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Chapter 51 POWER STEERING


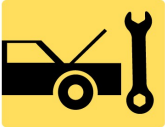


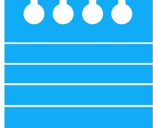


Opening Your Class





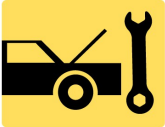



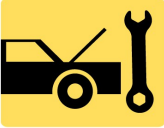


KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers Automotive Maintenance and Light Repair . It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure 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. <ul style="list-style-type: none">— Prepare for ASE Suspension and Steering (A4) certification test content area “A” (Steering Systems Diagnosis and Repairs).— Discuss the components and operation of power steering pumps— List the components of a typical power-recirculating-ball-nut steering gear system.— Describe the operation of a power rack-and-pinion steering system.
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.







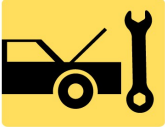






ICONS	Ch51 POWER STEERING
       <p>QUESTION</p>     	<p>1. SLIDE 1 CH51 POWER STEERING</p> <p>2. SLIDES 2-3 EXPLAIN OBJECTIVES</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED</p> <p><u>Steering System (62 Links)</u></p> <p>4. SLIDES 4-6 EXPLAIN Power Steering Pump and Reservoir</p> <p>7. SLIDE 7 EXPLAIN Figure 51-1 typical integral power steering pump when mounted inside the reservoir.</p> <p><u>DISCUSSION: DISCUSS DIFFERENCE BETWEEN PRESSURE AND FORCE</u></p> <p>8. SLIDE 8 EXPLAIN FIGURE 51-2 Typical remote reservoir.</p> <p>9. SLIDE 9 EXPLAIN FIGURE 51-3 Typical power steering pump assemblies.</p> <p>10. SLIDE 10 EXPLAIN Figure 51-4 GM vane-type pump</p> <p><u>DEMONSTRATION: SHOW COMPONENTS OF A TYPICAL INTEGRAL POWER STEERING PUMP AND REMOTE RESERVOIRS</u></p> <p><u>DEMONSTRATION: SHOW INTERNAL PARTS OF A VANE PUMP</u></p> <p>11. SLIDES 11-13 EXPLAIN Power Steering Hoses</p> <p>14. SLIDE 14 EXPLAIN Figure 51-5 power steering fluid cooler, if used, is located in the return hose. Often the “cooler” is simply a length of return metal line that is arranged in a loop and routed near front of vehicle. The airflow past return line helps reduce temperature of fluid.</p>




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   	<p><u>POWER STEERING HYDRAULICS</u></p> <p><u>DISCUSSION: ASK THE STUDENTS TO DISCUSS WHY NOT ALL POWER STEERING UNITS HAVE A POWER STEERING FLUID COOLER</u> <u>FIGURE 51-5</u></p> <p><u>ANIMATION: INTEGRAL POWER STEERING GEAR OPERATION</u></p> <p><u>WWW.MYAUTOMOTIVELAB.COM</u> <small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A4_ANIMATION/CHAPTER30_FIG_30_13/INDEX.HTM</small></p> <p>15. SLIDES 15-17 EXPLAIN Integral Power Steering</p> <p>18. SLIDE 18 EXPLAIN Figure 51-6 Forces acting on the rack piston of an integral power steering gear.</p> <p>19. SLIDE 19 EXPLAIN Figure 51-7 During a left turn, inner element turns so that left-turn circuits are open to pressure and right-turn circuits are open to return circuit</p> <p>20. SLIDE 20 EXPLAIN Figure 51-8 During a left turn, the high-pressure fluid helps push piston along worm gear, thereby reducing the steering effort from driver.</p>
 	<p><u>DEMONSTRATION: SHOW EXAMPLES OF ROTARY CONTROL VALVES AND DISCUSS THEIR INNER AND OUTER ELEMENTS</u></p> <p>BE CAREFUL WHEN WORKING ON POWER STEERING. THESE SYSTEMS CAN REACH PEAK PRESSURES OF OVER 1,000 PSI.</p>
  	<p><u>ANIMATION: ROTARY VALVE OPERATION</u></p> <p><u>WWW.MYAUTOMOTIVELAB.COM</u> <small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A4_ANIMATION/CHAPTER30_FIG_30_15/INDEX.HTM</small></p> <p><u>POWER STEERING GEAR</u></p> <p><u>DEMONSTRATION: SHOW EXAMPLES OF SEALS, O-RINGS, AND FLUID LINES IN A RACK-AND-PINION STEERING UNIT</u></p>

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   <p>QUESTION</p>   	<p>DEMONSTRATION: SHOW THE STUDENTS EXAMPLES OF CONTROL VALVES AND CHECK VALVES._</p> <p>DISCUSSION: ASK THE STUDENTS TO DISCUSS HOW TO DETERMINE WHETHER THE CHECK VALVE IS NOT OPERATING PROPERLY.</p> <p>FLUID IN BELLOWS COVERING THE INNER TIE ROD INDICATES A BAD SEAL IN RACK:</p> <p>HANDS-ON TASK: HAVE THE STUDENTS LABEL FLUID LINES ON A POWER STEERING RACK. HAVE THE STUDENTS USE STICKY NOTES OR MASKING TAPE._</p> <ol style="list-style-type: none"> 21. SLIDE 21 EXPLAIN Figure 51-9 Low-speed flow control. 22. SLIDE 22 EXPLAIN Figure 51-10 High-speed flow control operation. 23. SLIDE 23 EXPLAIN Figure 51-11 Pressure-relief mode. In this mode the steering gear has blocked the flow of fluid from the pump and the pressure rises, which unseats the pressure-relief valve. Now fluid flows back to the inlet through the pressure-relief orifice and passage
    <p>QUESTION</p> 	<p>ANIMATION: EVO OPERATION WWW.MYAUTOMOTIVELAB.COM</p> <p><small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A4_ANIMATION/CHAPTER30_FIG_30_25/INDEX.HTM</small></p> <p>DEMONSTRATION: SHOW AN ELECTRONIC VARIABLE ORIFICE (EVO) ACTUATOR ASSEMBLY</p> <p>DISCUSSION: ASK STUDENTS TO DISCUSS WHETHER AN ELECTRONIC VARIABLE ORIFICE (EVO) SYSTEM OR TWO-FLOW ELECTRONIC (TFE) SYSTEM IS BETTER</p> <ol style="list-style-type: none"> 24. SLIDE 24 EXPLAIN Figure 51-12 Power Steering Pressure Switch 25. SLIDE 25 EXPLAIN Figure 51-13 EVO actuator assembly

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	<p>DEMONSTRATION: SHOW THE STUDENTS HOW TO USE THE ON-LINE SERVICE MANUAL (OR DATABASE) COMPONENT LOCATOR</p>
	<p>HANDS-ON TASK: HAVE THE STUDENTS USE ON-LINE SERVICE MANUAL (OR DATABASE) COMPONENT LOCATOR TO FIND THE EVO ACTUATOR ASSEMBLY</p>
	<p>POWER RACK & PINION GEAR OPERATION WWW.MYAUTOMOTIVELAB.COM <small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A4_ANIMATION/CHAPTER30_FIG_30_20/INDEX.HTM</small></p>
	<p>DEMONSTRATION: SHOW EXAMPLES OF ELECTRIC POWER STEERING (EPS) ASSEMBLIES <u>FIGURE 51-14</u></p>
	<p>BECOME FAMILIAR WITH SERVICING PROCEDURES FOR ELECTRIC POWER STEERING UNITS. MANY VEHICLES NOW INCLUDE THEM, & MORE VEHICLES WILL BE INCLUDING THEM IN NEAR FUTURE.</p>
	<p>26. SLIDE 26 EXPLAIN Figure 51-14 Toyota Prius EPS assembly</p>
	<p>27. SLIDE 27 EXPLAIN Figure 51-15 The torque sensor converts the torque the driver is applying to the steering wheel into a voltage signal.</p>
	<p>28. SLIDE 28 EXPLAIN Figure 51-16 The electric power steering in Toyota/Lexus SUVs uses a brushless DC motor around rack of unit and operates on 42 volts.</p>
	<p>29. SLIDE 29 EXPLAIN Figure 51-17 Photo of the electric power steering gear on a Lexus RX 400h taken from underneath the vehicle.</p>
	<p>30. SLIDE 30 EXPLAIN Figure 51-18 A cross-sectional view of a Honda electric power steering (EPS) gear.</p>
	<p>31. SLIDE 31 EXPLAIN Figure 51-19 Honda electric power steering unit cutaway.</p>
	<p>32. SLIDE 32 EXPLAIN Figure 51-20 Power Steering Control Module (PSCM) is attached to the motor of the electric power steering assembly.</p>
	<p>33. SLIDE 33 EXPLAIN Figure 51-21 Schematic showing the electric power steering and the torque/position sensor</p>

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	<p>DEMONSTRATION: SHOW EXAMPLE OF A SCAN TOOL AND EXPLAIN HOW IT WORKS TO DIAGNOSE ELECTRIC POWER STEERING</p>
	<p>34. SLIDE 34 EXPLAIN CHART 51-1</p> <p>35. SLIDES 35-37 EXPLAIN Electrohydraulic Power Steering: EHPS Module</p>
	<p>VIDEO: RACK & PINION DIAGNOSIS WWW.MYAUTOMOTIVELAB.COM</p> <p><small>HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO0640X480.PHP?TITLE=DIAGNOSING%20RACK%20AND%20PINION%20PROBLEMS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/SUSPENSION_STEERING/DIAGNOSING_RACK_PINION_PROBLEMS.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/SUSPENSION_STEERING/XML/DIAGNOSING_RACK_PINION_PROBLEMS.XML</small></p>
	<p>DEMONSTRATION: SHOW VARIOUS USED BELTS & DESCRIBE DIFFERENT TYPES OF WEAR. SHOW HOW TO USE A BELT TENSION GAUGE. SHOW OEM RECOMMENDATIONS ON HOW TO PROPERLY SET THE TENSION ON THE ACCESSORY DRIVE BELT OF A POWER STEERING UNIT</p>
	<p>HANDS-ON TASK: HAVE THE STUDENTS INSPECT A VEHICLE'S ACCESSORY DRIVE BELT FOR WEAR</p>
	<p>38. SLIDES 38-39 EXPLAIN Power Steering Diagnosis and Troubleshooting</p> <p>40. SLIDE 40 EXPLAIN Figure 51-37 typical service manual illustration showing the method to use to properly tension the accessory drive belt.</p>
	<p>FIGURE 51-37 ON SLIDE 40 SHOULD BE LABELED FIGURE 51-22</p>
 	<p>NATEF MLR TASK A4B5 REMOVE, INSPECT, REPLACE, AND ADJUST POWER STEERING PUMP DRIVE BELT.</p>
	<p>DEMONSTRATION: SHOW THE STUDENTS POWER STEERING FLUID, BOTH NEW AND USED. STUDENTS SHOULD KNOW LOOK AND SMELL.</p> <p>FIGURE 51-23</p>
	<p>41. SLIDE 41 EXPLAIN FIGURE 51-23 A check of the power steering fluid should include inspecting not only the level but the condition and color of the fluid, which</p>

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 	<p>could indicate a possible problem with other components in the steering system</p> <p>NATEF MLR TASK A4B2 DETERMINE PROPER POWER STEERING FLUID TYPE; INSPECT FLUID LEVEL AND CONDITION</p>
	<p>42. SLIDE 42 EXPLAIN Power Steering Diagnosis and Troubleshooting</p> <p>43. SLIDE 43 EXPLAIN Figure 51-24 Some power steering fluid is unique to the climate, such as this cold climate fluid recommended for use in General Motors vehicles when temperatures are low.</p> <p>44. SLIDE 44 EXPLAIN Figure 51-25 Inspect both high-pressure and return power steering hoses. Make sure the hoses are routed correctly and not touching sections of the body to prevent power steering noise from being transferred to the passenger compartment</p>
	<p><u>DEMONSTRATION: SHOW EXAMPLES OF POWER STEERING ANALYZERS</u></p>
	<p><u>DEMONSTRATION: SHOW HOW TO CONNECT A POWER STEERING ANALYZER TO A POWER STEERING SYSTEM</u></p>
	<p><u>DEMONSTRATION: SHOW THE STUDENTS HOW TO REMOVE AND REPLACE A POWER STEERING PUMP PULLEY.</u></p>
	<p><u>HANDS-ON TASK: HAVE THE STUDENTS REMOVE AND REPLACE A POWER STEERING PUMP PULLEY</u></p>
 	<p><u>NATEF MLR TASK A4B3. FLUSH, FILL, AND BLEED POWER STEERING SYSTEM</u></p>
 	<p><u>NATEF MLR TASK A4B4 INSPECT FOR POWER STEERING FLUID LEAKAGE; DETERMINE NECESSARY ACTION.</u></p>
 	<p><u>NATEF MLR TASK A4B6 INSPECT & REPLACE POWER STEERING HOSES & FITTINGS.</u></p>

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	<p><u>NATEF MLR TASK A4B7</u> REPLACE POWER STEERING PUMP FILTER(S).</p>
	<p><u>NATEF MLR TASK A4B23</u> IDENTIFY HYBRID VEHICLE POWER STEERING SYSTEM ELECTRICAL CIRCUITS AND SAFETY PRECAUTIONS.</p>
	<p>SEARCH INTERNET: HAVE STUDENTS SEARCH INTERNET TO RESEARCH TILT MECHANISMS AND TELESCOPING STEERING COLUMNS. DIVIDE THE STUDENTS INTO TWO DEBATE GROUPS. HAVE THE FIRST GROUP DEFEND THE TILT-MECHANISM STEERING COLUMN AS THE BEST CHOICE, BASED ON ITS FEATURES. HAVE THE SECOND GROUP DEFEND THE TELESCOPING STEERING COLUMN IS BEST CHOICE, BASED ON FEATURES.</p>