Automotive Technology 6th Edition
Chapter 104 DRUM BRAKE 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: 1. Discuss the procedures recommended for brake drum diagnosis, removal, and disassembly. 2. Discuss the procedure for inspecting drum brake parts. 3. Describe how to clean, lubricate, reassemble, and adjust drum brake parts. 4. Describe the symptoms of a faulty drum brake. 5. This chapter will help prepare for the Brakes (A5) ASE certification test content area "B" (Drum Brake Diagnosis and Repair).
Establish the Mood or Climate	Provide a ***WELCOME,*** 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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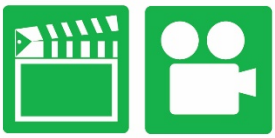
http://www.jameshalderman.com/automotive_principles.html

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

ICONS	Chapter 104 Drum Brake Diagnosis
	**1. SLIDE 1 CH104 DRUM BRAKE DIAGNOSIS/SERVICE**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **http://www.jameshalderman.com/automotive_principles.html** **DOWNLOAD** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF**
	**Videos**
	**DISCUSSION:** Ask students to discuss the steps to diagnose drum brakes. What steps are involved in servicing drum brakes? Customers notice brake noise when the weather warms up in northern climates. This is the first time in months they open their windows.
	**DISCUSSION BRAKE FADE:** Ask student to talk about the causes of mechanical brake fade in drum brakes. Invite students to list ways to avoid dangerous heat build-up within the brake drum. Ask students to discuss the causes and symptoms of gas fade. Why is this type of brake fade rare? Ask students to talk about how water fade happens and discuss the problems it causes. How should the driver react to water fade? Ask students to talk about the causes of lining fade in drum brakes. Ask students to explain what makes the brake lining slippery when this type of brake fade occurs
	**DEMONSTRATION:** Show students how to do the quick-and-easy drum brake adjustment check. Does the drum ring like a bell?

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	**DISCUSSION:** Ask students to talk about why drum brakes need to be adjusted periodically, and discuss how this is accomplished.
	Check backing plate support pads for wear. If they are grooved they can be built up with a wire feed welder and ground flat.
	**ON-VEHICLE ASEEDUCATION TASK C1:** Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine needed action.
	
	**WARNING:** Removal of brake drum should occur inside a sealed vacuum enclosure equipped with a HEPA filter or washed with a brake washer. • SEE FIGURE 104–1.
	2. **SLIDE 2 EXPLAIN FIGURE 104–1** An aqueous-based (water-based) brake washer can be used to wet down the outside of the brake assembly before removing drum. After drum is removed, wash down shoes and other parts to capture the dust into washer. 3. **SLIDE 3 EXPLAIN FIGURE 104–2** ***Tinnerman*** nuts are used at assembly plant to prevent brake drum from falling off until wheels are installed. 4. **SLIDE 4 EXPLAIN FIGURE 104–3** Turning bolts that are threaded into the brake drum forces the drum off of the hub.
	**DISCUSSION:** discuss how to remove a brake drum that is rusted to wheel hub. What methods are most effective in loosening drum? Ask students to talk about how to remove a brake drum when brake shoes have worn into drum. What method is recommended for dealing with this problem?
	**DEMONSTRATION:** Show students how to perform cutting-the-nails trick to remove a brake drum when linings have worn a groove into drum.

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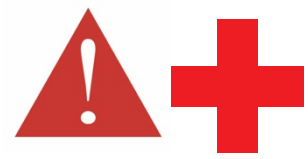
	**5. SLIDE 5 EXPLAIN Figure 104-4** If brake shoes have worn into drum, the adjuster can be backed in after removing access plug. After removing plug, use a wire or a screwdriver to move the adjusting lever away from the starwheel, then turn the starwheel with a brake adjusting tool, often called a "brake spoon."
	**HANDS-ON TASK: Once the brake drum is removed, have students inspect the backing plate for wear. If the backing plate shows excessive wear, have students replace it. If not, have them service the backing plate. Have students remove the return, or retracting, springs of the drum brakes and then remove the hold-down springs and other brake parts. Ask students to inspect return, hold-down, and connecting springs and determine whether they can be reused or need to be replaced.**
	**SAFETY ISSUE: Recommend that students use a solvent to wet down brake shoes & brake components after brake drum is removed to prevent spread of airborne asbestos. Advise them to take proper precautions, such as using a liquid soaking agent, before removing a brake drum to be sure that any asbestos particles inside do not become airborne. Dispose of brake clean and cleaning solvents use to wet down the brakes according to EPA regulations.**
	**EXPLAIN TECH TIP: *Cutting the Nails Trick*** **Many times a brake drum cannot be removed because linings have worn a groove into the drum. Attempting to adjust brakes inward is often a frustrating and time consuming operation. The easy solution is to use a pair of diagonal side-cut pliers and cut the heads off hold down pins (nails) at the backing plate. This releases brake shoes from backing plate and allows enough movement of shoes to permit removal of brake drum without bending backing plate. The hold-down pins (nails) must obviously be replaced, but they are included in most drum brake hardware kits. Since most brake experts recommend replacing all drum brake hardware anyway, this solution does not cost any**

more than normal, may save backing plate from damage, and saves the service technician lots of time. • SEE FIGURE 104–5.

6. **SLIDE 6 EXPLAIN Figure 104-5** Using side-cut pliers to cut the heads off of the hold-down pins (nails) from the backing plate to release the drum from the shoes.
7. **SLIDE 7 EXPLAIN Figure 104-6** A liquid soaking solvent, such as brake cleaner, should be used to wet the linings. The purpose of wetting the lining material to prevent the possibility of asbestos from the lining becoming airborne. Asbestos is only hazardous when asbestos dust is airborne and is breathed in during brake system service.
8. **SLIDE 8 EXPLAIN Figure 104-7** Using a brake spring tool to release a return (retracting) spring from the anchor pin.
9. **SLIDE 9 EXPLAIN Figure 104-8** special tool, called a hold-down spring tool, being used to depress and rotate the retainer.

10. **SLIDE 10 EXPLAIN Figure 104-9** typical rusty backing plate shoe pad. This can cause the brakes to squeak when the shoes move outward during a brake application and again when the brake pedal is released.
11. **SLIDE 11 EXPLAIN Figure 104-10** Applying lithium grease to the raised pads on the backing plate.
12. **SLIDE 12 EXPLAIN Figure 104-11** rule of thumb is that lining should be at least thickness of a nickel. This applies to both drum brake shoes and disc brake pads.
13. **SLIDE 13 EXPLAIN FIGURE 104–12** tire tread depth gauge can be used to measure lining thickness. When measuring riveted linings, measure to head of rivets.
14. **SLIDE 14 EXPLAIN FIGURE 104–13** Cracked brake lining must be replaced.

DEMONSTRATION: Show how lining table on brake shoe supports the friction material that constitutes the brake lining. Show students how shoe web transfers to lining table force that activates shoe. Describe purpose of holes & notches

DISCUSSION: Ask students to discuss how riveted brake linings are attached to the lining table of a drum brake shoe. What are the

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	advantages and disadvantages of this method of brake shoe assembly? **DEMONSTRATION:** Show students the lining edge codes on a drum brake shoe, and explain the meaning of **Letters & Numbers** embedded in lining. Show students **Lining Codes** relating to coefficient of friction. Ask students to interpret meaning of these codes.
	**Bonding eliminates the chance of brake material building up in the rivet holes**
	**DISCUSSION:** Ask students to talk about how brake linings are bonded to brake shoes. Invite students to compare riveting and bonding of brake linings and to suggest which is preferable for passenger vehicle use.
	**When inspecting and cleaning riveted shoes remove hardened brake dust from the rivet holes. This material will cut into the drums long before the rivets touch the drum.**
	**HANDS-ON TASK:** Have students inspect the drum brake lining, measuring its thickness by using a micrometer, to determine whether the brake lining needs to be replaced.
	**DEMONSTRATION:** Show students examples of brake shoe return springs, and demonstrate how they retract the shoes to their unapplied position. Show students how the brake shoe hold downs keep brake shoes firmly against support pads on backing plate to prevent noise, vibration, and wear.
	**DEMONSTRATION:** Show students how to do the drop test to test the return springs. Did the spring ring or make a thud? Ask students to interpret the results of the test.
	**EXPLAIN TECH TIP:** ***The Drop Test*** **Brake return (retracting) springs can be tested by dropping them to the floor. A good spring should "thud" when spring hits the ground. This noise indicates that spring has not stretched and that all coils of springs are touching each other. If spring**

"rings" when dropped, spring should be replaced because coils are not touching each other. • SEE FIGURE 104–14. Although this drop test is often used, many experts recommend replacing all brake springs every time brake linings are replaced. Heat generated by the brake system often weakens springs enough to affect their ability to retract brake shoes, especially when hot, yet not "ring" when dropped.

15. **SLIDE 15 EXPLAIN Figure 104-14** top spring is a good-looking spring because all coils of the spring are touching each other. The bottom spring is stretched and should be discarded. The arrow points to the back side of the spring, which goes into a hole in the brake shoe. The open loop of the spring is not strong enough to keep from straightening out during use. Using the back side of the hook provides a strong, long-lasting hold in brake shoe.
16. **SLIDE 16 EXPLAIN Figure 104-15** Exploded view of a typical wheel cylinder. Note how the flat part of the cups touches the flat part of the piston. The cup expander and spring go between the cups.
17. **SLIDE 17 EXPLAIN Figure 104-16** Many wheel cylinders are bolted to the support plate (backing plate). O-ring seal helps keep water & dirt out of drum brake.
18. **SLIDE 18 EXPLAIN FIGURE 104–17** This special tool makes it a lot easier to remove wheel cylinder clip. A socket (1 1/8 inch, 12 point) can be used to push the clip back onto the wheel cylinder.
19. **SLIDE 19 EXPLAIN FIGURE 104–18** rust inside this wheel cylinder will not affect operation as it is located inside the working area of sealing cups..

Slight sign of brake fluid behind the wheel cylinder dust boot is okay. It is what keeps the seal lubricated. Anymore than a small trace indicates seal leaks.

20. **SLIDE 20 EXPLAIN FIGURE 104–19** When new, thicker brake linings are installed, the pistons and cups are forced back into wheel cylinder and pushed through the sludge that is present in every cylinder.
21. **SLIDE 21 EXPLAIN Figure 104-20** This starwheel adjuster is damaged and must be replaced. A lack of

proper lubrication can cause the starwheel to become frozen in one place and not adjust properly.

EXPLAIN TECH TIP: ***Time—Not Mileage—Is Important*** **Many brake experts recommend rebuilding or replacing wheel cylinders at every other brake job. Some experts recommend that the wheel cylinders be overhauled or replaced every time the brake linings are replaced. If wheel cylinders are found to be leaking, they must be replaced or overhauled. The most important factor is time, not mileage, when determining when to repair or replace hydraulic components. The longer the time, the more moisture is absorbed by brake fluid. The greater amount of moisture absorbed by brake fluid, greater corrosion to metal hydraulic components. For example, brakes will probably wear out much sooner on a vehicle that is used all day every day than on a vehicle driven only a short distance every week. In this example, the high-mileage vehicle may need replacement brake linings every year, whereas the short distance vehicle will require several years before replacement brakes are. The technician should try to determine amount of time brake fluid has been in vehicle. The longer brake fluid has been in system, greater chances that wheel cylinders need to be replaced or overhauled.**

HANDS-ON TASK: Have students remove and replace hold down springs using the proper tool for the job. Use a lab vehicle or trainer

22. **SLIDE 22 EXPLAIN FIGURE 104–21** Pre-assembly of starwheel adjuster with its connecting spring often helps when reassembling drum brake. Check to make sure that starwheel adjuster is on correct side of vehicle because they use different threads (left-hand and right-hand).

DEMONSTRATION: Show students the parking brake linkage on a rear drum brake and discuss how it works.

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	**DEMONSTRATION:** Show students examples of brake drums and ask them to talk about function of ribs or fins around the outer edge of the drum.
	The hold-down pins have reference numbers on the back of them to identify their application.
	**DEMONSTRATION:** Show students how to perform masking-tape trick to prevent contamination of brake linings during installation.
	**DISCUSSION:** Have students talk about other ways they can keep the brake linings free of contamination
	**Replace Brake Shoes (View) (Download)**
	23. **SLIDE 23 EXPLAIN FIGURE 104–22** Sometimes it is necessary to cross the shoes when pre-assembling the starwheel adjuster and connecting spring. 24. **SLIDE 24 EXPLAIN FIGURE 104–23** Brake spring pliers being used to install connecting spring... 25. **SLIDE 25 EXPLAIN FIGURE 104–24** Notice that brake shoe is not contacting anchor pin. This often occurs when the parking brake cable is stuck or not adjusted properly.
	**DEMONSTRATION:** Show the students the procedure you use to assemble drum brake shoes. Let them know that there is no manufacture recommendation for this process. What works best for them to accomplish the outcome is okay
	**DISCUSSION:** Have students talk about why you don't use a screw driver or pliers to install and remove return springs. (pliers nick the paint on the springs and accelerate corrosion)
	Hold back of return spring pin against the backing plate with your finger while pushing on spring with hold down spring tool. Move clearance tool up and down on the shoes to determine the widest spot.

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	**26. SLIDE 26 EXPLAIN FIGURE 104–25** first step in using a brake shoe clearance gauge is to adjust it to the drum inside diameter and tighten lock screw. **27. SLIDE 27 EXPLAIN FIGURE 104–26** Place gauge over shoes and adjust brakes until they contact inside of gauge.
	**EXPLAIN TECH TIP:** ***Masking Tape Trick*** **Some technicians cover friction material with masking tape to prevent contaminating linings with dirt or grease during installation. After everything has been installed and double-checked, masking tape is removed and brake drums are installed. • SEE FIGURE 104–27.**
	**28. SLIDE 28 EXPLAIN FIGURE 104–27** To prevent getting grease on the lining, wise technician covers the friction material with masking tape. The tape is removed after brake shoes have been installed**.**
	**DEMONSTRATION: how students how to adjust the reinstalled drum brakes by using a brake shoe clearance gauge**
	**Star-wheel adjusters wheels should be checked for tooth wear**
	**DEMONSTRATION: Show students how to adjust lever-latch automatic adjuster.**
	**DISCUSSION: Ask students to discuss how a lever-latch automatic adjuster works to adjust lining-to-drum clearance.**
	**DISCUSSION: Ask students to talk about how a strut-quadrant automatic adjuster works. Have students identify the adjuster's component parts and compare its operation to that of a lever-latch automatic adjuster.**
	**HANDS-ON TASK: Have students use adjusting link mechanism to fine-tune clearance between the brake lining and the drum.**

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	29. SLIDES 29-37 OPTIONAL EXPLAIN DRUM BRAKE SERVICE
 	**ON-VEHICLE ASEEDUCATION TASK C4:.** Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
 	**ON-VEHICLE ASEEDUCATION TASK C5:** Inspect wheel cylinders for leaks and proper operation; remove and replace as needed
 	**ON-VEHICLE ASEEDUCATION TASK C6:** Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; perform final checks and adjustments.
	**SEARCH INTERNET:** Have students use Internet to research the self-servo characteristic of drum brakes, which increases stopping power without additional effort by the driver.