

Automotive Fuel and Emissions Control Systems 4/E

Chapter 30 Scan Tools & Engine Performance Diagnosis

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Automotive Fuel and Emissions Control Systems . 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 session or class.	Explain the chapter learning objectives to the students. <ol style="list-style-type: none">1. Identify the steps of a diagnostic process.2. Identify the types of scan tools.3. Describe the troubleshooting procedures to follow when a diagnostic trouble code is set.4. Explain the procedure for diagnosing and testing an onboard diagnostics generation II (OBD II) system.5. Explain the methods that are used to reprogram (reflash) a vehicle computer.6. Discuss the diagnostic routines and the procedures for resetting the PCM.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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 Fuel & Emission Control 4th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 30: [Chapter Images](#)

ICONS



Ch30 Scan Tools & Performance Diagnosis

1. SLIDE 1 CH30 SCAN TOOLS & ENGINE PERFORMANCE DIAGNOSIS

2. SLIDE 2 EXPLAIN Figure 30-1 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

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
@ <http://www.jameshalderman.com/>

WEB SITE REGULARLY 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?



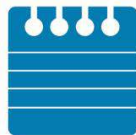





INTERMITTENT PROBLEMS CAN BE DIFFICULT TO DIAGNOSE. IT IS IMPORTANT TO GATHER AS MUCH INFORMATION AS POSSIBLE FOR ACCURATE DIAGNOSIS. FIND OUT TEMPERATURES, SPEEDS, OR OPERATING CONDITIONS WHEN PROBLEMS OCCUR. TRY TO DUPLICATE OPERATING CONDITIONS & CAUSE PROBLEM TO OCCUR.















3. SLIDE 3 EXPLAIN Figure 30-2 Step #1 is to verify the customer concern or problem. If the problem cannot be verified, then the repair cannot be verified.










4. SLIDE 4 EXPLAIN Figure 30-3 Form that customer should fill out if there is a driveability concern to help the service technician more quickly find the root cause









ICONS	Ch30 Scan Tools & Performance Diagnosis
 	<p>DEMONSTRATION: GIVE COPIES OF DIAGNOSIS WORKSHEET LIKE <u>FIGURE 30-3</u>. HAVE STUDENTS COMPLETE WORKSHEET USING PROBLEM THEY MAY BE EXPERIENCING, OR MAY HAVE EXPERIENCED IN PAST WITH THEIR OWN CARS.</p>
	<p>EXPLAIN TECH-TIP</p>
	<p>DISCUSSION: HAVE STUDENTS TALK ABOUT <u>INFORMATION FROM CUSTOMER</u> 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?</p>
	<p>DISCUSSION: 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 30-4 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.</p>
	<p>EXPLAIN TECH-TIP</p> <p>6. SLIDE 6 EXPLAIN FIGURE 30-5 Using a bright light makes seeing where the smoke is coming from easier. In this case, smoke was added to the intake manifold with inlet blocked with a yellow plastic cap and smoke was seen escaping past a gasket at idle air control.</p>
	<p>7. SLIDE 7 EXPLAIN FIGURE 30-6 A 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.</p>
 	<p>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</p>





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	<p>VISUALIZE AMOUNT OF RESISTANCE INSIDE COMBUSTION CHAMBER. <u>FIGURE 88-6</u></p> <p>8. SLIDE 8 EXPLAIN Figure 30-7 Step 3 in diagnostic process is to retrieve any stored diagnostic trouble codes</p>
	<p><u>DEMONSTRATION: CREATE DTC ON A VEHICLE; FOR EXAMPLE, BY DISCONNECTING ECT SENSOR. SHOW STUDENTS HOW TO CONNECT SCAN TOOL AND ACCESS DTC. RECONNECT SENSOR AND DEMONSTRATE THE PROCEDURE FOR ERASING THE DTC. <u>FIGURE 30-7</u></u></p>
	<p>9. SLIDE 9 EXPLAIN Figure 30-8 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 30-9 Looking carefully at the scan tool data is very helpful in locating the source of a problem</p> <p>11. SLIDE 11 EXPLAIN Figure 30-10 Step 8 is very important. Be sure that the customer's concern has been corrected</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. <u>FIGURE 30-9</u></u></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>EXPLAIN TECH-TIP</p>

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	<p>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.</p>
	<p>DEMONSTRATION: SHOW HOW TO USE A <u>SMOKE MACHINE</u> TO FIND AIR OR VACUUM LEAKS. SIMULATE A VACUUM LEAK BY REMOVING A VACUUM LINE FROM INTAKE MANIFOLD.</p>
	<p>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.</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 21 EXPLAIN Figure 30-11 TECH 2 scan tool is the factory scan tool used on General Motors vehicles</p> <p>13. SLIDE 13 EXPLAIN FIGURE 30-12 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 GENERIC SCAN TOOLS? WHAT ARE ADVANTAGES & DISADVANTAGES OF BOTH TYPES OF TOOLS? <u>FIGURES 30-11 & 12</u></p>

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 	<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</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 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</u></p>
 	<p><u>ON-VEHICLE NATEF TASK: RETRIEVE AND RECORD STORED OBD II DIAGNOSTIC TROUBLE CODES; CLEAR CODES.</u></p>
	<p>14. SLIDE 14 EXPLAIN Figure 30-13 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>
 	<p><u>DEMONSTRATION: USING OLDER GM OBD-I VEHICLE, SET DTC, BY DISCONNECTING A COOLANT TEMPERATURE SENSOR. SHOW HOW TO RETRIEVE THE DTC THROUGH FLASHING CHECK</u></p>

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	<p><u>ENGINE LIGHT. FIGURE 30-13</u></p> <p><u>HANDS-ON TASK: HAVE STUDENTS 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.</u></p>
	<p>EXPLAIN TECH-TIP</p>
	<p>15. SLIDE 15 EXPLAIN Figure 30-14 Ford OBD-I self-test connector. The location of this connector can vary with model and year of vehicle.</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 30-14 & 15</u></p>
	<p><u>DEMONSTRATION: WHILE PERFORMING KOER TEST ON FORD OBD-I VEHICLE, DEMONSTRATE DYNAMIC RESPONSE CHECK, WHEN PROMPTED. FIGURES 30-14 & 15</u></p>
	<p>EXPLAIN TECH-TIP</p>
	<p>16. SLIDE 16 EXPLAIN FIGURE 30-15 To retrieve Ford DTCs using a test light and a jumper wire, turn ignition switch on (engine off) and make the connections shown. The test light will blink out the diagnostic trouble codes.</p>
	<p>17. SLIDE 17 EXPLAIN FIGURE 30-16 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.</p>
	<p><u>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</u></p>

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 	<p>INFORMATION. <u>FIGURE 30-16</u></p> <p><u>DEMONSTRATION:</u> 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.</p>
	<p><u>HANDS-ON TASK:</u> BASED ON ABOVE DEMO, HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS <u>RESEARCH THE DTC CODE DEFINITIONS.</u></p>
	<p><u>Meter Usage Measure Frequency Hz</u></p> <p><u>Meter Usage Measure Ohms</u></p>
	<p><u>O2 Sensor Volt Check</u></p> <p><u>Output Driver Control</u></p>
	<p><u>Positive Crankcase Ventilation (PCV)</u></p> <p><u>Potentiometer</u></p>
	<p><u>Quick Check Injector</u></p> <p><u>Quick Check Injector Volts</u></p>
	<p><u>Secondary Air Injection</u></p> <p><u>Scope Display Dual Trace</u></p>
	<p><u>Test Engine Coolant Temperature ECT Sensor</u></p> <p><u>Test Injector Resistance</u></p>
 	<p>18. SLIDE 18 EXPLAIN FIGURE 30-17 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:</u> 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.</p>
	<p><u>HANDS-ON TASK:</u> BASED ON ABOVE DEMO, HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS <u>RESEARCH THE DTC CODE DEFINITIONS.</u></p>

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   	<p>19. SLIDE 19 EXPLAIN FIGURE 30-18 Follow on-screen instructions</p> <p>20. SLIDE 20 EXPLAIN FIGURE 30-19 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 30-20 Connecting cables and a computer to perform offboard programming</p> <p>22. SLIDE 22 EXPLAIN FIGURE 30-21 J2534 pass-through reprogramming system does not need a scan tool to reflash the PCM on most 2004 and newer vehicles</p> <p>23. SLIDE 23 EXPLAIN FIGURE 30-22 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, HAVE STUDENTS REPROGRAM A PCM</u></p>