
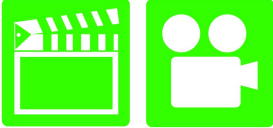

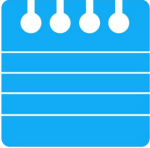







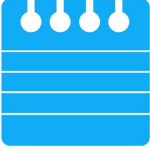













Automotive Maintenance and Light Repair, 1ST Edition

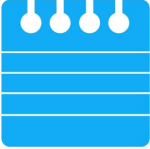







Chapter 21 In-Vehicle Engine Service

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 certification test content area “A” (General Engine Diagnosis)• Diagnose and replace the thermostat.• Diagnose and replace the water pump.• Diagnose and replace an intake manifold gasket.• Determine and verify correct cam timing• Replace a timing a belt• Describe how to adjust valves• Explain hybrid engine precautions
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	Ch21 In-Vehicle Engine Service
	<p>1. SLIDE 1 C21 In-Vehicle Engine Service</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>2. SLIDES 2-3 EXPLAIN Objectives</p> <p>4. SLIDE 4 EXPLAIN Thermostat Replacement</p> <p>5. SLIDE 5 EXPLAIN Figure 21-1 If thermostat has a JIGGLE VALVE, it should be placed toward top to allow air to escape. If a thermostat were to become stuck open or open too soon, this can set DTC P0128 (coolant temperature below thermostat regulating temperature)</p>
	<p>6. SLIDES 6-10 EXPLAIN Thermostat Replacement</p> <p>RUNNING ENGINE WITHOUT THERMOSTAT COULD CAUSE OVERHEATING. COOLANT FLOWS TOO FAST TO ALLOW RADIATOR TIME TO REMOVE HEAT.</p>
	<p>HANDS-ON TASK: HAVE STUDENTS BENCH TEST A THERMOSTAT</p>
	<p>DEMONSTRATION: SHOW STUDENTS HOW TO BURP (PURGE) AIR FROM COOLING SYSTEM</p>
	<p>11. SLIDES 11-14 EXPLAIN Water Pump Replacement</p> <p>15. SLIDE 15 EXPLAIN Figure 21-2 Use caution if using a steel scraper to remove a gasket from aluminum parts. It is best to use a wood or plastic scraper.</p>
	<p>WATER PUMP WEEP HOLE LEAKS WILL SOMETIMES LEAK ONLY HOT OR COLD</p>
	<p>ON-VEHICLE HANDS-ON TASK: HAVE STUDENTS INSPECT WATER PUMP. INSPECTIONS SHOULD INCLUDE: BEARINGS, LEAKS, FLOW.</p>

ICONS	Ch21 In-Vehicle Engine Service
	<p>AFTER WATER PUMP REPLACEMENT, COOLING SYSTEM SHOULD BE FILLED AND PRESSURED AS SOON AS POSSIBLE. THIS WILL ENABLE YOU TO FIND ANY LEAKS BEFORE JOB IS COMPLETED.</p>
	<p>16. SLIDES 16-18 EXPLAIN Intake Manifold Gasket Inspection</p>
	<p>19. SLIDE 19 EXPLAIN Figure 21-3 An intake manifold gasket that failed and allowed coolant to be drawn into the cylinder(s).</p>
	<p>20. SLIDE 20 EXPLAIN Intake Manifold Gasket Inspection: Diagnose Leaking Intake Manifold Gasket</p>
	<p>21. SLIDES 21-23 EXPLAIN Intake Manifold Gasket Replacement</p>
	<p>24. SLIDE 24 EXPLAIN Figure 21-4 lower intake manifold attaches to the cylinder heads.</p>
	<p>25. SLIDE 25 EXPLAIN Figure 21-5 upper intake manifold, called plenum, attaches to lower intake manifold.</p>
	<p>26. SLIDES 26-29 EXPLAIN Intake Manifold Gasket Replacement</p>
	<p>30. SLIDE 30 EXPLAIN Figure 21-6 Many aftermarket replacement intake manifolds have a different appearance from the original manifold.</p>
	<p>31. SLIDES 31-32 EXPLAIN Intake Manifold Gasket Replacement</p>
	<p><u>DEMONSTRATION: SHOW STUDENTS HOW TO USE TORQUE WRENCH TO TIGHTEN AN INTAKE MANIFOLD.</u></p>
	<p><u>ON-VEHICLE HANDS-ON TASK: HAVE STUDENTS R&R AN INTAKE MANIFOLD GASKET, USING THE CORRECT PROCEDURE.</u></p>
	<p>33. SLIDES 33-38 EXPLAIN Timing Belt Replacement &</p> <p>39. SLIDE 39 EXPLAIN FIGURE 21-7 single overhead camshaft engine with a timing belt that also rotates water pump.</p>
	<p>MOST OVERHEAD CAM (OHC) ENGINES USED TODAY ARE NOT FREE RUNNING. MEANS THAT ENGINE DAMAGE CAN OCCUR IF TIMING BELT BREAKS. THIS DAMAGE COULD BE BENT VALVES, DAMAGED VALVE SEATS, HOLED PISTONS, ETC.</p>

ICONS	Ch21 In-Vehicle Engine Service
	<p>ALWAYS ROTATE ENGINE BY HAND TO VERIFY TIMING. IF BINDING IS FELT, STOP! THIS COULD MEAN THAT VALVES ARE HITTING PISTONS.</p>
	<p>ON-VEHICLE NATEF TASK: INSPECT AND REPLACE CAMSHAFT & DRIVE BELT/CHAIN</p>
	<p>DIGITAL PHOTOGRAPHS TAKEN BEFORE DISASSEMBLY FOR VALVE ADJUSTMENT CAN SAVE TIME WHEN REASSEMBLING</p>
	<p>40. SLIDES 40-43 EXPLAIN Hybrid Engine Precautions</p> <p>44. SLIDE 44 EXPLAIN Figure 26-8 A Toyota/Lexus hybrid electric vehicle has a ready light. If the ready light is on, the engine can start at anytime without warning.</p>
	<p>45. SLIDE 45 EXPLAIN Hybrid Engine Precautions</p> <p>46. SLIDE 46 EXPLAIN Figure 26-9 Always use viscosity of oil as specified on oil fill cap.</p>
	<p>DISCUSSION: ASK STUDENTS WHY IT IS IMPORTANT TO USE CORRECT TORQUE SEQUENCE AND TORQUE VALUES.</p>
	<p>47. SLIDES 47-70 EXPLAIN ADJUSTING VALVES</p>
	<p>ON-VEHICLE NATEF TASK: ADJUST VALVES (MECHANICAL OR HYDRAULIC LIFTERS)</p>