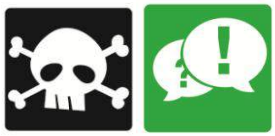
Advanced Engine Performance Diagnosis 6/E
Chapter 4 Engine and Misfire Diagnosis
Opening Your Class

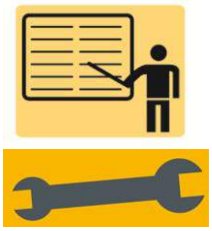
KEY ELEMENT	EXAMPLES
Introduce Content	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked 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. Prepare for ASE Engine Performance (A8) certification test content area "A" (General Diagnosis). 2. Discuss engine noise and engine smoke concerns and its relation to engine condition. 3. Describe how to perform dry, wet, and running compression tests. 4. Explain how to perform a cylinder leakage test. 5. Discuss vacuum testing to determine engine condition. 6. Describe how to test for excessive exhaust system back pressure. 7. List the possible causes of an engine misfire 8. Explain how to perform a diagnostic step-by-step procedure to determine the root cause of a misfire. 9. Describe how to perform a cylinder power balance, cylinder contribution test, and cylinder pressure testing
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 04: Chapter Images

ICONS	Chapter 4 Engine & Misfire Diagnosis
         	**1. SLIDE 1 Ch4 ENGINE & MISFIRE DIAGNOSIS** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **ENGINE DIAGNOSIS** **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)** 2. **SLIDE 2 EXPLAIN Figure 4-1** White steam is usually an indication of a blown (defective) cylinder head gasket that allows engine coolant to flow into the combustion chamber where it is turned to steam. **DISCUSS WARNING** **DISCUSSION: Ask students to describe some common mechanical-related customer complaints about the engine.** **DISCUSSION: discuss questions they should ask customers prior to diagnosing an engine problem. Then discuss visual inspections they should conduct** 3. **SLIDE 3 EXPLAIN Figure 4-2** What looks like an oil pan gasket leak can be a rocker cover gasket leak. Always look up and look for the highest place you see oil leaking; that should be repaired first. 4. **SLIDE 4 EXPLAIN Figure 4-3** noisy valve was discovered to be a pushrod that punched through a rocker

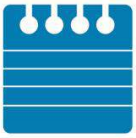
ICONS	Chapter 4 Engine & Misfire Diagnosis
	arm on this General Motors 3.1 liter V-6 engine. 5. **SLIDE 5 EXPLAIN Figure 4-4** accessory belt tensioner. Most tensioners have a mark that indicates normal operating location.
DEMO	**DEMONSTRATION: Show students location of crankcase vent hose**
	HANDS-ON TASK: Have students check oil level and condition of an engine. Then have them check the coolant level and condition of an engine.
	DISCUSSION: Talk about the different types of leaks that may be observed under a vehicle and how the color of the fluid indicates the type of leak. Discuss consequences of oil leaks.
We Support NATEF	**ON-VEHICLE TASK: NATEF Task Inspect engine for fuel, oil, coolant and other leaks; determine necessary action (P-1) PAGE 67**
	HANDS-ON TASK: Use foot powder spray trick to check for engine oil leaks. Review Tech Tip in textbook before attempting this task.
	6. **SLIDE 6 EXPLAIN Figure 4-5** cracked exhaust manifold can make clicking sound that is often difficult to find.
QUESTION	**DISCUSSION: Ask students to describe some of the possible causes of engine knock. Discuss possible causes of low oil pressure.**
We Support NATEF	**ON-VEHICLE TASK: NATEF Task Diagnose engine noises and vibration; determine necessary action (P-2) Page 68:**
	7. **SLIDE 7 EXPLAIN Figure 4-6** To measure engine oil pressure, remove the oil pressure sending (sender) unit usually located near the oil filter. Screw the pressure gauge into the oil pressure sending unit hole
DEMO	**DEMONSTRATION: Show students how to use an oil pressure gauge to test oil pressure.**

ICONS	Chapter 4 Engine & Misfire Diagnosis
	**ON-VEHICLE NATEF TASK: Perform oil pressure test; determine necessary action (P-1) Page 74** **DISCUSSION: When you are driving your car, oil pressure warning light IS ON. What conditions are indicated? What actions should you take as a driver? Discuss differences between oil light and an oil gauge on dash. Why does oil gauge vary at idle on some vehicles and not on others?**
	8. **SLIDE 8 EXPLAIN Figure 4-7** GM Tech 2 scan tool display showing a random misfire DTC has been detected.
	EXPLAIN TECH TIP
	9. **SLIDE 9 EXPLAIN Figure 4-8** broken accessory drive belt tensioner can cause engine speed to vary as belt loosens and then tightens causing what is measured by CKP as uneven engine speed and a possible P0300 random misfire diagnostic trouble code.
	EXPLAIN TECH TIP
	10. **SLIDE 10 EXPLAIN Figure 4-9** scan tool, such as a Tech 2, can often identify ignition system related faults that can be the cause of a misfire. 11. **SLIDE 11 EXPLAIN Figure 4-10** Ford IDS scan tool has a graph function that allows the technician to view the data on the cylinder contribution test visually, making diagnosis easier. 12. **SLIDE 12 EXPLAIN Figure 4-11** Using a vacuum hose & test light to ground one cylinder at a time on a distributorless ignition system. Works on all types of ignition systems & provides a method for grounding out 1 cylinder at a time without fear of damage. To avoid possible damage to catalytic converter, do not short out a cylinder for longer than 5 seconds.
	13. **SLIDE 13 EXPLAIN Figure 4-12A** relative compression test shown on a Fluke scope

ICONS	Chapter 4 Engine & Misfire Diagnosis
	14. **SLIDE 14 EXPLAIN Figure 4-12B** relative compression test as shown on a Pico scope
	**DEMONSTRATION: Show students a compression gauge & how it attaches to engine.**
	**DEMONSTRATION: Show students hose trick for installing spark plugs**
	15. **SLIDE 15 EXPLAIN Figure 4-13** A pressure waveform display showing the pressures inside the cylinder during engine cranking through all four strokes (720 degrees of crankshaft rotation). 16. **SLIDE 16 EXPLAIN Figure 4-14** coil-on-plug ignition coil and spark plug were removed and the pressure transducer was threaded into the spark plug hole. 17. **SLIDE 17 EXPLAIN Figure 4-15** Pico scope connected to a laptop computer is being used to capture the cylinder pressure waveform
	**EXPLAIN TECH TIP**
	18. **SLIDE 18 EXPLAIN Figure 4-16** It often requires an assistant to perform compression test: One person watches the first puff reading on the gauge and other person cranks engine. 19. **SLIDE 19 EXPLAIN Figure 4-17** Badly burned exhaust valve. A compression test could have detected a problem, and a cylinder leakage test (leak-down test) could have been used to determine the exact problem 20. **SLIDE 20 EXPLAIN Figure 4-18** two-piece compression gauge set. The threaded hose is screwed into the spark plug hole after removing the spark plug. The gauge part is then snapped onto the end of the hose.
	**DEMONSTRATION: Show students how to perform a wet compression test and discuss results.**

ICONS	Chapter 4 Engine & Misfire Diagnosis
	**DISCUSSION: Discuss the reasons for loss of compression. Ask students to describe how to perform a Compression Test**
	**DEMONSTRATION: Show students how to perform a running (dynamic) compression test.**
	**DISCUSSION: Ask how cranking, idling, & higher RPM compare with respect to compression pressure.**
	**ON-VEHICLE NATEF TASK: Perform cylinder compression tests; determine necessary action (P-1) PAGE 72**
	21. **SLIDE 21 EXPLAIN Figure 4-19** typical handheld cylinder leakage tester. 22. **SLIDE 22 EXPLAIN Figure 4-20** whistle stop used to find top dead center. Remove the spark plug and install the whistle stop, then rotate the engine by hand. When the whistle stops making a sound, the piston is at the top
	**DEMONSTRATION: Show students how to perform a cylinder leakage test, using a handheld cylinder leakage tester.**
	**ON-VEHICLE NATEF TASK: Perform cylinder leakage tests; determine necessary action (P-1) PAGE 73**
	
	**DEMONSTRATION: Show students how to conduct a cylinder power balance test.**
	**DEMONSTRATION: Show students how to use a whistle stop to find top dead center (TDC) of compression stroke.**

ICONS	Chapter 4 Engine & Misfire Diagnosis
	**ON-VEHICLE NATEF TASK: Perform cylinder power balance tests; determine necessary action (P-2) PAGE 71**
	23. **SLIDE 23 EXPLAIN Figure 4-21** An engine in good mechanical condition should produce 17 to 21 in. Hg of vacuum at idle at sea level. 24. **SLIDE 24 EXPLAIN Figure 4-22** A steady but low reading could indicate retarded valve or ignition timing.
	**DISCUSSION: Discuss the various types of manifold vacuum tests & their purposes.**
	25. **SLIDE 25 EXPLAIN Figure 4-23** A gauge reading with the needle fluctuating 3 to 9 in. Hg below normal often indicates a vacuum leak in the intake system. 26. **SLIDE 26 EXPLAIN Figure 4-24** A leaking head gasket can cause the needle to vibrate as it moves through a range from below to above normal. 27. **SLIDE 27 EXPLAIN Figure 4-25** oscillating needle 1 or 2 in. Hg below normal could indicate an incorrect air-fuel mixture (either too rich or too lean). 28. **SLIDE 28 EXPLAIN Figure 4-26** rapidly vibrating needle at idle that becomes steady as engine speed is increased indicates worn valve guides. 29. **SLIDE 29 EXPLAIN Figure 4-27** needle drops 1 or 2 in. Hg from normal reading, one of engine valves is burned or not seating properly. 30. **SLIDE 30 EXPLAIN Figure 4-28** Weak valve springs will produce a normal reading at idle, as engine speed increases, needle will fluctuate rapidly between 12-24 in
	**Needle that drops to near zero when the engine is accelerated rapidly and then rises slightly to a reading below normal indicates an exhaust restriction.**
	**ON-VEHICLE NATEF TASK: Perform engine vacuum tests; determine necessary action (P-1) PAGE 70**
	**DEMONSTRATION: Show students how to test back pressure by using a vacuum gauge**

ICONS	Chapter 4 Engine & Misfire Diagnosis
	31. **SLIDE 31 EXPLAIN Figure 4-29** A typical vacuum waveform as displayed on a scope connected to a vacuum transducer and connected to the intake manifold 32. **SLIDE 32 EXPLAIN Figure 4-30** The relationship among cylinders showing where the intake stroke occurs in relation to other cylinders.
	**A pressure gauge adapter can be fashioned from a short section of brake line.**
	**Show CHECKING EXHAUST BACKPRESSURE VIDEO: 2 MINUTES: CH26**
	33. **SLIDE 33 EXPLAIN Figure 4-31** technician-made adapter used to test exhaust system back pressure. 34. **SLIDE 34 EXPLAIN Figure 4-32** A technician marked pressure gauge showing a green line for acceptable backpressure readings and the red line indicating excessive backpressure readings.
	**DISCUSSION: Compare and contrast various types of exhaust restriction tests.**
	35. **SLIDE 35 EXPLAIN Figure 4-33** tester that uses a blue liquid to check for exhaust gases in the exhaust, which would indicate a head gasket leak problem. 36. **SLIDES 36-53 COMPRESSION TEST SHOW**
	**DISCUSSION: Ask students how they would diagnose a head gasket failure. Compare various diagnostic techniques described in textbook: using an exhaust gas analyzer, using a chemical tester, determining if there are bubbles in the coolant, & observing for excessive exhaust steam.**
	**DISCUSSION: As you are driving, coolant temperature light becomes illuminated (or coolant gauge reads high). What actions should you take?**