove the shoes.
- 9. Inspect the backing plate and axle for damage. If the axle was damaged remove and replace the axle and the bearings.

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9. Repair Procedure (cont'd)

9.4 Rotor, Caliper, And Pads Removal

To remove the rotor, caliper, and pads:

- 1. Restrain the vehicle and release the parking brake (rear wheels only).
- 2. Raise the wheel, axle, or vehicle and remove the wheel and tire assembly.
- 3. Open the master cylinder and remove about half of the fluid.
- 4. Compress the caliper pistons.
- 5. Use a HEPA-filter vacuum system to remove and collect all brake dust.
- 6. Remove the caliper and support it with a piece of wire tied to the vehicle.
- 7. Remove the pads from the caliper.
- 8. Remove the rotor. If the rotor is part of a hub assembly, protect the bearings and grease from contamination.

9.5 Parts Cleaning

- 1. Vacuum any dust from the disassembled parts and inspect for damage or wear.
- 2. Remove any corrosion, ridges, or rough edges from the shoe contact points on the backing plate.
- 3. Clean and inspect the springs, clips and other hardware.
- 4. Clean and lubricate the adjuster parts.
- 5. Inspect the wheel cylinder or caliper for leaks.
- 6. Inspect the caliper for seized pistons.
- 7. Inspect all bearings and seals for damage.

9.6 Drum And Shoe Installation

To install shoes and drums:

- 1. Replace the backing plate, if necessary, following the vehicle maker's recommendations.
- 2. Rebuild or replace the wheel cylinder, if necessary.
- 3. Lubricate the shoe contact points on the backing plate.
- 4. Position the shoes on the backing plate with the cylinder pushrods and anchor pins engaged.
- 5. Install the hold-down springs and other retaining hardware.
- 6. Install the adjuster assembly and retracting springs.
- 7. Install the parking brake hardware (rear wheels only).
- 8. Install the drum. Loosen the adjuster, if necessary.
- 9. Adjust the brake shoes to the vehicle maker's specifications.
- 10. Clean, inspect, repack, and adjust the wheel bearings, as necessary.
- 11. Fill the master cylinder reservoirs with brake fluid.
- 12. Bleed the system, and adjust the parking brake, following the vehicle maker's recommendations.
- 13. Adjust the brakes as necessary.
- 14. Check the brake fluid level.

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9. Repair Procedure (cont'd)

9.7 Rotor, Caliper, And Pads Installation

To install a rotor, caliper, and pads:

- 1. Install the rotor.
- 2. Clean, inspect, repack, and adjust the wheel bearings, as necessary.
- 3. Lubricate the caliper sliding surfaces.
- 4. Compress the caliper pistons.
- 5. Install the pads in the caliper.
- 6. Install the caliper.
- 7. Torque the caliper fasteners to the vehicle maker's recommendations.
- 8. Replace any worn or damaged parking brake parts (rear only).
- 9. Fill the master cylinder reservoirs with brake fluid.
- 10. Bleed the system, and adjust the parking brake, following the vehicle maker's recommendations.
- 11. Check the brake fluid level.



10. Use Of Recycled (Salvage) Parts

10.1 Salvage Drums Or Rotors

Inspect a salvage drum or rotor for the following:

- cracks, scoring, or other visible damage
- maximum diameter or minimum thickness to allow resurfacing
- radial or lateral runout
- corrosion that has caused pitting

Do not use salvage drums or rotors that are cracked or warped.

Salvage drums or rotors should be inspected to determine if they must be resurfaced before installation. If after resurfacing, the drum diameter is greater than the maximum allowable, or the rotor thickness is less than the minimum allowable, the parts should be discarded.

10.2 Salvage Wheel Cylinders And Backing Plates, Or Calipers

Do not use salvage wheel cylinders, backing plates, or rotors having any visible damage.



11. Inspection And Testing

11.1 Brake System Inspection

When repairs are completed, inspect a brake system for these conditions:

- proper routing of all lines and hoses
- proper brake fluid levels
- proper installation of all fasteners, brackets, and retaining clips
- no leaks
- proper operation of the brake warning lamp
- proper pedal operation and feel
- proper shoe or pad retraction
- proper operation of the parking brake system
- proper operation of the brakes during a road-test
- proper operation of the stop lamps

Correct any defects.