











Advanced Automotive Electricity & Electronics

Chapter 10 Cranking System Diagnosis & Service

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. <ol style="list-style-type: none">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 <i>WELCOME</i> , 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.

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       <p>QUESTION</p>  <p>DEMO</p>  	<p>1. SLIDE 1 CH20 CRANKING SYSTEM DIAGNOSIS & SERVICE</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p><u>Starter Circuit Voltage Drop Tests</u> <u>Starter Circuit Voltage Drop Tests 2</u></p> <p>2. SLIDE 2 EXPLAIN: STARTING SYSTEM TROUBLESHOOTING PROCEDURE</p> <p>3. SLIDE 3 EXPLAIN Figure 10-1 theft deterrent indicator lamp of the dash. A flashing lamp usually indicates a fault in the system, and the engine may not start.</p> <p><u>DISCUSSION:</u> 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?</p> <p><u>DEMONSTRATION:</u> 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. <u>FIGURE 10-1</u></p> <p><u>HANDS-ON TASK:</u> 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.</p> <p>4. SLIDE 4 EXPLAIN: VOLTAGE DROP TESTING</p> <p>5. SLIDE 5 EXPLAIN Figure 10-2 Voltmeter hookups for voltage drop testing of a solenoid-type cranking circuit.</p> <p>6. SLIDE 6 EXPLAIN Figure 10-3 Voltmeter hookups for voltage drop testing of a Ford cranking circuit.</p>

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7. **SLIDE 7 EXPLAIN Figure 10-4** 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).

8. **SLIDES 8-9 EXPLAIN TECH TIPS & NOTE ON SLIDE 9**

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.

10. **SLIDE 10 EXPLAIN:** VOLTAGE DROP TESTING

11. **SLIDE 11 EXPLAIN NOTE**

12. **SLIDE 12 EXPLAIN:** VOLTAGE DROP TESTING

13. **SLIDE 13 EXPLAIN:** CONTROL CIRCUIT TESTING

14. **SLIDE 14 EXPLAIN TECH TIP**

15. **SLIDE 15 EXPLAIN:** STARTER AMPERAGE TEST

16. **SLIDE 16 EXPLAIN Figure 10-5** 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?

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DEMO



DEMO



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 & 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_MYLIBS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20STARTER%20CURRENT%20DRAW&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T4.MOV&CAPTION=CHET/CHET_MYLIBS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T4.XML](http://media.pearsoncmg.com/ph/chet/chet_mylibs/akamai/template/video640x480.php?title=checking%20starter%20current%20draw&clip=pandc/chet/2012/automotive/starting_charging_elect/a6t4.mov&caption=chet/chet_mylibs/akamai/2012/automotive/starting_charging_elect/xml/a6t4.xml)

17. SLIDE 17 **EXPLAIN**: STARTER REMOVAL
18. SLIDE 18 **EXPLAIN** NOTE
19. SLIDE 19 **EXPLAIN** Figure 10-6 The starter is located under the intake manifold on this Cadillac Northstar engine
20. SLIDE 20 **EXPLAIN**: STARTER MOTOR SERVICE
21. SLIDE 21 **EXPLAIN** Figure 10-7 exploded view of a typical solenoid-operated starter.
22. SLIDE 22 **EXPLAIN** Figure 10-8 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).
23. SLIDE 23 **EXPLAIN** Figure 10-9 Measuring an armature shaft for runout using dial indicator & V-blocks.
24. SLIDE 24 **EXPLAIN** Figure 10-10 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.

25. SLIDE 25 **EXPLAIN**: STARTER INSTALLATION
26. SLIDE 26 **EXPLAIN** NOTE

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27. SLIDES 27-28 **EXPLAIN** Bench Testing & Starter Installation

29. SLIDE 29 **EXPLAIN** NOTE

30. SLIDE 30 **EXPLAIN** Bench Testing & Starter Installation

31. SLIDE 31 **EXPLAIN** CAUTION

32. SLIDE 32 **EXPLAIN**: STARTER DRIVE-TO-FLYWHEEL CLEARANCE

33. SLIDE 33 **EXPLAIN** Figure 10-11 A shim (or half shim) may be needed to provide the proper clearance between the flywheel teeth of the engine & pinion teeth



SHOW VIDEO: MEASURING STARTER CIRCUIT VOLTAGE DROP

[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLIBS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=MEASURING%20STARTER%20CIRCUIT%20VOLTAGE%20DROP&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T5.MOV&CAPTION=CHET/CHET_MYLIBS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T5.XML](http://media.pearsoncmg.com/ph/chet/chet_mylibs/akamai/template/video640x480.php?title=measuring%20starter%20circuit%20voltage%20drop&clip=pandc/chet/2012/automotive/starting_charging_elect/a6t5.mov&caption=chet/mylibs/akamai/2012/automotive/starting_charging_elect/xml/a6t5.xml)



34. SLIDE 34 **EXPLAIN** TECH TIP



35. SLIDE 35 **EXPLAIN** Starting System Symptom Guide



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.

35. SLIDE 35 **EXPLAIN** Starting System Symptom Guide

36. SLIDES 36-58 **EXPLAIN** STARTER OVERHAUL





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.

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 	<p>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</p>