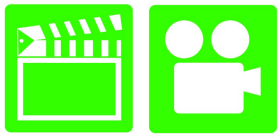
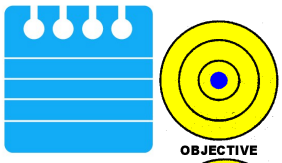
A8 Engine Performance 4th Edition

Chapter 15 Advanced Starting and Charging Systems Diagnosis

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive 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. Prepare for Engine repair (A1) ASE certification test content area "D" (Lubrication and Cooling Systems Diagnosis and Repair). 2. Describe how coolant flows through an engine. 3. Discuss the operation of the thermostat. 4. Explain the purpose and function of the radiator pressure cap. 5. Describe the various types of antifreeze and how to recycle and discard used coolant. 6. Discuss how to diagnose cooling system problems.
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	Ch15 Adv Starting & Charging Sys Diagnosis
	**1. SLIDE 1 CH15 Advanced Starting and Charging Systems Diagnosis**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED**
	**POWER POINTS DONE BY INDIVIDUAL LEARNING OBJECTIVES, SO THERE IS POWER POINT FILE FOR EACH LEARNING OBJECTIVE**
	**2. SLIDE 2 EXPLAIN OBJECTIVE CH15 AEP_LO1** **3. SLIDE 3 EXPLAIN Purpose and Function**
	**2. SLIDE 2 EXPLAIN OBJECTIVE CH15 AEP_LO2** **3. SLIDE 3 EXPLAIN BATTERY RATINGS**
	**DEMONSTRATION: USING A VOLTMETER, DEMONSTRATE HOW TO FIND CORRODED AND/OR POOR CONNECTIONS BY MEASURING VOLTAGE DROP**
	**DEMONSTRATION: SHOW PROCEDURE FOR REMOVING SURFACE CHARGE**
	**SHOW VIDEO: BATTERY REMOVAL VIDEO** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=BATTERY%20REMOVAL&CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/CLIP15BATTREMOV1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/XML/CLIP15BATTREMOV1.XML
	**DEMONSTRATION: DEMO OPEN CIRCUIT VOLTAGE (OCV) TEST FIGURES 15-4 & 15-5**
	**DEMONSTRATION: SHOW STUDENTS HOW TO LOAD TEST BATTERY. TYPICALLY DONE AT ½ CCR.**
	**VIDEO: BATTERY LOAD TESTING** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=LOAD%20TESTING%20THE%20BATTERY&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T3.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T3.XML

ICONS	Ch15 Adv Starting & Charging Sys Diagnosis
QUESTION	**DISCUSSION: HAVE STUDENTS DISCUSS DIFFERENCE BETWEEN BATTERY LOAD TESTING AND CONDUCTANCE TESTING. WHAT ARE PROS & CONS OF EACH?**
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO PROPERLY TEST A BATTERY USING CONDUCTANCE TESTER FIGURE 15-9 CONDUCTANCE TESTING**
DEMO	**DEMONSTRATION: SHOW HOW TO PROPERLY DISABLE HIGH-VOLTAGE BATTERY TO DECREASE RISK OF INJURY/DEATH WHEN WORKING AROUND HIGH VOLTAGE SYSTEMS.**
	Jump Box Usage **Jump Starting Hybrids** **Jumper Cable Usage**
OBJECTIVE	2. SLIDE 2 EXPLAIN **OBJECTIVE CH15 AEP_LO3** 3. SLIDE 3-4 EXPLAIN **Battery Electrical Drain Test**
	PARASITIC DRAW TEST VIDEO HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=MEASURING%20PARASITIC%20DRAW&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T1.XML
	5. **SLIDE 5 EXPLAIN FIGURE 15–13** (a) Memory saver. The part numbers represent components from Radio Shack®. (b) A schematic drawing of same memory saver
DEMO	**DEMONSTRATION: SHOW HOW TO USE A MEMORY SAVER TO RETAIN RADIO MEMORY. FIGURE 15-13**
	6. **SLIDES 6-7 EXPLAIN** BATTERY ELECTRICAL DRAIN TESTING USING AN AMMETER 8. **SLIDE 8 EXPLAIN Figure 15-14** This mini clamp-on digital multimeter is being used to measure the amount of battery electrical drain that is present. In this case, a reading of 20 Ma (displayed on the meter as 00.02 A) is within the normal range of 20 to 30 Ma. Be sure to clamp around all of the positive battery cable or all of negative battery cable, whichever is easiest to get clamp around. 9. **SLIDES 9-10 EXPLAIN** PROCEDURE FOR BATTERY ELECTRICAL DRAIN TEST

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	11. **SLIDE 11 EXPLAIN Figure 15-15** After connecting shut-off tool, start engine and operate all accessories. Stop engine and turn off everything. Connect ammeter across shut-off switch in parallel. Wait 20 minutes. This time allows all electronic circuits to "time out" or shut down. Open switch—all current now will flow through te ammeter. Reading > specified (>50 Ma, or 0.05 A) indicates a problem that should be corrected.
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO PERFORM A PARASITIC DRAW TEST USING AN AMMETER WITH AN INDUCTIVE LEAD.**
DEMO	**DEMONSTRATION: SHOW THE STUDENTS HOW TO PERFORM A PARASITIC DRAW TEST USING AN AMMETER HOOKED UP IN SERIES.**
	12. **SLIDE 12 EXPLAIN Figure 15-16** battery was replaced in this Acura and the radio displayed "code" when the replacement battery was installed. Thankfully, the owner had the five-digit code required to unlock the radio.
QUESTION	**DISCUSSION: DISCUSS WHY VEHICLE MANUFACTURERS USE RADIOS THAT REQUIRE CODES AFTER THE BATTERY HAS BEEN DISCONNECTED. WHAT SHOULD BE CHECKED BEFORE DISCONNECTING BATTERY?**
	13. **SLIDE 13 EXPLAIN FINDING SOURCE OF DRAIN**
	14. **SLIDES 14-15 EXPLAIN WHAT TO DO IF A BATTERY DRAIN STILL EXISTS AFTER ALL THE FUSES ARE DISCONNECTED**
We Support NATEF	**NATEF TASK SHEET: MEASURE AND DIAGNOSE THE CAUSE (S) OF EXCESSIVE PARASITIC DRAW; DETERMINE NECESSARY ACTION.**
We Support NATEF	**NATEF TASK SHEET: MAINTAIN OR RESTORE ELECTRONIC MEMORY FUNCTIONS.**
We Support NATEF	**NATEF TASK SHEET PERFORM BATTERY STATE-OF-CHARGE (CONDUCTANCE) TEST; DETERMINE NECESSARY ACTION. PERFORM BATTERY CAPACITY TEST; CONFIRM PROPER BATTERY CAPACITY FOR VEHICLE APPLICATION; DETERMINE NECESSARY ACTION.**

ICONS	Ch15 Adv Starting & Charging Sys Diagnosis
	**NATEF TASK SHEET: INSPECT, CLEAN, FILL, AND/OR REPLACE BATTERY, BATTERY CABLES, CONNECTORS, CLAMPS, AND HOLD-DOWNS**
	**NATEF TASK SHEET: PERFORM BATTERY CHARGE**
	**NATEF TASK SHEET: START A VEHICLE USING JUMPER CABLES OR AN AUXILIARY POWER SUPPLY**
	**NATEF TASK SHEET: IDENTIFY ELECTRONIC MODULES, SECURITY SYSTEMS, RADIOS, AND OTHER ACCESSORIES THAT REQUIRE REINITIALIZATION OR CODE ENTRY FOLLOWING BATTERY DISCONNECT.**
	**NATEF TASK SHEET: IDENTIFY HYBRID VEHICLE AUXILIARY (12V) BATTERY SERVICE, REPAIR AND TEST PROCEDURES.**
	16. **SLIDE 16 EXPLAIN FIGURE 15–17** A typical ignition switch showing all of the electrical terminals after the connector has been removed
	**DISCUSSION: DISCUSS HOW BATTERY CONDITION IS CRITICAL TO 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?**
	17. **SLIDE 17 EXPLAIN FIGURE 15–18** Some column-mounted ignition switches act directly on the contact points, whereas others use a link from the lock cylinder to the ignition switch 18. **SLIDE 18 EXPLAIN FIGURE 15–19** A typical solenoid-operated starter
	19. **SLIDE 19 EXPLAIN FIGURE 15–20** Carefully inspect all battery terminals for corrosion.
	**DEMONSTRATION: SHOW HOW TO USE SERVICE INFORMATION TO LOOK UP STARTING SYSTEM CONTROL CIRCUIT. HAVE THEM HELP YOU**

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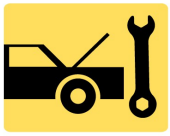
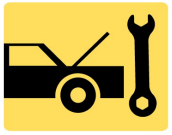
	**IDENTIFY DIFFERENT COMPONENTS OF STARTING SYSTEM CONTROL CIRCUIT** **HANDS-ON TASK: HAVE STUDENTS PRINT OUT A SCHEMATIC OF STARTER CIRCUIT FOR VEHICLE THEY WILL BE WORKING ON AND POINT OUT TEST POINTS. DISCUSS WITH THEM THAT STARTER CIRCUITS & COMPONENTS CAN VARY GREATLY FROM VEHICLE TO VEHICLE, & FROM OEM TO OEM.**
	2. **SLIDE 2 EXPLAIN OBJECTIVE CH15 AEP_LO4** 3. **SLIDE 3-4 EXPLAIN STARTER TESTING ON VEHICLE**
	5. **SLIDE 5 EXPLAIN FIGURE 15–21** When connecting a starter tester such as a Sun VAT 45 to the vehicle, make certain that the inductive probe is placed over all of the cables or wires from the battery. 6. **SLIDE 6 EXPLAIN FIGURE 15–22** Always check the battery, using a conductance or load tester. A battery showing a green charge indicator does not mean that the battery is good. 7. **SLIDES 7-8 EXPLAIN TESTING STARTER USING SCAN TOOL**
	2. **SLIDE 2 EXPLAIN OBJECTIVE CH15 AEP_LO5** 3. **SLIDE 3-7 EXPLAIN** VOLTAGE DROP TESTING
	
	**Starter Circuit Voltage Drop Tests** **Starter Circuit Voltage Drop Tests 2**
	8. **SLIDE 8 EXPLAIN Figure 15-23** Voltmeter hookups for voltage drop testing of GM solenoid-type cranking circuit. 9. **SLIDE 9 EXPLAIN Figure 15-24** Voltmeter hookups for voltage drop testing of a Ford cranking circuit. 10. **SLIDE 10 EXPLAIN Figure 15-25** Using the voltmeter leads from a starting and charging test unit to measure the voltage drop between the battery terminal (red lead) and the cable end (black lead). The engine must be cranked to cause current to flow through this connection
	

ICONS	Ch15 Adv Starting & Charging Sys Diagnosis
DEMO	**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.**
DEMO	**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.**
	**70. SLIDE 70 EXPLAIN: FIGURE 7–26** Starter diagnosis chart
 QUESTION	**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?**
DEMO	**DEMONSTRATION: SHOW SCAN TOOL DIAGNOSIS PROCESS FROM THE ABOVE DISCUSSION.**
 QUESTION	**DISCUSSION: DISCUSS WAYS CURRENT CAN BE MEASURED IN 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_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

ICONS	Ch15 Adv Starting & Charging Sys Diagnosis
	**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
	72. **SLIDE 72 EXPLAIN**: STARTER DRIVE-TO-FLYWHEEL CLEARANCE 73. **SLIDE 73 EXPLAIN Figure 7-27** shim (or half shim) may be needed to provide the proper clearance between the flywheel teeth of the engine & pinion teeth 74. **SLIDE 74 EXPLAIN**: STARTER DRIVE-TO-FLYWHEEL CLEARANCE
	**NATEF TASK SHEET: INSPECT AND TEST STARTER RELAYS AND SOLENOIDS; INSPECT AND TEST SWITCHES, CONNECTORS, AND WIRES OF STARTER CONTROL CIRCUITS; PERFORM NECESSARY ACTION.**
	**NATEF TASK SHEET: PERFORM STARTER CURRENT DRAW TESTS; PERFORM STARTER CIRCUIT VOLTAGE DROP TESTS; DETERMINE NECESSARY ACTION. DIFFERENTIATE BETWEEN ELECTRICAL AND ENGINE MECHANICAL PROBLEMS THAT CAUSE SLOW-CRANK/NO-CRANK CONDITION**
	2. **SLIDE 2 EXPLAIN OBJECTIVE CH15 AEP_LO6** 3. **SLIDE 3-4 EXPLAIN** Testing the Alternator
	**DEMONSTRATION: SHOW SCHEMATIC DIAGRAMS FROM SEVERAL DIFFERENT VEHICLES AND POINT OUT THE CIRCUIT PROTECTION DEVICES TO THE STUDENTS. TRY TO FIND EXAMPLES OF SYSTEMS USING MAXI FUSES, FUSIBLE LINKS, AND MEGA FUSES. SHOW HOW TO DETERMINE LOCATION OF DEVICES.**
	**DEMONSTRATION: SHOW/DISCUSS INFORMATION PROVIDED BY SERVICE BULLETINS AND PRACTICE OF CHECKING FOR SERVICE BULLETINS AS PART OF DIAGNOSING CHARGING SYSTEM CONCERNS. POINT OUT THAT SERVICE BULLETINS CAN CONTAIN INFORMATION ABOUT PROBLEMS SUCH AS PATTERN FAILURES WITH REGARD TO WIRE HARNESS ROUTING AND CONTROL MODULE CALIBRATIONS.**

ICONS	Ch15 Adv Starting & Charging Sys Diagnosis
	**SHOW VIDEO: TESTING CHARGING SYSTEM OUTPUT VIDEO:** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=TESTING%20CHARGING%20SYSTEM%20OUTPUT&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T6.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T6.XML
	**DEMONSTRATION: DEMONSTRATE WAYS TO DO AN ALTERNATOR OUTPUT TEST. SHOW STUDENTS HOW TO PERFORM CARBON PILE TEST WITH AVR OR EQUIVALENT TOOL. HAVE STUDENTS INTERPRET RESULTS BY COMPARING THEM TO OEM SPECIFICATIONS.**
	**NATEF TASK SHEET: PERFORM CHARGING SYSTEM OUTPUT TEST; DETERMINE NECESSARY ACTION. DIAGNOSE CHARGING SYSTEM FOR THE CAUSE OF UNDERCHARGE, NO-CHARGE, AND OVERCHARGE CONDITIONS.**
	**NATEF TASK SHEET PERFORM CHARGING CIRCUIT VOLTAGE DROP TESTS; DETERMINE NECESSARY ACTION.**
	**Charging Circuit Volt Drop Ground Side** **Charging Circuit Volt Drop Power Side**
	**HANDS-ON TASK: HAVE STUDENTS LOCATE AMP RATING OF ALTERNATORS. HAVE THEM REPORT WHERE INFORMATION WAS LOCATED & WHAT RATINGS WERE.**