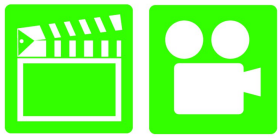
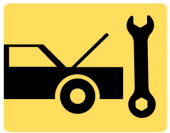
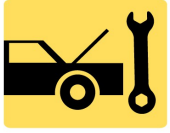
Advanced Automotive Electricity & Electronics

Chapter 18 Horn, Wiper, and Blower Motor Circuits

Opening Your Class

KEY ELEMENT	EXAMPLES
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. 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 "A" (General Electrical/Electronic System Diagnosis).**
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	Ch18 Horn, Wiper, & Blower Motor Circuits
	**1. SLIDE 1 CH18 HORN, WIPER, & BLOWER MOTOR CIRCUITS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**2. SLIDE 2 EXPLAIN Horns** **3. SLIDE 3 EXPLAIN Figure 18-1** Two horns are used on this vehicle. Many vehicles use only one horn, often hidden underneath the vehicle
	**DEMONSTRATION: USING DIFFERENT TUNING FORKS, DEMONSTRATE 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.**
	**4. SLIDE 4 EXPLAIN Figure 18-2** A typical horn circuit. Note that horn button completes ground circuit for relay. **5. SLIDE 5 EXPLAIN** Horns **6. SLIDE 6 EXPLAIN CAUTION** **7. SLIDE 7 EXPLAIN** Horns **8. SLIDE 8 EXPLAIN Figure 18-3** Horns typically mount to radiator core support or bracket at front of vehicle.
	**DEMONSTRATION: SHOW HOW TO USE DMM TO TEST HORN RELAY**
	**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**

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	**ON-VEHICLE NATEF TASK: DIAGNOSE INCORRECT HORN OPERATION; PERFORM NECESSARY ACTION.**
	9. **SLIDES 9-10 EXPLAIN** Windshield Wiper and Washer System 11. **SLIDE 11 EXPLAIN Figure 18-4** A circuit diagram is necessary to troubleshoot a windshield wiper problem. 12. **SLIDE 12 EXPLAIN Figure 18-5** The motor and linkage bolt to the body and connect to the switch with a wiring harness
	13. **SLIDE 13 EXPLAIN Figure 18-6** 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. 14. **SLIDE 14 EXPLAIN Figure 18-7** 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. 15. **SLIDE 15 EXPLAIN Figure 18-8** A wiring diagram of a three-speed windshield wiper circuit using a two-brush motor, but both series-wound and shunt field coil. 16. **SLIDE 16 EXPLAIN Figure 18-9** 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**
	**DISCUSSION: DISCUSS DIFFERENCE BETWEEN SERIES-WOUND FIELD & SHUNT FIELD MOTORS. HOW ARE ELECTRICAL CONNECTIONS MADE TO EACH?**
	**DEMONSTRATION: SHOW STUDENTS HOW WIPER/WASHER OPERATES**

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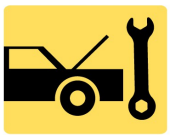
	**DISCUSSION:** DISCUSS WHAT CONTROLS ACTUAL OPERATION OF THE WIPER. WHAT ELSE COULD COME ON WHEN THE WIPERS ARE ON?
	**DISCUSSION:** DISCUSS HOW WIPER MOTORS MAY BE MADE TO OPERATE AT MORE THAN ONE SPEED. ASK STUDENTS TO EXPLAIN LOW &HIGH-SPEED OPERATION.
	**DISCUSSION:** DISCUSS DIFFERENT WINDSHIELD WIPER MODES OF OPERATION. WHY ARE THERE VARIATIONS AMONG WIPER SYSTEMS AND CIRCUITS?
	17. **SLIDE 17** EXPLAIN **Figure 18-10** wiper motor connector pin chart. 18. **SLIDE 18** EXPLAIN Windshield Wiper and Washer System 19. **SLIDE 19** EXPLAIN NOTE 20. **SLIDE 20** EXPLAIN Windshield Wiper and Washer System
	21. **SLIDE 21 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE**
	22. **SLIDE 22** EXPLAIN **Figure 18-11** wiper motor and linkage mount under the cowl panel on many vehicles. 23. **SLIDE 23** EXPLAIN **Figure 18-12** single wiper arm mounts directly to motor on most rear wiper applications
	**DEMONSTRATION:** SHOW STUDENTS HOW TO USE A WIRING DIAGRAM TO TRACE CURRENT FLOW THROUGH A TYPICAL WIPER CIRCUIT.
	**DEMONSTRATION:** SHOW STUDENTS HOW TO TRACE CURRENT FLOW THROUGH WINDSHIELD WIPER COMBINATION/MULTIFUNCTION SWITCHES
	**HANDS-ON TASK:** HAVE STUDENTS DOWNLOAD A WIPER SYSTEM WIRING DIAGRAM AND USING A HIGHLIGHTER TRACE THE CURRENT FLOW.

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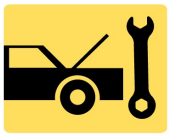
	**DEMONSTRATION:** SHOW STUDENTS HOW TO CORRECTLY REMOVE TRIM PANELS TO GAIN ACCESS TO REAR WIPER MOTORS WITHOUT DAMAGING THE MOUNTING CLIPS/HARDWARE.
	**HANDS-ON TASK:** HAVE STUDENTS GAIN ACCESS TO WIPER LINKAGE USED TO LUBE COMPONENTS AND INSPECT IT FOR PROPER OPERATION.
	**DISCUSSION:** DISCUSS HOW TO DETERMINE WHETHER INOPERATIVE WIPER CONCERNS ARE CAUSED BY MECHANICAL OR ELECTRICAL. WHAT IS INDICATED BY DETERMINING WHETHER VOLTAGE IS AVAILABLE OR NOT?
	**DEMONSTRATION:** SHOW THE STUDENTS 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 ON WINDSHIELD.
	**DISCUSSION:** DISCUSS DIFFERENT METHODS USED TO CONTROL INTERMITTENT (PULSE) WIPER OPERATION. WHAT DOES THE VARIABLE RESISTOR, OR RHEOSTAT, CONTROL?
	24. **SLIDE 24** EXPLAIN **FIGURE 18–13** Circuit diagram of a rheostat-controlled, electronically timed interval wiper
	25. **SLIDE 25** EXPLAIN Windshield Wiper and Washer System
	26. **SLIDE 26** EXPLAIN TECH TIP
	27. **SLIDE 27** EXPLAIN **Figure 18-14** Disconnect the hose at the pump and operate the switch to check a washer pump.
	28. **SLIDE 28** EXPLAIN **Figure 18-15** 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.

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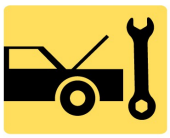
	**YOU CAN ADD A LITTLE WASHER FLUID TO A COMPLETELY EMPTY RESERVOIR & CHECK IT FOR LEAKS BEFORE COMPLETELY FILLING IT. THIS WILL PREVENT WASTING WASHER FLUID ON SYSTEMS THAT HAVE A LEAKING RESERVOIR.**
	**DISCUSSION: DISCUSS THE WINDSHIELD WASHER RESERVOIR. HOW CAN YOU TELL THE WINDSHIELD WASHER & COOLANT OVERFLOW RESERVOIRS APART?**
	**DISCUSSION: DISCUSS USING WINDSHIELD WASHER FLUID INSTEAD OF REGULAR WATER. WHAT CAN HAPPEN IN FREEZING WEATHER IF PURE WATER IS USED?**
	29. **SLIDE 29** EXPLAIN Rain Sense Wiper System 30. **SLIDE 30** EXPLAIN **Figure 18-16** A typical rain sensing module located on the inside of the windshield near the inside rearview mirror. 31. **SLIDE 31** EXPLAIN **Figure 18-17** 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?**
	**HANDS-ON TASK: HAVE THE STUDENTS EXPLAIN HOW WIPER MOTORS MAY BE MADE TO OPERATE AT MORE THAN ONE SPEED. GRADE STUDENTS ON THEIR ABILITY TO EXPLAIN LOW & HIGH-SPEED MOTOR OPERATION.**
	**ON-VEHICLE NATEF TASK: DIAGNOSE INCORRECT WIPER OPERATION; PERFORM NECESSARY ACTION**
	32. **SLIDE 32** EXPLAIN **Blower Motor** 33. **SLIDE 33** EXPLAIN **Figure 18-18** 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.

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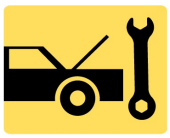
	34. **SLIDE 34** EXPLAIN **Figure 18-19** A typical blower motor circuit with four speeds. The three lowest fan speeds (low, medium-low, and medium-high) use the blower motor resistors to drop the voltage to the motor and reduce current to the motor. On high, the resistors are bypassed. The "high" position on the fan switch energizes a relay, which supplies the current for the blower on high through a fusible link.
	**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.**
	35. **SLIDE 35** EXPLAIN **Figure 18-20** 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".
	36. **SLIDE 36** EXPLAIN **Figure 18-21** brushless DC motor that uses the body computer to control the speed.
	37. **SLIDE 37** EXPLAIN **Blower Motor**
	38. **SLIDE 38** EXPLAIN **TECH TIP**
	39. **SLIDE 39** EXPLAIN **NOTE**
	40. **SLIDE 40** EXPLAIN **Figure 18-22** Using a mini AC/DC clamp-on multimeter to measure the current draw of a blower motor.
	**DEMONSTRATION: SHOW HOW TO USE DMM TO MEASURE VOLTAGE DROP THROUGHOUT A BLOWER MOTOR CIRCUIT.**

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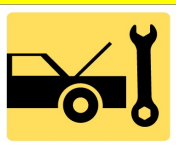	**HANDS-ON TASK:** HAVE THE STUDENTS LOCATE, INSPECT, AND TEST A BLOWER MOTOR USING COMMON TEST EQUIPMENT.
	41. **SLIDES 41-42 EXPLAIN Electrical Accessory Symptom Guide**
	**ON-VEHICLE NATEF TASK:** DIAGNOSE STATIC AND WEAK OR NO RECEPTION; DETERMINE NECESSARY ACTION.