ATE5 Chapter 115 ELECTRONIC SUSPENSION SYSTEMS

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 characteristics of the various sensors used for electronic suspension control. 2. Describe electronic suspension system actuators. 3. List the types of electronic suspension systems. 4. Describe the parts and operation of the automatic level control 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 115: ATE5 Chapter Images

ICONS	Chapter 115 Electronic Suspension
	1. SLIDE 1 CH115 ELECTRONIC SUSPENSION SYSTEMS
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED
	**Videos**
	2. **SLIDE 2 EXPLAIN Figure 115-1** An electronically controlled suspension system can help reduce body roll and other reactions better than most conventional suspension systems. 3. **SLIDE 3 EXPLAIN Figure 115-2** Input devices monitor conditions and provide information to the electronic control module, which processes the information and operates the actuators to control the movement of the suspension. 4. **SLIDE 4 EXPLAIN Figure 115-3** typical electronic suspension height sensor, which bolts to the body and connects to the lower control arm through a control link and lever. 5. **SLIDE 5 EXPLAIN Figure 115-4** When suspension action moves the lever, it rotates the slotted disc and varies how much of the photo transistor is exposed to the LEDs, which vary the input signal.
	**DEMONSTRATION: Show examples of electronic suspension height sensors FIGURE 115-4**
	**Ice build-up on sensor linkages can cause sensor damage.**
	**DISCUSSION: Ask the students to discuss symptoms that indicate a problem with an automobile's height sensor FIGURE 115-4**

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	6. **SLIDE 6 EXPLAIN Figure 115-5** Typical suspension position sensor. 7. **SLIDE 7 EXPLAIN Figure 115-6** three-wire suspension position sensor schematic. 8. **SLIDE 8 EXPLAIN** Figure 115-7 A suspension height sensor.
	**DEMONSTRATION: Show examples of suspension position sensors Figure 115-6. Show the students an example of suspension height sensor & show how it is mounted FIGURE 115-7**
	**When you are backprobing 3-wire sensor, reference voltage on all 3 wires indicates a bad ground**
	9. **SLIDE 9 EXPLAIN Figure 115-8** The steering wheel position (handwheel position) sensor wiring schematic and how the signal varies with the direction that the steering wheel is turned. 10. **SLIDE 10 EXPLAIN Figure 115-9** The handwheel position sensor is located at the base of the steering column. 11. **SLIDE 11 EXPLAIN Figure 115-10** Steering wheel (handwheel) position sensor schematic.
	**DEMONSTRATION: Show examples of handwheel position sensors FIGURE 115-10**
	**DISCUSSION: Ask the students to discuss some uses for the additional signals that a handwheel sensor can produce: FIGURE 115-10**
	**Be sure to read & Follow OEM instructions on disabling an airbag before working on steering column.**
	12. **SLIDE 12 EXPLAIN Figure 115-11** VS sensor information transmitted to EBCM by Class 2 serial data. 13. **SLIDE 13 EXPLAIN Figure 115-12** air pressure sensor. 14. **SLIDE 14 EXPLAIN Figure 115-13** schematic showing the lateral acceleration sensor and the EBCM.

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	15. **SLIDE 15 EXPLAIN Figure 115-14** visual inspection showed a liquid had spilled. 16. **SLIDE 16 EXPLAIN Figure 115-15** Yaw rate sensor showing the typical location and schematic. 17. **SLIDE 17 EXPLAIN Figure 115-16** A magnetic field is created whenever an electrical current flows through a coil of wire wrapped around an iron core.
	**DEMONSTRATION: Show examples of standalone yaw rate sensors and a yaw rate sensor combined with a lateral accelerometer sensor FIGURE 115-15**
	18. **SLIDE 18 EXPLAIN Figure 115-17** When magnets are near each other, like poles repel and opposite poles attract. 19. **SLIDE 19 EXPLAIN Figure 115-18** When electrical current magnetizes the plunger in a solenoid, the magnetic field moves the plunger against spring force. With no current, the spring pushes the plunger back to its original position. 20. **SLIDE 20 EXPLAIN Figure 115-19** This air supply solenoid blocks pressurized air from the air spring valves when off. The plunger pulls upward to allow airflow to the air spring valves when the solenoid is energized. 21. **SLIDE 21 EXPLAIN Figure 115-20** An actuator motor uses a permanent magnet and four stator coils to drive the air spring control rod. 22. **SLIDE 22 EXPLAIN Figure 115-21** The stator coils of the actuator are energized in three ways to provide soft, medium, or firm ride from the air springs and shock absorbers.
	23. **SLIDE 23 EXPLAIN Figure 115-22** Selectable Ride as used on Chevrolet and GMC pickup trucks. 24. **SLIDE 24 EXPLAIN Figure 115-23** ALC maintains the same ride height either loaded or unloaded by increasing or decreasing air pressure in rear air shocks.
	**DISCUSSION: Ask the students to discuss whether manufacturers other than General Motors have systems similar to the Automatic Level Control (ALC) system FIGURE 115-23**

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	25. **SLIDE 25 EXPLAIN Figure 115-24** A typical schematic showing the air suspension compressor assembly and sensor. 26. **SLIDE 26 EXPLAIN Figure 115-25** The typical variable-rate air spring system uses three height sensors, two in the front and one in the rear, to monitor trim height and to provide input signals to the ECM.
	**DISCUSSION: Ask the students to discuss whether manufacturers other than Ford offer variable-rate air spring system or one similar to it.** **FIGURE 115-25**
	27. **SLIDE 27 EXPLAIN Figure 115-26** The air spring compressor assembly is usually mounted on rubber cushions to help isolate it from the body of the vehicle. All of the air entering or leaving the air springs flows through the regenerative air dryer. 28. **SLIDE 28 EXPLAIN Figure 115-27** A solenoid valve at the top of each spring regulates airflow into and out of the air spring.
	29. **SLIDE 29 EXPLAIN Figure 115-28** Schematic showing Computer Command Ride (CCR) system 30. **SLIDE 30 EXPLAIN Figure 115-29** Schematic showing the shock control used in the RSS system. 31. **SLIDE 31 EXPLAIN Figure 115-30** Bi-state dampers (shocks) use a solenoid to control fluid flow in the unit to control compression and rebound actions.
	**DEMONSTRATION: Show the students examples of bi-state dampers FIGURE 115-30**
	32. **SLIDE 32 EXPLAIN Figure 115-31** Solenoid valve controlled shock absorber circuit showing the left front (LF) shock as an example.
	**DEMONSTRATION: Use the schematic in Figure 115–32 to show the students how a CCR module works.**
	33. **SLIDE 33 EXPLAIN Figure 115-32** A typical CCR module schematic. 34. **SLIDE 34 EXPLAIN Figure 115-33** The three dampening modes of a CCR shock absorber.

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	35. **SLIDE 35 EXPLAIN Figure 115-34** Integral shock solenoid.
	**DEMONSTRATION: Show the students examples of self leveling shocks and explain how they work.**
	36. **SLIDE 36 EXPLAIN Figure 115-35** typical ZF Sachs self-leveling shock, as used on the rear of a Chrysler minivan 37. **SLIDE 37 EXPLAIN Figure 115-36** Schematic of the ALC system 38. **SLIDE 38 EXPLAIN Figure 115-37** Air compressor assembly can be located at various locations depending on the vehicle. 39. **SLIDE 39 EXPLAIN Figure 115-38** The exhaust solenoid is controlled by rear integration module (RIM). 40. **SLIDE 40 EXPLAIN Figure 115-39** Schematic showing the rear integration module (RIM) and how it controls the ALC compressor.
	**DEMONSTRATION: Show the students examples of scan tools they could use to command solenoids and verify their operation**.
	**ON-VEHICLE NATEF TASK: Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action. Page 350**
	41. **SLIDE 41 EXPLAIN Figure 115-40** Vehicles that use magneto-rheological shock absorbers have a sensor located near each wheel, as shown on this C6 Corvette. 42. **SLIDE 42 EXPLAIN Figure 115-41** The controller for the magneto-rheological suspension system on a C6 Corvette is located behind the right front wheel. 43. **SLIDE 43 EXPLAIN Figure 115-42** A cutaway of a magneto-rheological shock absorber as displayed at the Corvette Museum in Bowling Green, Kentucky. 44. **SLIDE 44 EXPLAIN FIGURE 115-43** Most electronic level-control sensors can be adjusted, like this GM unit.
	**DEMONSTRATION: Show the students sensors and controllers for magneto-rheological suspension systems FIGURE 115-42**

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  	**DISCUSSION:** Ask the students to discuss the strategy they would use to find an electrical fault in a leveling system. **FIGURE 115-43** **OPTIONAL SEARCH INTERNET:** Have students use nternet to research suspension position sensors. Ask them to be prepared to list at least 10 different models of automobiles and the names given to the suspension position sensors in those models in a class discussion. Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)