






















# Automatic Transmissions and Transaxles, 6e











## Chapter 8 Drivetrain Electricity and Electronics











### Opening Your Class











KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This course or class covers operation and service of <b>Automatic Transmissions and Transaxles, 6e</b> . It correlates material to task lists specified by ASE and NATEF.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain the chapter learning objectives to the students. <ol style="list-style-type: none"><li>1. Explain the characteristics of electricity.</li><li>2. Differentiate between conductors, insulators, and semiconductors.</li><li>3. Explain the units of electrical measurement.</li><li>4. List the parts of a complete circuit.</li><li>5. Discuss the types of electrical circuit faults.</li><li>6. Explain how to detect and measure electrical voltage, current, and resistance.</li><li>7. Discuss the purpose and function of terminals, connectors, relays, and switches.</li></ol>
<b>Establish the Mood or Climate</b>	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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	Ch08 Drivetrain Electricity and Electronics
          	<p>1. SLIDE 1 DRIVETRAIN ELECTRICITY AND ELECTRONICS</p> <p>2. SLIDES 2-4 EXPLAIN OBJECTIVES</p> <p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b> @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p>5. SLIDE 5 EXPLAIN Characteristics of Electricity</p> <p>6. SLIDE 6 EXPLAIN FIGURE 8–2 The nucleus of an atom has a positive (+) charge and the surrounding electrons have a negative (–) charge.</p> <p><b><u>ANIMATION ON AN ATOM</u></b>  <b><u>WWW.MYAUTOMOTIVELAB.COM</u></b>  <a href="http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_2/index.htm">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31 FIG 31 2/INDEX.HTM</a></p> <p><b><u>ANIMATION ON AN LIKE &amp; UNLIKE ATTRACTION</u></b>  <b><u>WWW.MYAUTOMOTIVELAB.COM</u></b>  <a href="http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_4/index.htm">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31 FIG 31 4/INDEX.HTM</a></p> <p><b><u>DISCUSSION: DISCUSS FLOW OF ELECTRICAL CURRENT AND HOW THE CONSTANT FLOW, OR JUMPING OF ELECTRONS, CREATES CURRENT</u></b></p> <p><b><u>ELECTRON FLOW</u></b></p> <p><b><u>DEMONSTRATION: USE MAGNETS TO DEMONSTRATE HOW OPPOSITES FORCES ATTRACT &amp; LIKE FORCES REPEL. SHOW HOW MAGNETS ATTRACT &amp; REPEL EACH OTHER DEPENDING ON ORIENTATION OF THEIR POLES.</u></b></p> <p>7. SLIDE 7 EXPLAIN Conductors, Insulators, Semiconductors</p> <p>8. SLIDE 8 EXPLAIN FIGURE 8–7 Insulators are elements with five to eight electrons in the outer orbit</p> <p><b><u>DISCUSSION: HAVE STUDENTS DISCUSS DIFFERENT CONDUCTORS. WHY IS COPPER MOST COMMONLY USED CONDUCTOR IN ELECTRICAL SYSTEMS.</u></b></p>



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	<p><b>DISCUSSION:</b> DISCUSS INSULATORS &amp; REASON THEY MAKE POOR CONDUCTORS. WHAT IS RELATIONSHIP BETWEEN NUMBER OF ELECTRONS AN INSULATOR MATERIAL HAS &amp; ITS ABILITY TO ACQUIRE &amp; RELEASE ELECTRONS?</p>
	<p><b>COMPLETE TASK SHEET ON ELECTRICAL FUNDAMENTALS</b></p>
	<p>9. SLIDE 9 EXPLAIN Electrical Measurement</p>
	<p><b>DEMONSTRATION: SHOW HOW DMM MEASURES VOLTAGE. USE TRAINER TO SHOW STUDENTS MEASURING VOLTAGE</b></p>
	<p><b>ANIMATION: RESISTANCE (FIGURE 3-19)</b>  <a href="http://www.myautomotivelab.com">WWW.MYAUTOMOTIVELAB.COM</a>  <a href="http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a7_animation/chapter31_fig_31_19/index.htm">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A7_ANIMATION/CHAPTER31 FIG 31_19/INDEX.HTM</a></p>
	<p><b>DISCUSSION:</b> HAVE STUDENTS TALK ABOUT RESISTANCE TO ELECTRON FLOW, OR OHMS. HOW DOES MATERIAL USED AS A CONDUCTOR AFFECT RESISTANCE?</p>
	<p><b>ELECTRON TRAVEL, HEAT</b></p>
	<p><b>DISCUSSION:</b> DISCUSS HEAT, LIGHT, PRESSURE, CHEMICAL, &amp; MAGNETIC MEANS OF PRODUCING ELECTRICAL CURRENT. WHICH PRINCIPLE IS BASIS OF AUTOMOTIVE BATTERY? WHICH PRINCIPLE IS BASIS FOR HOW AN ALTERNATOR WORKS?</p>
	<p><u>Electron Travel, Light</u>  <u>Electron Travel, Magnet</u></p>
	<p><u>Electron Travel, Pressure</u></p> <p>10. SLIDE 10 EXPLAIN Parts of a Complete Circuit</p> <p>11. SLIDE 11 EXPLAIN FIGURE 8-16 The return path back to the battery can be any electrical conductor, such as a copper wire or the metal frame or body of vehicle.</p>

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         	<p><b><u>DEMONSTRATION:</u> DEMONSTRATE BASIC ELECTRICAL CIRCUIT ON <u>TRAINER</u>. WHAT HAPPENS WHEN CIRCUIT IS SHORTED TO GROUND</b></p> <p><b><u>TRAINER TASK:</u> ALLOW STUDENTS TO BLOW FUSE BY CREATING A SHORT CIRCUIT, OBSERVING WHAT IT TAKES TO CREATE SHORT CIRCUIT AND WHAT RESULTS ARE FOUND</b></p> <p><b><u>DISCUSSION:</u> DISCUSS GROUND PATH. WHY DOESN'T A SEPARATE GROUND WIRE HAVE TO BE RUN FROM THE BATTERY TO EACH ELECTRICAL LOAD? DISCUSS HOW AND WHY A SHORT-TO-VOLTAGE OCCURS. WHAT IS THE REASON THAT A SHORT-TO-VOLTAGE MAY/MAY NOT BLOW FUSE?</b></p> <p>12. <b>SLIDES 12-13 EXPLAIN</b> Types of Electrical Circuit Faults</p> <p><b><u>DISCUSSION:</u> ASK STUDENTS TO DISCUSS EFFECTS OF HIGHER THAN-NORMAL RESISTANCE ON VARIOUS COMPONENTS IN AN AUTOMOTIVE ELECTRICAL SYSTEM. WHAT CAN CAUSE HIGH RESISTANCE?</b></p> <p><b><u>DEMONSTRATION:</u> USE AN INDUCTIVE AMMETER OR CHARGING SYSTEM TESTER TO SHOW THAT <i>AMOUNT OF CURRENT LEAVING BATTERY ON POSITIVE IS RETURNED ON NEGATIVE SIDE.</i></b></p> <p><u>Ohm's Law, Current</u></p> <p><u>Ohm's Law, Resistance</u></p> <p><u>Ohm's Law, Volt</u></p> <p><b><u>DISCUSSION:</u> ASK STUDENTS TO TALK ABOUT OHM'S LAW. WHAT IS APPLICATION OF OHM'S LAW IN AUTOMOTIVE WIRING CIRCUITS?</b></p> <p>14. <b>SLIDE 14 EXPLAIN</b> Detecting and Measuring Electrical Voltage, Current and Resistance</p> <p>15. <b>SLIDE 15 EXPLAIN FIGURE 8-31</b> Using a digital multimeter set to read ohms (<math>\Omega</math>) to test this light bulb. The meter reads the resistance of the filament.</p>

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	<p><a href="#">Measure AC Ripple</a></p> <p><a href="#">Measure Battery Voltage Drop</a></p> <p><a href="#">Meter Usage Battery Volt Check</a></p> <p><a href="#">Meter Usage Check CAN Circuit</a></p> <p><a href="#">Meter Usage Measure Amps</a></p> <p><a href="#">Meter Usage Measure Frequency</a></p> <p><a href="#">Meter Usage Measure Ohms</a></p> <p><a href="#">Meter Usage Measure Volts</a></p> <p><a href="#">Meter Usage Testing Diode</a></p>
	<p><b>COMPLETE <u>TASK SHEET</u> ON ELECTRICAL CIRCUITS</b></p>
	<p><b><u>DISCUSSION:</u> DISCUSS VARIOUS SCALES AND SETTINGS ON A DMM. WHAT IS REASON THAT TEST RESULTS USING A DMM ARE MORE ACCURATE? DISCUSS THE AUTORANGE FEATURES</b></p>
 	<p><b><u>NATEF TASK SHEET: OHM'S LAW:</u> DIAGNOSE ELECTRICAL/ELECTRONIC INTEGRITY OF SERIES, PARALLEL &amp; SERIES-PARALLEL CIRCUITS USING PRINCIPLES OF ELECTRICITY (OHM'S LAW)</b></p>
 	<p><b><u>NATEF TASK SHEET</u> DEMONSTRATE PROPER USE OF DIGITAL MULTIMETER (DMM) DURING DIAGNOSIS OF ELECTRICAL CIRCUIT PROBLEMS, INCLUDING: SOURCE VOLTAGE, VOLTAGE DROP, CURRENT FLOW, &amp; RESISTANCE</b></p>
	<p><b>16. SLIDES 16-17 EXPLAIN</b> Terminals, Connectors, Relays, and Switches</p> <p><b>18. SLIDE 18 EXPLAIN FIGURE 8-37</b> Some terminals have seals attached to help seal the electrical connections.</p>
	<p><b><u>VIDEO: WIRING HARNESS INSTALLATION</u></b>  <a href="http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Wiring%20Harness%20Installation&amp;clip=pandc/chet/2012/automotive/Installing_EFI_System/T12CD9.mov&amp;caption=chet/chet_mylabs/akamai/2012/automotive/Installing_EFI_System/xml/T12CD9.xml">http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Wiring%20Harness%20Installation&amp;clip=pandc/chet/2012/automotive/Installing_EFI_System/T12CD9.mov&amp;caption=chet/chet_mylabs/akamai/2012/automotive/Installing_EFI_System/xml/T12CD9.xml</a></p>
	<p><b><u>VIDEO: FUSES &amp; CIRCUIT BREAKERS VIDEO</u></b>  <a href="http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=FUSES%20AND%20CIRCUIT%20BREAKERS&amp;clip=pandc/chet/2012/automotive/Auto_Shop_Safety/clip18fuses1.mov&amp;caption=chet/chet_mylabs/akamai/2012/automotive/Auto_Shop_Safety/xml/clip18fuses1.xml">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=FUSES%20AND%20CIRCUIT%20BREAKERS&amp;CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/CLIP18FUSES1.MOV&amp;CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/XML/CLIP18FUSES1.XML</a></p>

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	<p><b>DISCUSSION:</b> HAVE THE STUDENTS TALK ABOUT THE DIFFERENT COLORS FOR AMPERAGE RATINGS. WHY ARE COLORS A GOOD IDEA?</p>
	<p><b>DEMONSTRATION:</b> SHOW SEVERAL DIFFERENT TYPES OF CONNECTORS, INCLUDING THOSE WITH CONNECTOR POSITION ASSURANCE CLIPS.</p>
	<p>EXPLAIN THAT IT'S NECESSARY TO GUARANTEE THAT CONNECTORS WILL STAY TOGETHER IN SUPPLEMENTAL RESTRAINT SYSTEMS.</p>
	<p><b>DEMONSTRATE</b> REMOVAL OF TERMINALS FROM SEVERAL DIFFERENT TYPES OF CONNECTORS. MAKE SURE TO HAVE PROPER TERMINAL REMOVAL TOOLS AVAILABLE FOR TEACHING STUDENTS ABOUT DIFFERENT CONNECTORS.</p>
	<p><b>DISCUSSION:</b> DISCUSS PROCESS OF SOLDERING WIRES AND THE TYPE OF SOLDER USED. WHAT DO THE PERCENTAGES OF EACH ALLOY IN A SOLDER DETERMINE?</p>
	<p><b>DEMONSTRATION:</b> DEMONSTRATE USE OF A SOLDERING IRON TO CONNECT WIRING. POINT OUT TO THE STUDENTS THAT THEY SHOULD MAKE SURE THAT THE SOLDER JOINT IS SMOOTH;</p>
	<p>OTHERWISE, A SHARP POINT COULD PUNCTURE SHRINK WRAP AND CAUSE A SHORT CIRCUIT COMPLETE NATEF TASK SHEET REMOVE AND REPLACE TERMINAL END FROM CONNECTOR; REPLACE CONNECTORS AND TERMINAL ENDS</p>
	<p>COMPLETE NATEF TASK SHEET REPAIR WIRING HARNESS (INCLUDING CAN/BUS SYSTEMS)</p>
	<p>COMPLETE NATEF TASK SHEET PERFORM SOLDER REPAIR OF ELECTRICAL WIRING</p>
	<p>19. SLIDES 19-20 EXPLAIN Speed Sensors and TP Speed</p>

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	<p><b>DISCUSSION:</b> PROVIDE THE STUDENTS WITH A <u>WIRING DIAGRAM OF A TP CIRCUIT</u> TO STUDY AND DISCUSS. WHAT IS THE FUNCTION OF EACH WIRE CONNECTED TO SENSOR?</p>
	<p><b>HANDS-ON TASK:</b> HAVE STUDENTS LOCATE AND VISUALLY INSPECT A <u>TP SENSOR</u> FOR PROPER CONNECTION, ATTACHMENT, AND CONDITION.</p>
	<p>SOME TP SENSORS HAVE 4 WIRES. THE FOURTH WIRE IS COMMONLY A SWITCH CIRCUIT USED TO PROVIDE A SIGNAL THAT VEHICLE IS AT IDLE.</p>
	<p>SOME TP SENSORS GO BAD IN ONLY ONE SPOT—VEHICLES THAT ARE DRIVEN AT CONSTANT SPEEDS TEND TO WEAR THE TP IN ONE SPOT.</p>
	<p><b>ANIMATION:</b> <u>TP OPERATION</u>  <a href="http://www.myautomotivelab.com">WWW.MYAUTOMOTIVELAB.COM</a>  <a href="http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/a16_animation/chapter55_fig_55_11/index.htm">HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A16_ANIMATION/CHAPTER55_FIG_55_11/INDEX.HTM</a></p>
	<p><b>DISCUSSION:</b> HAVE STUDENTS DISCUSS <u>HOW TP SENSORS AFFECT AUTOMATIC TRANSMISSION FUNCTION</u>. HOW COULD VARIOUS TP MALFUNCTIONS CAUSE ABNORMAL AUTOMATIC TRANSMISSION OPERATION?</p>
	<ol style="list-style-type: none"> <li>21. SLIDE 21 EXPLAIN Networks and Network Classification</li> <li>22. SLIDE 22 EXPLAIN FIGURE 8–58 A typical BUS system showing module CAN communications and twisted pairs of wire.</li> </ol>
	<p><b>DISCUSSION:</b> HAVE THE STUDENTS TALK ABOUT THE DIFFERENT TYPES OF COMMUNICATION BETWEEN MODULES OR NODES. WHY DO THERE NEED TO BE DIFFERENT TYPES OF COMMUNICATION?</p>
	<p><b>DEMONSTRATION:</b> DEMONSTRATE OR EXPLAIN TO THE STUDENTS HOW A POWER WINDOW SYSTEM WORKED 10 YEARS AGO AND HOW A MODERN POWER WINDOW SYSTEM WORKS. USE <u>PROJECT BOARD</u> TO DEMO CAN &amp; NETWORK COMMUNICATION</p>

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 	<p><b>HANDS-ON TASK: PRINT OUT STEPS FOR DIAGNOSING AND TESTING NETWORK DIAGNOSTIC CODE. ASK STUDENTS TO FOLLOW DIAGNOSTIC STEPS TO SEE REPAIR PATH.</b></p> <p><b>23. SLIDES 23-26 EXPLAIN Summary</b></p>