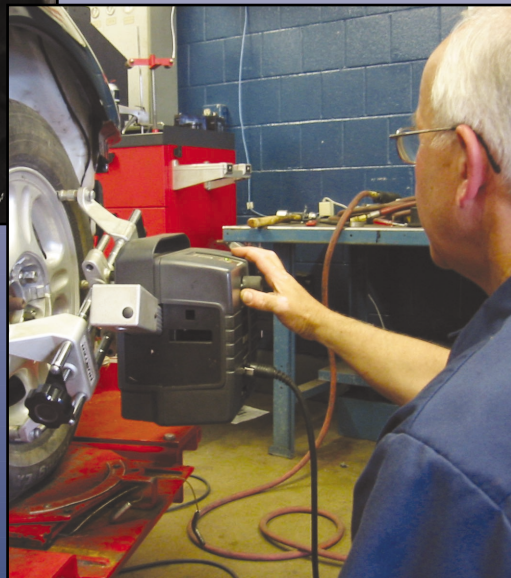
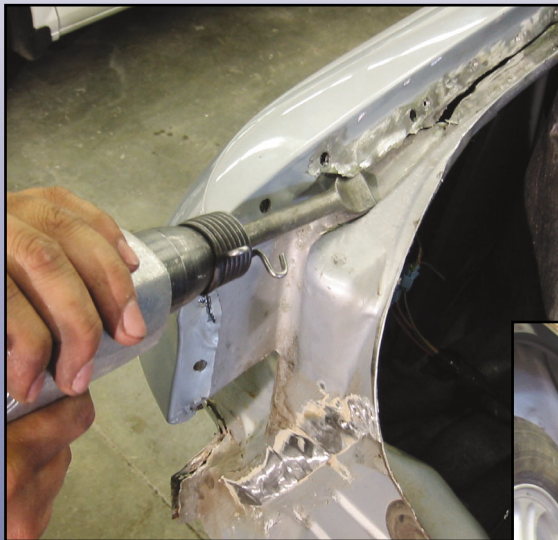




AUTO BODY REPAIR

## BRAKING SYSTEM REPAIR



TEACHER'S GUIDE

SHOPWARE®

## INTRODUCTION

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This Teacher's Guide provides information to help you get the most out of *Braking System Repair*. The contents in this guide will enable you to prepare your students before using the program and present follow-up activities to reinforce the program's key learning points.

*Braking System Repair* describes testing and diagnosing necessary repairs to braking systems. After viewing this video and completing some of the learning activities included in this guide, students will be better prepared to bleed, flush, and pressure-test a brake hydraulic system; remove a caliper assembly; and check parking brake system operation. Use the *Braking System Repair* video and accompanying activities provided in this guide to teach students basic braking system concepts and guidelines for performing basic brake maintenance and repairs.

## LEARNING OBJECTIVES

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After viewing the program, students will be able to:

- Demonstrate a basic knowledge of braking system operations and safety procedures.
- Identify procedures for testing and determining repairs to braking systems.
- Describe procedures for performing common repairs to braking systems.

## EDUCATIONAL STANDARDS

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The primary certifying body for automotive technician training programs is the National Institute for Automotive Service Excellence (ASE). ASE is a non-profit organization established in 1972 by the automotive industry to improve the quality of vehicle repair and service through the voluntary testing and certification of automotive repair technicians. The National Automotive Technicians Education Foundation (NATEF) is a separate non-profit foundation within ASE. The mission of NATEF is to improve the quality of automotive technician training programs nationwide through voluntary certification. The State Departments of Education in all 50 states support ASE/NATEF certification of automotive programs.

### National Standards

This program correlates with the Program Certification Standards for Automobile Technician Training Programs from the National Institute for Automotive Service Excellence (ASE) and the National Automotive Technicians Education Foundation (NATEF). The content has been aligned with the following educational standards, which reflect the tasks in the ASE Program Certification Standards for Automobile General Service Technician Programs.

### Brakes

- Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports; replace brake lines (double flare and ISO types), hoses, fittings, and supports.



- Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; remove and replace hoses; tighten loose fittings and supports.
- Identify, handle, store, and install appropriate brake fluids; dispose of in accordance with federal, state, and local regulations.
- Pressure test brake hydraulic system; determine needed repair.
- Adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies and wheel bearings.
- Identify and replace ABS wheel speed sensor components according to manufacturer's specifications.
- Depressurize ABS hydraulic system according to manufacturer's procedures.
- Identify the proper procedures for handling brake dust.
- Check for bent or damaged brake system components.

2002 Automobile Program Standards, *by the National Automotive Technicians Education Foundation, Copyright 2002 by the National Automotive Technicians Education Foundation. Reprinted with permission.*

### **Language Arts and Communication Standards**

According to ASE/NATEF standards, the automobile technician must be proficient in the following Language Arts and Communications related academic skills that are embedded in the occupation. The activities and information presented in this program and accompanying teacher's guide are aligned to the following standards from the National Automotive Technicians Education Foundation from the National Institute for Automotive Service Excellence.

- Request, collect, comprehend, evaluate, and apply oral and written information gathered from customers, associates, and supervisors regarding problem symptoms and potential solutions to problems.
- Identify the purpose for all written and oral communication and then choose the most effective strategies for listening, reading, speaking, and writing to facilitate the communication process.
- Adapt a reading strategy for all written materials, e.g. customer's notes, service manuals, shop manuals, technical bulletins, etc., relevant to problem identification, diagnosis, solution, and repair.
- Use study habits and techniques, i.e. previewing, scanning, skimming, taking notes, etc., when reviewing publications (shop manuals, references, databases, operator's manuals, and text resources) for problem solving, diagnosis, and repair.
- Use prior knowledge learned from solving similar problems to diagnose and repair specific problems.
- Write clear, concise, complete, and grammatically accurate sentences and paragraphs.
- Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.
- Follow all oral/written directions that relate to the task or system under study.
- Comprehend and apply industry definitions and specifications to diagnose and solve problems in all automotive systems and components of the automobile and light truck.
- Comprehend and use problem-solving techniques and decision trees that are contained in service manuals and databases to determine cause-and-effect relationships.



- Use the service manual to identify the manufacturer's specifications for system parameters, operation, and potential malfunctions.
- Interpret charts, tables, or graphs to determine the manufacturer's specifications for systems operation to identify out-of-tolerance systems and subsystems.
- Use English and metric angle and distance measurements and techniques to determine parallel lines, perpendicular lines, and angle variances from the manufacturer's specifications.
- Visually perceive the geometric relationship of systems and sub-systems that require alignment.
- Use formulas to indirectly confirm that systems are outside of the manufacturer's specifications.
- Follow all safety regulations and procedures while performing any task.

Standards for the English Language Arts, by the *International Reading Association and the National Council of Teachers of English*, Copyright 1996 by the *International Reading Association and the National Council of Teachers of English*. Reprinted with permission.

### Technology Standards

The activities in this Teacher's Guide were created in compliance with the following *National Education Technology Standards* from the National Education Technology Standards Project. The content has been aligned with the following educational standards and benchmarks.

- Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- Use technology tools to enhance learning, increase productivity, and promote creativity.
- Use technology to locate, evaluate, and collect information from a variety of sources.

The National Education Technology Standards reprinted with permission from the International Society for Technology Education.

## PROGRAM OVERVIEW

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How do brakes work? Are all brakes the same? What types of repairs are necessary on braking systems? These are some of the questions answered in this compelling video, *Braking System Repair*, which introduces basic braking system concepts, including types of braking systems and components and how they work, safety requirements specific to brake repair, and methods and guidelines for inspecting, repairing, and testing braking systems. Students will see actual technicians bleed, flush, and pressure-test a brake hydraulic system; remove a caliper assembly; and check parking/emergency brake system operation. After viewing this video, students will have a more detailed understanding of the operation of braking systems and performing basic brake maintenance and repairs.



## MAIN TOPICS

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### Topic 1: Basic Principles of Brake Systems

This section of the program describes how a brake system works using three interdependent systems—leverage, hydraulic pressure, and friction—to slow the speed of a car.

### Topic 2: Types of Braking Systems and Components

This section begins by discussing the various braking systems components and how each one functions when the brake pedal is pressed. The section also describes drum and disc brakes, as well as anti-lock and power-assist brakes, the most common types of braking systems found in new vehicles today.

### Topic 3: Tools and Safety Requirements for Brake Repair

This section introduces by name the tools used to perform brake repairs, and safety requirements specific to brake repair, such as avoiding exposure to asbestos-containing brake dust and proper disposal of contaminated brake fluid.

### Topic 4: Inspecting Brake Systems

This section of the program describes the sequence of visually inspecting braking system components, including the parking/emergency brakes, and guidelines for determining the extent of brake damage or wear and assessing needed repairs.

### Topic 5: Basic Brake Maintenance and Repair Guidelines

This topic describes guidelines and recommendations for repairing brake lines, replacing brake fluid, bleeding the brake system, servicing wheel bearings, and removing a caliper assembly. Students will learn the importance of testing brake repairs by test driving the vehicle and checking specific performance factors to ensure safe operation of the vehicle.

## FAST FACTS

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- Braking systems create an incredible stopping force that is ten times more powerful than the force putting the car in motion.
- Braking systems use three different methods to slow the speed of a car: leverage, hydraulic pressure, and friction.
- The brake system allows a 90-pound person to stop a 5,000-pound vehicle simply by pressing down on the brake pedal.
- A typical automobile has *disc brakes* in the front, and *drum brakes* in the rear, although some have disc brakes in both the front and rear.
- The brake system is controlled by the master brake cylinder that holds brake fluid and sends hydraulic pressure to each wheel through brake lines each time the operator depresses the brake pedal.
- For safety reasons, Anti-lock Braking Systems, or ABS, are becoming the most common type of brakes in newer cars because wheels do not lock up during normal braking, and the brake pressure in each wheel automatically adjusts according to speed during hard braking while maintaining stability on slippery surfaces.



- Do not use compressed air to clean brake components. Brake dust may contain asbestos! To prevent the brake dust from becoming airborne while disassembling brake systems, wash components down with brake cleaner.
- Before doing any work on the brake system of a vehicle, you need to figure out the extent of the damage or wear and assess what repairs or replacement parts are needed.
- The parking or emergency brake uses a cable with direct force instead of a hydraulic system like regular brakes, thus providing the vehicle with a back up braking system in case the hydraulic system fails.
- One of the most common brake repairs an auto body professional will do is repairing brake lines. Once the brake lines are repaired, new brake fluid must be added.
- Bleeding brakes is done to remove air from the brake fluid. Air inhibits the proper functioning of a hydraulic system.
- If the vehicle you are working on has collision damage around one of the wheels, chances are you will need to remove the caliper assembly.
- There are three general types of disc brakes: sliding caliper, floating caliper, and fixed caliper. Sliding and floating are similar, and are the most common.
- It is critical to thoroughly test brake work by taking the vehicle for a test drive before releasing it to its owner.

## VOCABULARY TERMS

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**anti-locking braking systems (ABS):** Type of braking system that uses individually controlled valves in each brake line and speed sensors located at each wheel to achieve maximum braking force, which prevent the wheels from stopping completely during a sudden stop.

**brake:** A device for stopping motion by means of friction caused by a clamping force from a stationary caliper or shoe, against a rotating rotor or drum.

**brake fluid:** A special type of hydraulic fluid, designed specifically for brakes, that transfers the motion of a driver stepping on a brake pedal directly to operate a brake caliper or wheel cylinder.

**brake lines:** Seamless, steel-reinforced flexible rubber or nylon hoses that conduct brake fluid from the master cylinder to the slave cylinders at each wheel.

**brake pads:** Components used specifically with disc brake systems that fit inside the calipers and create friction and stopping power when pressed against the brake rotor.

**brake shoes:** Curved pieces of metal used specifically with drum brake systems that fit inside the brake drum, and are pressed against the drum by a wheel cylinder when the brakes are applied, thus slowing or stopping the car.

**caliper:** A c-shaped device used with disc brakes. When a driver presses on the brake pedal, the caliper piston squeezes the brake pads against the rotor and causes the car to slow down or stop.

**control valves:** Components that balance the braking force at each wheel and ensure that the rear brakes are always activated before the front brakes.

**disc brakes:** Type of braking system that uses a disc (also called rotor) that is directly connected to the wheel, which is straddled by a caliper that holds the disc pads. When a driver steps on the brakes, hydraulic pressure is delivered to the caliper which presses the brake pads against both sides of the disc to slow or stop the vehicle.

**disc runout:** Side-to-side warping of the brake disc friction surfaces.



**drum brakes:** Type of braking system that uses a drum-shaped (cylinder) housing that is directly connected to the wheel. When a driver steps on the brake pedal, curved brake shoes inside the drum press against the drum, creating friction to slow or stop motion of the wheel.

**friction:** The measure of difficulty to slide one object over another. The method used to slow the speed of a vehicle using resistance of one object that is moved in contact with another; methods include pressing brake pads against a brake disc or drum, and a moving vehicle's tires contacting the road.

**glazing:** A term that refers to a brake lining that has become smooth and glossy due to overheating.

**hydraulic pressure:** Method used to slow the speed of a vehicle using the pressure of fluid for power.

**leverage:** Method used to slow the speed of a vehicle by multiplying the mechanical pressure, or force from the operator's foot on the brake pedal, several times before passing it on to the hydraulic system.

**master brake cylinder:** Primary brake system component that holds brake fluid and sends hydraulic pressure to each wheel through brake lines each time the operator depresses the brake pedal; primary component for pressurizing fluid in a hydraulic system.

**power-assisted brakes (power brakes):** Type of braking system, often vacuum-assisted, that lessens the amount of force an operator has to apply to the brake pedal.

**slave cylinder (wheel cylinder):** Cylinders in which movable pistons convert hydraulic brake fluid pressure into mechanical force, causing hydraulic pressure against the piston(s) within the wheel cylinder to force the brake shoes or pads against the drum or rotor.

## **PRE-PROGRAM DISCUSSION QUESTIONS**

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1. What type(s) of braking system are you familiar with? Can you describe how it/they work(s)?
2. How do you know when a vehicle needs brake repairs? What are some of the clues?
3. What do you think is the most common brake repair that you will perform?
4. Can you name some variables or causes of brake wear?
5. What are some safety measures that should be considered when performing brake repairs?
6. What is the last thing you should do before releasing a repaired vehicle to its owner?

## **POST-PROGRAM DISCUSSION QUESTIONS**

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1. Now that you have seen the *Braking System Repair* video, can you name and describe one of the three methods braking systems used to slow the speed of a car? Can you name the two others?
2. In what way does the parking or emergency brake differ from conventional brakes?
3. If the vehicle you're working on has collision damage around one of the wheels, what assembly will you most likely remove, and why?



4. What hazardous material may be found in brake dust? Do you know when this material is hazardous? How can you prevent exposure to it?
5. What is the final step after making braking system repairs? Why is this step critical to the entire brake repair process?

## GROUP ACTIVITIES

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### Tools of the Trade

The *Braking System Repair* video introduced by name various tools specific to brake work. As a group, prepare a list of the tools that you will need to perform brake repairs. Consult the *Braking System Repair* video, the Internet, and any other sources that you have available. Divide the list into hand tools and power tools. Then, find or illustrate pictures of each tool. Prepare a poster for each group of tools, labeling each with its name and its use. Be prepared to share your posters with the class. You can begin at by visiting the following website: [www.brakeandfrontend.com/tsbrake/9014.htm](http://www.brakeandfrontend.com/tsbrake/9014.htm).

### Design an Advertisement

Your group has just opened a new automotive service shop and has decided to advertise a week-long brake repair special during the grand opening. Prepare an advertisement that will be posted in the service shop waiting room. As a group, decide the nature of the repairs and the related costs that are included in the actual special. Remember, your prices must be highly competitive! Include other items in your advertisement such as a customer satisfaction pledge, consumer's Bill of Rights, or your shop's commitment to safety. Design the advertisement to attract the attention of potential customers. Include your company's logo or character figure at the top of the ad.

### Brake Repair Presentation

Your group needs to teach the class about an aspect of brake repair. As a group, decide upon the specific topic that you think would generate the most interest. Then, research the chosen topic. You may consider pursuing information that was not presented in the *Braking System Repair* video. You may want to start at [www.diy.net.com](http://www.diy.net.com) and click on automotive-related links for ideas. Consider the following while researching information:

- Specific areas of the selected topic to present
- Step-by-step procedures if the chosen topic includes them
- Safety alerts of which students should be aware
- Photographs or illustrations

As a group, divide up the presentation sections. For example, if there are 8 main sections and 4 group members, assign 2 sections to each group member. Then, each student will prepare their segment on poster board, which addresses the bulleted items above, whenever possible. When it is time to present the topic to the class, all group members will line up in front of the class to deliver their individual segment in sequential order, turning over their poster board when prompted by the previous group member. After the presentation is completed, the instructor will conduct a debriefing session in question and answer format.





## INDIVIDUAL STUDENT PROJECTS

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### Field Trip Reporter

Often you see advertisements for brake repair specials posted in newspapers and waiting areas of auto repair shops. Do you think one price fits all? Do you think the advertised price is close to the price consumers pay, or is the advertised price often misleading? Visit a minimum of three auto repair shops, particularly those that advertise a brake job special. Ask each establishment the following questions:

- What repairs/parts are included in the advertised price?
- Are rear brakes included in the advertised price? What type of work is typically NOT included in the advertised special?
- When is the price for actual repairs usually quoted?
- Is it unusual for consumers to pay more than the promotional price? If Yes, why is that the case?
- In general, how much does the average preventive maintenance brake job cost?

After you have compiled your findings, report them collectively in the form of a newspaper article or an editorial, including your own personal views. Conclude the article or editorial with general advice about brake repair specials. Include a catchy headline that will grab the attention of readers.

### Handle With Care

In brake repair, as in any other auto repair work, your personal safety while on the job is very important. Bear in mind that working with braking systems requires additional safety measures both related and unrelated to the actual braking system. Reference the *Braking System Repair* video, automotive magazines and books, or the Internet to discover safety Dos and Don'ts when working on braking systems. Then, divide a piece of poster board into two columns. Label the top of left column DOs and label the top right column DON'Ts. List safety measures and tips all auto body repair professionals should follow when working with braking systems. Include pictures or illustrations whenever possible. Here's topic to get you started: Consider guidelines for handling and disposing of brake fluid.

### Braking System Check

Imagine for a moment that you are buying a used two-year old Chevrolet Corvette. The previous owner suggests you have the braking system looked at. Now imagine you have a clipboard with a checklist in hand to begin the initial brake inspection on the Corvette. But wait! The checklist you thought you had is blank. Before you perform the brake inspection, you will need to list all the things an auto body repair professional should inspect prior to beginning a brake job, and tasks to perform in order to make the necessary repairs. You may research checklist items using automotive magazines, auto repair manuals, or the Internet. While creating your checklist, include guidelines and recommendations for performing the repairs whenever possible.

### Example:

- Check the backing plates to make sure they do not interfere with the drums. Look for unusual amounts of moisture around the brakes that could signify leaking brake lines or rubber seals.



## INTERNET ACTIVITIES

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### Brake Repair Tips

It's been said that experience is the best teacher, but when you are just beginning to troubleshoot braking system problems, new technicians are at a disadvantage. However, one way to learn about troubleshooting braking system problems without working side-by-side with a mentor is to research this information on the Internet. Do squealing brakes mean a brake job is in order? Why is bleeding the brakes necessary? What are the telltale signs that a rotor or drum needs to be replaced? Research various Web sites for tips about troubleshooting and repairing brakes. After completing your research, create a 2-page Tech Tips manual that contains at least 12 helpful tips about common issues that experienced automotive technicians have resolved. Include pictures if possible. To get started, visit [autos.yahoo.com](http://autos.yahoo.com) and click the "Maintain" tab in the upper right corner. Then, click the "More..." link under the "Repair Tips & Advice" heading. Finally, click the "Brakes" link. You can also visit [www.autosite.com/garage/subsys/sysbrake.asp](http://www.autosite.com/garage/subsys/sysbrake.asp) and [autorepair.about.com/cs/troubleshooting/a/bl302a.htm](http://autorepair.about.com/cs/troubleshooting/a/bl302a.htm).

### Trivia Expedition

Did you know that the modern car is made up of some 14,000 parts? Did you know that one of those parts is the brake warning light that has been standard equipment since 1970? These are some of the interesting facts and trivia you will learn by visiting [www.innerauto.com/main.html](http://www.innerauto.com/main.html) and by clicking the upper left "Brake System" graphic. Click the "Descriptions" button to generate an alphabetic "Description Index" on the right side of the screen. Scroll down to the letter B section, where you will find a dozen or so of brake-related links beginning with "Brake Animation." As you click the links, write down ten facts or trivia items you learned about brakes. After completing this activity, students may share their findings with the class.

### Give Yourself a Brake

The *Braking System Repair* video discussed disc brakes, drum brakes, and anti-lock and power-assist braking systems. Access [auto.howstuffworks.com/brake.htm](http://auto.howstuffworks.com/brake.htm) and click the applicable links to learn more about how each type works. For this activity, prepare a poster that includes brief descriptions and illustrations of the following items for each type of braking system:

- The main components
- How the braking system works
- The type of servicing required for the braking system

It may be necessary to click other related links within the How Stuff Works Web site to obtain your information.



## ASSESSMENT QUESTIONS

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**Q:** When the ignition is turned on, the ABS system light on an ABS-equipped vehicle will come on automatically and remain lit until the ignition is turned off. (*True or False*)

**A:** False

**Feedback:** If a vehicle is equipped with ABS, the ABS system light will come on automatically when the ignition is turned on. It will perform a self-check and then turn off if the ABS system checks out okay. It will remain lit if something is wrong.

**Q:** Technician A says that bleeding the brake system should be done one wheel at a time, starting with the wheel closest to the master cylinder. Technician B says that bleeding the brake system should be done one wheel at a time, starting with the wheel furthest from the master cylinder. Who is correct?

- (a) Technician A
- (b) Technician B
- (c) Both A and B
- (d) Neither A nor B

**A:** (c)

**Feedback:** Both Technician A and B are correct. The bleeding sequence begins by cleaning the bleeder screw, attaching the drain hose to the bleeder screw and submerging the other end in a clear jar partially filled with brake fluid. Bleed one wheel at a time, starting with the wheel closest to, or furthest from the master cylinder. Follow the manufacturer's guidelines to decide the order in which to bleed each wheel.

**Q:** Which of the following is NOT a feature of anti-lock braking systems (ABS)?

- (a) During normal braking, the wheels do not lock up, regardless of the driving surface.
- (b) During hard braking, brake pressure in each wheel is automatically adjusted according to speed.
- (c) During hard braking, rear wheels each receive the same pressure to maintain stability.
- (d) During any braking situation, less force is needed to engage the brake pedal.

**A:** (d)

**Feedback:** The first three choices apply to anti-lock braking systems. The last choice applies to power-assisted, or power brakes. Power-assisted, or power brakes, lessen the amount of force an operator has to apply to the brake pedal. They also reduce the distance an operator's foot has to travel to engage the brakes.

**Q:** When should shoes be replaced on drum brakes?

- (a) When the pads are worn off and metal hits metal
- (b) Whenever a wheel alignment is performed on the vehicle
- (c) When they are worn to within one-eighth inch of the metal baking plate
- (d) After every 15,000 to 20,000 miles, depending on whether the car does more city driving or highway driving

**A:** (c)



**Feedback:** Before doing any work on the brake system of a vehicle, an auto body repair technician must figure out the extent of the damage or wear and assess what repairs or replacement parts are needed. When inspecting drum brakes, the technician will have to remove the drums and measure the shoes. If the shoes are worn to within one-eighth inch of the metal backing plate, they need to be replaced.

**Q:** Which of the following statements about handling brake fluid is FALSE?

- (a) Brake fluid should not come in contact with painted surfaces because it will corrode paint.
- (b) Most vehicles can use any one of the different types of brake fluid.
- (c) Immediately cover the brake fluid container and avoid opening the brake fluid reservoir, because brake fluid absorbs moisture.
- (d) Brake fluid drained from a system should not be reused because it may contain contaminants.

**A:** (b)

**Feedback:** Brake fluid eats paint and absorbs water from the air; used brake fluid should never be reused since it may contain contaminants. Be sure to use the right type of brake fluid. Different types of brake fluid should not be mixed as they can react with one another. Check the master cylinder for a label that will tell you the correct type for the car being worked on.

**Q:** Technician A says that a typical automobile has disc brakes in the front and drum brakes in the rear. Technician B says that some automobiles have drum brakes in both the front and rear. Who is correct?

- (a) Technician A
- (b) Technician B
- (c) Both A and B
- (d) Neither A nor B

**A:** (a)

**Feedback:** Technician A is correct. A typical automobile has disc brakes in the front and *drum* brakes in the rear. Some automobiles have disc brakes in both the front and rear.

**Q:** Compressed air should not be used to clean brake components because brake dust may contain \_\_\_\_\_.

**A:** asbestos

**Feedback:** Do not use compressed air to clean brake components. Brake dust may contain asbestos. Asbestos is harmful once it becomes airborne. To prevent the brake dust from becoming airborne while disassembling brake systems, wash components down with brake cleaner. Asbestos brake linings are slowly being phased out in newly manufactured vehicles.

**Q:** What is the main difference between the parking or emergency brake and conventional braking systems?

**A:** The parking or emergency brake uses a cable with direct force instead of a hydraulic system.



**Feedback:** The parking or emergency brake uses a cable with direct force instead of a hydraulic system like the regular brakes. This gives vehicles a back-up braking system in case the hydraulic system fails. On most vehicles, parking brakes work on the rear wheels, engaging one brake shoe on each wheel. When the parking brake is released, a spring on the shoe returns it to its normal position.

**Q:** Technician A says that kinked brake lines can be repaired by replacing the kinked section. Technician B says that kinked brake lines should be replaced using generic copper or aluminum parts . Who is correct?

- (a) Technician A
- (b) Technician B
- (c) Both A and B
- (d) Neither A nor B

**A:** (d)

**Feedback:** Neither Technician A nor B is correct. One of the most common brake repairs an auto body repair technician will do is repairing brake lines. To service cut, kinked, or bent brake lines, replace them with new lines from the original equipment manufacturer. Do not use copper, aluminum, or rubber hoses. Do not attempt to repair nylon brake lines. Do not use compression fittings. Route the brake lines in the same locations as they were from the factory.

**Q:** After repairing and/or replacing pads or rotors, a technician should test drive the vehicle and make 8 to 10 stops from about 30 miles per hour. (*True or False*)

**A:** True

**Feedback:** A technician should make 8 to 10 stops from about 30 miles per hour to burish, or seat, new pads or when a rotor has been replaced or resurfaced.

## **ADDITIONAL RESOURCES**

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### **WEB SITES**

#### **About.Com**

[autorepair.about.com](http://autorepair.about.com)

#### **Advance Auto Parts**

[www.advanceautoparts.com](http://www.advanceautoparts.com)

#### **Auto Body Online**

[www.autobodyonline.com](http://www.autobodyonline.com)

#### **Auto Body PI**

[www.autopi.com/frame.htm](http://www.autopi.com/frame.htm)

#### **Auto Body Pro**

[www.autobodypro.com](http://www.autobodypro.com)



**Automotive Body Repair News**

[www.abrn.com/abrn](http://www.abrn.com/abrn)

**Auto Channel**

[www.theautochannel.com](http://www.theautochannel.com)

**Automotive Learning Online**

[www.innerauto.com](http://www.innerauto.com)

**Auto Glossary**

[www.autoglossary.com](http://www.autoglossary.com)

**Auto Inc. Online**

[www.autoinc.org](http://www.autoinc.org)

**Automotive Information Center**

[www.autobytel.com/index.cfm](http://www.autobytel.com/index.cfm)

**New Car Reviews by AutoSite**

[www.autosite.com/garage/subsys/sysbrake.asp](http://www.autosite.com/garage/subsys/sysbrake.asp)

**Automotive Service Association**

[www.asashop.org](http://www.asashop.org)

**Automotive Technical Library**

[hostingprod.com/@aa1car.com/library.htm](http://hostingprod.com/@aa1car.com/library.htm)

**Automotive Youth Educational Systems (AYES)**

[www.ayes.org/index.asp](http://www.ayes.org/index.asp)

**Collision Repair Industry Insight**

[www.collision-insight.com](http://www.collision-insight.com)

**Do-It Yourself Network—Automotive Repair**

[www.diy.net.com](http://www.diy.net.com)

([www.diy.net.com/diy/ab\\_brakes/0,2020,DIY\\_13682,00.html](http://www.diy.net.com/diy/ab_brakes/0,2020,DIY_13682,00.html))

**How Stuff Works—Auto Stuff Page**

<http://auto.howstuffworks.com/brake.htm>

**I-car**

[www.i-car.com](http://www.i-car.com)

**National Automotive Service Task Force**

[www.nastf.org](http://www.nastf.org)



## National Automotive Technicians Education Foundation—Program Standards

[www.natef.org/program\\_standards/collision/index.cfm](http://www.natef.org/program_standards/collision/index.cfm)

### OEM Listing: Auto Body Online

[www.autobodyonline.com/industry/OEM/index.cfm](http://www.autobodyonline.com/industry/OEM/index.cfm)

### Tektips—Auto Body Pro Website

[www.autobodypro.com/tektips.htm](http://www.autobodypro.com/tektips.htm)

## BOOKS

Chilton Book Company. *Chilton's Guide to Auto Body Repair*. Chilton Book Co., 1990. ISBN: 080197898X

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