

Automotive Maintenance and Light Repair, 1ST Edition

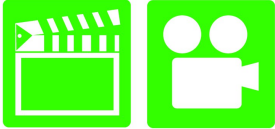
Chapter 55 BRAKE FLUID & LINES

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automotive Maintenance and Light Repair . 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. <ul style="list-style-type: none">⤵ Prepare for the Brakes (A5) ASE certification test.⤵ List the types of brake fluids.⤵ Describe where armored brake line is used.⤵ Discuss the differences between double-flare and ISO flare⤵ Explain how flexible brake lines should be handled during service.⤵ List the precautions necessary when handling or disposing of brake fluid.⤵ Discuss the types of rubber that are used in brake system components.
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.

ICONS

Ch55 BRAKE FLUID & LINES



1. SLIDE 1 CH55 BRAKE FLUID & LINES
2. SLIDES 2-3 EXPLAIN OBJECTIVES

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

4. SLIDES 4-5 EXPLAIN Brake Fluid
6. SLIDE 6 EXPLAIN Figure 55-1 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.
7. SLIDE 7 EXPLAIN CHART 55-1
8. SLIDE 8 EXPLAIN Figure 55-2 Brake fluid absorbs moisture from air at rate of about 2% per year. As brake fluid absorbs water, its boiling temperature decreases.







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

9. SLIDE 9 EXPLAIN Figure 55-3 DOT 5 brake fluid is used mostly in motorcycles because if spilled, it will not hurt painted surfaces.

VIDEO: BRAKE FLUID RECOMMENDATIONS
WWW.MYAUTOMOTIVELAB.COM

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=BRAKE%20FLUIDS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/A5-F6.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/XML/A5-F6.ADB.XML](http://media.pearsoncmg.com/ph/chet/chet_myLABS/akamai/template/video640x480.php?title=brake%20fluids&clip=pandc/chet/2012/automotive/a5-f6.mov&caption=chet/chet_myLABS/akamai/2012/automotive/xml/a5-f6.adb.xml)

10. SLIDE 10 EXPLAIN FIGURE 55-4 Both rubber sealing cups were exactly same size. Cup on left was exposed to mineral oil. Notice how seal greatly expanded.
11. SLIDE 11 EXPLAIN Brake Fluid: Brake Fluid Inspection and Testing

ICONS	Ch55 BRAKE FLUID & LINES
	<p>DISCUSSION: ask students to discuss performance characteristics and 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? Ask students to 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)? Ask students to discuss performance characteristics and uses of DOT 5.1 brake fluid. What types of vehicles might use DOT 5.1 fluid?</p>
	<p>DISCUSSION: ASK STUDENTS TO TALK ABOUT WHY THEY SHOULD <i>NEVER</i> USE MINERAL OIL IN A BRAKE SYSTEM DESIGNED FOR DOT BRAKE FLUIDS. ASK STUDENTS TO DISCUSS CHARACTERISTICS & USES OF DOT 5 BRAKE FLUID. WHAT ARE ADVANTAGES OF SILICONE-BASED BRAKE FLUIDS? WHAT ARE DISADVANTAGES?</p>
	<ol style="list-style-type: none"> 12. SLIDE 12 EXPLAIN Figure 55-5 If brake fluid is black in color, it should be replaced. 13. SLIDE 13 EXPLAIN Figure 55-6 (a) brake fluid test strip is being used to test the condition of brake fluid (b) Color of test strip is then compared with chart on package, which indicates condition and if fluid should be replaced. 14. SLIDE 14 EXPLAIN Figure 55-7 electronic tester that measures boiling temperature of the brake fluid is useful to help determine if the brake fluid needs to be replaced.
	<p>DEMONSTRATION: SHOW STUDENTS HOW TO USE BRAKE FLUID TEST STRIP. SHOW HOW TO USE BRAKE FLUID TESTER & DISCUSS RESULTS.</p>
	<p>NATEF MLR TASK A5A7 TEST BRAKE FLUID FOR CONTAMINATION.</p>
	<ol style="list-style-type: none"> 15. SLIDES 15-18 EXPLAIN Brake Fluid Service Procedures and Precautions 19. SLIDE 19 EXPLAIN CHART 55-2

ICONS



QUESTION



QUESTION



Ch55 BRAKE FLUID & LINES

NATEF MLR TASK A5B4 SELECT, HANDLE, STORE, & FILL BRAKE FLUIDS TO PROPER LEVEL.

DISCUSSION: ASK STUDENTS TO DISCUSS BRAKE FLUID SERVICING PROCEDURES. WHAT PRECAUTIONS SHOULD THEY TAKE TO PREVENT CONTAMINATION OF BRAKE FLUID?





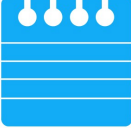




IF POSSIBLE, STORE BRAKE FLUID IN A MOISTURE-FREE AREA, SUCH AS AN OLD REFRIGERATOR.

20. **SLIDE 20 EXPLAIN Figure 55-8** The master cylinder piston seals are usually constructed from EPDM rubber, and the diaphragm of the vacuum power brake booster is usually made from SBR.
21. **SLIDE 21 EXPLAIN Figure 55-9** Cross-sectional view of a typical drum brake wheel cylinder. Most wheel cylinder boots and cups are either SBR or EPDM rubber.
22. **SLIDE 22 EXPLAIN Figure 55-10** Exploded view of a typical disc brake caliper. Both the caliper seal and dust boot are constructed of EPDM rubber.

DEMONSTRATION: SHOW 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: DISCUSS 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?

23. **SLIDES 23-25 EXPLAIN** Brake Lines
26. **SLIDE 26 EXPLAIN Figure 55-11** Steel brake tubing is double-walled for strength and plated for corrosion resistance.
27. **SLIDE 27 EXPLAIN** Brake Lines
28. **SLIDE 28 EXPLAIN Figure 55-12 & EXPLAIN Figure 55-13** ISO fitting, also called a bubble or ball-type flare.

ICONS	Ch55 BRAKE FLUID & LINES
	<p>29. SLIDE 29 EXPLAIN FIGURE 55-14 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. (b) The insert is pressed into the end of the tubing. This creates the first bend..</p> <p>30. SLIDE 30 EXPLAIN FIGURE 55-14 (CONTINUED) (c) Remove the insert and use the pointed tool to complete the overlap double flare. (d) The completed operation as it appears while still in the clamp.</p>
	<p><u>DEMONSTRATION: SHOW STUDENTS THE DOUBLE-WALLED STEEL BRAKE LINES CONNECTING THE MASTER CYLINDER TO EACH BRAKE, AND DISCUSS HOW THEIR CONSTRUCTION IS DESIGNED TO CARRY BRAKE FLUID WHILE PROVIDING MAXIMUM DURABILITY</u></p>
 	<p><u>DEMONSTRATION: SHOW DOUBLE-FLARE & ISO BRAKE LINE ENDS, & TALK ABOUT THEIR PURPOSE & FUNCTION. ASK STUDENTS TO TALK ABOUT WHY REPLACEMENT BRAKE LINES MUST BE SAME DIAMETER AS ORIGINALS. SHOW HOW TO FLARE END OF BRAKE LINE BY USING DOUBLE-LAP FLARE FITTING</u></p>
	<p><u>AFTER CUTTING OR FLARING BRAKE LINES, USE DRY SHOP AIR TO BLOW OUT CONTAMINATES.</u></p>
	<p><u>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</u></p>
	<p>31. SLIDE 31 EXPLAIN Figure 55-15 Making an ISO flare requires a special tool. (a) Use the gauge, which is part of the tool, to position the brake line at the specified distance from the base of the tool. (b) The ISO forming tool will create the perfect "bubble" or ISO flare.</p>
	<p><u>DEMONSTRATION: SHOW STUDENTS HOW TO FLARE THE END OF A BRAKE LINE BY USING AN ISO FITTING</u></p>
	<p><u>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.</u></p>

ICONS**Ch55 BRAKE FLUID & LINES**

32. **SLIDE 32 EXPLAIN Figure 55-16** 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.
33. **SLIDE 33 EXPLAIN Figure 55-17** The coils in the brake line help prevent cracks caused by vibration.
34. **SLIDE 34 EXPLAIN Figure 55-18** Armored brake line is usually used in the location where the line may be exposed to rock or road debris damage. Even armored brake line can leak and a visual inspection is an important part of any brake service.
35. **SLIDE 35 EXPLAIN FIGURE 55-19** A tube bender being used to bend a brake line.
36. **SLIDE 36 EXPLAIN Figure 55-20** 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.
37. **SLIDE 37 EXPLAIN Figure 55-21 (a)** Typical flexible brake hose showing the multiple layers of rubber and fabric. **(b)** Inside diameter (ID) printed on hose (3 mm).
38. **SLIDE 38 EXPLAIN Figure 55-22** Typical flexible brake hose faults. Many faults cannot be seen, yet can cause brakes to remain applied after brake pedal is released.
39. **SLIDE 39 EXPLAIN Figure 55-23** Flexible brake hose should be carefully inspected for cuts or other damage, especially near sections where brake hose is attached to vehicle. Notice crack & cut hose next to mounting bracket
40. **SLIDE 40 EXPLAIN FIGURE 55-24** 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

SHOW VIDEO: REPLACING BRAKE LINES
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[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=SDOUBLE-FLARE%20AND%20ISO%20FLARE&CLIP=PANDC/CHET/2012/AUTOMOTIVE/CLIP2.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/XML/CLIP2.ADB.XML](http://media.pearsoncmg.com/ph/chet/chet_myLABS/akamai/template/video640x480.php?title=SDOUBLE-FLARE%20AND%20ISO%20FLARE&clip=pandc/chet/2012/automotive/clip2.mov&caption=chet/chet_myLABS/akamai/2012/automotive/xml/clip2.adb.xml)

ICONS	Ch55 BRAKE FLUID & LINES
   	<p>ANIMATION: LEAK IN HYDRUALIC SYSTEM WWW.MYAUTOMOTIVELAB.COM <small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/BRAKES/AUTO_ANIMATIONS/CH05_FIG05_12/INDEX.HTML</small></p> <p>SHOW ANIMATION: BRAKE HOSE FAULTS WWW.MYAUTOMOTIVELAB.COM <small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/BRAKES/AUTO_ANIMATIONS/CH07_FIG07_23/INDEX.HTML</small></p> <p>NATEF MLR TASK A5B3 INSPECT BRAKE LINES, FLEXIBLE HOSES, AND FITTINGS FOR LEAKS, DENTS, KINKS, RUST, CRACKS, BULGING, AND WEAR; CHECK FOR LOOSE FITTINGS AND SUPPORTS; DETERMINE NECESSARY ACTION.</p>