

Automotive Technology 6th Edition

Chapter 107 Parking Brake Operation, Diagnosis, & Service

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEEducation (NATEF) Task Sheets.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> 1. Discuss parking brake standards, components, warning lamp and automatic parking brake release. 2. Explain parking brake linkages. 3. Describe drum parking brakes. 4. Describe caliper-actuated disc parking brakes. 5. Explain how to adjust a parking brake properly. 6. Discuss electric parking brakes. 7. This chapter will help prepare for the Brakes (A5) ASE certification test content area "A" (Hydraulic, Power Assist, and Parking Brake Systems Diagnosis and Repair).
Establish the Mood or Climate	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: Lesson plan is based on 6th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

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NOTE: You can use Chapter Images or possibly Power Point files:

ICONS



Chapter 107 Parking Brakes

1. SLIDE 1 CH107 PARKING BRAKE OPERATION, DIAGNOSIS, SERVICE

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
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WEB SITE IS CONSTANTLY UPDATED

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Crossword Puzzle (Microsoft Word) (PDF)

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Videos

[Parking Brake Warning Light \(View\) \(Download\)](#)

DISCUSSION: discuss reasons behind the federal mandate to use a dual master cylinder in all vehicles to provide a backup hydraulic system in case of emergencies. What are FNVSS 135 requirements for parking brake performance?

It is important to know which wheels function as parking brakes when jacking up a car. Most often it is rear wheels, but not always. If braking wheels are lifted off ground, car may roll and fall off jack. It's always best to jack a car on level pavement and use chocks on wheels not being raised

2. **SLIDE 2 EXPLAIN Figure 107-1** Typical parking brake cable system showing the foot-operated parking brake lever and cable routing.
3. **SLIDE 3 EXPLAIN Figure 107-2** A typical parking brake pedal assembly.
4. **SLIDE 4 EXPLAIN Figure 107-3** Typical hand-operated parking brake. Note that the adjustment for the cable is underneath the vehicle at the equalizer.
5. **SLIDE 5 EXPLAIN Figure 107-4** ratchet mechanism is used to lock parking brakes in applied position.

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6. SLIDE 6 **EXPLAIN** Figure 107-5 A remote-mounted parking brake release lever.

DEMONSTRATION: Show students linkages for a floor-mounted parking brake lever and discuss how they function as part of the parking brake system. Show students the parking brake cables that run under a vehicle, and note their construction

DISCUSSION: Ask students to talk about the purpose and function of parking brake control and application cables.

DEMONSTRATION: Show students the parking brake linkage levers on a vehicle, and talk about how they work to augment application force. Ask students to discuss how intermediate levers boost parking brake application force further

7. SLIDE 7 **EXPLAIN** Figure 107-6 Automatic parking brake release mechanisms usually use a vacuum servo to operate the release lever.
8. SLIDE 8 **EXPLAIN** Figure 107-7 The two plastic vacuum tubes on the steering column are used to release the parking brake when the gear selector is moved from park into a drive gear.

DISCUSS CASE STUDY: *Pump to Release?*

A customer called and asked a dealer for help because parking brake could not be released. The technician discovered that customer was attempting to release parking brake by depressing parking brake pedal, as was done on customer's previous vehicle. Technician simply pulled on release lever and parking brake was released.

Summary:

- **Complaint—Customer called and asked for help releasing parking brake as it would not release.**
- **Cause—service technician simply pulled on parking brake release lever to disengage parking brake.**

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- **Correction—No repair was needed except to inform the customer that parking brake on new vehicle was released using a release lever and not by depressing foot-operated parking brake pedal as was used in owner's previous vehicle**

DEMONSTRATION: Show students an example of a vehicle that uses a vacuum servo as an automatic parking brake release mechanism, and discuss how it releases the parking brake when the shifter is placed into gear.

9. **SLIDE 9 EXPLAIN Figure 107-8** The cable from the activating lever to the equalizer is commonly called the control cable. From the equalizer, the individual brake cables are often called application cables. These individual cables can usually be purchased separately.

DISCUSSION: Ask students to discuss how linkage equalizers ensure that a balance of parking brake force is applied to each brake shoe. Ask students to talk about various parking brake linkage designs and how they work. Ask students to talk about the differences between front- and rear-entry parking brake cable designs. How does a front-entry cable work on a dual-servo system?

EXPLAIN TECH TIP: Look for Swollen Parking Brake Cables. Always inspect parking brake cables for proper operation. A cable that is larger in diameter in one section indicates that it is rusting inside and has swollen. • **SEE FIGURE 107-9.** A rusting parking brake cable can keep the rear brake applied even though parking brake lever has been released. This can cause dragging brakes, reduced fuel economy, and possible vehicle damage due to overheated brakes.

10. **SLIDE 10 EXPLAIN Figure 107-9** Notice how rust inside the covering of this parking brake cable has caused the cable to swell
11. **SLIDE 11 EXPLAIN Figure 107-10** Intermediate levers in the parking brake linkage increase the application force.

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12. SLIDE 12 **EXPLAIN** Figure 107-11 A cable guide is a common type of parking brake linkage equalizer.
13. SLIDE 13 **EXPLAIN** Figure 107-12 Some parking brake equalizers are installed in the brake cable.
14. SLIDE 14 **EXPLAIN** Figure 107-13 Many parking brake linkages use both an intermediate lever and an equalizer.

DEMONSTRATION: Show students an example of integral drum parking brakes and discuss how they operate. Why are they the most popular design for drum parking brakes?

15. SLIDE 15 **EXPLAIN** Figure 107-14 Notice the spring at the end of the parking brake strut. This antirattle spring keeps tension on the strut. The parking brake lever is usually attached with a pin and spring (wavy) washer and retained by a horseshoe clip.
16. SLIDE 16 **EXPLAIN** Figure 107-15 The parking brake cable pulls on the parking brake lever, which in turn forces the brake shoe against the drum.
17. SLIDE 17 **EXPLAIN** Figure 107-16 The inside “hat” of the disc brake rotor is the friction surface for the parking brake shoes.
18. SLIDE 18 **EXPLAIN** Figure 107-17 A typical rear disc brake auxiliary drum brake friction assembly.
19. SLIDE 19 **EXPLAIN** Figure 107-18 A Ford rear brake caliper ball and ramp-type apply mechanism.
20. SLIDE 20 **EXPLAIN** Figure 107-19 Operation of a ball and ramp-type rear disc brake caliper parking brake.
21. SLIDE 21 **EXPLAIN** Figure 107-20 Automatic adjustment of a ball & ramp-type rear disc brake parking brake occurs when the service brakes are applied.
22. SLIDE 22 **EXPLAIN** Figure 107-21 A typical General Motors rear disc brake with an integral parking brake. This type uses a screw, nut, and cone mechanism to apply the caliper piston.
23. SLIDE 23 **EXPLAIN** Figure 107-22 Parking brake application of a General Motors rear drive brake caliper.
24. SLIDE 24 **EXPLAIN** Figure 107-23 Automatic adjustment of a General Motors rear disc brake caliper.

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DEMONSTRATION: Show students an example of a rear disc brake with a parking brake integrated into the hub of the brake rotor, and discuss how it works. Ask students to compare its operation to a rear drum parking brake

DISCUSSION: Ask students to discuss how caliper-actuated disc parking brakes work. Why are floating or sliding calipers necessary to their operation? Ask students to talk about how the ball-and-ramp actuating system works on Ford vehicles to operate the rear brake calipers

DISCUSSION: Ask students to discuss how the screw, nut, and cone actuating system works to apply the rear caliper pistons to rear brake calipers. What is purpose of balance spring between piston and caliper bore? Ask students to review & comment on GM parking brake components shown in **Figures 103-20 to 103-23**

25. **SLIDE 25 EXPLAIN Figure 107-24** Removing the piston from a typical General Motors rear disc brake caliper.
26. **SLIDE 26 EXPLAIN Figure 107-25** Installing the piston into a General Motors rear disc brake caliper.
27. **SLIDE 27 EXPLAIN Figure 107-26** piston installation tool is often needed to complete the installation of the piston in a General Motors rear disc brake.
28. **SLIDE 28 EXPLAIN Figure 107-27** A spanner wrench (or needle-nose pliers) can be used to rotate the caliper piston prior to installing the disc brake pads. A notch on the piston must line up with a tab on the back of the brake pad to keep the piston from rotating when the parking brake is applied.
29. **SLIDE 29 EXPLAIN Figure 107-28** After removing the parking brake lever and thrust bearing, remove the antirotation pin.
30. **SLIDE 30 EXPLAIN Figure 107-29** Unscrew the thrust screw from the piston with an Allen (hex) wrench. After removing the thrust screw, push the piston out of the caliper bore.
31. **SLIDE 31 EXPLAIN Figure 107-30** To test the piston adjuster, thread the thrust screw into the piston. Hold the piston and pull the thrust screw outward 1/4 in. (6 mm).

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The adjuster nut should not turn when the thrust screw retracts. Replace the piston assembly if not functioning correctly.

32. **SLIDE 32 EXPLAIN Figure 107-31** To adjust the parking brake cable on a Ford vehicle equipped with rear disc brakes, start by loosening the cable adjustment until the cables to the calipers are slack. Tighten until the caliper lever moves. Position a 1/4-in. drill bit or dowel into the caliper alignment hole. Adjustment is correct if the parking brake lever does not hit the 1/4-in. dowel.

EXPLAIN TECH TIP: Parking Brake “Click” Test

When diagnosing any brake problem, apply parking brake and count “clicks.” This method works for both hand- and foot-operated parking brakes. Most vehicle manufacturers specify a maximum of 10 clicks. If parking brake travel exceeds this amount, rear brakes may be worn or out of adjustment.

CAUTION: Do not adjust the parking brake cable until the rear brakes have been thoroughly inspected and adjusted. If the rear brake lining is usable, check for the proper operation of the self-adjustment mechanism. If the rear brakes are out of adjustment, the service brake pedal will also be low. 10-click test is a fast and easy way to determine if the problem is due to rear brakes.

33. **SLIDE 33 EXPLAIN Figure 107-32** After checking that the rear brakes are okay and properly adjusted, the parking brake cable can be adjusted. Always follow the manufacturer’s recommended procedure.
34. **SLIDE 34 EXPLAIN Figure 107-33** Many hand-operated parking brakes are adjusted inside the vehicle.
35. **SLIDE 35 EXPLAIN Figure 107-34** Always check that both brake shoes contact the anchor pin.

DEMONSTRATION: Show students how to do the parking brake click test. What problem is indicated by more than 10 clicks?

HANDS-ON TASK: Have students check several vehicles for proper parking brake adjustment using the click test

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36. SLIDE 36 **EXPLAIN** Figure 103-35 A 1/8-in. (3-mm) drill bit is placed through an access hole in the backing plate to adjust this General Motors leading-trailing rear parking brake. Adjust the parking brake cable until drill can just fit between shoe web and parking brake lever.

DISCUSSION: Ask students to discuss the advent and advantages of **Electric Parking Brakes (EPB)**, in which a computer-controlled motor activates brake caliper. Although these systems are currently only found on luxury cars, what is likelihood they will soon be found on lower-priced passenger vehicles?

EXPLAIN TECH TIP: Hose Clamp or Wrench Trick

It is often difficult to remove a parking brake cable from backing plate due to design of retainer. The many fingers used to hold cable to backing plate can be squeezed all at once if a hose clamp is used to compress the fingers. A wrench as shown in • **FIGURE 107-36** can also be used.

37. SLIDE 37 **EXPLAIN** FIGURE 103-36 Many parking brake cables can be removed easily from the backing plate using a 1/2-inch (13-mm) box-end wrench
38. SLIDE 38 **EXPLAIN** Figure 103-37 electric parking brake button on center console of a Jaguar.

ON-VEHICLE ASE EDUCATION TASK F3: Check parking brake system and components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.

ON-VEHICLE ASE EDUCATION TASK F4: Check parking brake operation and parking brake indicator light system operation; determine needed action.

ON-VEHICLE ASE EDUCATION TASK F5: Check operation of brake stop light system..

HOMEWORK: Have students use Internet to research ten car models and which type of parking brake is used on each: pedal, lever, or handle. Ask

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	them to prepare a table presenting this data and to explain if they see a pattern of type of brake used by specific manufacturers.