Automotive Engines
Chapter 23 IN-VEHICLE ENGINE SERVICE
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This engine systems course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
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 as listed on the second SLIDE. 1. Prepare for ASE certification test content area "A" (General Engine Diagnosis). 2. Diagnose and replace the thermostat. 3. Diagnose and replace the water pump. 4. Diagnose and replace an intake manifold gasket. 5. Determine and verify correct cam timing. 6. Replace a timing belt. 7. Describe how to adjust valves. 8. Explain hybrid engine precautions.
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.

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	**1. SLIDE CH23 IN-VEHICLE ENGINE SERVICE** **2. SLIDES 2-3 EXPLAIN Objectives & KEY TERMS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS UPDATED REGULARLY**
	**4. SLIDE 4 EXPLAIN** Thermostat Replacement **5. SLIDE 5 EXPLAIN FIGURE 23-1** 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 a **DTC P0128** (coolant temperature below thermostat regulating temperature). **6. SLIDES 6-7 EXPLAIN Thermostat Replacement**
	**Running an engine without a thermostat could cause overheating. Coolant flows too fast to allow radiator time to remove heat.**
	**HANDS-ON TASK: Have students bench test a thermostat**
	**DEMONSTRATION: Show students how to burp (purge) the air from a cooling system.**
	**8. SLIDES 8-9 EXPLAIN** Water Pump Replacement **10. SLIDE 10 EXPLAIN FIGURE 23-2** Use caution if using a steel scraper to remove a gasket from aluminum parts. It is best to use a wood or plastic scraper.
	**Water pump weep hole leaks will sometimes leak only hot or cold**
	**ON-VEHICLE HANDS-ON TASK: Have students inspect water pump. Inspections should include: bearings, leaks, flow.**

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	**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.**
	**11. SLIDE 11** EXPLAIN Intake Manifold Gasket Inspection **12. SLIDE 12** EXPLAIN **FIGURE 23-3** An intake manifold gasket that failed and allowed coolant to be drawn into the cylinder(s).
	**13. SLIDE 13** EXPLAIN Intake Manifold Gasket Inspection **14. SLIDES 14-16** EXPLAIN Intake Manifold Gasket Replacement **17. SLIDE 17** EXPLAIN **FIGURE 23-4** lower intake manifold attaches to the cylinder heads. & EXPLAIN **FIGURE 23-5** upper intake manifold, often called a plenum, attaches to the lower intake manifold. **18. SLIDE 18** EXPLAIN **FIGURE 23-6** Many aftermarket replacement intake manifolds have a different appearance from the original manifold.
	**DEMONSTRATION: Show students how to use torque wrench to tighten an intake manifold.**
	**ON-VEHICLE HANDS-ON TASK: Have students R&R an intake manifold gasket, using the correct procedure.**
	**19. SLIDES 19-21** EXPLAIN Timing Belt Replacement **22. SLIDE 22** EXPLAIN **FIGURE 23–7** A single overhead camshaft engine with a timing belt that also rotates the water pump
	**Most overhead cam (OHC) engines used today are not Free Running. This means that engine damage can occur if timing belt breaks. This damage could be bent valves, damaged valve seats, holed pistons, etc. Always rotate an engine by hand to verify timing. If any binding is felt, stop! This could mean that valves are hitting pistons.**
	

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	**ON-VEHICLE NATEF TASK: Inspect and replace camshaft and drive belt/chain: PAGE 103**
	**Digital photographs taken before disassembly for valve adjustment can save time when reassembling**
	23. **SLIDES 23-24 EXPLAIN** Hybrid Engine Precautions 25. **SLIDE 25 EXPLAIN FIGURE 23-8** A Toyota/Lexus hybrid electric vehicle has a ready light. If the ready light is on, the engine can start at anytime without warning. 26. **SLIDES 26-27 EXPLAIN** Hybrid Engine Precautions & **EXPLAIN FIGURE 23-9** Always use viscosity of oil as specified on oil fill cap.
	**DISCUSSION: Ask students why it is important to use correct torque sequence and torque values.**
	**ON-VEHICLE NON-NATEF TASK: Adjust valves (mechanical or hydraulic lifters)**
	**SEARCH INTERNET: Have students use Internet to find information on interference (non-free-running) engines. Have students make a chart of all the students' cars. (If they don't have a car, have them pick one from lab vehicles.) The chart should show which engines are free-running.**
	**Talk through SUMMARY and questions**
	**HOMEWORK: complete Ch23 crossword puzzle: http://www.jameshalderman.com/links/book_engine_theory_serv_7/cw/crossword_ch_23.pdf**