ATE5 Chapter 96 Brake Fluid & Lines

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: 1. Discuss the purpose and function of brake fluids and the procedure required to service brake fluid. 2. Discuss the types of rubber that are used in brake system components. 3. Discuss the use of brake lines.
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 96: ATE5 Chapter Images

ICONS	Chapter 96 Brake Fluid & Lines
	1. **SLIDE 1 CH96 Brake Fluid & Lines** 2. **SLIDE 2 EXPLAIN Figure 96-1** Brake fluid can absorb moisture from the air even through plastic, so many experts recommend that brake fluid be purchased in metal containers, if possible. 3. **SLIDE 3 EXPLAIN Figure 96-2** Brake fluid absorbs moisture from the air at the rate of about 2% per year. As the brake fluid absorbs water, its boiling temperature decreases.
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @** **http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Videos**
	**DISCUSSION: Ask students to talk about types of brake fluids and their chemical characteristics. What must all brake fluids have in common? Ask students to discuss brake fluid specifications. What do SAE DOT specification standards signify? (Have students refer to Federal Motor Vehicle Standard 116 covering all fluids for use in hydraulic brake systems of motor vehicles, brake fluid containers, and brake fluid labeling issue**
	4. **SLIDE 4 EXPLAIN Figure 96-3** DOT 5 brake fluid is used mostly in motorcycles because if spilled, it will not hurt painted surfaces.
	**DISCUSSION: discuss uses of DOT 3 brake fluid. Why is it the most commonly used brake fluid? Why is it important to keep DOT 3 brake fluid in a sealed container? Talk about performance characteristics and uses of DOT 4 brake fluid? What differentiates it from DOT 3 brake fluid, and why does it cost more? Why is it important to change brake fluid on a vehicle equipped with ABS every 30,000 miles (48,000 km)? Discuss performance characteristics and uses of DOT 5.1 brake fluid. What types of vehicles might use DOT 5.1 fluid?**

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	**DISCUSSION:** **Ask students to talk about why they should *never* use mineral oil in a brake system designed for DOT brake fluids. Ask students to discuss the performance characteristics and uses of DOT 5 brake fluid. What are advantages of silicone-based brake fluids? What are disadvantages**
	5. **SLIDE 5 EXPLAIN FIGURE 96-4 Both rubber sealing cups were exactly the same size.** 6. **SLIDE 6 EXPLAIN Figure 96-5** If brake fluid is black in color, it should be replaced. 7. **SLIDE 7 EXPLAIN Figure 96-6 (a)** brake fluid test strip is being used to test the condition of the brake fluid. 8. **SLIDE 8 EXPLAIN Figure 96-6 (b)** The color of the test strip is then compared with a chart on the package, which indicates the condition and if the fluid should be replaced. 9. **SLIDE 9 EXPLAIN Figure 96-7** electronic tester that measures boiling temperature of the brake fluid is useful to help determine if the brake fluid needs to be replaced.
	**DEMONSTRATION:** **Show students how to use a brake fluid test strip. Show students how to use a brake fluid tester and discuss the results.**
	**ON-VEHICLE NATEF TASK: Brake fluid usage and test for contamination. Page 296**
	**DISCUSSION:** **Ask students to discuss brake fluid servicing procedures. What precautions should they take to prevent contamination of brake fluid?**
	**If possible, store brake fluid in a moisture-free area, such as an old refrigerator.**
	10. **SLIDE 10 EXPLAIN Figure 96-8** master cylinder piston seals are usually constructed from EPDM rubber, and the diaphragm of the vacuum power brake booster is usually made from SBR.

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	11. **SLIDE 11 EXPLAIN Figure 96-9** Cross-sectional view of a typical drum brake wheel cylinder. Most wheel cylinder boots and cups are either SBR or EPDM rubber. 12. **SLIDE 12 EXPLAIN Figure 96-10** Exploded view of a typical disc brake caliper. Both the caliper seal and dust boot are constructed of EPDM rubber.
	**DEMONSTRATION: Show students the EPDM rubber parts found in master cylinder, drum brake wheel cylinder, and disc brake caliper and discuss the effect of brake fluid on these components.**
	**DISCUSSION: Ask students to talk about the rubber components found in braking systems, including the master cylinder and disc and drum brake assemblies. How might these be affected by prolonged exposure to brake fluid?**
	13. **SLIDE 13 EXPLAIN Figure 96-11** Steel brake tubing is double-walled for strength & plated for corrosion 14. **SLIDE 14 EXPLAIN Figure 96-12** An SAE flare brake line fitting. Because of the slight difference in flare angle, double-flare fitting seals cause a wedging action. 15. **SLIDE 15 EXPLAIN Figure 96-13** ISO fitting, also called a bubble or ball-type flare. 16. **SLIDE 16 EXPLAIN Figure 96-14** tubing cutter is preferred tool to use to cut brake line because it leaves a clean edge.
	17. **SLIDE 17 EXPLAIN Figure 96-15 (a)** Double flaring the end of a brake line. (a) Clamp the line at the correct height above the surface of the clamping tool using the shoulder of the insert as a gauge. 18. **SLIDE 18 EXPLAIN Figure 96-15 (b)** Double flaring the end of a brake line. (b) The insert is pressed into the end of the tubing. This creates the first bend. 19. **SLIDE 19 EXPLAIN Figure 96-15 (c)** Double flaring the end of a brake line. (c) Remove the insert and use the pointed tool to complete the overlap double flare. 20. **SLIDE 20 EXPLAIN Figure 96-15 (d)** Double flaring the end of a brake line. (d) The completed operation as it appears while still in the clamp. 21. **SLIDE 21 EXPLAIN Figure 96-16 (a)** Making an ISO flare requires a special tool. (a) Position the brake line into the two-part tool at the correct height using the gauge end of the tool.

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	**DEMONSTRATION: Show double-walled steel brake lines connecting the master cylinder to each brake, and discuss how their construction is designed to carry brake fluid**
	**DEMONSTRATION: Show double-flare & ISO brake line ends, and talk about their purpose & function. Ask students to talk about why replacement brake lines must be same diameter as originals. Show students how to flare end of brake line by using a double-lap flare fitting**
	**After cutting or flaring brake lines, use dry shop air to blow out contaminates.**
	**HANDS-ON TASK: Have students double-lap flare a brake line. Use a small diameter line first than a larger diameter so they can see the difference**
	22. **SLIDE 22 EXPLAIN Figure 96-16 (b)** Making an ISO flare requires a special tool. (b) Assemble the two blocks of the tool together and clamp in a vise. Turn tool around and thread it into the tool block. The end of the threaded part of the tool forms the "bubble" or ISO flare.
	**DEMONSTRATION: Show students how to flare the end of a brake line by using an ISO fitting**
	**Show ANIMATION:** **SAE and ISO Flares (View) (Download)**
	**HANDS-ON TASK: Have students ISO flare a brake line. Use a small diameter line first than a larger diameter so they can see the difference.**
	23. **SLIDE 23 EXPLAIN Figure 96-17** Whenever disconnecting or tightening a brake line, always use the correct size flare-nut wrench. A flare-nut wrench is also called a tube-nut wrench or a line wrench. 24. **SLIDE 24 EXPLAIN Figure 96-18** The coils in the brake line help prevent cracks caused by vibration. 25. **SLIDE 25 EXPLAIN Figure 96-19** Armored brake line is usually used in the location where the line may be exposed to rock or road debris damage. Even armored

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 	brake line can leak and a visual inspection is an important part of any brake service. 26. **SLIDE 26 EXPLAIN FIGURE 96-20** A tube bender being used to bend a brake line. 27. **SLIDE 27 EXPLAIN Figure 96-21** Flexible brake hoses are used between the frame or body of the vehicle and the wheel brakes. Because of suspension and/or steering movement, these flexible brake lines must be strong enough to handle high brake fluid pressures, yet remain flexible. Note that this flexible brake hose is further protected against road debris with a plastic conduit covering. 28. **SLIDE 28 EXPLAIN Figure 96-22 (a)** Typical flexible brake hose showing multiple layers of rubber and fabric. 29. **SLIDE 29 EXPLAIN Figure 96-22 (b)** The inside diameter (ID) is printed on the hose (3 mm). 30. **SLIDE 30 EXPLAIN Figure 96-23** Typical flexible brake hose faults. Many faults cannot be seen, yet can cause brakes to remain applied after brake pedal is released. 31. **SLIDE 31 EXPLAIN Figure 96-4** Flexible brake hose should be carefully inspected for cuts or other damage, especially near sections where the brake hose is attached to the vehicle. Notice the crack and cut hose next to the mounting bracket **ON-VEHICLE NATEF TASK: Brake hose and line inspection and replacement. Page 295** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**