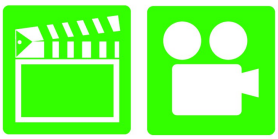
Advanced Automotive Electricity & Electronics

Chapter 23 ELECTRONIC SUSPENSION SYSTEMS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Advanced Automotive Electricity & Electronics.** 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 learning objectives to students as listed on SLIDE. 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. **The chapter helps prepare for ASE Suspension and Steering (A4) certification test content area "B" (Suspension System Diagnosis and Repair).**
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.

ICONS	Chapter 23 Electronic Suspension
   	**1. SLIDE 1 CH23 ELECTRONIC SUSPENSION SYSTEMS** **Check for VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Suspension System (55 Links)** **2. SLIDE 2 EXPLAIN Need for Electronic Suspensions** **3. SLIDE 3 EXPLAIN Figure 23-1** electronically controlled suspension system can help reduce body roll and other reactions better than most conventional suspension systems. **4. SLIDE 4 EXPLAIN** Electronic Suspension Controls and Sensors **5. SLIDE 5 EXPLAIN Figure 23-2** 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**.** **6. SLIDE 6 EXPLAIN Figure 23-3** typical electronic suspension height sensor, which bolts to the body and connects to the lower control arm through a control link and lever. **7. SLIDE 7 EXPLAIN Figure 23-4** 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 the students examples of electronic suspension height sensors FIGURE 23-4** **DISCUSSION: Ask the students to discuss symptoms that indicate a problem with an automobile's height sensor FIGURE 23-4**

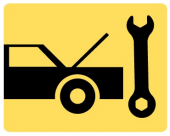
ICONS	Chapter 23 Electronic Suspension
	Ice build-up on sensor linkages can cause sensor damage.
	8. **SLIDE 8** EXPLAIN **Figure 23-5** Typical suspension position sensor. 9. **SLIDE 9** EXPLAIN **Figure 23-6** three-wire suspension position sensor schematic. 10. **SLIDE 19** EXPLAIN **Figure 23-7** A suspension height sensor.
DEMO	**DEMONSTRATION: Show examples of suspension position sensors Figure 23-6. Show the students an example of suspension height sensor & show how it is mounted FIGURE 23-7**
	When you are backprobing 3-wire sensor, reference voltage on all 3 wires indicates a bad ground
Video	**Show VIDEO: Measuring Ride Height www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Measuring%20Ride%20Height&clip=pandc/chet/2012/automotive/Suspension_Steering/Measuring_Ride_Height.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Suspension_Steering/xml/Measuring_Ride_Height.xml
	11. **SLIDE 11** EXPLAIN **Figure 23-8** steering wheel position (handwheel position) sensor wiring schematic and how the signal varies with the direction that the steering wheel is turned. 12. **SLIDE 12** EXPLAIN **Figure 23-9** handwheel position sensor is located at the base of the steering column. 13. **SLIDE 13** EXPLAIN **Figure 23-10** Steering wheel (handwheel) position sensor schematic.
DEMO	**DEMONSTRATION: Show examples of handwheel position sensors FIGURE 23-10**
QUESTION	**DISCUSSION: Ask the students to discuss some uses for the additional signals that a handwheel sensor can produce: FIGURE 23-10**

ICONS	Chapter 23 Electronic Suspension
	Be sure to read & Follow OEM instructions on disabling an airbag before working on steering column.
	14. **SLIDE 14** EXPLAIN **Figure 23-11** VS sensor information transmitted to EBCM by Class 2 serial data.
	15. **SLIDE 15** EXPLAIN **Figure 23-12** An air pressure sensor.
	16. **SLIDE 16** EXPLAIN Electronic Suspension Controls and Sensors
	17. **SLIDE 17** EXPLAIN NOTE
	18. **SLIDE 18** EXPLAIN **Electronic Suspension Controls and Sensors**
	19. **SLIDE 19** EXPLAIN **Figure 23-13** schematic showing the lateral acceleration sensor and the EBCM.
	20. **SLIDE 20** EXPLAIN **FIGURE 23–14** The lateral accelerometer sensor (G-sensor) is usually located under the center console
	21. **SLIDE 21** EXPLAIN TECH TIP
	22. **SLIDE 22** EXPLAIN **Figure 23-15** Yaw rate sensor showing the typical location and schematic.
	23. **SLIDE 23** EXPLAIN **Electronic Suspension System Actuators & Types**
	24. **SLIDE 24** EXPLAIN **Figure 23-16** magnetic field is created whenever an electrical current flows through a coil of wire wrapped around an iron core.
DEMO	**DEMONSTRATION: Show examples of standalone yaw rate sensors and a yaw rate sensor combined with a lateral accelerometer sensor FIGURE 9-15**
	25. **SLIDE 25** EXPLAIN **Figure 23-17** When magnets are near each other, like poles repel and opposite poles attract
	26. **SLIDE 26** EXPLAIN **Figure 23-18** 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.

ICONS	Chapter 23 Electronic Suspension
	**27. SLIDE 27 EXPLAIN Figure 23-19** 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 **28. SLIDE 28 EXPLAIN Figure 23-20** An actuator motor uses a permanent magnet and four stator coils to drive the air spring control rod. **29. SLIDE 29 EXPLAIN Figure 23-21** 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
	**30. SLIDE 30 EXPLAIN Figure 23-22** Selectable Ride as used on Chevrolet and GMC pickup trucks. **31. SLIDE 31 EXPLAIN Figure 23-23** ALC maintains the same ride height either loaded or unloaded by increasing or decreasing the air pressure in the 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 23-23**
	**32. SLIDE 32 EXPLAIN Figure 23-24** A typical schematic showing the air suspension compressor assembly and sensor **33. SLIDE 33 EXPLAIN Figure 23-25** 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 23-25**
	**34. SLIDE 34 EXPLAIN Figure 23-26** 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. **35. SLIDE 35 EXPLAIN Figure 23-27** A solenoid valve at the top of each spring regulates airflow into and out of the air spring.

ICONS	Chapter 23 Electronic Suspension
	36. **SLIDE 36 EXPLAIN FIGURE 23-28** Schematic showing Computer Command Ride (CCR) system. 37. **SLIDE 37 EXPLAIN Electronic Suspension System Actuators & Types** 38. **SLIDE 38 EXPLAIN CAUTION** 39. **SLIDE 39 EXPLAIN Electronic Suspension System Actuators & Types** 40. **SLIDE 40 EXPLAIN Figure 23-29** Schematic showing the shock control used in the RSS system. 41. **SLIDE 41 EXPLAIN Figure 23-30** 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 23-30**
	42. **SLIDE 42 EXPLAIN TECH TIP**
	43. **SLIDE 43 EXPLAIN Figure 23-31** Solenoid valve controlled shock absorber circuit showing the left front (LF) shock as an example.
	**DEMONSTRATION: Use the schematic in Figure 23–32 to show the students how a CCR module works.**
	44. **SLIDE 44 EXPLAIN Figure 23-32** A typical CCR module schematic. 45. **SLIDE 45 EXPLAIN Figure 23-33** The three dampening modes of a CCR shock absorber. 46. **SLIDE 46 EXPLAIN Figure 23-34** Integral shock solenoid. 47. **SLIDE 47 EXPLAIN TECH TIP**
	**DEMONSTRATION: Show the students examples of self leveling shocks and explain how they work.**
	48. **SLIDE 48 EXPLAIN FIGURE 23-35** A typical ZF Sachs self-leveling shock, as used on the rear of a Chrysler minivan 49. **SLIDE 49 EXPLAIN Electronic Suspension System Actuators & Types**

ICONS	Chapter 23 Electronic Suspension
	50. **SLIDE 50** EXPLAIN NOTE 51. **SLIDE 51** EXPLAIN Automatic Level Control (ALC) 52. **SLIDE 52** EXPLAIN NOTE 53. **SLIDE 53** EXPLAIN **Figure 23-36** Schematic of the ALC system. 54. **SLIDE 54** EXPLAIN **Figure 23-37** Air compressor assembly can be located at various locations depending on the vehicle. 55. **SLIDE 55** EXPLAIN **Figure 23-38** The exhaust solenoid is controlled by rear integration module (RIM) 56. **SLIDE 56** EXPLAIN **Figure 23-39** Schematic showing the rear integration module (RIM) and how it controls the ALC compressor.
DEMO	**DEMONSTRATION: Show the students examples of scan tools they could use to command solenoids and verify their operation.**
We Support ASE NATEF	**ON-VEHICLE NATEF TASK: Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action**
	57. **SLIDE 57** EXPLAIN Magneto-Rheological (MR) Suspension 58. **SLIDE 58** EXPLAIN **Figure 23-40** Vehicles that use magneto-rheological shock absorbers have a sensor located near each wheel, as shown on this C6 Corvette. 59. **SLIDE 59** EXPLAIN **Figure 23-41** The controller for the magneto-rheological suspension system on a C6 Corvette is located behind the right front wheel. 60. **SLIDE 60** EXPLAIN **Figure 23-42** A cutaway of a magneto-rheological shock absorber as displayed at the Corvette Museum in Bowling Green, Kentucky.
DEMO	**DEMONSTRATION: Show the students sensors and controllers for magneto-rheological suspension systems FIGURE 23-42**
QUESTION	61. **SLIDE 61** EXPLAIN TECH TIP **DISCUSSION: Ask the students to discuss the strategy they would use to find an electrical fault in a leveling system. FIGURE 23-43**

ICONS	Chapter 23 Electronic Suspension
	62. **SLIDE 62** EXPLAIN Troubleshooting Rear Electronic Leveling System 63. **SLIDE 63** EXPLAIN **FIGURE 23–43** Most electronic level-control sensors can be adjusted, such as this General Motors unit. **OPTIONAL SEARCH INTERNET: Have students use Internet to research suspension position sensors. Ask them to be prepared to list at least 10 different models of VEHICLES and names given to suspension position sensors in those models in a class discussion.**