Advanced Engine Performance Diagnosis 6/E
Chapter 3 Variable Valve Timing Systems
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This 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: 1. List the reasons for variable valve timing. 2. Discuss the various types of variable valve timing. 3. Explain how to diagnose variable valve timing faults. 4. This chapter will help you prepare for Engine Repair (A8) ASE certification test content area "A" (General Engine 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.

NOTE: This lesson plan is based on Advanced Engine Performance Diagnosis 6/E Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 03: Chapter Images

ICONS	Ch03 Variable Valve Timing Systems
	1. **SLIDE 1 CH3 VARIABLE VALVE TIMING SYSTEMS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**Videos**
	**At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**
	
	**ON-VEHICLE NATEF TASK Research CAMSHAFT SPECS**
	**DISCUSSION: Ask the students to explain the difference between a free-wheeling engine design & interference engine design. Figures 32-14/15**
	2. **SLIDE 1 EXPLAIN Figure 3-1** Camshaft rotation during advance and retard. 3. **SLIDE 3 EXPLAIN Figure 3-2** The camshaft is rotated in relation to the crankshaft by the PCM to provide changes in valve timing. 4. **SLIDE 4 EXPLAIN Figure 3-3** Spline cam phaser assembly
	**VVT Operation (View) (Download)**
	**DISCUSSION: Ask the students how oil viscosity may affect operation of camshaft position actuator**

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	**DEMONSTRATION: Show an example of a camshaft position actuator oil control valve.**
	**HANDS-ON TASK: Have students search service information to determine what controls camshaft position actuator oil control valve.**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**DISCUSSION: Ask the students to discuss the advantages of intake and exhaust camshaft phasing.**
	**Control solenoid screen can become plugged if the oil is not changed regularly. Changes in performance and emissions.**
	5. **SLIDE 5 EXPLAIN Figure 3-4** Spline phaser. 6. **SLIDE 6 EXPLAIN FIGURE 3-5** The screen(s) protect the solenoid valve from dirt and debris that can cause the valve to stick 7. **SLIDE 7 EXPLAIN Figure 3-6** vane phaser is used to move camshaft, using changes in oil pressure from the oil control valve. 8. **SLIDE 8 EXPLAIN Figure 3-7** magnetically controlled vane phaser. 9. **SLIDE 9 EXPLAIN Figure 3-8** PCM commands 50% duty cycle, oil flow through phaser drops to zero. 10. **SLIDE 10 EXPLAIN Figure 3-9** camshaft position actuator used in a cam-in-block engine.
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**DEMONSTRATION: Using a scan tool and vehicle equipped with variable valve timing, show the students what variable valve timing data can be observed using the scan tool.**

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	**HANDS-ON TASK:** For a vehicle that uses variable valve timing, have the students use service information to read a description of the variable valve timing and how it is controlled on that vehicle.
	**DEMONSTRATION:** Show an example of a vane phaser system, if one is available.
	**HANDS-ON TASK:** Have the students use service information to research the role that the PCM plays in activation of the variable valve controls.
	**ON-VEHICLE NATEF TASK** Establish camshaft position sensor indexing. (P-1) Page 99
	**VVT Operation (View) (Download)**
	11. **SLIDE 11 EXPLAIN Figure 3-10** A plastic mockup of a Honda VTEC system that uses two different camshaft profiles—one for low-speed engine operation and the other for high speed. 12. **SLIDE 12 EXPLAIN Figure 3-11** Engine oil pressure is used to switch cam lobes on a VTEC system. 13. **SLIDE 13 EXPLAIN Figure 3-12** A typical variable cam timing control valve. The solenoid is controlled by the engine computer and directs engine oil pressure to move a helical gear, which rotates the camshaft relative to the timing chain sprocket 14. **SLIDE 14 EXPLAIN Figure 3-13** schematic of a variable valve timing control circuit, showing that battery power (+) is being applied to the variable valve timing (VVT) solenoid and pulsed to ground by the PCM 15. **SLIDE 15 EXPLAIN Figure 3-14** variable valve timing solenoid being controlled by applying voltage from PCM
	**HANDS-ON TASK:** For a vehicle with variable timing, have students' list PCM codes that are associated with the variable valve timing system.

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	**DISCUSS REAL WORLD FIX**
	**DEMONSTRATION: Using a scan tool, show how PWM is used to control the actuator solenoid.**
	**HANDS-ON TASK: Have students use service information to research VTEC system used by Honda.**
	**DEMONSTRATION: Show some examples of camshaft position sensors.**
	16. **SLIDE 16 EXPLAIN Figure 3-15** Oil pressure applied to the locking pin causes the inside of the lifter to freely move inside the outer shell of the lifter, thereby keeping the valve closed 17. **SLIDE 17 EXPLAIN Figure 3-16** Active fuel management includes many different components and changes to the oiling system, which makes routine oil changes even more important on engines equipped with this system 18. **SLIDE 18 EXPLAIN Figure 3-17** driver information display on a Chevrolet Impala with a 5.3 liter V-8 equipped with active fuel management
	**DEMONSTRATION: Show some examples, if available, of cylinder deactivation controls used by various OEMS.**
	**DISCUSSION: Ask the students to discuss the main purpose of cylinder deactivation. (Answer: Fuel economy.)**