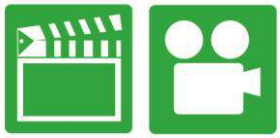
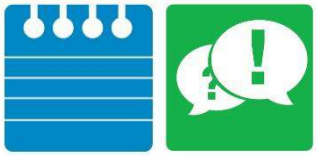
Automotive Electrical & Engine Performance 7/E

Chapter 20 Charging System Diagnosis and Service

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. Discuss the various methods to test the charging system. 2. Discuss the alternator output test. 3. Explain how to disassemble an alternator and test its component parts. This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "D" (Charging System 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 20: Chapter Images

ICONS	Ch20 Charging System Diagnosis & Service
       	**1. SLIDE 1 CH20 CHARGING SYSTEM DIAGNOSIS & SERVICE** **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)** **Charging Circuit Volt Drop Ground Side** **Charging Circuit Volt Drop Power Side** **2. SLIDE 2 EXPLAIN Figure 20-1** The digital multimeter should be set to read DC volts, with the red lead connected to the positive (+) battery terminal and the black meter lead connected to negative (-) battery terminal **3. SLIDE 3 EXPLAIN Figure 20-2** A scan tool can be used to diagnose charging system problems. **DISCUSS FREQUENTLY ASKED QUESTION & NOTE** **EXPLAIN TECH TIP** **4. SLIDE 4 EXPLAIN FIGURE 20–3** Before replacing an alternator, the wise technician checks that battery voltage is present at the output and battery voltage sense terminals. If not, then there is a fault in the wiring.

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	**DEMONSTRATION: SHOW SCHEMATIC DIAGRAMS FROM SEVERAL DIFFERENT VEHICLES AND POINT OUT CIRCUIT PROTECTION DEVICES. TRY TO FIND EXAMPLES OF SYSTEMS USING MAXI FUSES, FUSIBLE LINKS, AND MEGA FUSES. SHOW HOW TO DETERMINE LOCATION OF DEVICES.**
	5. **SLIDE 5 EXPLAIN Figure 20-4** This accessory drive belt is worn and requires replacement. Newer belts are made from ethylene propylene diene monomer (EPDM). This rubber does not crack like older belts & may not show wear even though ribs do wear & can cause slippage.
	**DEMONSTRATION: SHOW THE STUDENTS HOW TO USE A STETHOSCOPE TO ISOLATE A BELT/BEARING NOISE CONCERN. FIGURE 20-4**
	**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.**
	**EXPLAIN CHART 20-1** Typical belt tension for various widths of belts. Tension is force needed to depress belt as displayed on belt tension gauge
	6. **SLIDE 6 EXPLAIN Figure 20-5** Check service information for the exact marks where the tensioner should be located for proper belt tension
	**EXPLAIN TECH TIP**
	7. **SLIDE 7 EXPLAIN FIGURE 20–6** This overrunning alternator dampener (OAD) is longer than an overrunning alternator pulley (OAP) because it contains a dampener spring as well as a one-way clutch. Be sure to check that it locks in one direction.
	8. **SLIDE 8 EXPLAIN Figure 20-7** Testing AC ripple at the output terminal of the alternator is more accurate than testing at the battery due to the resistance of wiring between the alternator and battery. The reading shown on meter, set to AC volts, is only 78 mV (0.078 V), far below what reading would be if a diode were defective.

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	**EXPLAIN TECH TIP**
	**9. SLIDE 9 EXPLAIN FIGURE 20–8** Charging system voltage can be easily checked at the lighter plug by connecting a lighter plug to the voltmeter through a double banana plug. **10. SLIDE 10 EXPLAIN FIGURE 20–9** A mini clamp-on meter can be used to measure alternator output as shown here (105.2 Amp.). Then the meter can be used to check AC current ripple by selecting AC Amps on the rotary dial. AC ripple current should be less than 10% of the DC current output.
	**11. SLIDE 11 EXPLAIN FIGURE 20–10** Voltmeter hookup to test the voltage drop of the charging circuit.
	**EXPLAIN TECH TIP**
	**12. SLIDE 12 EXPLAIN OUTPUT TEST & FIGURE 20-11** Charging system voltage can be easily checked at the lighter plug by connecting a lighter plug to the voltmeter through a double banana plug.
	**DEMONSTRATION: DEMONSTRATE WAYS TO DO AN ALTERNATOR OUTPUT TEST. SHOW HOW TO PERFORM CARBON PILE TEST WITH AVR OR EQUIVALENT TOOL. HAVE STUDENTS INTERPRET RESULTS BY COMPARING THEM TO OEM SPECS**
	**NATEF TASK SHEET: PERFORM CHARGING SYSTEM OUTPUT TEST; DETERMINE ACTION. DIAGNOSE FOR CAUSE OF UNDERCHARGE, NO-CHARGE, AND OVERCHARGE CONDITIONS.**
	**NATEF TASK SHEET: INSPECT, ADJUST, OR REPLACE GENERATOR (ALTERNATOR) DRIVE BELTS, PULLEYS, AND TENSIONERS; CHECK PULLEY AND BELT ALIGNMENT.** **REMOVE, INSPECT, AND INSTALL GENERATOR (ALTERNATOR)**
	**NATEF TASK SHEET PERFORM CHARGING CIRCUIT VOLTAGE DROP TESTS; DETERMINE NECESSARY ACTION.**

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	13. **SLIDE 13 EXPLAIN FIGURE 20–12** The best place to install a charging system tester amp probe is around the generator output terminal wire, as shown
	**EXPLAIN TECH TIP**
	14. **SLIDE 14 EXPLAIN FIGURE 20–13** Replacing an alternator is not always as easy as it is from a Buick with a 3800 V-6, where the alternator is easy to access. Many alternators are difficult to access, and require the removal of other components
	**HANDS-ON TASK: HAVE STUDENTS LOCATE AMP RATING OF ALTERNATORS ON SEVERAL DIFFERENT VEHICLES. HAVE THEM REPORT WHERE INFORMATION WAS LOCATED & WHAT RATINGS WERE.**
	**EXPLAIN TECH TIPS**
	**DEMONSTRATION: DEMONSTRATE HOW TO PROPERLY REMOVE AN ALTERNATOR USING OEM SERVICE PROCEDURES. HAVE THE STUDENTS LOOK UP THE LABOR TIME FOR THE ALTERNATOR R&R OPERATION FOR SEVERAL DIFFERENT VEHICLES AND REPORT THEIR FINDINGS TO CLASS.**
	**EXPLAIN TECH TIP**
	**EXPLAIN ALTERNATOR DISASSEMBLY**
	15. **SLIDE 15 EXPLAIN Figure 20-14** Always mark the case of the alternator before disassembly to be assured of correct reassembly
	**DISCUSSION: HAVE THE STUDENTS DISCUSS THE IMPORTANCE OF CHECKING THE WIRE HARNESS ROUTING BEFORE REMOVING THE OLD ALTERNATOR. WHAT COULD RESULT FROM ROUTING THE WIRE HARNESS INCORRECTLY?**
	DISCUSS FREQUENTLY ASKED QUESTION

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	**16. SLIDE 16 EXPLAIN Figure 20-15** Explanation of clock positions. Because four through bolts are equally spaced, it is possible for an alternator to be installed in one of four different clock positions. The connector position is determined by viewing the alternator from the diode end with the threaded adjusting lug in the up or 12 o'clock position. Select the 3 o'clock, 6 o'clock, 9 o'clock, or 12 o'clock position to match the unit being replaced. **17. SLIDE 17 EXPLAIN Figure 20-16** Testing an alternator rotor using an ohmmeter. **18. SLIDE 18 EXPLAIN Figure 20-17** If the ohmmeter reads infinity between any two of the three stator windings, the stator is open and, therefore, defective. The ohmmeter should read infinity between any stator lead and the steel laminations. If the reading is less than infinity, the stator is grounded. Stator windings cannot be tested if shorted because normal resistance is very low.
	**19. SLIDE 19 EXPLAIN Figure 20-18** Typical diode trio. If one leg of a diode trio is open, the alternator may produce close to normal output, but the charge indicator light on the dash will be on dimly. **20. SLIDE 20 EXPLAIN**: TESTING RECTIFIER & **EXPLAIN Figure 20-19** typical rectifier bridge contains all 6 diodes in one replaceable assembly **EXPLAIN: REASSEMBLING ALTERNATOR** **21. SLIDE 21 EXPLAIN FIGURE 20-20** brush holder assembly with new brushes installed. The holes in the brushes are used to hold the brushes up in the holder when it is installed in the alternator. After the rotor has been installed, the retaining pin is removed which allows the brushes to contact the slip rings of the rotor **EXPLAIN Alternator Installation** **22. SLIDES 22-57 ALTERNATOR OVERHAUL SHOW** **DISCUSS REAL WORLD FIX**