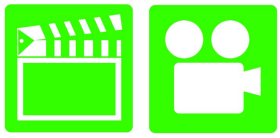
Advanced Automotive Electricity & Electronics

Chapter 12 Charging System Diagnosis and 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. 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 "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	Ch12 Charging System Diagnosis & Service
	**1. SLIDE 1 CH12 CHARGING SYSTEM DIAGNOSIS & SERVICE**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Charging Circuit Volt Drop Ground Side** **Charging Circuit Volt Drop Power Side**
	**2. SLIDE 2: EXPLAIN** CHARGING SYSTEM TESTING & SERVICE **3. SLIDE 3 EXPLAIN Figure 12-1** 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. **4. SLIDE 4 EXPLAIN NOTE** **5. SLIDE 5: EXPLAIN** CHARGING SYSTEM TESTING & SERVICE **6. SLIDE 6 EXPLAIN Figure 12-2** A scan tool can be used to diagnose charging system problems. **7. SLIDE 7 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE** **8. SLIDE 8 EXPLAIN FIGURE 12–3** 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. **9. SLIDE 9 EXPLAIN TECH TIP**
 	**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.**
	**10. SLIDE 10 EXPLAIN** CHARGING SYSTEM TESTING & SERVICE **11. SLIDE 11 EXPLAIN** DRIVE BELT

ICONS	Ch12 Charging System Diagnosis & Service
	INSPECTION/ADJUSTMENT 12. **SLIDE 12 EXPLAIN Figure 12-4** 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 12-4**
	**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.**
	13. **SLIDE 13 EXPLAIN CHART 12-1** Typical belt tension for various widths of belts. Tension is the force needed to depress the belt as displayed on a belt tension gauge
	14. **SLIDE 14 EXPLAIN TECH TIP**
	15. **SLIDE 15 EXPLAIN Figure 12-5** Check service information for the exact marks where the tensioner should be located for proper belt tension. 16. **SLIDE 16 EXPLAIN Testing Alternator Using Scope** 17. **SLIDE 17 EXPLAIN FIGURE 12–6** 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.
	18. **SLIDE 18 EXPLAIN Figure 12-7** 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.

19. **SLIDE 19 EXPLAIN FIGURE 12–8** Charging system voltage can be easily checked at the lighter plug by connecting a lighter plug to the voltmeter through a double banana plug.
20. **SLIDE 20 EXPLAIN: AC RIPPLE CHECK**
21. **SLIDE 21 EXPLAIN FIGURE 12.9** 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

22. **SLIDE 22 EXPLAIN TECH TIP**

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

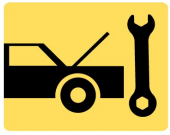
23. **SLIDE 23 EXPLAIN: AC RIPPLE CHECK**
24. **SLIDE 24 EXPLAIN 2 NOTES**
25. **SLIDE 25 EXPLAIN FIGURE 12.10** Testing AC ripple at the output terminal of the alternator is more accurate than testing at battery due to the resistance of the wiring between alternator and the battery. The reading shown on meter, set to AC volts, is only 78 mV (0.078 V), far below what reading would be if a diode were defective
26. **SLIDE 26 EXPLAIN: AC RIPPLE CHECK**

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.

SHOW VIDEO: BENCH TESTING ALTERNATOR COMPONENTS VIDEO

HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=BENCH%20TESTING%20ALTERNATOR%20COMPONENTS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T7.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T7.XML

27. **SLIDE 27 EXPLAIN FIGURE 12-11** Charging system voltage can be easily checked at the lighter plug by connecting a lighter plug to the voltmeter through a

ICONS	Ch12 Charging System Diagnosis & Service
	double banana plug.
	**28. SLIDE 28 EXPLAIN TECH TIP**
	**NATEF TASK SHEET: PERFORM CHARGING SYSTEM OUTPUT TEST; DETERMINE NECESSARY ACTION.** **TASK SHEET: DIAGNOSE CHARGING SYSTEM FOR THE 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)**
	**STUDENTS COMPLETE NATEF TASK SHEET A6D5 PERFORM CHARGING CIRCUIT VOLTAGE DROP TESTS; DETERMINE NECESSARY ACTION.**
	29. SLIDE 29 EXPLAIN Figure 12-12 mini clamp-on meter can be used to measure alternator output as shown here (105.2 Amp). Then 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.
	**30. SLIDE 30: EXPLAIN CHARGING SYSTEM VOLTAGE DROP TESTING**
	31. SLIDE 31 EXPLAIN Figure 12-13 Voltmeter hookup to test the voltage drop of the charging circuit.
	32. SLIDES 32-33 EXPLAIN: ALTERNATOR OUTPUT TEST
	34. SLIDE 34 EXPLAIN Figure 12-14 typical tester used to test batteries as well as the cranking and charging system. Always follow the operating instructions
	35. SLIDE 35 EXPLAIN CAUTION
	36. SLIDE 36 EXPLAIN: MINIMUM REQUIRED ALTERNATOR OUTPUT
	37. SLIDE 37 EXPLAIN NOTE
	**HANDS-ON TASK: HAVE STUDENTS LOCATE AMP RATING OF ALTERNATORS ON SEVERAL DIFFERENT VEHICLES. HAVE THEM REPORT WHERE**

ICONS	Ch12 Charging System Diagnosis & Service
	INFORMATION WAS LOCATED & WHAT RATINGS WERE.
	38. SLIDE 38 EXPLAIN: MINIMUM REQUIRED ALTERNATOR OUTPUT 39. SLIDE 39 EXPLAIN **Figure 12-15** The best place to install a charging system tester amp probe is around the alternator output terminal wire, as shown.
	40. SLIDES 40-41 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.**
	42. SLIDE 42 EXPLAIN **Alternator Removal** 43. SLIDE 43 EXPLAIN **FIGURE 12–16** 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. 44. SLIDE 44 EXPLAIN **Figure 12-17** Always mark the case of the alternator before disassembly to be assured of correct reassembly
	45. SLIDE 45 EXPLAIN TECH TIP
	46. SLIDE 46 EXPLAIN **FREQUENTLY ASKED QUESTION & NOTE** 47. SLIDE 47 EXPLAIN **Figure 12-18 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.**
	**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?**

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	**48. SLIDE 48 EXPLAIN Alternator Removal & Disassembly** **49. SLIDE 49 EXPLAIN NOTE** **50. SLIDE 50 EXPLAIN Figure 12-19** Testing an alternator rotor using an ohmmeter. **51. SLIDE 15 EXPLAIN Figure 12-20** 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.
	**52. SLIDE 52 EXPLAIN Figure 12-21** 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. **53. SLIDE 53 EXPLAIN Alternator Removal & Disassembly** **54. SLIDE 54 EXPLAIN NOTE** **55. SLIDE 55 EXPLAIN**: TESTING RECTIFIER **56. SLIDE 56 EXPLAIN Figure 12-22** typical rectifier bridge contains all 6 diodes in one replaceable assembly **57. SLIDE 57 EXPLAIN: REASSEMBLING ALTERNATOR** **58. SLIDE 58 EXPLAIN FIGURE 12.23** A 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
	**59. SLIDE 59 EXPLAIN REAL WORLD FIX**
	**60. SLIDE 60 EXPLAIN Remanufactured Alternators** **61. SLIDE 61 EXPLAIN Alternator Installation** **62. SLIDES 62-97 EXPLAIN: ALTERNATOR INSTALLATION**