

Automotive Fuel and Emissions Control Systems 4/E


Chapter 25 Evaporative Emission Control Systems










Opening Your Class




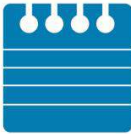




KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Automotive Fuel and Emissions Control Systems . It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to 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. Explain the purpose and function of the evaporative emission control (EVAP) system.2. Compare enhanced and non-enhanced evaporative control (EVAP) systems.3. Describe leak detection pump systems and onboard refueling vapor recovery.4. Describe how to diagnose EVAP system faults.5. Discuss the functions of an evaporative system monitor and interpret the EVAP diagnostic trouble codes.
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 25: [Chapter Images](#)







ICONS	Ch25 Evaporative Emission Control Systems
	<p>1. SLIDE 1 CH25 Evaporative Emission Control Systems</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED</p> <p><u>VIDEOS</u></p> <p>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</p> <p>Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)</p> <p>2. SLIDE 2 EXPLAIN Evaporative Emission Control System & EXPLAIN Figure 25-1 Capless system from a Ford Flex does not use a replaceable cap; instead, it is spring-loaded closed</p> <p>DISCUSS FREQUENTLY ASKED QUESTION</p> <p>3. SLIDE 3 EXPLAIN Figure 25-2 A charcoal canister can be located under the hood or underneath the vehicle.</p> <p>4. SLIDE 4 EXPLAIN Figure 25-3 EVAP system includes all of lines, hoses, and valves, plus charcoal canister.</p> <p><u>DISCUSSION: HAVE THE STUDENTS LIST AND DESCRIBE MAIN FUNCTIONS OF THE EVAPORATIVE SYSTEM & POTENTIAL PROBLEMS. WHAT IS THE SYSTEM DESIGNED TO DO WITH FUEL VAPORS (HYDROCARBONS)? WHAT ARE POTENTIAL PROBLEMS WITH THE SYSTEM?</u></p> <p><u>EVAPORATIVE EMISSION CONTROL SYSTEM (VIEW) (DOWNLOAD)</u></p>

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	<p>5. SLIDE 5 EXPLAIN Figure 25-4 typical EVAP system. Note that when computer turns on canister purge solenoid valve, manifold vacuum draws any stored vapors from canister into engine. Manifold vacuum also is applied to pressure control valve. When this valve opens, fumes from fuel tank are drawn into charcoal canister and eventually into engine. When solenoid valve is turned off (or the engine stops and there is no manifold vacuum), pressure control valve is spring-loaded shut to keep vapors inside the fuel tank from escaping to atmosphere.</p>
	<p>DEMONSTRATION: PASS AROUND EXAMPLES OF EVAPORATIVE PURGE & VENT SOLENOIDS. SHOW HOW TO LOCATE PURGE AND VENT SOLENOIDS ON A VEHICLE USING ELECTRICAL COMPONENT LOCATOR.</p>
	<p>6. SLIDE 6 EXPLAIN FIGURE 25-5 An enhanced EVAP system is able to perform system and leak detection diagnosis</p>
	<p>12. SLIDE 12 EXPLAIN TECH-TIP</p>
	<p>HANDS-ON TASK: STUDENTS CUT OPEN A USED EVAPORATIVE CANISTER TO SHOW THE STUDENTS WHAT ACTIVATED CHARCOAL GRANULES LOOK LIKE.</p>
	<p>SAFETY REMIND THE STUDENTS OF EXTREME FIRE HAZARD OF WORKING AROUND & SERVICING EVAPORATIVE EMISSION SYSTEM ON A VEHICLE. FUEL VAPORS ARE EXTREMELY EXPLOSIVE.</p>
	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT FUEL EVAPORATION RATES. WHAT FACTORS (E.G., ALCOHOL CONTENT, TEMPERATURE, ATMOSPHERIC PRESSURE, ETC.) INFLUENCE FUEL EVAPORATION RATES?</p>
	<p>DEMONSTRATION: SHOW HOW TO USE AN ALCOHOL TEST KIT TO OBTAIN A SAMPLE OF FUEL FROM A VEHICLE & TEST FOR ALCOHOL CONTENT.</p>
	

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	<p>7. SLIDE 7 EXPLAIN FIGURE 25-6 leak detection pump (LDP) used on some Chrysler vehicles to pressurize (slightly) the fuel system to check for leaks</p>
	<p>DEMONSTRATION: SHOW HOW TO USE A VEHICLE UNDERHOOD ECS LABEL & WIRING DIAGRAM AND/OR VACUUM DIAGRAM TO DETERMINE WHETHER VEHICLE HAS AN ENHANCED OR NON-ENHANCED SYSTEM</p>
	<p>HANDS-ON TASK: ASK THE STUDENTS TO IDENTIFY AND LOCATE PURGE SOLENOID & EVAPORATIVE CANISTERS ON THEIR OWN CARS USING OEM SERVICE INFORMATION.</p>
	<p>STUDENTS CAN REMEMBER REST POSITION OF BOTH <u>PURGE</u> & <u>VENT</u> SOLENOIDS (NORMALLY CLOSED & NORMALLY OPEN, RESPECTIVELY) BY USING ANALOGY OF A HOME'S FRONT & BACK DOORS. FRONT DOOR IS USUALLY <u>CLOSED</u>,</p>
	<p>WHEREAS BACK DOOR IS FREQUENTLY LEFT <u>OPEN</u>. EXPLAIN HOW VENT SOLENOIDS CAN BE TESTED USING JUMPER WIRES AND A 12 V SOURCE TO ALLOW SYSTEM TESTING. REMEMBER, THE VENT SOLENOID IS NORMALLY OPEN AND SHOULD BE ENERGIZED FOR ONLY SHORT PERIODS (5 MINUTES OR LESS) TO PREVENT DAMAGE.</p>
	<p>DEMONSTRATION: PASS AROUND VARIOUS LEAK DETECTION PUMPS. SHOW LOCATION OF THE PUMP ON VEHICLE.</p>
	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT LEAK DETECTION PUMP SYSTEMS. WHAT OTHER POSSIBLE METHODS MIGHT MANUFACTURERS USE TO LEAK TEST AN EVAPORATIVE SYSTEM WITHOUT USING A PUMP?</p>
	<p>DEMONSTRATION: USING SMALL DRILL BITS FOR AUTOMATIC TRANSMISSION SERVICE, DRILL TWO .020" & 0.040" HOLES IN A SMALL ALUMINUM PLATE. HAVE STUDENTS OBSERVE DRILLED PLATE SO THEY CAN VISUALIZE <u>SIZE OF LEAK</u> THAT AN ENHANCED SYSTEM MUST DETECT.</p>

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 	<p>8. SLIDE 8 EXPLAIN Onboard Refueling Vapor Recovery & EXPLAIN Figure 25-7 restricted fuel fill pipe shown on vehicle with the interior removed</p> <p>9. SLIDE 9 EXPLAIN Diagnosing the EVAP System & EXPLAIN FIGURE 25-8 Some vehicles will display a message if an evaporative control system leak is detected that could be result of a loose gas cap.</p> <p>10. SLIDE 10 EXPLAIN Figure 25-9 To test for a leak, this tester was set to the 0.020-inch hole and turned on. The ball rose in the scale on the left, and the red arrow was moved to that location. If when testing the system for leaks the ball rises higher than the arrow, then the leak is larger than 0.02 inch. If the ball does not rise to the level of the arrow, the leak is smaller than 0.020 inch</p> <p>11. SLIDE 11 EXPLAIN Figure 25-10 unit is applying smoke to the fuel tank through an adapter, and the leak was easily found to be the gas cap seal</p>
 	<p><u>DEMONSTRATION: SHOW STUDENTS BASIC EVAPORATIVE EMISSIONS SYSTEM COMPONENTS. MAKE SURE STUDENTS CAN IDENTIFY COMPONENTS & THEIR FUNCTIONS</u></p>
	<p><u>DEMONSTRATION: SHOW HOW TO LEAK-CHECK AN EVAPORATIVE SYSTEM USING A SMOKE MACHINE. CREATE A SMALL LEAK BY DISCONNECTING A VACUUM OR VAPOR HOSE TO SHOW SMOKE DIAGNOSIS.</u></p>
	<p>12. SLIDE 12 EXPLAIN Figure 25-11 emission tester that uses nitrogen to pressurize the fuel system.</p>
 	<p><u>SAFETY</u> REMIND STUDENTS THAT IT IS IMPERATIVE TO USE AN INERT GAS SUCH AS <u>NITROGEN</u> TO PREVENT POSSIBLE EXPLOSIONS WHEN PRESSURE-CHECKING EVAPORATIVE EMISSION SYSTEM FOR LEAKS. USING COMPRESSED AIR COULD PRODUCE A <u>FLAMMABLE MIXTURE OF FUEL VAPORS AND OXYGEN.</u></p>

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 	<p><u>ON-VEHICLE NATEF TASK</u> DIAGNOSE EMISSIONS AND DRIVEABILITY CONCERNS CAUSED BY THE EVAPORATIVE EMISSIONS CONTROL SYSTEM; DETERMINE ACTION</p>
 	<p><u>ON-VEHICLE NATEF TASK: INSPECT AND TEST</u> COMPONENTS AND HOSES OF <u>EVAPORATIVE</u> EMISSIONS CONTROL SYSTEM</p>
 	<p><u>ON-VEHICLE NATEF TASK: INTERPRET</u> DIAGNOSTIC TROUBLE CODES (DTCs) AND SCAN TOOL DATA RELATED TO THE <u>EMISSIONS CONTROL SYSTEMS</u>; DETERMINE ACTION</p>
 	<p><u>ON-VEHICLE NATEF TASK: DIAGNOSE</u> EMISSIONS AND DRIVEABILITY CONCERNS CAUSED BY THE EXHAUST GAS RECIRCULATION (<u>EGR</u>) SYSTEM; DETERMINE NECESSARY ACTION.</p>
	<p>13. SLIDE 13 EXPLAIN Evaporative System Monitor & EXPLAIN Figure 25-12 fuel tank pressure sensor (black unit with three wires) looks like a MAP sensor and is usually located on top of fuel pump module (white unit)</p>
	<p>14. SLIDE 14 EXPLAIN FIGURE 25–13 A tank car was cleaned using steam, and then both the bottom drain and the top vent were closed. The next day, the tank had collapsed because of the air pressure difference when the inside cooled. The higher outside air pressure caused the tank to collapse</p>
	<p>EXPLAIN TECH-TIP</p>
	<p>15. SLIDE 15 EXPLAIN FIGURE 25-14 This Toyota cap has a warning—the check engine light will come on if not tightened until one click.</p>
	<p><u>DISCUSSION: DISCUSS THE ROLE THAT FUEL STABILITY AS WELL AS ENGINE-OPERATING CONDITIONS PLAY BEFORE <u>OBD II</u> EVAPORATIVE MONITOR WILL RUN. ASK STUDENTS TO LIST ENABLING CRITERIA FOR THE EVAPORATIVE MONITOR TO RUN.</u></p>
	<p><u>DEMONSTRATION: SHOW FUEL TANK UNITS WITH <u>FUEL TANK PRESSURE (FTP)</u> SENSORS: POINT OUT THAT THESE SENSORS, ABLE TO SENSE VERY SMALL PRESSURE CHANGES, ARE MUCH MORE SENSITIVE THAN TRADITIONAL</u></p>
 	

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     	<p>PRESSURE SENSORS.</p> <p>16. SLIDE 16 EXPLAIN FIGURE 25-15 To easily check the fuel tank pressure sensor, remove the cap, and the sensor should read about 1.7 volts</p> <p>HANDS-ON TASK: HAVE THE STUDENTS LOOK UP AN <u>EVAP DTC</u> FOR A PARTICULAR VEHICLE USING <u>ELECTRONIC SERVICE INFORMATION</u>. WHAT CONDITIONS MUST BE MET TO CAUSE <u>PCM</u> TO SET <u>DTC</u>? HAVE STUDENTS DESCRIBE OEM TROUBLESHOOTING PROCESS FOR DIAGNOSING <u>DTC</u>.</p> <p>EXPLAIN TECH-TIP</p> <p>17. SLIDE 17 EXPLAIN FIGURE 25-16 The fuel level must be above 15% and below 85% before the EVAP monitor will run on most vehicles</p> <p>PCM ON A VEHICLE THAT USES ENGINE-OFF NATURAL VACUUM FOR EVAPORATIVE SYSTEM TESTING MUST STAY "ON," OPERATING LONG AFTER VEHICLE OWNER HAS SHUT OFF IGNITION, IN ORDER TO SATISFACTORILY TEST EVAPORATIVE SYSTEM INTEGRITY. DON'T OVERLOOK THIS CAPABILITY WHEN DIAGNOSING A PARASITIC BATTERY DRAIN.</p> <p>DISCUSSION: HAVE THE STUDENTS DISCUSS HOW A <u>HYBRID VEHICLE'S EVAPORATIVE EMISSION SYSTEM</u> SHOULD DIFFER FROM THAT OF A TRADITIONAL VEHICLE. WILL HYBRID VEHICLE OPERATE LONGER WITH FUEL IN TANK? WHAT MUST THE HYBRID'S SYSTEM BE CAPABLE OF DOING FOR LONGER PERIODS OF TIME?</p>