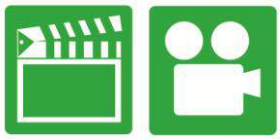
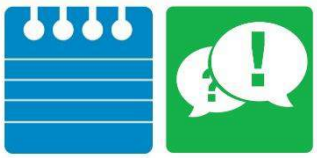
Automotive Electrical & Engine Performance 7/E

Chapter 24 ACCESSORY CIRCUITS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	**This course or class covers Automotive Electrical & Engine Performance. 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. 1. Explain how cruise control operates and how to troubleshoot the circuit. 2. Discuss how to test a heated rear window defogger circuit and rear window heating grids. 3. Describe how power windows and power seats operate. 4. Diagnose incorrect electric lock and keyless entry operation, and determine necessary action. 5. Explain how a antitheft system works, and diagnose faulty operation. This chapter will help you prepare for the ASE Electrical/Electronic systems (A6) certification test content area “h” (Accessories 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.

NOTE: This lesson plan is based on Automotive Electrical & Engine Performance 7/E Chapter Images found on Jim’s web site @ www.jameshalderman.com
LINK CHP 24: Chapter Images

ICONS	Ch24 ACCESSORY CIRCUITS
	**1. SLIDE 1 CH24 ACCESSORY CIRCUITS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Videos**
	**At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**
	
	**2. SLIDE 2 EXPLAIN Figure 24-1** 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
	**DEMONSTRATION: SHOW STUDENTS COMPONENTS OF CRUISE CONTROL SYSTEM. IF POSSIBLE, SHOW MULTIPLE OEM SYSTEMS TO DEMONSTRATE DIFFERENT DESIGNS.** **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.**
	
	**3. SLIDE 3 EXPLAIN Figure 24-2** cruise control used on a Toyota/Lexus.

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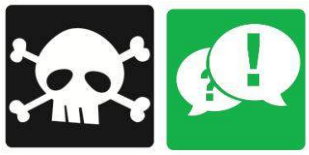	**DISCUSS WARNING**
	4. **SLIDE 4 EXPLAIN Figure 24-3** Circuit diagram of a typical electronic cruise control system
	**EXPLAIN TECH TIP**
	**NOT ALL VEHICLES HAVE TRAILER TOW MODE. MORE COMMON ON HEAVY-DUTY PICKUPS**
	**HANDS-ON TASK: HAVE THE STUDENTS DESCRIBE CRUISE CONTROL SYSTEMS AND HOW THEY OPERATE. HAVE THEM CREATE A TABLE TO LIST SOME COMMON CAUSES OF INOPERATIVE CRUISE CONTROL SYSTEMS.**
	**DISCUSSION: DISCUSS USE OF MULTIPLE SAFETY SWITCHES. WHY IS A CLUTCH OR BRAKE SWITCH NECESSARY?**
	**DISCUSSION: HAVE STUDENTS TALK ABOUT INTEGRATION OF CRUISE CONTROL SYSTEM WITH ECM. DOES THIS HELP WITH TROUBLESHOOTING PROCEDURES?**
	**EXPLAIN TECH TIP**
	5. **SLIDE 5 EXPLAIN** Electronic Cruise Control & **EXPLAIN Figure 24-4** typical electronic throttle with the protective covers removed.
	**EXPLAIN TECH TIP** 6. **SLIDE 6 EXPLAIN FIGURE 24–5** A trailer icon lights on the dash of this Cadillac when the transmission trailer towing mode is selected.
	**DISCUSSION: DISCUSS ELECTRONIC THROTTLE CRUISE CONTROL. WHAT COMPONENTS ARE NOT NEEDED?**

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	7. **SLIDE 7 EXPLAIN** Radar Cruise Control **& EXPLAIN Figure 24-6** Radar cruise control uses sensors to keep the distance the same even when traffic slows ahead. 8. **SLIDE 8 EXPLAIN Figure 24-7** Most radar cruise control systems use radar, both long and short range. Some systems use optical or infrared cameras to detect objects. **Radar Cruise Control**
  	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE RADAR CRUISE CONTROL SYSTEMS. HOW DO THESE SYSTEMS OPERATE?** **DISCUSSION: DISCUSS WHY RADAR CRUISE CONTROL DOES NOT INTERFERE WITH A RADAR DETECTOR. WHAT ARE THE FREQUENCIES OF LONG-RANGE AND SHORT RANGE RADAR?**
	9. **SLIDE 9 EXPLAIN** Precollision System & **EXPLAIN Figure 24-8** precollision system is designed to prevent a collision first, and then interacts to prepare for a collision if needed.
 	**ON-VEHICLE NATEF TASK: DIAGNOSE BODY ELECTRONIC SYSTEM CIRCUITS USING A SCAN TOOL.**
	10. **SLIDE 10 EXPLAIN** Heated Rear Window Defoggers & **EXPLAIN Figure 24-9** switch and relay control current through heating grid of a rear window defogger. 11. **SLIDE 11 EXPLAIN Figure 24-10** 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 the vehicle), the voltmeter reading should steadily decrease as the meter approaches ground side of grid. 12. **SLIDE 12 EXPLAIN Figure 24-11** The typical repair material contains conductive silver-filled polymer, which dries in 10 minutes and is usable in 30 minutes
	**EXPLAIN TECH TIP**

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	**DISCUSSION: HAVE STUDENTS TALK ABOUT STEPS & TOOLS REQUIRED TO TEST REAR WINDOW DEFROSTER GRID. WILL ALL GRIDLINES HAVE SAME VOLTAGE DROP?**
	**DEMONSTRATION: SHOW HOW TO TEST A REAR WINDOW DEFROSTER GRID WITH DMM. NOTE VOLTAGE DROP FROM POWER SIDE TO GROUND SIDE OF WINDOW.**
	**DEMONSTRATION: SHOW REAR WINDOW DEFROSTER GRID. SHOW HOW TO REPAIR A BROKEN OR DAMAGED GRID**
	**DEMONSTRATION: SHOW GLASS FROM HEATED MIRROR. WHY DOESN'T HEATED MIRROR USE GRIDS SIMILAR TO THOSE IN REAR WINDOW?**
	**DISCUSSION: DISCUSS HEATED MIRRORS. WHAT ARE PURPOSE & FUNCTION OF THESE MIRRORS?**
	13. **SLIDE 13 EXPLAIN** Homelink Garage Door Opener & **EXPLAIN Figure 24-12** Typical HomeLink garage door opener buttons. Notice that three different units can be controlled from the vehicle using HomeLink system
	14. **SLIDE 14 EXPLAIN** Power Windows & **EXPLAIN Figure 24-13** typical power window circuit using PM motors. Control of direction of window operation is achieved by directing polarity of current through non-grounded motors. The only ground for entire system is located at master control (driver's side) switch assembly.
	**DEMONSTRATION: SHOW STUDENTS HOW POWER WINDOWS OPERATE**
	15. **SLIDE 15 EXPLAIN Figure 24-14** electric motor & regulator assembly raise & lower glass on power window
	**DEMONSTRATION: TRACE PW CIRCUIT TO UNDERSTAND HOW BOTH MOTOR TERMINALS ARE AT GROUND POTENTIAL BEFORE SWITCHES ARE MOVED. TRACE CURRENT FLOW SO STUDENTS UNDERSTAND HOW POWER IS REVERSED.**

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	**16. SLIDE 16 EXPLAIN Figure 24-15** A master power window control panel with the buttons and the cover removed.
	**EXPLAIN TECH TIP**
	**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**
	**17. SLIDE 17 EXPLAIN Power Seats & EXPLAIN Figure 24-16** A power seat uses electric motors under the seat, which drive cables that extend to operate screw jacks (up/down) or gears to move seat forward and back.
	**18. SLIDE 18 EXPLAIN Figure 24-17** 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.
	19. SLIDE 19 EXPLAIN Figure 24-18 A typical memory seat module showing the three-wire potentiometer used to determine seat position
	**EXPLAIN TECH TIPS**
	**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 SYSTEMS IN NEWER VEHICLES ARE ACCESSIBLE ONLY WITH A DEDICATED OEM SCAN TOOL OR LAPTOP COMPUTER.**

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	**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**
	**DEMONSTRATION: POWER SEATS:TRACE CIRCUIT SO STUDENTS UNDERSTAND HOW POWER SEATS OPERATE**
	**DEMONSTRATION: REMOVE POWER DRIVER SEAT FROM A LAB VEHICLE. FLIP SEAT OVER & POINT OUT PARTS OF POWER SEAT ASSEMBLY**
	**HANDS-ON TASK: REMOVE A POWER SEAT FROM LAB VEHICLE. REMIND THEM THAT THEY ALWAYS NEED TO USE ON-LINE SERVICE INFORMATION TO FIND PROPER PROCEDURE.**
	**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?**
	**DISCUSSION: DISCUSS POWER SEAT CIRCUITS. WHY IS A CIRCUIT BREAKER USED INSTEAD OF FUSE FOR POWER SEAT CIRCUIT PROTECTION?**
	20. **SLIDE 20 EXPLAIN Electrically Heated Seats; Heated and Cooled Seats & EXPLAIN Figure 24-19** 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.
	**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?**
	**DISCUSSION: DISCUSS ELECTRICALLY HEATED SEATS. HOW ARE SEATS HEATED? HOW IS TEMPERATURE REGULATED?**

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        	**21. SLIDE 21 EXPLAIN Figure 24-20** Peltier effect device is capable of heating or cooling, depending on the polarity of the applied current. **EXPLAIN TECH TIP** **DISCUSSION: DISCUSS HEATED & COOLED SEATS. WHAT IS THERMOELECTRIC DEVICE (TED)? HOW ARE MOST SEATS EQUIPPED?** **22. SLIDE 22 EXPLAIN Heated Steering Wheel & EXPLAIN Figure 24-21** The heated steering wheel is controlled by a switch on the steering wheel in this vehicle **DISCUSSION: DISCUSS COMPONENTS OF A HEATED & COOLED STEERING WHEEL. HOW DOES HEATER AND COOLING OPERATE?** **23. SLIDE 23 EXPLAIN Figure 24-22** 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 **EXPLAIN TECH TIP** **DISCUSS REAL WORLD FIX** **24. SLIDE 24 EXPLAIN FIGURE 24–23** Electrically folded mirror in the folded position **25. SLIDE 25 EXPLAIN FIGURE 24–24** The electric mirror control is located on the driver's side door panel on this Cadillac Escalade. **26. SLIDE 26 EXPLAIN Figure 24-25** 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.

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	**Power Door Locks**
	27. **SLIDE 27 EXPLAIN Keyless Entry & Figure 24-26** A key fob remote with the cover removed showing the replaceable battery. 28. **SLIDE 28 EXPLAIN Figure 24-27** A typical vehicle showing the location of the various components of the remote keyless entry system
	**DEMONSTRATION: DEMO RKE OPERATION**
	**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"?**
	**DISCUSSION: DISCUSS ROLLING CODE TRANSMITTERS. WHAT OTHER COMPONENT USES ROLLING CODE TECHNOLOGY?**
	**DISCUSSION: DISCUSS REMOTE KEYLESS ENTRY (RKE) SYSTEMS & THEIR COMPONENTS INVOLVED IN THESE SYSTEMS. HOW DO ELECTRONIC KEY FOBS OR TRANSMITTERS WORK?**
	**HANDS-ON TASK: DIVIDE STUDENTS INTO GROUPS. HAVE THEM WORK TOGETHER TO CREATE A SPREADSHEET THAT SHOWS PROCEDURES FOR PROGRAMMING REMOTE KEYLESS ENTRY TRANSMITTERS.**
	29. **SLIDE 29 EXPLAIN Antitheft Systems & EXPLAIN Figure 24-28** 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.

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	**DEMONSTRATION:** USE **LAB VEHICLE** TO SHOW COMPONENTS OF **ANTITHEFT SYSTEM**. ACTIVATE SYSTEM TO SHOW HOW LAMPS FLASH & HORN OR SIREN SOUNDS.
	**DISCUSSION:** HAVE STUDENTS TALK ABOUT ANTITHEFT SYSTEMS. WHAT ARE COMPONENTS OF ANTITHEFT SYSTEM?
	**ANTITHEFT SYSTEM**
	MOST ANTITHEFT KEYS NOW HAVE A TRANSPONDER CHIP EMBEDDED IN PLASTIC HEAD OF KEY
	30. **SLIDE 30 EXPLAIN Figure 24-29** Door switches, which complete the ground circuit with the door open, are a common source of high resistance. 31. **SLIDE 31 EXPLAIN Figure 24-30** special tool is needed to diagnose a GM VATS security system and special keys that contain a resistor pellet. 32. **SLIDE 32 EXPLAIN Figure 24-31** 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

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 	**TROUBLESHOOTING ANY ELECTRONIC SYSTEM?** **ON-VEHICLE NATEF TASK: DIAGNOSE PROBLEMS WITH THE ANTI-THEFT SYSTEM** **EXPLAIN ELECTRICAL ACCESSORY SYMPTOM GUIDE** **33. SLIDE 33 EXPLAIN Figure 24-32** Corrosion or faults at the junction between the wiring and the rear window electrical grid are the source of many rear window defogger problems.
 	**ON-VEHICLE NATEF TASK: DIAGNOSE MOTOR-DRIVEN ACCESSORY CIRCUITS; DETERMINE NECESSARY ACTION.** **DEMONSTRATION: SHOW STUDENTS HOW TO REMOVE A DOOR PANEL. EXPLAIN HIDDEN FASTENERS.**
 	**ON-VEHICLE NATEF TASK: REMOVE & REINSTALL DOOR PANEL** **34. SLIDES 34-45 DOOR PANEL REMOVAL SLIDE SHOW**