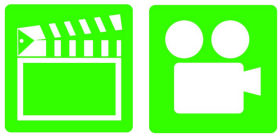
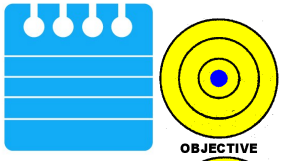
A8 Engine Performance 4th Edition

Chapter 13 Engine Condition Diagnosis

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Engine Performance.** 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. 1. Prepare for ASE Engine Performance (A8) certification test content area "A" (General Engine Diagnosis). 2. List the visual checks to determine engine condition. 3. Discuss engine noise and its relation to engine condition. 4. Describe how to perform dry, wet, and running compression tests. 5. Explain how to perform a cylinder leakage test. 6. Discuss vacuum testing to determine engine condition. 7. Describe how to test for excessive exhaust system back pressure.
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.

ICONS	Ch13 Engine Condition Diagnosis
	**1. SLIDE 1 CH13 Engine Condition Diagnosis**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED**
	**POWER POINTS DONE BY INDIVIDUAL LEARNING OBJECTIVES, SO THERE IS POWER POINT FILE FOR EACH LEARNING OBJECTIVE**
	**2. SLIDE 2 EXPLAIN OBJECTIVE CH13 AEP_LO1** **3. SLIDES 3-4 EXPLAIN Typical Engine-Related Complaints**
	**5. SLIDE 5 EXPLAIN Figure 13-1** Blowby gases coming out of the crankcase vent hose. Excessive amounts of combustion gases flow past the piston rings and into the crankcase. **6. SLIDE 6 EXPLAIN Figure 13-2** 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.
	**DISCUSSION: ASK STUDENTS TO DESCRIBE SOME COMMON MECHANICAL-RELATED CUSTOMER COMPLAINTS ABOUT THE ENGINE.**
	**DISCUSSION: ASK STUDENTS TO CONSIDER KINDS OF QUESTIONS THEY SHOULD ASK CUSTOMERS PRIOR TO DIAGNOSING AN ENGINE PROBLEM. THEN DISCUSS VISUAL INSPECTIONS THEY SHOULD CONDUCT**
	**7. SLIDES 7-8 EXPLAIN** The Driver Is Your Best Resource
	**2. SLIDE 2 EXPLAIN OBJECTIVE CH13 AEP_LO2** **3. SLIDE 3 EXPLAIN VISUAL CHECKS**

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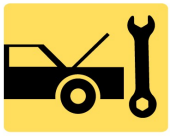
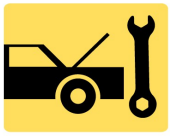
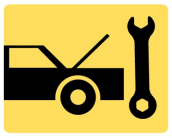
	4. **SLIDE 4 EXPLAIN Figure 13-3** What looks like an oil pan gasket leak can be a rocker cover gasket leak. Always look up and look for the highest place you see oil leaking; that should be repaired first. 5. **SLIDE 5 EXPLAIN Figure 13-4** transmission and flexplate (flywheel) were removed to check the exact location of this oil leak. The rear main seal and/or the oil pan gasket could be the cause of this leak. 6. **SLIDE 6 EXPLAIN Figure 13-5** Using a black light to spot leaks after adding dye to the oil.
	**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.**
	**ON-VEHICLE TASK: NATEF TASK: INSPECT ENGINE FOR FUEL, OIL, COOLANT AND OTHER LEAKS; DETERMINE NECESSARY ACTION.**
	**HANDS-ON TASK: USE FOOT POWDER SPRAY TRICK TO CHECK FOR ENGINE OIL LEAKS**
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH13 AEP_LO3** 3. **SLIDES 3-4 EXPLAIN** Engine Noise Diagnosis
	**DISCUSSION: ASK STUDENTS TO DESCRIBE SOME OF THE POSSIBLE CAUSES OF ENGINE KNOCK. DISCUSS CAUSES OF LOW OIL PRESSURE.**
	**ENGINE NOISES** **WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=LISTENING%20TO%20ENGINE%20NOISE&CLIP=PANDC/CHET/2012/AUTOMOTIVE/ENGINES/A1T1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/ENGINES/XML/A1T1.XML

ICONS	Ch13 Engine Condition Diagnosis
	**VIDEO ENGINE NOISE DIAGNOSIS WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=LISTENING%20TO%20ENGINE%20NOISE&CLIP=PANDC/CHET/2012/AUTOMOTIVE/TEST_READINESS_A1/CA_T4.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/TEST_READINESS_A1/XML/CA_T4.XML
	**ON-VEHICLE TASK: NATEF TASK: DIAGNOSE ENGINE NOISES AND VIBRATION; DETERMINE NECESSARY ACTION**
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH13 AEP_LO4** 3. SLIDES 3-4 EXPLAIN Compression Test
	5. SLIDE 5 EXPLAIN **FIGURE 13–10** A 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
	**HANDS-ON TASK: HAVE STUDENTS CONDUCT PAPER TEST OF EXHAUST FLOW TO CHECK FOR ENGINE PROBLEMS.**
	**DEMONSTRATION: SHOW HOW TO USE AN OIL PRESSURE GAUGE TO TEST OIL PRESSURE.**
	**ON-VEHICLE NATEF TASK: PERFORM OIL PRESSURE TEST; DETERMINE NECESSARY ACTION**
	**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?**
	6. SLIDE 6 EXPLAIN **Figure 13-11** Use a vacuum or fuel line hose over the spark plug to install it without danger of cross-threading the cylinder head.
	**DEMONSTRATION: SHOW STUDENTS A COMPRESSION GAUGE & HOW IT ATTACHES TO ENGINE.**

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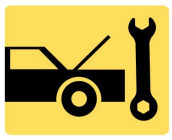
	**DEMONSTRATION: SHOW STUDENTS HOSE TRICK FOR INSTALLING SPARK PLUGS**
	7. **SLIDE 7 EXPLAIN** Wet Compression Test & **EXPLAIN Figure 13-12** Badly burned exhaust valve. A compression test could have detected a problem, and a cylinder leakage test (leak-down test) could have been used to determine the exact problem 8. **SLIDE 8 EXPLAIN** Running (Dynamic) Compression Test
	
 	**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 WET COMPRESSION TEST AND DISCUSS RESULTS.**
	**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.**
 	2. **SLIDE 2 EXPLAIN OBJECTIVE CH13 AEP_LO5** 3. **SLIDES 3-4 EXPLAIN** Cylinder Leakage Test
	5. **SLIDE 5 EXPLAIN Figure 13-13** typical handheld cylinder leakage tester. 6. **SLIDE 6 EXPLAIN Figure 13-14** 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

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DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO PERFORM A CYLINDER LEAKAGE TEST, USING A HANDHELD CYLINDER LEAKAGE TESTER.**
We Support NATEF	**ON-VEHICLE NATEF TASK: PERFORM CYLINDER LEAKAGE TESTS; DETERMINE NECESSARY ACTION (P-1)**
	VIDEO: POWER BALANCE, COMPRESSION TEST: WWW.MYAUTOMOTIVELAB.COM HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=PERFORMING,%20POWER%20BALANCE,%20COMPRESSION,&CLIP=PANDC/CHET/2012/AUTOMOTIVE/ENGINE_PERFORMANCE/PERFORMING_POWER_BALANCE.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/ENGINE_PERFORMANCE/XML/PERFORMING_POWER_BALANCE.XML
	7. SLIDES 7-8 EXPLAIN Cylinder Power Balance Test
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO CONDUCT A CYLINDER POWER BALANCE TEST.**
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO USE A WHISTLE STOP TO FIND TOP DEAD CENTER (TDC) OF COMPRESSION STROKE.**
OBJECTIVE	2. SLIDE 2 EXPLAIN **OBJECTIVE CH13 AEP_LO6** 3. SLIDES 3-4 EXPLAIN Cylinder Power Balance Test
We Support NATEF	**ON-VEHICLE NATEF TASK: PERFORM CYLINDER POWER BALANCE TESTS; DETERMINE NECESSARY ACTION.**
OBJECTIVE	2. SLIDE 2 EXPLAIN **OBJECTIVE CH13 AEP_LO7** 3. SLIDE 3 EXPLAIN Exhaust Restriction Test
DEMO	**DEMONSTRATION: SHOW STUDENTS HOW TO TEST BACK PRESSURE BY USING A VACUUM GAUGE**

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	**A PRESSURE GAUGE ADAPTER CAN BE FASHIONED FROM A SHORT SECTION OF BRAKE LINE.**
	**CHECKING EXHAUST BACKPRESSURE: WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20EXHAUST%20BACK%20PRESSURE&CLIP=PANDC/CHET/2012/AUTOMOTIVE/ADVANCED_DRIVABILITY/L1T2.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/OBD2_GM/XML/L1T2.XML
	**DISCUSSION: COMPARE AND CONTRAST VARIOUS TYPES OF EXHAUST RESTRICTION TESTS.**
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH13 AEP_LO8** 3. SLIDES 3-7 EXPLAIN Vacuum Tests
	8. SLIDE 8 EXPLAIN **Figure 13-16** An engine in good mechanical condition should produce 17 to 21 in. Hg of vacuum at idle at sea level. 9. SLIDE 9 EXPLAIN **Figure 13-17** steady but low reading could indicate retarded valve or ignition timing. **EXPLAIN Figure 13-18** gauge reading with the needle fluctuating 3 to 9 in. Hg below normal often indicates a vacuum leak in the intake system
	**DISCUSSION: DISCUSS THE VARIOUS TYPES OF MANIFOLD VACUUM TESTS & THEIR PURPOSES.**
	**Vacuum Gauge, Retarded Timing** **Vacuum Gauge, Retarded Valve or Ignition Timing** **Vacuum Gauge, Head Gasket Leak** **Vacuum Gauge, Intake Leak** **Vacuum Gauge, Rich or Lean Fuel Mixture** **Vacuum Gauge, Bad Valve Guide** **Vacuum Gauge, Faulty Valve** **Vacuum Gauge, Weak Valve Springs** **Vacuum Gauge, Advanced Ignition Timing** **Vacuum Gauge Readings**
	10. SLIDE 10 EXPLAIN **Figure 13-19** leaking head gasket can cause needle to vibrate as it moves through a range from below to above normal. **EXPLAIN Figure 13-20** oscillating needle 1-2 in. Hg below normal could indicate

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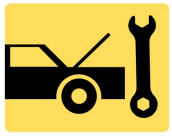
	an incorrect air-fuel mixture (either too rich or too lean). 11. **SLIDE 11 EXPLAIN Figure 13-21** rapidly vibrating needle at idle that becomes steady as engine speed is increased indicates worn valve guides. **EXPLAIN Figure 13-22** needle drops 1-2 in. Hg from normal reading, one of engine valves is burned or not seating 12. **SLIDE 12 EXPLAIN Figure 13-23** Weak valve springs will produce a normal reading at idle, as engine speed increases, needle will fluctuate rapidly between 12-24 in. **EXPLAIN Figure 13-24** steady needle reading that drops 2 or 3 in. Hg when engine speed is increased slightly above idle indicates ignition timing is retarded.
	13. **SLIDE 13 EXPLAIN Figure 13-25** steady needle reading that rises 2 or 3 in. Hg when the engine speed is increased slightly above idle indicates that the ignition timing is advanced. **EXPLAIN Figure 13-26** needle that drops to near zero when engine is accelerated rapidly and then rises slightly to a reading below normal indicates an exhaust restriction. 14. **SLIDES 14-15 EXPLAIN Testing Back Pressure with a Pressure Gauge** 16. **SLIDE 16 EXPLAIN FIGURE 13–27** A technician-made adapter used to test exhaust system back pressure.
 	**ON-VEHICLE NATEF TASK:** **PERFORM ENGINE VACUUM TESTS; DETERMINE NECESSARY ACTION.**
  QUESTION	**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.**
  QUESTION	**DISCUSSION: AS YOU ARE DRIVING, COOLANT TEMPERATURE LIGHT BECOMES ILLUMINATED (OR COOLANT GAUGE READS HIGH). WHAT ACTIONS SHOULD YOU TAKE?**