# ATE5 Chapter 102 DISC BRAKE DIAGNOSIS & SERVICE

## Opening Your Class

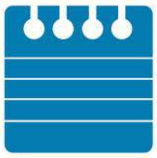
| KEY ELEMENT | EXAMPLES |
|---|---|
| **Introduce Content** | This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references. |
| **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:<br>1. Discuss how to diagnose problems with disc brakes.<br>2. Describe how to inspect, disassemble, and service disc brake calipers.<br>3. Explain disc brake squeal correction.<br>4. State the symptoms of a faulty disc brake. |
| **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: This lesson plan is based on the 5th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com**

**LINK CHP 102: ATE5 Chapter Images**

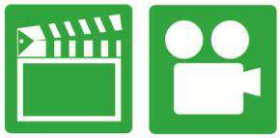
| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|


**DISCUSSION:** **Ask students to discuss procedure for diagnosing disc brake problems.**



**To verify customer complaint, ask customer to drive vehicle while you ride along on a test drive to make sure vehicle is operated in same manner in which problem occurs**

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



## Videos

Rotor Runout & Steering Wheel Shake (View) (Download)
Rotor Runout (View) (Download)
Rotor Thickness Variation & Brake Pedal Pulsation (View) (Download)

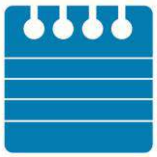
1. **SLIDE 1 CH102 DISC BRAKE DIAGNOSIS & SERVICE**

2. **SLIDE 2 EXPLAIN Figure 102-1** 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 102-2** This cracked disc brake pad must be replaced even though it is thicker than minimum allowed by vehicle manufacturer and the wear sensor was not close to the rotor.

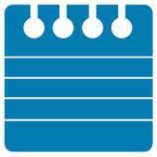
**The electronic sensor in a brake pad that operates the wear indicator is easily broken when removing the pads.**

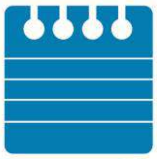
4. **SLIDE 4 EXPLAIN Figure 102-3** Be careful to observe the direction in which replacement linings are facing. Some vehicle manufacturers offset the friction material on the steel backing to help prevent or minimize tapered pad wear. Check service information for details as to which direction the pads should be installed.

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
| | 5. **SLIDE 5 EXPLAIN Figure 102-4** 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: discuss the process of visually inspecting disc brakes. What should they do beyond checking the thickness of the lining?** |
|  | 6. **SLIDE 6 EXPLAIN Figure 102-5 (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."<br>7. **SLIDE 7 EXPLAIN Figure 102-6** Many manufacturers recommend removing ½ of brake fluid from master cylinder before servicing disc brakes. Use a squeeze bulb and dispose of used brake fluid properly.<br>8. **SLIDE 8 EXPLAIN Figure 102-7** Most manufacturers recommend that the bleeder valve be opened and the 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 102-8** 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.<br>10. **SLIDE 10 EXPLAIN Figure 102-9** Caliper retaining bolts are often called guide pins. These guide pins are used to retain the caliper to the steering knuckle. These pins also slide through metal bushings and rubber O-rings.<br>11. **SLIDE 11 EXPLAIN Figure 102-10** If the caliper is not being removed, it must be supported properly so that the weight of the caliper is not pulling on the flexible rubber brake line. A suitable piece of wire, such as a coat hanger, may be used. |

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
| | 12. **SLIDE 12 EXPLAIN Figure 102-11** 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.<br>13. **SLIDE 13 EXPLAIN Figure 102-12** After piston is removed from the caliper housing, the dust boot can often be removed using a straight blade screwdriver.<br>14. **SLIDE 14 EXPLAIN Figure 102-13** Phenolic (plastic) pistons should be carefully inspected.<br>15. **SLIDE 15 EXPLAIN Figure 102-14** If there are any surface flaws such as rust pits on the piston, it should be replaced.<br>16. **SLIDE 16 EXPLAIN FIGURE 102-15** These pads were found to be cracked and a section was missing |
|  | **DEMONSTRATION: Show 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 how to get caliper piston into a caliper that needs dust boot installed before piston. Use low air pressure through brake line hole. Place piston on top of dust boot. Air pressure will expand dust boot out just far enough for you to sneak piston between top lip of seal. Another way to install piston into seal is to work your fingers in between the seal and the piston and pull seal around piston as you apply light pressure down on the piston** |
|  | 17. **SLIDE 17 EXPLAIN Figure 102-16** Removing the square-cut O-ring seal from the caliper bore. Use a wooden or plastic tool to prevent damage to seal groove.<br>18. **SLIDE 18 EXPLAIN Figure 102-17** Some OEMs 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. |

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
|  | 19. **SLIDE 19 EXPLAIN Figure 102-18** 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.<br>20. **SLIDE 20 EXPLAIN Figure 102-19** Brake assembly fluid or clean brake fluid from a sealed container can be used to lubricate the caliper seal and caliper pistons before assembly.<br>21. **SLIDE 21 EXPLAIN Figure 102-20** Installing caliper piston. Many calipers require that dust boot be installed in groove of piston and/or caliper before installing piston.<br>22. **SLIDE 22 EXPLAIN Figure 102-21** 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.<br>23. **SLIDE 23 EXPLAIN Figure 102-22** Seating the dust boot into the caliper housing using a special plastic seating tool.<br>24. **SLIDE 24 EXPLAIN Figure 102-23** All rubber bushings should be lubricated with silicone brake grease for proper operation.<br>25. **SLIDE 25 EXPLAIN Figure 102-24 (a)** Using a screwdriver to force the outboard pad into proper position before bending the retaining tabs.<br>26. **SLIDE 26 EXPLAIN Figure 102-24 (b)** Use two hammers to bend the tab where it extends through the hole in the caliper body.<br>27. **SLIDE 27 EXPLAIN Figure 102-25** Often, a hammer is necessary to bend the retainer flange to make certain that the pads fit tightly to the 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 the caliper or caliper mount. If the 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.** |
|  | 28. **SLIDE 28 EXPLAIN FIGURE 102-26** A loaded caliper includes all hardware and shims with the correct pads all in one convenient package, ready to install on the vehicle |

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
| | 29. **SLIDE 29 EXPLAIN Figure 102-27** 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.<br>30. **SLIDE 30 EXPLAIN Figure 102-28** Using an air-powered sanding disc to clean the caliper mount pads.<br>31. **SLIDE 31 EXPLAIN Figure 102-29** 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.<br>32. **SLIDE 32 EXPLAIN Figure 102-30** Note twisted flexible brake line |
|  | **DEMONSTRATION: Show the students the 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 students the 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.** |
|  | 33. **SLIDE 33 EXPLAIN Figure 102-31** 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.<br>34. **SLIDE 34 EXPLAIN Figure 102-32** Notice the beveled pads. The shape of pad helps reduce brake noise. |
|  | **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** |

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
| | **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 brakes. Ask students to discuss why rear drum brakes might skid during hard application of the brakes** |
|   | **DEMONSTRATION: Show students how to use a brake pressure tester to diagnose an imbalance between the left- and right-side brakes.** |
|   | **DEMONSTRATION: Show how to torque a wheel using a torque stick and to double check with a torque wrench when the car is on the ground.** |
|  | 35. **SLIDE 35 EXPLAIN FIGURE 102-33** screwdriver blade is used to keep the piston applied to allow self-adjustment to occur when the brake pedal is released.<br>36. **SLIDE 36 EXPLAIN FIGURE 102-34A** brake pressure tester.<br>37. **SLIDE 37 EXPLAIN FIGURE 102-34B** 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 |

| ICONS | Chapter 102 Disc Brake Diagnosis & SVC |
|---|---|
| | the pressure—the pressure should be the same if the caliper is able to slide on its pins or slides. |
| | **38. SLIDES 38-55 OPTIONAL EXPLAIN DISC BRAKE SERVICE** |
|  | **ON-VEHICLE NATEF TASK: Disc brake caliper and related component inspection and service. Page 308** |
|  | **ON-VEHICLE NATEF TASK: Install wheel, torque lug nuts, and make final checks and adjustments. Page 309** |
|  | **ON-VEHICLE NATEF TASK: Check brake pad wear indicator system operation; determine necessary action. Page 310** |
|  | **SEARCH INTERNET: 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 Crosley Hotshot to 1963 Studebaker Avanti.** |
|  | **Crossword Puzzle (Microsoft Word) (PDF)** |
| | **Word Search Puzzle (Microsoft Word) (PDF)** |