ATE5 Chapter 106 ABS COMPONENTS & OPERATION

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. Explain the need for antilock braking systems (ABS). 2. Describe the operation and system configurations of ABS. 3. Describe the purpose and function of the ABS components, such as wheel speed sensors, ABS control module, and hydraulic modulator assembly. 4. Explain the operation of the brake pedal travel sensor and the tire pressure monitoring system.
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 106: ATE5 Chapter Images

ICONS	Chapter 106 ABS Operation
	**1. SLIDE 1 CH106 ABS COMPONENTS & OPERATION**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**Videos**
	**DEMONSTRATION: Show students the ABS components**
	2. **SLIDE 2 EXPLAIN Figure 106-1** Max braking traction occurs when tire slip is between 10%-20%. A rotating tire has 0% slip & locked-up wheel has 100% slip
	3. **SLIDE 3 EXPLAIN Figure 106-2** Traction is determined by pavement conditions and tire slip. 4. **SLIDE 4 EXPLAIN Figure 106-3** good driver can control tire slip more accurately than an ABS if the vehicle is traveling on a smooth, dry road surface. 5. **SLIDE 5 EXPLAIN Figure 106-4** wedge of gravel or snow in the front of a locked wheel can help stop a vehicle faster than would occur if the wheel brakes were pulsed on and off by an antilock braking system 6. **SLIDE 6 EXPLAIN Figure 106-5** Being able to steer and control the vehicle during rapid braking is one major advantage of an antilock braking system.
	**DISCUSSION: discuss purpose and function of ABS systems. How do they work to prevent wheel lock-up and help the driver maintain steering control? Discuss meaning of tire slip and how it relates to traction. Discuss how road conditions impact tire slip and braking distances**
	**DISCUSSION: discuss operation of ABS. How does antilock control module monitor the relative deceleration rates of wheels during braking? Discuss how solenoids are used with ABS to hold, release, and reapply hydraulic pressure to brakes.**

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	**Antilock Braking System (View) (Download)**
	7. **SLIDE 7 EXPLAIN Figure 106-6** A typical stop on a slippery road surface without antilock brakes. Notice that the wheels stopped rotating and skidded until the vehicle finally came to a stop.
	**DEMONSTRATION: Show students how the ABS works on the trainer**
	8. **SLIDE 8 EXPLAIN Figure 106-7** ABS configuration includes **4-channel, 3-channel, and single-channel**. 9. **SLIDE 9 EXPLAIN Figure 106-8** typical integral ABS unit that combines function of master cylinder, brake booster, and antilock braking system in one assembly. 10. **SLIDE 10 EXPLAIN Figure 106-9** A typical nonintegral-type (remote) ABS.
	**DISCUSSION: discuss how a 4-channel ABS system works. What is advantage of having each wheel equipped with its own speed sensor? Ask students to discuss how a 3-channel ABS system works. What is advantage of this configuration, and where would you find it most often? Ask students to discuss how a single-channel ABS system works. What types of vehicle generally have single-channel systems and why? Discuss differences between integral & nonintegral brakes. Why has nonintegral ABS become most common system?**
	11. **SLIDE 11 EXPLAIN Figure 106-10** schematic drawing of a typical antilock braking system. 12. **SLIDE 12 EXPLAIN Figure 106-11** Wheel speed sensors for the rear wheels may be located on the rear axle, on transmission, or on individual wheel knuckle. 13. **SLIDE 13 EXPLAIN Figure 106-12** schematic of a typical wheel speed sensor. The toothed ring is also called a *tone ring*. 14. **SLIDE 14 EXPLAIN Figure 106-13** Wheel speed sensors produce an alternating current (AC) signal with a frequency that varies in proportion to wheel speed. 15. **SLIDE 15 EXPLAIN Figure 106-14** A digital wheel speed sensor produces a square wave output signal.

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	**DEMONSTRATION:** Show location of the ABS wheel speed sensors (WSS) and discuss how they let the control module know when the wheel is about to lock up.
	**DISCUSSION:** Ask students to talk about why air gap between end of a wheel speed sensor and its tone ring are vital to the proper operation of ABS.
	**DEMONSTRATION:** Show students an example of a digital wheel speed sensor, and discuss how it works. What are the advantages of this type of sensor over a conventional wheel speed sensor?
	**DISCUSSION:** Have students talk about why to use a brass feeler gauge when checking the air gap on a wheel speed sensor.
	**DISCUSSION:** Have students talk about why a wheel speed sensor produces an alternating current.
	**HANDS-ON TASK:** Have students check a wheel speed sensor with DMM.
	16. **SLIDE 16 EXPLAIN Figure 106-15** Typical inputs and outputs for brake control modules.
	**DISCUSSION:** Ask students to talk about the purpose and function of **ABS Warning Lamp**. What is indicated when light comes on or stays on while driving? What actions does ABS take?
	**DEMONSTRATION:** Show students the ABS electronic control module, and discuss how it uses input from the wheel and other sensors to control hydraulic pressure during braking to prevent wheel lock-up
	**DISCUSSION:** Ask students to discuss the conditions under which the ABS control module goes into active mode and takes control of vehicle braking. What actions does it take when active? When does it return to standby mode?

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	17. **SLIDE 17 EXPLAIN Figure 106-16** ABS three-way solenoid can increase, maintain, or decrease brake pressure to a given brake circuit.
	**DEMONSTRATION: Show students an ABS 3-way solenoid, and discuss how it works to open and close valves between the master cylinder and the individual brake circuits to increase, maintain, or decrease pressure to those circuits.**
	**DISCUSSION: Ask students to talk about ABS brake pressure control cycle. What is the function of isolation solenoid in the pressure-holding stage? What is the role of release solenoid in pressure-reduction stage if wheel starts to lock? What occurs during the pressure-increase stage?**
	18. **SLIDE 18 EXPLAIN Figure 106-17** isolation or hold phase of an ABS on a Bosch 2 system. 19. **SLIDE 19 EXPLAIN Figure 106-18** During pressure reduction stage, pressure is vented from the brake circuit so the tire can speed up and regain traction. 20. **SLIDE 20 EXPLAIN Figure 106-19** control module reapplies pressure to affected brake circuit once tire achieves traction so that normal braking can continue. 21. **SLIDE 21 EXPLAIN Figure 106-20** An integral ABS unit with a pump motor to provide power assist during all phases of braking and brake pressure during ABS stops.
	**DEMONSTRATION: Show Integral ABS Master Cylinder. Show students how they work together for conventional brakes and ABS brakes.**
	**DEMONSTRATION: Show how to SAFELY depressurize an integral ABS Accumulator**
	**DISCUSSION: Ask students to discuss why accumulator should be depressurized prior to servicing an integral ABS. Ask students to discuss the function of pump motor in restoring brake pressure during ABS braking. How is pump motor activated during an ABS stop? How does it also generate power assist for conventional braking in some systems?**

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	**ON-VEHICLE NATEF TASK (A5-G-4)** **Depressurize high-pressure components of the electronic brake control system. (P-3) Page 325**
	**DEMONSTRATION: Show students how ABS Hydraulic Modulator works on the trainer**
	**HANDS-ON TASK: Have students use a high lighter to trace ABS circuit on a WIRING DIAGRAM. Have them trace circuit from the module to four wheel speed sensors. Marking with a different color any connections in circuit.**
	**DISCUSSION: Ask students to talk about reason for brake-pedal pulsation during an ABS stop. What may be indicated if the brake pedal pulses during a non-ABS stop? Ask students to talk about the function of the electronic controller in an ABS. What aspects of ABS operation does it control?** 22. SLIDES 22-33 OPTIONAL EXPLAIN WHEEL SPEED SENSOR
	
	**SEARCH INTERNET: Have students investigate education requirements, experience and certification required to enter the career of brakes technician with focus on ABS diagnosis and repair.** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**