
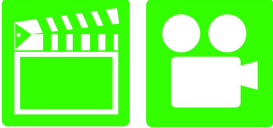





















Advanced Automotive Electricity & Electronics











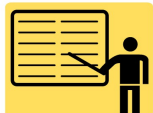
Chapter 19 ACCESSORY CIRCUITS










Opening Your Class

| KEY ELEMENT | EXAMPLES |
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| Introduce Content | This course or class covers operation and service of Advanced Automotive Electricity and Electronics Systems . 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. <ol style="list-style-type: none">1. Explain how cruise control operates and how to troubleshoot the circuit.2. Describe how power windows and power seats operate.3. Diagnose incorrect electric lock and keyless entry operation, and determine necessary action.4. Explain how an antitheft system works, and diagnose faulty operation. <p>This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "A" (General Electrical/Electronic System Diagnosis).</p> |
| 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 | Ch19 ACCESSORY CIRCUITS |
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|    | <p>1. SLIDE 1 CH19 ACCESSORY CIRCUITS</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p>2. SLIDE 2 EXPLAIN Cruise Control</p> <p>3. SLIDE 3 EXPLAIN Figure 19-1 This cruise control servo unit has an electrical connection with wires that go to the cruise control module or the vehicle computer, depending on the vehicle. The vacuum hoses supply engine manifold vacuum to the rubber diaphragm that moves the throttle linkage to maintain the preset speed</p> |
|   | <p>DEMONSTRATION: SHOW STUDENTS COMPONENTS OF CRUISE CONTROL SYSTEM. IF POSSIBLE, SHOW MULTIPLE OEM SYSTEMS TO DEMONSTRATE DIFFERENT DESIGNS.</p> |
|   | <p>WHEN SERVICING CRUISE CONTROL SYSTEM, YOU WILL BE CLOSE TO AIR BAG & ABS. SERVICE INFORMATION WILL INSTRUCT YOU WHEN TO DISARM AND/OR DEPRESSURIZE THESE SYSTEMS. FAILURE TO FOLLOW THESE PROCEDURES CAN RESULT IN PERSONAL INJURY & COSTLY REPAIRS.</p> |
|  | <p>4. SLIDE 4 EXPLAIN Figure 19-2 cruise control used on a Toyota/Lexus.</p> |
| | <p>5. SLIDE 5 EXPLAIN Figure 19-3 Circuit diagram of a typical electronic cruise control system.</p> |
| | <p>6. SLIDE 6 EXPLAIN Cruise Control</p> |
|   | <p>7. SLIDE 7 EXPLAIN WARNING</p> <p>NOT ALL VEHICLES HAVE TRAILER TOW MODE. MORE COMMON ON HEAVY-DUTY PICKUPS</p> |

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|  | <p>HANDS-ON TASK: HAVE THE STUDENTS DESCRIBE CRUISE CONTROL SYSTEMS AND HOW THEY OPERATE. HAVE THEM CREATE A TABLE TO LIST SOME COMMON CAUSES OF INOPERATIVE CRUISE CONTROL SYSTEMS.</p> |
|  | <p>DISCUSSION: DISCUSS USE OF MULTIPLE SAFETY SWITCHES. WHY IS A <u>CLUTCH</u> OR <u>BRAKE SWITCH</u> NECESSARY?</p> |
|  | <p>DISCUSSION: HAVE STUDENTS TALK ABOUT INTEGRATION OF CRUISE CONTROL SYSTEM WITH <u>ECM</u>. DOES THIS HELP WITH TROUBLESHOOTING PROCEDURES?</p> |
|  | <p>8. SLIDE 8 EXPLAIN Cruise Control 9. SLIDE 9 EXPLAIN NOTE 10. SLIDE 10 EXPLAIN Cruise Control</p> |
|  | <p>11. SLIDE 11 EXPLAIN TECH TIP</p> |
|  | <p>12. SLIDE 12 EXPLAIN Troubleshooting Cruise Control</p> |
|  | <p>13. SLIDE 13 EXPLAIN TECH TIP</p> |
|  | <p>14. SLIDE 14 EXPLAIN Electronic Cruise Control 15. SLIDE 15 EXPLAIN Figure 19-4 A typical electronic throttle with the protective covers removed.</p> |
|  | <p>16. SLIDES 16-17 EXPLAIN Radar Cruise Control</p> <p><u>Radar Cruise Control</u></p> |
|  | <p>18. SLIDE 18 EXPLAIN TECH TIP</p> |
|  | <p>19. SLIDE 19 EXPLAIN FIGURE 19-5 A trailer icon lights on the dash of this Cadillac when the transmission trailer towing mode is selected.</p> |

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|  | <p><u>DISCUSSION: DISCUSS ELECTRONIC THROTTLE CRUISE CONTROL. WHAT COMPONENTS ARE NOT NEEDED WITH THIS SYSTEM?</u></p> |
|  | <p>20. SLIDE 20 EXPLAIN Figure 19-6 Radar cruise control uses sensors to keep the distance the same even when traffic slows ahead.</p> |
|  | <p>21. SLIDE 21 EXPLAIN Figure 19-7 Most radar cruise control systems use radar, both long and short range. Some systems use optical or infrared cameras to detect objects.</p> |
|  | <p>22. SLIDE 22 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p> |
|  | <p><u>DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE RADAR CRUISE CONTROL SYSTEMS. HOW DO THESE SYSTEMS OPERATE?</u></p> |
|  | <p><u>DISCUSSION: DISCUSS WHY RADAR CRUISE CONTROL DOES NOT INTERFERE WITH A RADAR DETECTOR. WHAT ARE THE FREQUENCIES OF LONG-RANGE AND SHORT RANGE RADAR?</u></p> |
|  | <p>23. SLIDE 23 EXPLAIN Precollision System</p> <p>24. SLIDE 24 EXPLAIN Figure 19-8 precollision system is designed to prevent a collision first, and then interacts to prepare for a collision if needed.</p> |
|  | <p><u>ON-VEHICLE NATEF TASK: DIAGNOSE BODY ELECTRONIC SYSTEM CIRCUITS USING A SCAN TOOL.</u></p> |
|  | <p>25. SLIDES 25-26 EXPLAIN Heated Rear Window Defoggers</p> <p>27. SLIDE 27 EXPLAIN Figure 19-9 switch and relay control current through heating grid of a rear window defogger.</p> |
|  | <p>28. SLIDE 28 EXPLAIN NOTE</p> |
|  | <p>29. SLIDE 29 EXPLAIN Figure 19-10 A rear window defogger electrical grid can be tested using a voltmeter to check for a decreasing voltage as the meter lead is moved from the power side toward the ground side. As the voltmeter positive lead is moved along grid (on inside of</p> |

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|  | <p>the vehicle), the voltmeter reading should steadily decrease as the meter approaches ground side of grid.</p> |
|  | <p>30. SLIDE 30 EXPLAIN TECH TIP</p> <p>DISCUSSION: HAVE STUDENTS TALK ABOUT STEPS & TOOLS REQUIRED TO TEST REAR WINDOW DEFROSTER GRID. WILL ALL GRIDLINES HAVE SAME VOLTAGE DROP?</p> |
|  | <p>31. SLIDE 31 EXPLAIN Figure 19-11 The typical repair material contains conductive silver-filled polymer, which dries in 10 minutes and is usable in 30 minutes.</p> <p>32. SLIDE 32 EXPLAIN HEATED MIRRORS</p> <p>33. SLIDE 33 EXPLAIN NOTE</p> |
|  | <p>DEMONSTRATION: SHOW HOW TO TEST A REAR WINDOW DEFROSTER GRID WITH DMM. NOTE VOLTAGE DROP FROM POWER SIDE TO GROUND SIDE OF WINDOW.</p> |
|  | <p>DEMONSTRATION: SHOW STUDENTS REAR WINDOW DEFROSTER GRID. SHOW HOW TO REPAIR A BROKEN OR DAMAGED GRID USING REPAIR MATERIAL.</p> |
|  | <p>DEMONSTRATION: SHOW GLASS FROM HEATED MIRROR. WHY DOESN'T HEATED MIRROR USE GRIDS SIMILAR TO THOSE IN REAR WINDOW GLASS?</p> |
|  | <p>DISCUSSION: DISCUSS HEATED MIRRORS. WHAT ARE PURPOSE & FUNCTION OF THESE MIRRORS?</p> |
|  | <p>34. SLIDE 34 EXPLAIN Homelink Garage Door Opener</p> <p>35. SLIDE 35 EXPLAIN NOTE</p> <p>36. SLIDE 36 EXPLAIN Figure 19-12 Typical HomeLink garage door opener buttons. Notice that three different units can be controlled from the vehicle using the HomeLink system</p> |
|  | <p>37. SLIDE 37 EXPLAIN Power Windows</p> <p>38. SLIDE 38 EXPLAIN Figure 19-13 typical power window circuit using PM motors. Control of the direction of window operation is achieved by directing the polarity of the current through the non-grounded motors. The</p> |

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only ground for the entire system is located at the master control (driver's side) switch assembly.

DEMONSTRATION: SHOW STUDENTS HOW POWER WINDOWS OPERATE

39. SLIDE 39 **EXPLAIN** Figure 19-14 An electric motor & regulator assembly raise and lower the glass on a power window

DEMONSTRATION: POWER WINDOWS: TRACE CIRCUIT SO STUDENTS UNDERSTAND HOW BOTH MOTOR TERMINALS ARE AT GROUND POTENTIAL BEFORE SWITCHES ARE MOVED. TRACE CURRENT FLOW SO STUDENTS UNDERSTAND HOW POWER IS REVERSED.

40. SLIDE 40 **EXPLAIN TECH TIP**

41. SLIDE 41 **EXPLAIN** Figure 19-15 A master power window control panel with the buttons and the cover removed.

Power Door Locks

Power Seat Control

Power Window Regulator






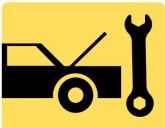




Power Windows










DEMONSTRATION: DEMONSTRATE PROCEDURE FOR CHECKING MASTER POWER WINDOW SWITCH. USE TEST LIGHT/DMM TO TEST FOR CURRENT ON PROPER WIRES; SWITCH CLOSED

42. SLIDE 42 **EXPLAIN** Power Seats

43. SLIDES 43-44 **EXPLAIN TECH TIPS & NOTE ON SLIDE 44**

DISCUSSION: DISCUSS PROGRAMMING PROCEDURE FOR AUTO UP/DOWN POWER WINDOWS. WHY WOULD IT BE HELPFUL TO BE ABLE TO PROGRAM WINDOWS WITHOUT USING SCAN TOOL? POINT OUT THAT MANY OF THE

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|   | <p>SYSTEMS IN NEWER VEHICLES ARE ACCESSIBLE ONLY WITH A DEDICATED OEM SCAN TOOL OR LAPTOP COMPUTER.</p> <p>WHEN SERVICING POWER WINDOWS, KEEP YOUR FINGERS & HANDS AWAY FROM LINKAGE WHILE IT IS IN OPERATION OR WHEN REMOVING COMPONENTS. LINKAGE HAS SHARP EDGES & CAN CAUSE SERIOUS INJURY</p> |
|  | <p>45. SLIDE 45 EXPLAIN Figure 19-16 A power seat uses electric motors under the seat, which drive cables that extend to operate screw jacks (up and down) or gears to move the seat forward and back.</p> <p>46. SLIDE 46 EXPLAIN Figure 19-17 A typical power seat circuit diagram. Notice that each motor has a built-in electronic (solid-state) PTC circuit protector. The seat control switch can change the direction in which the motor(s) runs by reversing the direction in which the current flows through the motor.</p> |
|  | <p><u>DEMONSTRATION: POWER SEATS:TRACE CIRCUIT SO STUDENTS UNDERSTAND HOW POWER SEATS OPERATE</u></p> |
|  | <p><u>DEMONSTRATION: REMOVE POWER DRIVER SEAT FROM A LAB VEHICLE. FLIP SEAT OVER & POINT OUT PARTS OF POWER SEAT ASSEMBLY</u></p> |
|  | <p><u>HANDS-ON TASK: HAVE STUDENTS REMOVE A POWER SEAT FROM LAB VEHICLE. REMIND THEM THAT THEY ALWAYS NEED TO USE ON-LINE SERVICE INFORMATION TO FIND PROPER PROCEDURE.</u></p> |
|   <p>QUESTION</p> | <p><u>DISCUSSION: DISCUSS POWER SEAT MOTORS. WHAT IS THE ADVANTAGE TO HAVING A SEPARATE MOTOR FOR EACH FUNCTION INSTEAD OF HAVING ONE-HOUSING WITH MULTIPLE ARMATURES?</u></p> |
|   <p>QUESTION</p> | <p><u>DISCUSSION: DISCUSS POWER SEAT CIRCUITS. WHY IS A CIRCUIT BREAKER USED INSTEAD OF FUSE FOR POWER SEAT CIRCUIT PROTECTION?</u></p> |

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|  | <p>47. SLIDE 47 EXPLAIN Figure 19-18 A typical memory seat module showing the three-wire potentiometer used to determine seat position</p> <p>48. SLIDE 48 EXPLAIN Power Seats</p> <p>49. SLIDE 49 EXPLAIN NOTE</p> <p>50. SLIDE 50 EXPLAIN Power Seats</p> <p>51. SLIDE 51 EXPLAIN Electrically Heated Seats; Heated and Cooled Seats</p> |
|  | <p>OPTIONAL HANDS-ON TASK: HAVE STUDENTS PROGRAM A MEMORY SEAT POSITION TO SUIT THEIR SIZE. HAVE THEM TALK ABOUT MEMORY SEATS. HOW MIGHT THIS FUNCTION BE HELPFUL WHERE SEVERAL PEOPLE SHARE A CAR?</p> |
|  | <p>52. SLIDE 52 EXPLAIN Figure 19-19 heating element of a heated seat is a replaceable part, but service requires that the upholstery be removed. The yellow part is the seat foam material and the entire white cover is the replaceable heating element. This is then covered by the seat material.</p> |
|  <p>QUESTION</p> | <p>DISCUSSION: DISCUSS ELECTRICALLY HEATED SEATS. HOW ARE SEATS HEATED? HOW IS TEMPERATURE REGULATED?</p> |
|  | <p>53. SLIDE 53 EXPLAIN Figure 19-20 Peltier effect device is capable of heating or cooling, depending on the polarity of the applied current.</p> |
|  | <p>54. SLIDE 54 EXPLAIN TECH TIP</p> |
|  <p>QUESTION</p> | <p>DISCUSSION: DISCUSS HEATED & COOLED SEATS. WHAT IS THERMOELECTRIC DEVICE (TED)? HOW ARE MOST SEATS EQUIPPED?</p> |
|  | <p>55. SLIDE 55 EXPLAIN Heated Steering Wheel</p> <p>56. SLIDE 56 EXPLAIN Figure 19-21 The heated steering wheel is controlled by a switch on the steering wheel in this vehicle</p> |
|  <p>QUESTION</p> | <p>DISCUSSION: DISCUSS COMPONENTS OF A HEATED & COOLED STEERING WHEEL. HOW DOES HEATER AND COOLING OPERATE?</p> |

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56. **SLIDE 56 EXPLAIN FIGURE 19-21** The heated steering wheel is controlled by a switch on the steering wheel in this vehicle

57. **SLIDE 57 EXPLAIN NOTE**

58. **SLIDE 58 EXPLAIN Adjustable Pedals**

59. **SLIDE 59 EXPLAIN Figure 19-22** A typical adjustable pedal assembly. Both the accelerator and the brake pedal can be moved forward and rearward by using the adjustable pedal position switch

60. **SLIDE 60 EXPLAIN TECH TIP**

61. **SLIDE 61 EXPLAIN REAL WORLD FIX**

62. **SLIDE 62 EXPLAIN FIGURE 19-23** Electrically folded mirror in the folded position &

63. **SLIDE 63 EXPLAIN FIGURE 19-24** The electric mirror control is located on the driver's side door panel on this Cadillac Escalade.

64. **SLIDE 64 EXPLAIN Figure 19-25** A typical electric power door lock circuit diagram. Note that the control circuit is protected by a fuse, whereas the power circuit is protected by a circuit breaker. As with the operation of power windows, power door locks typically use reversible permanent magnet (PM) non-grounded electric motors. These motors are geared mechanically to the lock-unlock mechanism.




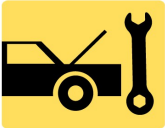






65. **SLIDE 65 EXPLAIN Keyless Entry**

Power Door Locks

66. **SLIDE 66 EXPLAIN Figure 19-26** A key fob remote with the cover removed showing the replaceable battery.

67. **SLIDE 67 EXPLAIN Figure 19-27** A typical vehicle showing the location of the various components of the remote keyless entry system.

DEMONSTRATION: DEMO RKE OPERATION

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|  | <p><u>DEMONSTRATION: OBTAIN SEVERAL REMOTE KEYLESS ENTRY FOBS OR TRANSMITTERS TO SHOW TO YOUR STUDENTS. SEPARATE THE CASES OF THE FOBS TO LET STUDENTS SEE THE INTERNAL COMPONENTS, ESPECIALLY KEYPAD TOUCH AREAS ON CIRCUIT BOARD. DISCUSS RANGE OF REMOTE KEYLESS ENTRY KEY FOBS. WHAT IS MEANT BY "LINE OF SIGHT"?</u></p> |
|  | <p><u>DISCUSSION: DISCUSS ROLLING CODE TRANSMITTERS. WHAT OTHER COMPONENT USES ROLLING CODE TECHNOLOGY?</u></p> |
|  | <p><u>DISCUSSION: DISCUSS REMOTE KEYLESS ENTRY (RKE) SYSTEMS & THEIR COMPONENTS INVOLVED IN THESE SYSTEMS. HOW DO ELECTRONIC KEY FOBS OR TRANSMITTERS WORK?</u></p> |
|  | <p><u>HANDS-ON TASK: DIVIDE STUDENTS INTO GROUPS. HAVE THEM WORK TOGETHER TO CREATE A SPREADSHEET THAT SHOWS PROCEDURES FOR PROGRAMMING REMOTE KEYLESS ENTRY TRANSMITTERS.</u></p> |
|  | <p>68. SLIDES 68-74 EXPLAIN CHART 19.1 Remote keyless programming steps for popular vehicles. Procedures may also apply to similar vehicles by the same manufacturer. Always refer to service information for specific vehicles</p> |
|  | <p>75 SLIDE 75 EXPLAIN Antitheft Systems</p> |
|  | <p>76. SLIDE 76 EXPLAIN Figure 19-28 A shock sensor used in alarm and antitheft systems. If the vehicle is moved, the magnet will move relative to the coil, inducing a small voltage that will trigger the alarm.</p> |
|  | <p><u>DEMONSTRATION: USE LAB VEHICLE TO SHOW COMPONENTS OF ANTITHEFT SYSTEM. ACTIVATE SYSTEM TO SHOW HOW LAMPS FLASH & HORN OR SIREN SOUNDS.</u></p> |
|  | <p><u>DISCUSSION: HAVE STUDENTS TALK ABOUT ANTITHEFT SYSTEMS. WHAT ARE COMPONENTS OF ANTITHEFT SYSTEM?</u></p> |
|  | <p><u>ANTITHEFT SYSTEM</u></p> |

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QUESTION



QUESTION



QUESTION



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MOST ANTITHEFT KEYS NOW HAVE A TRANSPONDER CHIP EMBEDDED IN PLASTIC HEAD OF KEY

77. **SLIDE 77 EXPLAIN** Figure 19-29 Door switches, which complete the ground circuit with the door open, are a common source of high resistance.
78. **SLIDE 78 EXPLAIN** Figure 19-30 special tool is needed to diagnose a GM VATS security system and special keys that contain a resistor pellet.
79. **SLIDES 79-82 EXPLAIN CHART 19-2** Immobilizer or vehicle theft deterrent key learn procedures for some popular vehicles.
83. **SLIDES 83-84 EXPLAIN** Electrical Accessory Symptom Guide
85. **SLIDE 85 EXPLAIN** Figure 19-31 Passlock series of General Motors security systems uses a conventional key. The magnet is located in the ignition lock cylinder and triggers the Hall-effect sensors.






DEMONSTRATION: IF AVAILABLE, SHOW YOUR STUDENTS AN EXAMPLE OF GM PASSKEY WITH EXPOSED RESISTOR. DEMONSTRATE HOW TO MEASURE RESISTANCE OF RESISTOR

DISCUSSION: DISCUSS GM PASSLOCK ANTITHEFT SYSTEM SHOWN BELOW. HOW DOES THIS LOCK CYLINDER SEND A SIGNAL TO INSTRUMENT CLUSTER OR BCM?

DISCUSSION: HAVE STUDENTS TALK ABOUT THE USE OF SPECIAL KEYS FOR ANTITHEFT SYSTEMS. WHAT HAPPENS IF AN UNPROGRAMMED KEY IS USED?

DISCUSSION: DISCUSS DIAGNOSTIC STEPS USED FOR TROUBLESHOOTING ANTITHEFT SYSTEM. WHY IS IT IMPORTANT TO HAVE ACCURATE SERVICE DATA BEFORE TROUBLESHOOTING ANY ELECTRONIC SYSTEM?

ON-VEHICLE NATEF TASK: DIAGNOSE PROBLEMS WITH THE ANTI-THEFT SYSTEM

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|  | <p>86. SLIDE 86 EXPLAIN Figure 19-32 Corrosion or faults at the junction between the wiring and the rear window electrical grid are the source of many rear window defogger problems.</p> |
|  | <p>ON-VEHICLE NATEF TASK: DIAGNOSE MOTOR-DRIVEN ACCESSORY CIRCUITS; DETERMINE NECESSARY ACTION.</p> |
|  | <p>87. SLIDES 87-98 EXPLAIN OPTIONAL DOOR PANEL REMOVAL</p> |
|  | <p>DEMONSTRATION: SHOW STUDENTS HOW TO REMOVE A DOOR PANEL. EXPLAIN HIDDEN FASTENERS.</p> |
|  | <p>ON-VEHICLE NATEF TASK: REMOVE & REINSTALL DOOR PANEL</p> |