

# Automotive Technology 5<sup>th</sup> Edition

## Chapter 59 ACCESSORY CIRCUITS

### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	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.
<b>Motivate Learners</b>	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.
<b>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.</b>	<p>Explain learning objectives to students as listed on NEXT SLIDE.</p> <ol style="list-style-type: none"> <li>1. Explain the operation of different types of cruise control, pre-collision system, and how to troubleshoot cruise control.</li> <li>2. Discuss heated rear window defoggers and heated mirrors.</li> <li>3. Diagnose incorrect electric lock and keyless entry operation, and determine necessary action.</li> <li>4. Describe how power windows and power seats operate.</li> <li>5. Discuss the operation of heated seats and steering wheel.</li> <li>6. Explain how an antitheft system works, and diagnose faulty operation.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <i><b>WELCOME</b></i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 5<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 59: [ATE5 Chapter Images](#)**

## ICONS



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### 1. SLIDE 1 Chapter 59 ACCESSORY CIRCUITS

2. SLIDE 2 EXPLAIN Figure 59-1 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

Check for **ADDITIONAL VIDEOS & ANIMATIONS**  
@ <http://www.jameshalderman.com/>  
**WEB SITE IS CONSTANTLY UPDATED**

### Videos

**DEMONSTRATION:** Use a lab vehicle to 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 59-2 cruise control used on a Toyota/Lexus.
4. SLIDE 4 EXPLAIN Figure 59-3 Circuit diagram of a typical electronic cruise control system

**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?

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**DISCUSSION:** Have students talk about integration of cruise control system with **ECM**. Does this help with troubleshooting procedures?

5. **SLIDE 5 EXPLAIN Figure 59-4** A typical electronic throttle with the protective covers removed

**DISCUSSION:** discuss **Electronic Throttle Cruise Control**. What components are not needed with this system?

7. **SLIDE 7 EXPLAIN Figure 59-6** Radar cruise control uses sensors to keep the distance the same even when traffic slows ahead.

**DISCUSSION:** Have the students talk about the **Radar Cruise Control Systems**. How do these systems operate?

**Antitheft System (View) (Download)**  
**Oil Pressure Gauge (View) (Download)**

8. **SLIDE 8 EXPLAIN Figure 59-7** Most radar cruise control systems use radar, both long and short range. Some systems use optical or infrared cameras to detect objects.

**DISCUSSION:** Discuss why **Radar Cruise Control** does not normally interfere with a radar detector. What are the frequencies of long-range and short range radar?

9. **SLIDE 9 EXPLAIN Figure 59-8** 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. **Page 179**

10. **SLIDE 10 EXPLAIN Figure 59-9** A switch and relay control current through the heating grid of a rear window defogger.

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11. **SLIDE 11 EXPLAIN Figure 59-10** 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 the grid (on the inside of the vehicle), the voltmeter reading should steadily decrease as the meter approaches the ground side of the grid.

**DISCUSSION:** Have students talk about steps & tools required to test Rear Window Defroster grid. Will all gridlines have same voltage drop?

12. **SLIDE 12 EXPLAIN Figure 59-11** The typical repair material contains conductive silver-filled polymer, which dries in 10 minutes and is usable in 30 minutes.

**DEMONSTRATION:** Show students how to test a rear window defroster grid with DMM. Have them note the voltage drop from the power side to ground side of window.

**DEMONSTRATION:** Show students rear window defroster grid. Show how to repair a broken or damaged grid using repair material.

**DEMONSTRATION:** Show the glass from a heated mirror. Why doesn't heated mirror use grids similar to those in rear window glass?

**DISCUSSION:** Discuss heated mirrors. What are the purpose and function of these mirrors?

13. **SLIDE 13 EXPLAIN Figure 59-12** Typical HomeLink garage door opener buttons. Notice that three different units can be controlled from the vehicle using the HomeLink system.
14. **SLIDE 14 EXPLAIN Figure 59-13** 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 only ground for the entire system is located at the master control (driver's side) switch assembly.

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**DEMONSTRATION: Show students how Power Windows Operate**

15. **SLIDE 15 EXPLAIN Figure 59-14** 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.**

16. **SLIDE 16 EXPLAIN Figure 59-15** A master power window control panel with the buttons and the cover removed.

**DEMONSTRATION: Demonstrate procedure for checking master power window switch. Use a test light & DMM to test for current on proper wires when the switch is activated.**

**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. 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**

17. **SLIDE 17 EXPLAIN Figure 59-16** 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.

[Power Door Locks \(View\) \(Download\)](#)

[Power Seat Control \(View\) \(Download\)](#)

[Power Window Regulator \(View\) \(Download\)](#)

[Power Windows \(View\) \(Download\)](#)

18. **SLIDE 18 EXPLAIN Figure 59-17** 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

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current flows through the motor.

**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:** 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.

**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?

19. SLIDE 19 EXPLAIN Figure 59-18 A typical memory seat module showing the three-wire potentiometer used to determine seat position

**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?

20. SLIDE 20 EXPLAIN Figure 59-19 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.

**DISCUSSION:** Discuss electrically heated seats. How are seats heated? How is temperature regulated?

21. SLIDE 21 EXPLAIN Figure 59-20 Peltier effect device is capable of heating or cooling, depending on the polarity of the applied current.



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### **DISCUSSION: Discuss heated & cooled seats. What is a thermoelectric device (TED)? How are most seats equipped?**

22. **SLIDE 22 EXPLAIN Figure 59-21** 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 59-22** 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
24. **SLIDE 24 EXPLAIN Figure 59-23** Electrically folded mirror in the folded position
25. **SLIDE 25 EXPLAIN Figure 59-24** electric mirror control located on driver's side door panel on this Cadillac Escalade
26. **SLIDE 26 EXPLAIN Figure 59-25** 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.
27. **SLIDE 27 EXPLAIN Figure 59-26** A key fob remote with the cover removed showing the replaceable battery.
28. **SLIDE 28 EXPLAIN Figure 59-27** 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**

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"line of sight"?

**DISCUSSION:** Have students talk about **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 Figure 59-28** 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.

**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?

Most antitheft keys now have a transponder chip embedded in plastic head of key

30. **SLIDE 30 EXPLAIN Figure 59-29** Door switches, which complete the ground circuit with the door open, are a common source of high resistance.
31. **SLIDE 31 EXPLAIN Figure 59-30** special tool is needed to diagnose a GM VATS security system and special keys that contain a resistor pellet.
32. **SLIDE 32 EXPLAIN Figure 59-31** 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



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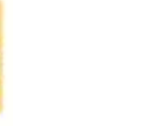
QUESTION



QUESTION



QUESTION



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### Antitheft System (View) (Download)

**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. (P-2 & P3) Page 180

33. **SLIDE 33 EXPLAIN** Figure 59-32 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. Page 177

34. **SLIDES 34-45 DOOR PANEL REMOVAL OPTIONAL**

**DEMONSTRATION:** Show students how to remove a door panel. Explain hidden fasteners.

**ON-VEHICLE NATEF TASK** Remove & reinstall door panel (P-1): Page 178

**Crossword Puzzle (Microsoft Word) (PDF)**  
**Word Search Puzzle (Microsoft Word) (PDF)**