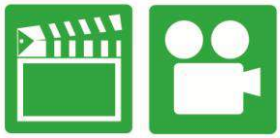
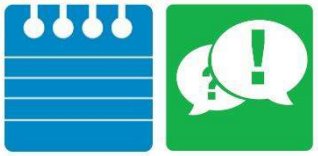
Automotive Electrical & Engine Performance 7/E

Chapter 23 Horn, Wiper, and Blower Motor 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. Describe how the horn operates, and diagnose faulty horn operation. 2. Explain the testing and diagnosis of windshield wipers and windshield washers. 3. Explain the operation and diagnosis of a blower motor. This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "G" (Horn and Wiper/Washer Diagnosis and Repair) and 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 23: Chapter Images

ICONS	Ch23 Horn, Wiper, & Blower Motor Circuits
	**1. SLIDE 1 CH23 HORN, WIPER, & BLOWER MOTOR 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 23-1** Two horns are used on this vehicle. Many vehicles use only one horn, often hidden underneath the vehicle
	**DEMONSTRATION: USING DIFFERENT TUNING FORKS, DEMO HOW DIFFERENT FREQUENCY VIBRATIONS PRODUCE DIFFERENT SOUND**
	**YOU CAN USE A TEST LIGHT TO DIAGNOSE CONTINUOUS HORN OPERATION COMPLAINTS. CONNECT TEST LIGHT IN PLACE OF HORN. LIGHT WILL GO OUT WHEN PROBLEM LOCATED.**
	3. **SLIDE 3 EXPLAIN Figure 23-2** A typical horn circuit. Note that the horn button completes the ground circuit for the relay.
	4. **SLIDE 4 EXPLAIN Figure 23-3** Horns typically mount to radiator core support or bracket at front of vehicle.
	**DEMONSTRATION: SHOW STUDENTS HOW TO USE A DMM TO TEST HORN RELAY**

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     	**HANDS-ON TASK: HAVE THE STUDENTS USE DMM TO TEST VARIOUS HORN SYSTEM COMPONENTS SUCH AS FUSES AND SWITCHES.** **HANDS-ON TASK: PROVIDE STUDENTS WITH A VEHICLE THAT HAS AN INOPERATIVE HORN. HAVE THEM USE TEST EQUIPMENT TO DIAGNOSE AND REPAIR THE HORN CIRCUIT. GRADE STUDENTS ON THEIR TROUBLESHOOTING TECHNIQUES AND ABILITY TO DIAGNOSE & REPAIR CIRCUIT** **ON-VEHICLE NATEF TASK: DIAGNOSE INCORRECT HORN OPERATION; PERFORM NECESSARY ACTION.** 5. **SLIDE 5 EXPLAIN Figure 23-4** A circuit diagram is necessary to troubleshoot a windshield wiper problem. 6. **SLIDE 6 EXPLAIN Figure 23-5** The motor and linkage bolt to the body and connect to the switch with a wiring harness 7. **SLIDE 7 EXPLAIN Figure 23-6** typical wiper motor with the housing cover removed. The motor itself has a worm gear on shaft that turns small intermediate gear, which then rotates gear and tube assembly, which rotates crank arm (not shown) that connects to wiper linkage. 8. **SLIDE 8 EXPLAIN Figure 23-7** wiring diagram of a 2-speed windshield wiper circuit using a three-brush, 2-speed motor. Dashed line for multifunction lever indicates that circuit shown is only part of total function of steering column lever. 9. **SLIDE 9 EXPLAIN Figure 23-8** A wiring diagram of a three-speed windshield wiper circuit using a two-brush motor, but both series-wound and shunt field coil. 10. **SLIDE 10 EXPLAIN Figure 23-9** A variable pulse rate windshield wiper circuit. Notice that the wiring travels from the passenger compartment through pass-through grommets to the underhood area. **DEMONSTRATION: SHOW STUDENTS INNER WORKINGS OF AN ELECTRIC WIPER MOTOR AND HOW TO INSPECT THE MOTOR FOR DEFECTS**

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	**DISCUSSION:** DISCUSS DIFFERENCE BETWEEN SERIES-WOUND FIELD & SHUNT FIELD MOTORS. HOW ARE ELECTRICAL CONNECTIONS MADE TO EACH?
	**DEMONSTRATION:** SHOW STUDENTS HOW WIPER/WASHER OPERATES
	**DISCUSSION:** DISCUSS WHAT CONTROLS ACTUAL OPERATION OF THE WIPER. WHAT ELSE COULD COME ON WHEN THE WIPERS ARE ON?
	**DISCUSSION:** DISCUSS HOW WIPER MOTORS MAY BE MADE TO OPERATE AT MORE THAN ONE SPEED. ASK STUDENTS TO EXPLAIN LOW &HIGH-SPEED OPERATION.
	**DISCUSSION:** DISCUSS DIFFERENT WINDSHIELD WIPER MODES OF OPERATION. WHY ARE THERE VARIATIONS AMONG WIPER SYSTEMS AND CIRCUITS?
	11. **SLIDE 11 EXPLAIN Figure 23-10** wiper motor connector pin chart.
	**DISCUSS FREQUENTLY ASKED QUESTION & NOTE**
	**DEMONSTRATION:** SHOW STUDENTS HOW TO USE A WIRING DIAGRAM TO TRACE CURRENT FLOW THROUGH A TYPICAL WIPER CIRCUIT.
	**DEMONSTRATION:** SHOW HOW TO TRACE CURRENT FLOW THROUGH WINDSHIELD WIPER COMBINATION/MULTIFUNCTION SWITCHES
	**HANDS-ON TASK:** HAVE STUDENTS DOWNLOAD WIPER SYSTEM WIRING DIAGRAM AND USING A HIGHLIGHTER TRACE THE CURRENT FLOW.
	**DEMONSTRATION:** SHOW STUDENTS HOW TO CORRECTLY REMOVE TRIM PANELS TO GAIN ACCESS TO REAR WIPER MOTORS WITHOUT DAMAGING THE MOUNTING CLIPS/HARDWARE.

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	**HANDS-ON TASK: HAVE STUDENTS GAIN ACCESS TO WIPER LINKAGE AND INSPECT IT FOR PROPER OPERATION.**
	**DISCUSSION: DISCUSS HOW TO DETERMINE WHETHER INOPERATIVE WIPER CONCERNS ARE CAUSED BY MECHANICAL OR ELECTRICAL. WHAT IS INDICATED BY DETERMINING WHETHER VOLTAGE IS AVAILABLE OR NOT?**
	12. **SLIDE 12 EXPLAIN Figure 23-11** wiper motor and linkage mount under the cowl panel on many vehicles. 13. **SLIDE 13 EXPLAIN Figure 23-12** single wiper arm mounts directly to motor on most rear wiper applications 14. **SLIDE 14 EXPLAIN FIGURE 23–13** Circuit diagram of a rheostat-controlled, electronically timed interval wiper
	**EXPLAIN TECH TIP**
	15. **SLIDE 15 EXPLAIN FIGURE 23-14** Disconnect the hose at the pump and operate the switch to check a washer pump. 16. **SLIDE 16 EXPLAIN FIGURE 23-15** Washer pumps usually install into the reservoir and are held in place with a retaining ring
	**DEMONSTRATION: SHOW STUDENTS HOW TO INSPECT WASHER SYSTEMS FOR LINE- AND SQUIRT-NOZZLE BLOCKAGE.**
	**YOU CAN ADD A LITTLE WASHER FLUID TO A COMPLETELY EMPTY RESERVOIR & CHECK IT FOR LEAKS BEFORE COMPLETELY FILLING IT. THIS WILL PREVENT WASTING WASHER FLUID ON SYSTEMS THAT HAVE A LEAKING RESERVOIR.**
	**DISCUSSION: DISCUSS THE WINDSHIELD WASHER RESERVOIR. HOW CAN YOU TELL THE WINDSHIELD WASHER & COOLANT OVERFLOW RESERVOIRS APART?**
	**DISCUSSION: DISCUSS USING WINDSHIELD WASHER FLUID INSTEAD OF REGULAR WATER. WHAT CAN HAPPEN IN FREEZING WEATHER IF PURE WATER IS USED?**

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	17. **SLIDE 17 EXPLAIN** Rain Sense Wiper System & **EXPLAIN Figure 23-16** A typical rain sensing module located on the inside of the windshield near the inside rearview mirror. 18. **SLIDE 18 EXPLAIN Figure 23-17** The electronics in the rain sense wiper module can detect the presence of rain drops under various lighting conditions
	**Rain Sensing**
	**DISCUSSION: DISCUSS HOW RAIN SENSE MODULE WORKS. WHAT HAPPENS WHEN WIPER SWITCH IS LEFT ON SENSE POSITION ALL OF TIME?**
	**DEMONSTRATION: SHOW HOW TO CONNECT A SCAN TOOL TO RETRIEVE INFORMATION REGARDING SYSTEMS CONTROLLED BY BCM. EXPLAIN HOW RAIN SENSE MODULE USES DIODES & PHOTOCELLS TO MEASURE MOISTURE LEVELS**
	**DISCUSSION: DISCUSS DIFFERENT METHODS USED TO CONTROL INTERMITTENT (PULSE) WIPER OPERATION. WHAT DOES THE VARIABLE RESISTOR, OR RHEOSTAT, CONTROL?**
	**HANDS-ON TASK: EXPLAIN HOW WIPER MOTORS MAY BE MADE TO OPERATE AT MORE THAN ONE SPEED.**
	**ON-VEHICLE NATEF TASK: DIAGNOSE INCORRECT WIPER OPERATION; PERFORM NECESSARY ACTION**
	19. **SLIDE 19 EXPLAIN Figure 23-18** A squirrel cage blower motor. A replacement blower motor usually does not come equipped with the squirrel cage blower, so it has to be switched from the old motor. 20. **SLIDE 20 EXPLAIN Figure 23-19** typical blower motor circuit with 4 speeds. 3 lowest fan speeds (low, medium-low, and medium-high) use blower motor resistors to drop voltage to motor and reduce current to the motor. On high, resistors are bypassed. The “high” position on fan switch energizes a relay, which supplies current for blower on high through a fusible link.

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	**DISCUSSION:** HAVE THE STUDENTS DISCUSS METHODS USED TO CONTROL BLOWER MOTOR SPEED. WHAT USUALLY CAUSES FAILURE OF HIGH-SPEED FUSE ON RELAY?
	**DEMONSTRATION:** SHOW THE STUDENTS HOW TO PROPERLY TEST BLOWER MOTOR RESISTOR PACKS USING A DMM
	**HANDS-ON TASK:** PROVIDE THE STUDENTS WITH A BLOWER MOTOR CIRCUIT COMPLAINT AND A WIRING DIAGRAM OF THE CIRCUIT. HAVE THEM DETERMINE POSSIBLE CAUSES, USING ONLY THEIR KNOWLEDGE OF CIRCUIT OPERATION AND THE WIRING DIAGRAM. GRADE STUDENTS ON THEIR ABILITY TO NARROW DOWN POSSIBLE CAUSES WITHOUT PERFORMING CIRCUIT TESTS.
	21. **SLIDE 21 EXPLAIN Figure 23-20** A typical blower motor resistor pack used to control blower motor speed. Some blower motor resistors are flat and look like a credit card and are called "credit card resistors". 22. **SLIDE 22 EXPLAIN Figure 23-21** brushless DC motor that uses the body computer to control the speed. 23. **SLIDE 23 EXPLAIN Figure 23-22** Using a mini AC/DC clamp-on multimeter to measure the current draw of a blower motor.
	**EXPLAIN TECH TIP**
	**DEMONSTRATION:** SHOW THE STUDENTS HOW TO USE A VOLTMETER TO MEASURE VOLTAGE DROP THROUGHOUT A BLOWER MOTOR CIRCUIT.
	**HANDS-ON TASK:** HAVE THE STUDENTS LOCATE, INSPECT, AND TEST A BLOWER MOTOR USING COMMON TEST EQUIPMENT.
	**ON-VEHICLE NATEF TASK:** DIAGNOSE STATIC AND WEAK OR NO RECEPTION; DETERMINE NECESSARY ACTION.