

# Automotive Technology 5<sup>th</sup> Edition










## Chapter 88 Scan Tools & Engine Performance Diagnosis








### Opening Your Class














KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	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.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> <li>1. Discuss the steps of the diagnostic process.</li> <li>2. Discuss the types of scan tools that are used to assess vehicle components.</li> <li>3. Explain the troubleshooting procedures to follow if a diagnostic trouble code has been set.</li> <li>4. Describe the methods that can be used to reprogram (reflash) a vehicle computer.</li> <li>5. Explain the manufacturer's diagnostic routines and the procedures for resetting the PCM.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <i><b>WELCOME</b></i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 the 5<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 88: [ATE5 Chapter Images](#)**

ICONS	Ch88 Scan Tool/Diagnosis
       <p data-bbox="350 1050 454 1079">QUESTION</p>    	<p data-bbox="623 302 1338 382"><b>1. SLIDE 1 CH88 SCAN TOOLS &amp; ENGINE PERFORMANCE DIAGNOSIS</b></p> <p data-bbox="623 394 1390 537"><b>2. SLIDE 2 EXPLAIN Figure 88-1</b> A 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.</p> <p data-bbox="623 550 1416 655"><b>3. SLIDE 3 EXPLAIN Figure 88-2</b> Step #1 is to verify the customer concern or problem. If the problem cannot be verified, then the repair cannot be verified</p> <p data-bbox="584 663 1240 697">Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b> @</p> <p data-bbox="584 701 1062 735"><a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a></p> <p data-bbox="584 739 1062 772">WEB SITE IS CONSTANTLY UPDATED</p> <p data-bbox="604 806 727 840"><u>Videos</u></p> <p data-bbox="584 945 1383 1155"><b><u>DISCUSSION:</u> HAVE THE STUDENTS DISCUSS THE <u>EIGHT-STEP DIAGNOSIS PROCEDURE.</u> WHY IS IT IMPORTANT TO BEGIN DIAGNOSIS WITH VERIFICATION OF COMPLAINT? <u>FIGURES 88-1 TO 88-2</u></b></p> <p data-bbox="584 1159 1416 1423"><b>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 &amp; CAUSE PROBLEM TO OCCUR.</b></p> <p data-bbox="623 1436 1403 1541"><b>4. SLIDE 4 EXPLAIN Figure 88-3</b> 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 data-bbox="584 1570 1393 1848"><b><u>DEMONSTRATION:</u> GIVE STUDENTS COPIES OF A DIAGNOSIS WORKSHEET LIKE EXAMPLE ON <u>PAGE 967.</u> HAVE STUDENTS COMPLETE WORKSHEET USING PROBLEM THEY MAY BE EXPERIENCING, OR MAY HAVE EXPERIENCED IN PAST WITH THEIR OWN CARS. <u>FIGURE 88-3</u></b></p>

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	<p><b><u>DISCUSSION:</u> 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?</b></p>
	<p><b><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></b></p>
	<p>5. <b>SLIDE 5 EXPLAIN Figure 88-4</b> 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. <b>SLIDE 6 EXPLAIN FIGURE 88-5</b> Using a bright light makes seeing where the smoke is coming from easier.</p>
<p><b><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></b></p>	<p>7. <b>SLIDE 7 EXPLAIN FIGURE 88-6</b> A spark tester connected to a spark plug wire or coil output.</p> <p>8. <b>SLIDE 8 EXPLAIN Figure 88-7</b> Step 3 in the diagnostic process is to retrieve any stored diagnostic trouble codes</p>
	<p><b><u>DEMONSTRATION:</u> CREATE A <u>DTC</u> ON A VEHICLE; FOR EXAMPLE, BY DISCONNECTING AN ENGINE COOLANT TEMPERATURE SENSOR. SHOW STUDENTS HOW TO CONNECT SCAN TOOL AND ACCESS DTC. RECONNECT SENSOR &amp; DEMONSTRATE PROCEDURE FOR ERASING DTC. <u>FIGURE 88-7</u></b></p>
	<p>9. <b>SLIDE 9 EXPLAIN Figure 88-8</b> 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. <b>SLIDE 10 EXPLAIN Figure 88-9</b> Looking carefully at the scan tool data is very helpful in locating the source of a problem.</p>

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 	<p><b><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 88-9</u></u></b></p>
	<p>11. <b>SLIDE 11 EXPLAIN</b> Figure 88-10 Step 8 is very important. Be sure that the customer's concern has been corrected</p>
 	<p><b><u>DEMONSTRATION: SHOW HOW TO PERFORM A THOROUGH <u>VISUAL INSPECTION</u>, STARTING WITH BASIC FLUID LEVEL CHECKS. RAISE &amp; SUPPORT VEHICLE, AND CONTINUE WITH A THOROUGH UNDERCAR INSPECTION BY CHECKING ITEMS SUCH AS SUSPENSION, &amp; BRAKE &amp; EXHAUST COMPONENTS AND SYSTEMS.</u></b></p>
	<p><b><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></b></p>
 	<p><b><u>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.</u></b></p>
	<p><b>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.</b></p>
  <p>QUESTION</p>	<p><b><u>DISCUSSION: HAVE THE STUDENTS TALK ABOUT <u>IGNITION VOLTAGE REQUIREMENTS</u>. WHAT CONDITIONS INSIDE COMBUSTION CHAMBER CAN AFFECT IGNITION VOLTAGE REQUIREMENTS?</u></b></p>
 	<p><b><u>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.</u></b></p>

ICONS	Ch88 Scan Tool/Diagnosis
	<p><b>HANDS-ON TASK:</b> 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 88-11 A TECH 2 scan tool is the factory scan tool used on General Motors vehicles.</p>
	<p><b><u>Scan Tool (View) (Download)</u></b></p>
	<p>13. SLIDE 13 EXPLAIN Figure 88-12 Some scan tools use pocket PCs which make it very convenient to use.</p>
 <p>QUESTION</p>	<p><b><u>DISCUSSION:</u></b> HAVE THE STUDENTS TALK ABOUT SCAN TOOLS. HOW DO <u>OEM SCAN TOOLS</u> DIFFER FROM GENERIC SCAN TOOLS? WHAT ARE ADVANTAGES &amp; DISADVANTAGES OF BOTH TYPES OF TOOLS? <u>FIGURES 88-11 &amp; 12</u></p>
	<p><b><u>DEMONSTRATION:</u></b> CONNECT BOTH <u>OEM &amp; GENERIC SCAN TOOLS</u> 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>FIGURES 88-11 &amp; 12</u></p>
	<p><b><u>DEMONSTRATION:</u></b> <u>DISCONNECT CRITICAL SENSORS, LIKE CRANK SENSOR AND AIRFLOW SENSOR,</u> ON A RUNNING ENGINE TO DEMONSTRATE ENGINE STALLING. RESTART ENGINE &amp; DISCONNECT SENSORS SUCH AS AN OXYGEN SENSOR AND COOLANT TEMPERATURE SENSOR TO DEMONSTRATE ENGINE OPERATION WITHOUT THIS DATA.</p>
	<p><b><u>HANDS-ON TASK:</u></b> HAVE THE STUDENTS <u>CONNECT AN OEM SCAN TOOL TO A RUNNING VEHICLE</u> AND RECORD ALL</p>

## ICONS

## Ch88 Scan Tool/Diagnosis



### DATASTREAM PARAMETERS AVAILABLE.

**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?**

**ON-VEHICLE NATEF TASK:) PERFORM ACTIVE TESTS USING A SCAN TOOL. PAGE 275**

**ON-VEHICLE NATEF TASK: RETRIEVE AND RECORD STORED OBD II DIAGNOSTIC TROUBLE CODES; CLEAR CODES. PAGE 276**






14. **SLIDE 14 EXPLAIN Figure 88-13** 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 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 88-13**

**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.**

15. **SLIDE 15 EXPLAIN Figure 88-14** A Ford OBD-I self-test connector. The location of this connector can vary with model and year of vehicle.

**DEMONSTRATION: CREATE A DTC IN OBD-I FORD VEHICLE, AND DEMONSTRATE KEY ON-ENGINE OFF (KOEO) CODE RETRIEVAL**

ICONS	Ch88 Scan Tool/Diagnosis
	<p>USING A JUMPER WIRE &amp; TEST LIGHT. HAVE STUDENTS COUNT <b><u>FLASHES OF TEST LIGHT TO RETRIEVE DTC. FIGURES 88-14 &amp; 15</u></b></p> <p><b><u>DEMONSTRATION:</u></b> WHILE PERFORMING KOER TEST ON FORD OBD-I VEHICLE, <b><u>DEMONSTRATE DYNAMIC RESPONSE CHECK, WHEN PROMPTED. FIGURES 88-14 &amp; 15</u></b></p>
	<p><b><u>HANDS-ON TASK:</u></b> 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. <b><u>FIGURE 88-16</u></b></p>
	<p><b><u>DEMONSTRATION:</u></b> 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><b><u>HANDS-ON TASK: BASED ON ABOVE DEMO,</u></b> HAVE STUDENTS RETRIEVE THE DTCS AND HAVE THE STUDENTS <b><u>RESEARCH THE DTC CODE DEFINITIONS.</u></b></p>
	<p><b><u>CROSSWORD PUZZLE (MICROSOFT WORD) (PDF)</u></b>  <b><u>WORD SEARCH PUZZLE (MICROSOFT WORD) (PDF)</u></b></p>