A8 Engine Performance 4th Edition
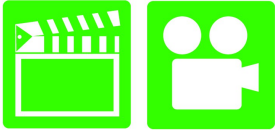
Chapter 33 Scan Tools & Engine Performance Diagnosis

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 the ASE computerized engine controls diagnosis (A8) certification test content area "E". 2. List the steps of the diagnostic process. 3. Describe the simple preliminary test that should be performed at the start of the diagnostic process. 4. List six items to check as part of a through visual inspection. 5. Explain the troubleshooting procedures to follow if a diagnostic trouble code has been set. 6. Explain the troubleshooting procedures to follow if no diagnostic trouble code has been set. 7. Discuss the type of scan tools that are used to ASSESS vehicle components. 8. Describe the methods that can be used to reprogram (reflash) a vehicle computer.
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	Ch33 Scan Tools & Eng. Perf. Diagnosis

1. **SLIDE 1 CH33 Scan Tools & Engine Performance 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 CH33 AEP_LO1**
3. **SLIDES 3-7 EXPLAIN** Eight-Step Diagnostic Procedure

8. **SLIDE 8 EXPLAIN Figure 33-1** funnel is one way to visualize the diagnostic process. The purpose is to narrow the possible causes of a concern until the root cause is determined and corrected. **EXPLAIN Figure 33-2** Step #1 is to verify the customer concern or problem. If the problem cannot be verified, then repair cannot be verified.

DISCUSSION: DISCUSS EIGHT-STEP DIAGNOSIS PROCEDURE. WHY IS IT IMPORTANT TO BEGIN DIAGNOSIS WITH VERIFICATION OF COMPLAINT? FIG 30-1/2 INTERMITTENT PROBLEMS CAN BE DIFFICULT TO DIAGNOSE. IT IS IMPORTANT TO GATHER AS MUCH INFORMATION AS POSSIBLE FOR ACCURATE DIAGNOSIS. FIND OUT TEMPERATURES, SPEEDS, OR OPERATING CONDITIONS WHEN PROBLEMS OCCUR. TRY TO DUPLICATE OPERATING CONDITIONS & CAUSE PROBLEM TO OCCUR.

9. **SLIDE 9 EXPLAIN Figure 33-3** Form that customer should fill out if there is a driveability concern to help the service technician more quickly find the root cause

DEMONSTRATION: GIVE STUDENTS COPIES OF FIGURE 33-3: DIAGNOSIS WORKSHEET. HAVE STUDENTS COMPLETE WORKSHEET USING PROBLEM THEY MAY BE EXPERIENCING, OR MAY HAVE EXPERIENCED IN PAST

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DISCUSSION: HAVE STUDENTS TALK ABOUT **INFORMATION FROM CUSTOMER** THAT MIGHT BE USEFUL IN DIAGNOSING A CONDITION LIKE AN OBJECTIONABLE NOISE. WHAT SPECIFIC QUESTIONS SHOULD BE ASKED OF CUSTOMER FOR EFFICIENT AND ACCURATE DIAGNOSIS?

DISCUSSION: HAVE THE STUDENTS DISCUSS HOW A ROAD TEST WITH CUSTOMER MIGHT HELP WITH PROBLEM DIAGNOSIS. WHAT ARE EXAMPLES OF **CONDITIONS THAT MIGHT HELP DUPLICATE A CONCERN**?

10. **SLIDE 10 EXPLAIN Figure 33-4** This is what was found when removing an air filter from a vehicle that had a lack-of-power concern. Obviously the nuts were deposited by squirrels or some other animal, blocking a lot of the airflow into the engine.

11. **SLIDE 11 EXPLAIN FIGURE 33-5** Using a bright light makes seeing where the smoke is coming from easier. In this case, smoke was added to the intake manifold with the inlet blocked with a yellow plastic cap and smoke was seen escaping past a gasket at the idle air control.

12. **SLIDE 12 EXPLAIN FIGURE 33-6** spark tester connected to a spark plug wire or coil output. A typical spark tester will only fire if at least 25,000 volts is available from the coil, making a spark tester a very useful tool. Do not use one that just lights when a spark is present, because they do not require more than about 2,000 volts to light.

DEMONSTRATION: SHOW HOW TO TEST AN IGNITION SYSTEM USING AN ADJUSTABLE SPARK TESTER. THESE TESTERS CAN BE ADJUSTED TO REQUIRE VERY HIGH VOLTAGE FROM THE IGNITION SYSTEM. THIS HELPS STUDENTS VISUALIZE AMOUNT OF RESISTANCE INSIDE COMBUSTION CHAMBER. **FIGURE 33-6**

13. **SLIDE 13 EXPLAIN Figure 33-7** Step 3 in diagnostic process is to retrieve any stored diagnostic trouble codes

DEMONSTRATION: CREATE A **DTC** ON A VEHICLE; FOR EXAMPLE, BY DISCONNECTING AN ENGINE COOLANT TEMPERATURE SENSOR. SHOW
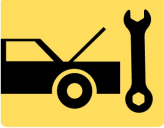
ICONS	Ch33 Scan Tools & Eng. Perf. Diagnosis

STUDENTS HOW TO CONNECT SCAN TOOL & ACCESS DTC. RECONNECT SENSOR AND DEMONSTRATE PROCEDURE FOR ERASING DTC. **FIGURE 33-7**

14. **SLIDE 14 EXPLAIN Figure 33-8** After checking for stored diagnostic trouble codes (DTCs), wise technician checks service information for any technical service bulletins that may relate to vehicle being serviced.

15. **SLIDE 15 EXPLAIN Figure 33-9** Looking carefully at scan tool data is helpful in locating source of a problem. **EXPLAIN Figure 33-10** Step 8 is very important. Be sure customer's concern has been corrected

DEMONSTRATION: PENDING DTC CAN BE SET BY DISCONNECTING AN EMISSION COMPONENT LIKE AN EGR VACUUM HOSE. DRIVE THE VEHICLE TO MEET ENABLING CRITERIA FOR EGR MONITOR. ONCE CONDITIONS HAVE BEEN MET, RECONNECT EGR VACUUM HOSE. SHOW HOW TO ACCESS AND DISPLAY PENDING DTC. **FIGURE 33-9**

DEMONSTRATION: SHOW HOW TO PERFORM A THOROUGH **VISUAL INSPECTION**, STARTING WITH BASIC FLUID LEVEL CHECKS. RAISE & SUPPORT VEHICLE, AND CONTINUE WITH A THOROUGH UNDERCAR INSPECTION BY CHECKING ITEMS SUCH AS SUSPENSION, & BRAKE & EXHAUST COMPONENTS AND SYSTEMS.

HANDS-ON TASK: HAVE THE STUDENTS PERFORM THOROUGH **VISUAL INSPECTIONS** ON EACH OTHER'S VEHICLES OR LAB VEHICLES. GRADE THEM ON THEIR ABILITY TO FIND DEFECTS OR PROBLEMS.

DEMONSTRATION: SHOW HOW TO USE A **SMOKE MACHINE** TO FIND AIR OR VACUUM LEAKS. SIMULATE A VACUUM LEAK BY REMOVING A VACUUM LINE FROM THE INTAKE MANIFOLD. SMOKE MACHINES CAN BE USED TO FIND EXHAUST LEAKS AS WELL. THE TIP OF SMOKE MACHINE CAN BE PUT INSIDE TAILPIPE AND, WHEN EXHAUST SYSTEM FILLS WITH SMOKE, ANY LEAKS WILL BE OBVIOUS.

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	DISCUSSION: HAVE THE STUDENTS TALK ABOUT IGNITION **VOLTAGE REQUIREMENTS.** WHAT CONDITIONS INSIDE COMBUSTION CHAMBER CAN AFFECT IGNITION VOLTAGE REQUIREMENTS?
	DEMONSTRATION: SHOW HOW TO CHECK FUEL PRESSURE BY **CONNECTING A FUEL PRESSURE GAUGE** TO FUEL RAIL. CAUTION STUDENTS OF THE DANGERS OF FUEL LEAKS WHILE OPERATING THE ENGINE.
	HANDS-ON TASK: ASK STUDENTS TO RESEARCH **WIRING DIAGRAMS** FOR THEIR OWN VEHICLES OR LAB VEHICLES. THEN HAVE THEM SELECT A SPECIFIC FUSE AND LIST HOW MANY INDIVIDUAL CIRCUITS WOULD NOT OPERATE IF THAT FUSE WERE TO OPEN OR BURN.
	VIDEO: 1 MINUTE SCAN DATA CHECKING WWW.MYAUTOMOTIVELAB.COM HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CHECKING%20SCAN%20DATA&CLIP=PANDC/CHET/2012/AUTOMOTIVE/5_GAS_ANALYSIS/CHECKSD.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/5_GAS_ANALYSIS/XML/CHECKSD.XML
	2. SLIDE 2 EXPLAIN **OBJECTIVE CH33 AEP_LO2**
	3. SLIDE 3 EXPLAIN Scan Tools
	4. **SLIDE 4 EXPLAIN Figure 33-11** TECH 2 scan tool is the factory scan tool used on General Motors vehicles. **EXPLAIN Figure 33-12** Some scan tools use pocket PCs which make it very convenient to use.
	DISCUSSION: DISCUSS SCAN TOOLS. HOW DO **OEM SCAN TOOLS** DIFFER FROM GENERIC SCAN TOOLS? WHAT ARE ADVANTAGES & DISADVANTAGES OF BOTH TYPES OF TOOLS? **FIGURES 33-11 & 12**
	DEMONSTRATION: CONNECT BOTH **OEM & GENERIC SCAN TOOLS** TO A VEHICLE ALLOW STUDENTS TO SEE INFORMATION AVAILABLE WITH EACH TOOL. DEMONSTRATE BIDIRECTIONAL CAPABILITIES BY INCREASING OR DECREASING IDLE SPEEDS, FOR EXAMPLE. **FIG 33-11 & 12**

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	2. SLIDE 2 EXPLAIN **OBJECTIVE CH33 AEP_LO3** 3. **SLIDES 3-4 EXPLAIN** Retrieval of Diagnostic Information 2. SLIDE 2 EXPLAIN **OBJECTIVE CH33 AEP_LO4** 3. **SLIDES 3-4 EXPLAIN** TROUBLESHOOTING USING DTCS

DEMONSTRATION: DISCONNECT CRITICAL SENSORS, LIKE CRANK SENSOR AND AIRFLOW SENSOR, ON A RUNNING ENGINE TO DEMONSTRATE ENGINE STALLING. RESTART ENGINE & DISCONNECT SENSORS SUCH AS AN OXYGEN SENSOR AND COOLANT TEMPERATURE SENSOR TO DEMONSTRATE ENGINE OPERATION WITHOUT THIS DATA.

HANDS-ON TASK: HAVE THE STUDENTS **CONNECT AN OEM SCAN TOOL TO A RUNNING VEHICLE** AND RECORD ALL **DATASTREAM PARAMETERS** AVAILABLE.

DISCUSSION: DISCUSS DATA PARAMETERS. WHAT **DATA PARAMETERS** ARE NECESSARY FOR ENGINE OPERATION? WHAT DATA PARAMETERS ARE CONSIDERED FUEL TRIM SENSORS OR MONITORS FOR EMISSIONS SYSTEMS?

VIDEO: 2 MIN CATALYST MONITORING @ IDLE WWW.MYAUTOMOTIVELAB.COM
HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=CATALYST%20MONITORING%20AT%20IDLE&CLIP=PANDC/CHET/2012/AUTOMOTIVE/OBD2_GM/VC2.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/OBD2_GM/XML/VC2.XML

ON-VEHICLE NATEF TASK PERFORM ACTIVE TESTS USING A SCAN TOOL

ON-VEHICLE NATEF TASK RETRIEVE AND RECORD STORED OBD II DIAGNOSTIC TROUBLE CODES; CLEAR CODES.

2. SLIDE 2 EXPLAIN **OBJECTIVE CH33 AEP_LO5**

3. **SLIDES 3-4 EXPLAIN** Flash Code Retrieval on OBD-I General Motors Vehicles

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5. **SLIDE 5 EXPLAIN Figure 33-13** To retrieve flash codes from an OBD-I General Motors vehicle, without a scan tool, connect terminals A and B with the ignition on–engine off. The M terminal is used to retrieve data from the sensors to a scan tool.

DEMONSTRATION: USING OLDER GM OBD-I VEHICLE, SET A DTC, BY DISCONNECTING A COOLANT TEMPERATURE SENSOR. SHOW HOW TO RETRIEVE THE DTC THROUGH FLASHING CHECK ENGINE LIGHT. FIGURE 33-13

HANDS-ON TASK: RESEARCH DTC FROM ABOVE DEMONSTRATION USING OEM SERVICE INFORMATION. THE STUDENTS SHOULD UNDERSTAND THE CONDITIONS THAT WERE MET FOR THE DTC TO SET. THEN HAVE STUDENTS USE OEM SERVICE INFORMATION TO FIND PREFERRED METHOD TO ERASE DTC.

VIDEO: 2 MIN OBD II ON GM VEHICLES WWW.MYAUTOMOTIVELAB.COM

HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=SPARK%20PLUG%20AND%20WIRES&CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/CLIP17SPARKPLUGS1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/XML/CLIP17SPARKPLUGS1.XML

6. **SLIDES 6 EXPLAIN** Retrieving Ford Diagnostic Codes

7. **SLIDE 7 EXPLAIN Figure 33-14** Ford OBD-I self-test connector. The location of this connector can vary with model and year of vehicle.

8. **SLIDES 8-9 EXPLAIN** Retrieving Ford Diagnostic Codes

10. **SLIDE 10 EXPLAIN FIGURE 33-15** To retrieve Ford DTCs using a test light and a jumper wire, turn the ignition switch on (engine off) and make the connections shown. The test light will blink out the diagnostic trouble codes

DEMONSTRATION: CREATE A DTC IN OBD-I FORD VEHICLE, AND DEMONSTRATE KEY ON-ENGINE OFF (KOEO) CODE RETRIEVAL USING A JUMPER WIRE & TEST LIGHT. HAVE STUDENTS COUNT FLASHES OF TEST LIGHT TO RETRIEVE DTC. FIGURES 33-14 & 15

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DEMONSTRATION: WHILE PERFORMING KOER TEST ON FORD OBD-I VEHICLE, **DEMONSTRATE DYNAMIC RESPONSE CHECK,** WHEN PROMPTED. **FIGURES 33-14 & 15**

11. **SLIDES 11-12 EXPLAIN** Flash Code Retrieval on Chrysler Vehicles

Meter Usage Measure Frequency Hz
Meter Usage Measure Ohms
O2 Sensor Volt Check
Output Driver Control
Positive Crankcase Ventilation (PCV)
Potentiometer
Quick Check Injector
Quick Check Injector Volts
Secondary Air Injection
Scope Display Dual Trace
Test Engine Coolant Temperature ECT Sensor
Test Injector Resistance

13. **SLIDE 13 EXPLAIN OBD II DIAGNOSIS**
14. **SLIDE 14 EXPLAIN FIGURE 33-16** A typical OBD-II data link connector (DLC). The location varies with make and model and may even be covered, but a tool is not needed to gain access. Check service information for the exact location if needed.

HANDS-ON TASK: HAVE THE STUDENTS LOCATE THE DIAGNOSTIC LINK CONNECTOR (DLC) ON THEIR OWN VEHICLES USING COMPONENT LOCATOR. HAVE THEM RETRIEVE DTCS USING A SCAN TOOL OR ON OLDER VEHICLES, THE FLASH CODE RETRIEVAL PROCEDURE AND OEM SERVICE INFORMATION. **FIGURE 33-16**

15. **SLIDE 15 EXPLAIN OBD-II ACTIVE TESTS**
16. **SLIDE 16 EXPLAIN SERVICE/FLASH PROGRAMMING**
17. **SLIDE 17 EXPLAIN FIGURE 33-17** The first step in the reprogramming procedure is to determine the current software installed using a scan tool. Not all scan tools can

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be used. In most cases using the factory scan tool is needed for reprogramming unless the scan tool is equipped to handle reprogramming

DEMONSTRATION: CREATE A DTC ON AN OBD-I VEHICLE BY DISCONNECTING A SENSOR, SUCH AS THE ENGINE COOLANT TEMPERATURE SENSOR. CREATE OPPOSITE DTC BY SHORTING THE CONNECTOR TERMINALS WITH A JUMPER WIRE. HANDS-ON TASK: BASED ON ABOVE DEMO, HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS RESEARCH THE DTC CODE DEFINITIONS.

18. **SLIDE 18 EXPLAIN SERVICE PROGRAMMING FIGURE 33-18 Follow on-screen instructions**

19. **SLIDE 19 EXPLAIN FIGURE 33-19** An Internet connection is usually needed to perform updates although some vehicle manufacturers use CDs which are updated regularly at a cost to the shop

20. **SLIDE 20 EXPLAIN FIGURE 33-20** Connecting cables and a computer to perform offboard programming

21. **SLIDES 21-22 EXPLAIN J2534 REPROGRAMMING**

23. **SLIDE 23 EXPLAIN FIGURE 33-21** J2534 pass-through reprogramming system does not need a scan tool to reflash the PCM on most 2004 and newer vehicles

24. **SLIDE 24 EXPLAIN FIGURE 33-22** A typical J2534 universal reprogrammer that uses the J2534 standards.

25. **SLIDES 25-27 EXPLAIN** MANUFACTURER'S DIAGNOSTIC ROUTINES

28. **SLIDES 28-29 EXPLAIN** COMPLETING SYSTEM REPAIRS

30. **SLIDE 30 EXPLAIN** PROCEDURES FOR RESETTING PCM

DEMONSTRATION: DEMO J2534 REPROGRAMMING

HANDS-ON TASK: BASED ON ABOVE DEMO, HAVE STUDENTS REPROGRAM A PCM