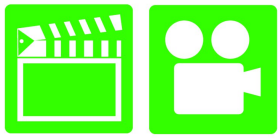
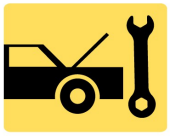
A6 Electricity & Electronics 4th Edition

Chapter 20 Cranking System Diagnosis & Service

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **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. Discuss how to perform a voltage drop test on the cranking circuit. 2. Perform control circuit testing and starter amperage test, and determine necessary action. 3. Explain starter motor service and bench testing. **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	Ch20 Cranking System Diagnosis & Service
	**1. SLIDE 1 CH20 CRANKING SYSTEM DIAGNOSIS & SERVICE**
	**2. SLIDES 2-3 EXPLAIN OBJECTIVES** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**Starter Circuit Voltage Drop Tests** **Starter Circuit Voltage Drop Tests 2**
	**4. SLIDES 4-5 EXPLAIN**: STARTING SYSTEM TROUBLESHOOTING PROCEDURE
	6. SLIDE 6 EXPLAIN Figure 20-1 theft deterrent indicator lamp of the dash. A flashing lamp usually indicates a fault in the system, and the engine may not start.
	**DISCUSSION: DISCUSS HOW BATTERY CONDITION IS CRITICAL TO THE FUNCTION OF ALL ELECTRICAL AND ELECTRONIC SYSTEMS IN THE VEHICLE. AFTER VERIFYING A CUSTOMER'S CONCERN ABOUT A FAULT IN THE CRANKING SYSTEM, WHAT SHOULD BE CHECKED?**
	**DEMONSTRATION: SHOW HOW TO USE SERVICE INFORMATION TO LOOK UP STARTING SYSTEM CONTROL CIRCUIT. HAVE THEM HELP YOU IDENTIFY DIFFERENT COMPONENTS OF STARTING SYSTEM CONTROL CIRCUIT. FIGURE 20-1**
	**HANDS-ON TASK: HAVE STUDENTS PRINT OUT A SCHEMATIC OF STARTER CIRCUIT FOR VEHICLE THEY WILL BE WORKING ON AND POINT OUT TEST POINTS. DISCUSS WITH THEM THAT STARTER CIRCUITS & COMPONENTS CAN VARY GREATLY FROM VEHICLE TO VEHICLE, & FROM OEM TO OEM.**
	**7. SLIDE 7 EXPLAIN**: VOLTAGE DROP TESTING
	8. SLIDE 8 EXPLAIN Figure 20-2 Voltmeter hookups for voltage drop testing of a solenoid-type cranking circuit.
	9. SLIDE 9 EXPLAIN Figure 20-3 Voltmeter hookups for voltage drop testing of a Ford cranking circuit.

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	10. **SLIDE 10 EXPLAIN Figure 20-4** To test the voltage drop of the battery cable connection, place one voltmeter lead on the battery terminal and the other voltmeter lead on the cable end and crank the engine. The voltmeter will read the difference in voltage between the two leads, which should not exceed 0.20 volt (200 mV).
	**DEMONSTRATION: SHOW HOW TO PERFORM A VOLTAGE DROP TEST ON STARTER MOTOR CIRCUIT OF LIVE VEHICLE. EMPHASIZE DISABLING THE VEHICLE. ALSO, EMPHASIZE HOW NOT TO ACCIDENTALLY TURN WRENCHES, JEWELRY, & OTHER METAL OBJECTS INTO ARC WELDERS.**
	**DEMONSTRATION: USE A JUMP BOX & REMOTE START SWITCH TO SET UP A STARTER ON A BENCH. PLACE ALLIGATOR CLIPS ON ENDS OF DMM LEADS TO PERFORM A VOLTAGE DROP TEST ON THE STARTER CONTROL CIRCUIT. USE A BUGGED WIRE WITH A SPLICED-IN RESISTOR TO SHOW WHAT UNWANTED RESISTANCE IN SIGNAL SIDE OF CIRCUIT CAN DO TO OVERALL CIRCUIT FUNCTION.**
	11. **SLIDE 11 EXPLAIN:** CONTROL CIRCUIT TESTING
	12. **SLIDE 12 EXPLAIN**: STARTER AMPERAGE TEST 13. **SLIDE 13 EXPLAIN Figure 20-5** A starter amperage tester uses an amp probe around the positive or negative battery cables
	**DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE USE OF NONINVASIVE TEST PROCEDURES; FOR INSTANCE, USING A SCAN TOOL TO CHECK FOR PROPER STARTER OPERATION BY COMMANDING THE STARTER RELAY ON AND OFF. HOW CAN NONINVASIVE TEST PROCEDURES SAVE TIME AND PREVENT UNNECESSARY DAMAGE TO WIRING AND COMPONENTS?**
	**DEMONSTRATION: SHOW SCAN TOOL DIAGNOSIS PROCESS FROM THE ABOVE DISCUSSION.**
	**DISCUSSION: DISCUSS THE WAYS CURRENT CAN BE MEASURED IN A CIRCUIT, SUCH AS USING A DMM IN SERIES SET ON AMPS, USING OHM'S LAW TO CALCULATE CURRENT BASED ON VOLTAGE &**

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	**RESISTANCE, OR MEASURING MAGNETIC FIELD SURROUNDING A CIRCUIT BY USING AN INDUCTIVE PICKUP. WHEN SHOULD EACH TYPE OF MEASUREMENT BE USED?** **SHOW VIDEO: CHECKING STARTER CURRENT DRAW VIDEO** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20STARTER%20CURRENT%20DRAW&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T4.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T4.XML
	**14. SLIDE 14 EXPLAIN**: STARTER REMOVAL **15. SLIDE 15 EXPLAIN Figure 20-6** The starter is located under the intake manifold on this Cadillac Northstar engine
	**16. SLIDE 16 EXPLAIN**: STARTER MOTOR SERVICE **17. SLIDE 17 EXPLAIN Figure 20-7** exploded view of a typical solenoid-operated starter. **18. SLIDE 18 EXPLAIN Figure 20-8** GM solenoid ohmmeter check. The reading between 1 and 3 (S terminal and ground) should be 0.4 to 0.6 ohm (hold-in winding). The reading between 1 and 2 (S terminal and M terminal) should be 0.2 to 0.4 ohm (pull-in winding). **19. SLIDE 19 EXPLAIN Starter Motor Service** **20. SLIDE 20 EXPLAIN Figure 20-9** Measuring an armature shaft for runout using dial indicator & V-blocks. **21. SLIDE 21 EXPLAIN Figure 20-10** Replacement starter brushes should be installed so the beveled edge matches the rotation of the commutator.
	**DEMONSTRATION: SHOW HOW TO BENCH-TEST A STARTER. EMPHASIZE THAT THE REMOTE STARTER CABLES SHOULD NOT SMOKE DURING THIS TEST.**
	**22. SLIDE 22 EXPLAIN**: STARTER INSTALLATION
	**23. SLIDE 23 EXPLAIN**: STARTER DRIVE-TO-FLYWHEEL CLEARANCE **24. SLIDE 24 EXPLAIN Figure 20-11** A shim (or half shim) may be needed to provide the proper clearance between the flywheel teeth of the engine & pinion teeth

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	**SHOW VIDEO: MEASURING STARTER CIRCUIT VOLTAGE DROP** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=MEASURING%20STARTER%20CIRCUIT%20VOLTAGE%20DROP&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T5.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T5.XML
	25. SLIDE 25 EXPLAIN SUMMARY
	**DEMONSTRATION: SHOW HOW TO PROPERLY HOOK UP AND PERFORM A STARTER CURRENT DRAW TEST USING AN AVR TESTER OR SIMILAR EQUIPMENT. EXPLAIN HOW AVR CAN BE USED TO PERFORM A VARIETY OF STARTING & CHARGING TESTS IN A SHORT AMOUNT OF TIME.**
	**NATEF TASK SHEET: REMOVE AND INSTALL STARTER IN A VEHICLE.**
	**NATEF TASK SHEET: INSPECT AND TEST STARTER RELAYS AND SOLENOIDS; DETERMINE NECESSARY ACTION.** **INSPECT AND TEST SWITCHES, CONNECTORS, AND WIRES OF STARTER CONTROL CIRCUITS; PERFORM NECESSARY ACTION.**
	**NATEF TASK SHEET: PERFORM STARTER CURRENT DRAW TESTS; DETERMINE NECESSARY ACTION.** **PERFORM STARTER CIRCUIT VOLTAGE DROP TESTS; DETERMINE NECESSARY ACTION.** **DIFFERENTIATE BETWEEN ELECTRICAL AND ENGINE MECHANICAL PROBLEMS THAT CAUSE SLOW-CRANK OR NO-CRANK CONDITION**