

Advanced Engine Performance Diagnosis 6/E

Chapter 1 The Diagnostic Process

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.	<p>Explain learning objectives to students as listed below:</p> <ol style="list-style-type: none"> 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 tests that should be performed at the start of the diagnostic process. 4. List six items to check as part of a thorough 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.

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 01: [Chapter Images](#)

ICONS

Ch01 The Diagnostic Process



1. SLIDE 1 CH01 DIAGNOSTIC PROCESS

2. SLIDE 2 EXPLAIN Figure 1-1 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.

3. SLIDE 3 EXPLAIN Figure 1-2 Step #1 is to verify the customer concern or problem. If the problem cannot be verified, then the repair cannot be verified

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 \(Microsoft Word\) \(PDF\)](#)



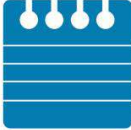











DISCUSSION: HAVE THE STUDENTS DISCUSS THE EIGHT-STEP DIAGNOSIS PROCEDURE. WHY IS IT IMPORTANT TO BEGIN DIAGNOSIS WITH VERIFICATION OF COMPLAINT? FIGURES 1-1 TO 1-2












8 STEP DIAGNOSTIC PROCEDURE










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.








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	<p>4. SLIDE 4 EXPLAIN Figure 1-3 Form that customer should fill out if there is a driveability concern to help the service technician more quickly find the root cause.</p>
	<p><u>DEMONSTRATION:</u> GIVE STUDENTS COPIES OF A DIAGNOSIS WORKSHEET. STUDENTS COMPLETE WORKSHEET USING PROBLEM THEY MAY BE EXPERIENCING, OR MAY HAVE EXPERIENCED IN PAST WITH THEIR OWN CARS. <u>FIGURE 1-3</u></p>
	<p><u>DISCUSSION:</u> HAVE STUDENTS TALK ABOUT <u>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?</u></p>
	<p><u>DISCUSSION:</u> HAVE THE STUDENTS DISCUSS HOW A ROAD TEST WITH CUSTOMER MIGHT HELP WITH PROBLEM DIAGNOSIS. WHAT ARE EXAMPLES OF <u>CONDITIONS THAT MIGHT HELP DUPLICATE A CONCERN?</u></p>
	<p>5. SLIDE 5 EXPLAIN Figure 1-4 This is what was found when removing an air filter from a vehicle that had a lack-of-power concern. Obviously nuts were deposited by squirrels or some other animal, blocking a lot of the airflow into the engine.</p>
	<p>6. SLIDE 6 EXPLAIN FIGURE 1-5 Using a bright light makes seeing where the smoke is coming from easier.</p> <p>EXPLAIN TECH TIPS</p>
	<p><u>DEMONSTRATION:</u> 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. <u>FIGURE 88-6</u></p>
	<p>7. SLIDE 7 EXPLAIN FIGURE 1-6 A spark tester connected to a spark plug wire or coil output.</p> <p>8. SLIDE 8 EXPLAIN Figure 1-7 Step 3 in the diagnostic process is to retrieve any stored diagnostic trouble codes</p>




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 	<p><u>DEMONSTRATION:</u> CREATE A <u>DTC ON A VEHICLE;</u> FOR EXAMPLE, BY DISCONNECTING AN ENGINE COOLANT TEMPERATURE SENSOR. SHOW STUDENTS HOW TO CONNECT SCAN TOOL AND ACCESS DTC. RECONNECT SENSOR & DEMONSTRATE PROCEDURE FOR ERASING DTC. <u>FIGURE 1-7</u></p>
	<p>9. SLIDE 9 EXPLAIN Figure 1-8 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.</p> <p>10. SLIDE 10 EXPLAIN Figure 1-9 Looking carefully at scan tool data is very helpful in locating source of a problem.</p>
	<p><u>DTC</u> <u>RETRIEVING TROUBLE CODES, CODE READER</u></p>
 	<p><u>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 88-9</u></p>
	<p>11. SLIDE 11 EXPLAIN Figure 1-10 Step 8 is very important. Be sure that customer's concern has been corrected</p>
 	<p><u>DEMONSTRATION: SHOW HOW TO PERFORM A THOROUGH <u>VISUAL INSPECTION,</u> 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.</u></p>
	<p><u>HANDS-ON TASK: HAVE THE STUDENTS PERFORM THOROUGH <u>VISUAL INSPECTIONS</u> ON EACH OTHER'S VEHICLES OR LAB VEHICLES. GRADE THEM ON THEIR ABILITY TO FIND DEFECTS OR PROBLEMS.</u></p>

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 	<p>DEMONSTRATION: SHOW THE STUDENTS HOW TO USE A <u>SMOKE MACHINE</u> TO FIND AIR OR VACUUM LEAKS. SIMULATE A VACUUM LEAK BY REMOVING A VACUUM LINE FROM THE INTAKE MANIFOLD.</p>
	<p>SMOKE MACHINES CAN BE USED TO FIND EXHAUST LEAKS. THE TIP OF SMOKE MACHINE CAN BE PUT INSIDE TAILPIPE AND, WHEN EXHAUST SYSTEM FILLS WITH SMOKE, ANY LEAKS WILL BE OBVIOUS.</p>
 	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT <u>IGNITION VOLTAGE REQUIREMENTS</u>. WHAT CONDITIONS INSIDE COMBUSTION CHAMBER CAN AFFECT IGNITION VOLTAGE REQUIREMENTS?</p>
 	<p>DEMONSTRATION: SHOW HOW TO CHECK FUEL PRESSURE BY <u>CONNECTING A FUEL PRESSURE GAUGE</u> TO FUEL RAIL. CAUTION STUDENTS OF THE DANGERS OF FUEL LEAKS WHILE OPERATING THE ENGINE.</p>
	<p>HANDS-ON TASK: ASK STUDENTS TO RESEARCH <u>WIRING DIAGRAMS</u> 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.</p>
	<p>12. SLIDE 12 EXPLAIN Figure 1-11 TECH 2 scan tool is the factory scan tool used on General Motors vehicles.</p>
	<p>EXPLAIN TECH TIP</p>
	<p>Scan Tool (View) (Download)</p>
	<p>13. SLIDE 13 EXPLAIN Figure 1-12 Some scan tools use pocket PCs which make it very convenient to use.</p>
 	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT <u>SCAN TOOLS</u>. HOW DO <u>OEM SCAN TOOLS</u> DIFFER FROM <u>GENERIC SCAN TOOLS</u>? WHAT ARE <u>ADVANTAGES & DISADVANTAGES</u> OF BOTH TYPES</p>

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 	<p>OF TOOLS? FIGURES 1-11 & 12</p> <p><u>DEMONSTRATION: CONNECT BOTH OEM & GENERIC SCAN TOOLS TO A VEHICLE AND ALLOW STUDENTS TO SEE INFORMATION AVAILABLE WITH EACH TOOL. DEMONSTRATE BIDIRECTIONAL CAPABILITIES BY INCREASING OR DECREASING IDLE SPEEDS, FOR EXAMPLE. FIGURES 1-11 & 12</u></p>
 	<p><u>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.</u></p>
	<p><u>HANDS-ON TASK: HAVE THE STUDENTS CONNECT AN OEM SCAN TOOL TO A RUNNING VEHICLE AND RECORD ALL DATASTREAM PARAMETERS AVAILABLE.</u></p>
	<p><u>DISCUSSION: HAVE THE STUDENTS DISCUSS DATA PARAMETERS. WHAT DATA PARAMETERS ARE NECESSARY FOR ENGINE OPERATION? WHAT DATA PARAMETERS ARE CONSIDERED FUEL TRIM SENSORS OR MONITORS FOR EMISSIONS SYSTEMS?</u></p>
 	<p><u>ON-VEHICLE NATEF TASK:) PERFORM ACTIVE TESTS USING A SCAN TOOL. PAGE 275</u></p>
 	<p><u>ON-VEHICLE NATEF TASK: RETRIEVE AND RECORD STORED OBD II DIAGNOSTIC TROUBLE CODES; CLEAR CODES. PAGE 276</u></p>
	<p>14. SLIDE 14 EXPLAIN Figure 1-13 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.</p>

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 	<p><u>DEMONSTRATION: USING AN OLDER GM OBD-I VEHICLE, SET A DTC, FOR EXAMPLE, BY DISCONNECTING A COOLANT TEMPERATURE SENSOR. SHOW HOW TO RETRIEVE THE DTC THROUGH FLASHING CHECK ENGINE LIGHT. FIGURE 1-13</u></p>
	<p><u>HANDS-ON TASK: HAVE THE STUDENTS RESEARCH THE 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.</u></p>
	<p>15. SLIDE 15 EXPLAIN Figure 1-14 Diagnostic trouble codes (DTCs) from Chrysler and Dodge vehicles can be retrieved by turning the ignition switch to on and then off three times.</p>
	<p>16. SLIDE 16 EXPLAIN Figure 1-15 data link connector (DLC) can be located in various locations.</p> <p>17. SLIDE 17 EXPLAIN Figure 1-16 A typical OBD-II data link connector (DLC). The location varies with make and model and may even be covered. Check service information for the exact location if needed.</p> <p>EXPLAIN TECH TIPS</p>
 	<p><u>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 1-14 & 15</u></p>
 	<p><u>DEMONSTRATION: WHILE PERFORMING KOER TEST ON FORD OBD-I VEHICLE, DEMONSTRATE DYNAMIC RESPONSE CHECK, WHEN PROMPTED. FIGURES 1-14 & 15</u></p>

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	<p>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. <u>FIGURE 1-16</u></p>
	<p><u>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.</u></p>
	<p><u>HANDS-ON TASK: BASED ON ABOVE DEMO, HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS <u>RESEARCH THE DTC CODE DEFINITIONS.</u></u></p>
	<p>18. SLIDE 18 EXPLAIN FIGURE 1-17 The first step in the reprogramming procedure is to determine the current software installed using a scan tool. Not all scan tools can be used. In most cases using the factory scan tool is needed for reprogramming unless the scan tool is equipped to handle reprogramming</p>
	<p><u>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.</u></p>
	<p><u>HANDS-ON TASK: BASED ON ABOVE DEMO, HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS <u>RESEARCH THE DTC CODE DEFINITIONS.</u></u></p>
	<p>19. SLIDE 19 EXPLAIN FIGURE 1-18 Follow the on-screen instructions</p> <p>20. SLIDE 20 EXPLAIN FIGURE 1-19 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</p> <p>21. SLIDE 21 EXPLAIN FIGURE 1-20 Connecting cables and a computer to perform off-board programming</p> <p>22. SLIDE 22 EXPLAIN FIGURE 1-21 J2534 pass-through reprogramming system does not need a scan tool</p>

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  	<p>to reflash the PCM on most 2004 and newer vehicles</p> <p>23. SLIDE 23 EXPLAIN FIGURE 1-22 A typical J2534 universal reprogrammer that uses the J2534 standards.</p> <p>EXPLAIN TECH TIPS</p> <p><u>DEMONSTRATION:</u> DEMO J2534 REPROGRAMMING</p> <p><u>HANDS-ON TASK: BASED ON ABOVE DEMO,</u> HAVE STUDENTS REPROGRAM A PCM</p>