

## A5 BRAKES 7<sup>th</sup> Edition

### Chapter 13 Disc Brake Diagnosis and Service

#### Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of <b>Automotive Brakes</b> . It correlates material to task lists specified by ASE and NATEF.
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 the chapter learning objectives to the students. <ol style="list-style-type: none"><li>1. Discuss how to diagnose problems with disc brakes.</li><li>2. Describe how to inspect, disassemble, and service disc brake calipers.</li><li>3. Explain disc brake squeal correction.</li><li>4. State the symptoms of a faulty disc brake.</li></ol> <p><b>This chapter will help you prepare for the Brakes (A5) ASE certification test content area "C" (DISC Brakes Service).</b></p>
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: This lesson plan is based on A5 BRAKES 7<sup>th</sup> Edition**

**Chapter Images found on Jim's web site @**

**[www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 13: [Chapter Images](#)**

## ICONS

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### 1. SLIDE 1 DISC BRAKE SVC

Check for **ADDITIONAL VIDEOS & ANIMATIONS @**  
<http://www.jameshalderman.com/>  
**WEB SITE IS CONSTANTLY UPDATED**

#### Videos

**At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them**

**Word Search Puzzle ([Microsoft Word](#)) ([PDF](#))**

**Word Search Puzzle ([Microsoft Word](#)) ([PDF](#))**

**DISCUSSION: ASK STUDENTS TO DISCUSS PROCEDURE FOR DIAGNOSING DISC BRAKE PROBLEMS.**

**TO VERIFY CUSTOMER CONCERN, ASK CUSTOMER TO DRIVE VEHICLE WHILE YOU RIDE ALONG TO MAKE SURE VEHICLE IS OPERATED IN SAME MANNER IN WHICH PROBLEM OCCURS**

2. **SLIDE 2 EXPLAIN** Figure 13-1 Minimum thickness for various types of disc brake pads. Pad wear sensors often make a “chirping” sound when the vehicle is moving if the pads are worn. Do not confuse that noise for a defective wheel bearing or other fault.

3. **SLIDE 3 EXPLAIN** Figure 13-2 This cracked disc brake pad must be replaced even though it is thicker than minimum allowed by OEM and the wear sensor was not close to the rotor.

**Brake Pad Wear Indicator Check (View) (Download)**

**ELECTRONIC SENSOR IN A BRAKE PAD THAT OPERATES WEAR INDICATOR IS EASILY BROKEN WHEN REMOVING PADS.**

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4. **SLIDE 4 EXPLAIN FIGURE 13.3** A brake pad display used by shops to help customers visualize the measurements taken when their brakes were inspected.
5. **SLIDE 5 EXPLAIN Figure 13-4** Most disc brake calipers have a brake inspection opening. For a thorough inspection, however, the caliper should be removed and the entire braking system thoroughly inspected.

**DEMONSTRATION: SHOW STUDENTS HOW TO DO THE BLEED AND SQUIRT TEST TO DETERMINE IF A BRAKE IS BEING COMPLETELY RELEASED.**

**DISCUSSION: ASK STUDENTS TO DISCUSS THE PROCESS OF VISUALLY INSPECTING DISC BRAKES. WHAT SHOULD THEY DO BEYOND CHECKING THE THICKNESS OF THE LINING?**

**[Rotor, Remove and Replace \(View\) \(Download\)](#)**

6. **SLIDE 6 EXPLAIN Figure 13-5 (a)** Both rear- and forward-mounted calipers have the bleeder valve at the top. Some calipers will fit on the wrong side of the vehicle, yet not be able to be bled correctly because the bleeder valve would point down, allowing trapped air to remain inside the caliper bore. If both calipers are being removed at the same time, mark them “left” and “right.”
7. **SLIDE 7 EXPLAIN Figure 13-6** Many manufacturers recommend removing  $\frac{1}{2}$  of brake fluid from master cylinder before servicing disc brakes. Use a squeeze bulb and dispose of used brake fluid properly.
8. **SLIDE 8 EXPLAIN Figure 13-7** Most manufacturers recommend that bleeder valve be opened and brake fluid forced into a container rather than back into the master cylinder reservoir. This helps prevent contaminated brake fluid from being forced into the master cylinder where the dirt and contamination could cause problems.
9. **SLIDE 9 EXPLAIN Figure 13-8** Many calipers use a hollow “banjo bolt” to retain flexible brake line to caliper housing. Fitting is usually round like a banjo. The copper washers should always be replaced and not reused.
10. **SLIDE 10 EXPLAIN Figure 13-9** Caliper retaining bolts are often called guide pins & used to retain caliper to steering knuckle. Pins slide through metal bushings and rubber O-rings.

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11. **SLIDE 11 EXPLAIN Figure 13-10** If the caliper is not being removed, it must be supported properly so that the weight of caliper is not pulling on flexible rubber brake line. A suitable piece of wire, such as a coat hanger, may be used
12. **SLIDE 12 EXPLAIN Figure 13-11** A wooden block or a folded shop cloth helps prevent damage when caliper pistons are removed. Use extreme care when removing a caliper piston using compressed air. The pressure applied can force the piston out of the caliper with tremendous force. Always follow service information instructions.
13. **SLIDE 13 EXPLAIN Figure 13-12** After piston is removed from the caliper housing, the dust boot can often be removed using a straight blade screwdriver.
14. **SLIDE 14 EXPLAIN Figure 102-13** Phenolic (plastic) pistons should be carefully inspected.
15. **SLIDE 15 EXPLAIN Figure 13-14** All caliper pistons should be inspected for damage and replaced if there are any faults found.



**DEMONSTRATION: SHOW STUDENTS AN EXAMPLE OF A PHENOLIC CALIPER PISTON, AND DISCUSS THE INITIAL PROBLEMS ASSOCIATED WITH THEM AND HOW THESE PROBLEMS WERE RESOLVED. SHOW STUDENTS AN EXAMPLE OF STEEL CALIPER PISTONS, AND DISCUSS THE BENEFITS AND DRAWBACKS OF STEEL VERSUS PHENOLIC CALIPER PISTONS.**



**DEMONSTRATION: SHOW PROCEDURE TO GET THE CALIPER PISTON INTO A CALIPER THAT HAS TO HAVE THE DUST BOOT INSTALLED BEFORE THE PISTON IS INSTALLED. USE VERY LOW AIR PRESSURE THROUGH BRAKE LINE HOLE. PLACE PISTON ON TOP OF DUST BOOT. THE AIR PRESSURE WILL EXPAND DUST BOOT OUT JUST FAR ENOUGH FOR YOU TO SNEAK THE PISTON BETWEEN TOP LIP OF SEAL.**



**ANOTHER WAY TO INSTALL PISTON INTO SEAL IS TO WORK YOUR FINGERS IN BETWEEN THE SEAL AND PISTON AND PULL SEAL AROUND PISTON AS YOU APPLY LIGHT PRESSURE DOWN ON PISTON**



16. **SLIDE 16 EXPLAIN Figure 13-15** These pads were found to be cracked and a section was missing from a part of one pad.
17. **SLIDE 17 EXPLAIN Figure 13-16** Removing the square-cut O-ring seal from the caliper bore. Use a wooden or plastic tool to prevent damage to seal groove.

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18. **SLIDE 18 EXPLAIN Figure 13-17** Some manufacturers recommend cleaning the inside of the caliper bore using a honing tool as shown. Even though the caliper piston does not contact the inside of this bore, removing any surface rust or corrosion is important to prevent future problems. If the honing process cannot remove any pits or scored areas, the caliper should be replaced.
19. **SLIDE 19 EXPLAIN Figure 13-18** Installing a new piston seal. Never reuse old rubber parts. A caliper overhaul kit includes just two items: the square-cut piston seal O-ring and dust boot
20. **SLIDE 20 EXPLAIN Figure 13-19** Brake assembly fluid or clean brake fluid from a sealed container can be used to lubricate the caliper seal and caliper pistons before assembly.
21. **SLIDE 21 EXPLAIN Figure 13-20** Installing caliper piston. Many calipers require that dust boot be installed in groove of piston and/or caliper before installing piston.
22. **SLIDE 22 EXPLAIN Figure 13-21** Installing a piston into a caliper. Sometimes a C-clamp is needed to install the piston. Both the piston and the piston seal should be coated in clean brake fluid before assembly.
23. **SLIDE 23 EXPLAIN Figure 13-22** Seating dust boot into caliper housing using a special plastic seating tool.
24. **SLIDE 24 EXPLAIN Figure 13-23** All rubber bushings should be lubricated with silicone brake grease for proper operation.
25. **SLIDE 25 EXPLAIN Figure 13-24 (a)** Using a screwdriver to force outboard pad into proper position before bending the retaining tabs. **(b)** Use 2 hammers to bend tab where it extends through hole in caliper body.
26. **SLIDE 26 EXPLAIN Figure 13-25** Often, a hammer is necessary to bend retainer flange to make certain that pads fit tightly to caliper. If the pads are loose, a “click” may be heard every time the brakes are depressed. This click occurs when the pad(s) move and then hit caliper or caliper mount. If pads are loose, a clicking noise may be heard while driving over rough road surfaces.

**HANDS-ON TASK: HAVE STUDENTS CARRY OUT THE STEPS TO REMOVE DISC BRAKE CALIPERS. HAVE STUDENTS INSPECT THE CALIPERS THEY HAVE REMOVED, AND SELECT STUDENTS TO REPORT THEIR OBSERVATIONS TO THE CLASS.**

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27. **SLIDE 27 EXPLAIN Figure 13-26** A loaded caliper includes all hardware and shims with the correct pads all in one convenient package, ready to install on the vehicle
28. **SLIDE 28 EXPLAIN Figure 13-27** Floating calipers must be able to slide during normal operation. Therefore, there must be clearance between the caliper and the caliper mounting pads (abutments). Too little clearance will prevent the caliper from sliding and too much clearance will cause the caliper to make a clunking noise when the brakes are applied.
29. **SLIDE 29 EXPLAIN Figure 13-28** Using an air-powered sanding disc to clean the caliper mount pads.
30. **SLIDE 30 EXPLAIN Figure 13-29** Determine which face of the special tool best fits the holes or slots in the piston. Sometimes needle-nose pliers can be used to rotate the piston back into the caliper bore.

**DEMONSTRATION: SHOW PROPER WAY TO REMOVE A BRAKE PAD THAT HAS AN ELECTRONIC WEAR SENSOR. SHOW STUDENTS HOW TO CHECK AN ELECTRONIC SENSOR FOR PROPER INSTALLATION WITH A CONTINUITY TESTER**

**DEMONSTRATION: SHOW CALIPER ABUTMENTS ON A DISC BRAKE, AND DISCUSS THE ISSUES CAUSED BY TOO MUCH CLEARANCE BETWEEN THE ABUTMENT AND THE CALIPER. WHAT CAUSES THIS AND WHAT ARE THE SYMPTOMS? ASK STUDENT TO IDENTIFY POSSIBLE REPAIRS**

**IT MAY TAKE SEVERAL TRIES TO GET RETAINING TABS TIGHT ON OUT BOARD PAD. THEY MUST BE TIGHT TO POINT WHERE YOU HAVE TO FORCE THEM ON BY HAND.**

31. **SLIDE 31 EXPLAIN Figure 13-30** Note the twisted flexible brake line. This was caught by an automotive instructor before the brake work on the vehicle was completed. The twisted brake line can cause brake hose failure if not corrected.
32. **SLIDE 32 EXPLAIN Figure 13-31** For best braking performance, purchase replacement disc brake pads that include all clips and shims specified by the vehicle manufacturer. Some pads even come with a package of the specified grease to use on the shims to reduce the possibility of brake noise.
33. **SLIDE 33 EXPLAIN Figure 13-32** Notice beveled pads. The



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shape of the pad helps reduce brake noise

34. **SLIDE 34 EXPLAIN FIGURE 13–33** The screwdriver blade is used to keep the piston applied to allow self-adjustment to occur when the brake pedal is released.
35. **SLIDE 35 EXPLAIN FIGURE 13–34 (a)** A brake pressure tester.
36. **SLIDE 36 EXPLAIN FIGURE 13–34 (b)** The small “pads” can be placed between the caliper piston and the rotor to check for applied pressure and inserted between the caliper and the rotor on the outside of the rotor to test the pressure—the pressure should be the same if the caliper is able to slide on its pins or slides.



**DISCUSSION:** ASK STUDENTS TO DISCUSS HOW TO TEST NEWLY INSTALLED BRAKE PADS PRIOR TO A TEST DRIVE AND WHY THIS IS AN IMPORTANT FIRST STEP. ASK STUDENTS TO TALK ABOUT THE CAUSES OF DISC BRAKE SQUEAL. HOW CAN YOU TELL THE DIFFERENCE BETWEEN THE SOUND OF A THIN-LINING WARNING SENSOR AND OTHER PROBLEMS ASSOCIATED WITH OPERATING DISC BRAKES? ASK STUDENTS TO DISCUSS THE PROCESS OF BEDDING-IN, OR BURNISHING, REPLACEMENT BRAKE PADS TO BREAK THEM IN. WHAT IS OEM RECOMMENDATION FOR PADS WITH WHICH THEY ARE WORKING? IS THIS TYPICALLY APPROPRIATE FOR NEW BRAKES TODAY?













**DEMONSTRATION:** SHOW STUDENTS AN EXAMPLE OF **ANTI-SQUEAL SHIMS** AND DISCUSS HOW THEY WORK. ASK STUDENTS TO DISCUSS WAYS TO PREVENT DISC BRAKE SQUEAL. TALK ABOUT HOW AND WHERE TO APPLY GREASE TO DISC BRAKES TO REDUCE BRAKE NOISE. ASK STUDENTS TO DISCUSS HOW TO MACHINE BRAKE ROTORS TO REDUCE BRAKE NOISE. HOW DOES CHANGING THE BRAKE PAD LINING AND SHAPE HELP DIMINISH BRAKE NOISE?



**ALWAYS PURCHASE REPLACEMENT DISC BRAKE PADS THAT INCLUDE ALL THE CLIPS, SHIMS, AND LUBRICANT SPECIFIED BY THE OEM**

**DISCUSSION:** ASK STUDENTS TO DISCUSS POSSIBLE CAUSES OF DRAGGING BRAKES. ASK STUDENTS TO TALK ABOUT WHY FRONT DISC BRAKES MIGHT BE VERY SENSITIVE TO LIGHT APPLICATION OF THE

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	<p><b>BRAKES. ASK STUDENTS TO DISCUSS WHY REAR DRUM BRAKES MIGHT SKID DURING HARD APPLICATION OF THE BRAKES</b></p> <p><b><u>DEMONSTRATION:</u> SHOW STUDENTS HOW TO USE A BRAKE PRESSURE TESTER TO DIAGNOSE AN IMBALANCE BETWEEN THE LEFT- AND RIGHT-SIDE BRAKES.</b></p>
	<p><b><u>DEMONSTRATION:</u> SHOW STUDENTS PROPER WAY TO TORQUE A WHEEL ON TO A VEHICLE USING A TORQUE STICK AND THEN TO DOUBLE CHECK THEIR WORK WITH A TORQUE WRENCH WHEN THE CAR IS ON THE GROUND.</b></p>
	<p>37. SLIDES 37-45 <b><u>EXPLAIN OPTIONAL DISC BRAKE SERVICE</u></b></p>
 	<p><b><u>ON-VEHICLE NATEF TASK</u> DISC BRAKE CALIPER AND RELATED COMPONENT INSPECTION AND SERVICE.</b></p>
 	<p><b><u>ON-VEHICLE NATEF TASK:</u> INSTALL WHEEL, TORQUE LUG NUTS, AND MAKE FINAL CHECKS AND ADJUSTMENTS.</b></p>
 	<p><b><u>ON-VEHICLE NATEF TASK:</u> CHECK BRAKE PAD WEAR INDICATOR SYSTEM OPERATION; DETERMINE NECESSARY ACTION</b></p>
	<p><b><u>SEARCH INTERNET:</u> AUTOMOTIVE DISC BRAKE DESIGNS HAVE A LONG HISTORY DATING BACK TO FREDERICK WILLIAM LANCHESTER'S PATENT IN 1902. HAVE STUDENTS COLLABORATE ON A REPORT COVERING EARLY HISTORY OF DISC BRAKE DESIGNS—FROM 1949 CROSLY HOTSHOT TO 1963 STUDEBAKER AVANTI.</b></p>