

Automotive Fuel and Emissions Control Systems 4/E

Chapter 26 Exhaust Gas Recirculation 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. Describe the purpose and functions of exhaust gas recirculation (EGR) systems.2. Explain the strategies to monitor onboard diagnostics generation II (OBD-II) exhaust gas recirculation (EGR) systems.3. Understand the procedure to follow when diagnosing a defective EGR system and interpret EGR-related OBD-II 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 26: [Chapter Images](#)

ICONS



Ch26 Exhaust Gas Recirculation Systems

1. SLIDE 1 CH26 Exhaust Gas Recirculation Systems

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](#))










2. **SLIDE 2 EXPLAIN FIGURE 26-1** Notice haze caused by nitrogen oxides that is often over many major cities

EXHAUST GAS RECIRCULATION, EGR

DISCUSSION: HAVE THE STUDENTS TALK ABOUT HOW EGR SYSTEMS ARE DESIGNED TO RECIRCULATE EXHAUST INTO THE COMBUSTION CHAMBER. WHAT CONDITIONS MUST BE PRESENT TO ALLOW PROPER ENGINE OPERATION WHILE EXHAUST IS RECIRCULATED? FIGURE 24-1

3. **SLIDE 3 EXPLAIN Figure 26-2** When the EGR valve opens, the exhaust gases flow through the valve and into passages in the intake manifold

DEMONSTRATION: WHILE APPLYING VACUUM USING A HAND-HELD PUMP, OPEN & CLOSE A STANDARD EGR VALVE SO STUDENTS CAN SEE DIAPHRAGM & VALVE OPERATION. FIGURE 26-2

ICONS	Ch26 Exhaust Gas Recirculation Systems
	<p><u>DEMONSTRATION: PASS AROUND VARIOUS EGR VALVES TO THE STUDENTS. POINT OUT POSITIVE AND NEGATIVE <u>FIGURE 26-2</u> BACKPRESSURE STYLES AND HOW THEY VARY.</u></p>
	<p>4. SLIDE 4 EXPLAIN Figure 26-3 Back pressure in the exhaust system is used to close the control valve, allowing engine vacuum to open the EGR VALVE</p>
	<p>5. SLIDE 5 EXPLAIN Figure 26-4 Typical vacuum-operated EGR valve. The operation of the valve is controlled by the PCM by pulsing the EGR control solenoid on and off.</p>
<p>EGR VALVES CAN BE TESTED FOR LEAKAGE BY INVERTING AND SPRAYING CARBURETOR CLEANER INTO THE PINTLE VALVE. IF THE CARBURETOR CLEANER LEAKS PAST PINTLE, VALVE IS DEFECTIVE.</p>	<p>EGR VALVES CAN BE TESTED FOR LEAKAGE BY INVERTING AND SPRAYING CARBURETOR CLEANER INTO THE PINTLE VALVE. IF THE CARBURETOR CLEANER LEAKS PAST PINTLE, VALVE IS DEFECTIVE.</p>
	<p>6. SLIDE 6 EXPLAIN Figure 26-5 An EGR valve position sensor on top of an EGR valve</p>
	<p><u>DEMONSTRATION: PASS AROUND BOTH DIGITAL & LINEAR EGR VALVES FOR THE STUDENTS TO SEE. <u>FIGURES 26-3, 4, & 5</u></u></p>
	<p><u>DEMONSTRATION: PASS AROUND <u>VARIOUS TYPES OF EGR VALVE POSITION SENSORS</u> FOR THE STUDENTS TO SEE. <u>FIG 26-3, 4, & 5</u></u></p>
	<p>7. SLIDE 7 EXPLAIN Figure 26-6 Digital EGR valve as used on some older General Motors engines.</p>
	<p>8. SLIDE 8 EXPLAIN Figure 26-7 GM linear EGR valve</p>
	<p>9. SLIDE 9 EXPLAIN FIGURE 26-8 GM linear EGR</p>
	<p>EXPLAIN TECH-TIP</p> <p><u>HANDS-ON TASK: HAVE STUDENTS GRADUALLY OPEN EGR VALVE WITH A HAND OPERATED VACUUM PUMP. HAVE THEM USE AN OHMMETER TO CHECK VALVE POSITION SENSOR RESISTANCE AT VARIOUS VALVE OPENINGS.</u></p>

ICONS

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DISCUSSION: DISCUSS THE DIFFERENCE BETWEEN LINEAR AND DIGITAL EGR VALVES.

WHAT IS THE DIFFERENCE? FIG 26-6, 7, & 8

DISCUSSION: ASK STUDENTS TO DISCUSS & LIST POSSIBLE SYMPTOMS OF A MALFUNCTIONING EGR SYSTEM. WHAT DRIVEABILITY ISSUES COULD BE CAUSED BY TOO MUCH, OR INCORRECT, EGR FLOW OR TIMING? WHAT PROBLEMS CAN BE CAUSED BY NO, TOO LITTLE, EGR FLOW?

10. SLIDE 10 EXPLAIN FIGURE 26-9 A typical Ford DPFE sensor and related components

11. SLIDE 11 EXPLAIN FIGURE 26-10 OBD-II active test. PCM opens the EGR valve, then monitors MAP sensor and/or engine speed (RPM) to meet acceptable values.












DISCUSSION: HAVE THE STUDENTS DISCUSS MALFUNCTIONING EGR SYSTEMS. WHAT PROBLEMS CAN BE ASSOCIATED WITH CONTROL SIDE OF EGR SYSTEM? WHAT PROBLEMS CAN BE ASSOCIATED WITH FUNCTIONAL SIDE OF THE EGR SYSTEM?


DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE VARIOUS TYPES OF WARNING LIGHTS THAT OEMS USE & SIGNIFICANCE OF THE AMBER COLOR. WHAT IS MIL & WHAT IS ITS COLOR?

DISCUSSION: DISCUSS OBD II EGR MONITORS, SEE FIGURE 26-10. HOW ARE THEY USED IN DIAGNOSIS?

HANDS-ON TASK: HAVE STUDENTS DISCONNECT EGR VACUUM HOSE ON A CAR AND DRIVE IT UNTIL IT MEETS ENABLING CRITERIA FOR EGR MONITOR TO RUN. CONNECT A SCAN TOOL & RETRIEVE DTC. IF MONITOR RUNS ONLY ONCE, DTC WILL BE STORED AS A PENDING CODE. IF THE MONITOR RUNS TWICE AND FAILS, A MATURED DTC WILL SET, AND THE MIL WILL BE ILLUMINATED.

18. SLIDE 18 EXPLAIN TECH-TIP

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  	<p>DISCUSS REAL-WORLD TIP</p> <p>EXPLAIN TECH-TIP</p> <p>12. SLIDE 12 EXPLAIN FIGURE 26-11 Removing EGR passage plugs from the intake manifold on a Honda</p>
  <p>QUESTION</p>	<p>DISCUSSION: HAVE THE STUDENTS DISCUSS DETONATION. WHAT IS DETONATION AND HOW IS IT CAUSED? WHAT ARE ITS EFFECTS? WHAT KIND OF MECHANICAL DAMAGE CAN DETONATION CAUSE TO THE ENGINE?</p>
	<p>HANDS-ON TASK: HAVE THE STUDENTS LOOK UP OEM PROCEDURES FOR TESTING EGR SYSTEM ON THEIR OWN VEHICLES.</p>
	<p>SPEED-DENSITY FUEL SYSTEM MEASURES INTAKE MAP (VACUUM) CAN BE FOOLED BY A STUCK OPEN EGR VALVE. OPEN EGR VALVE ADMITS EXHAUST PRESSURE INTO INTAKE MANIFOLD, WHICH PCM MISINTERPRETS AS AN INCREASE IN ENGINE LOAD, DRIVING FUEL SYSTEM VERY RICH. ADDITIONAL FUEL WILL KEEP ENGINE RUNNING, ALTHOUGH POORLY DUE TO EXCESS EXHAUST. BLACK EXHAUST SMOKE CAUSED BY THIS OVERLY RICH CONDITION CAN CAUSE TECHNICIAN TO MISTAKENLY LOOK FOR FUEL SYSTEM PROBLEM</p>
<p>DEMO</p> 	<p>DEMONSTRATION: ON A RUNNING ENGINE, APPLY VACUUM INCREMENTALLY TO THE EGR VALVE USING A HAND-HELD VACUUM PUMP. SHOW EFFECT OF INCREASED VACUUM ON ENGINE OPERATION AS EGR VALVE OPENS UP. APPLY ENOUGH VACUUM TO STALL THE ENGINE.</p>
<p>DEMO</p> 	<p>DEMONSTRATION: ON A VEHICLE WITH EITHER A DIGITAL OR LINEAR EGR VALVE, OPEN THE VALVE INCREMENTALLY WITH A BIDIRECTIONAL SCAN TOOL TO SHOW STUDENTS ITS EFFECTS</p>
 	<p>ON-VEHICLE NATEF TASK: INSPECT, TEST, SERVICE AND REPLACE COMPONENTS OF EGR SYSTEM, EXHAUST PASSAGES, VACUUM/PRESSURE CONTROLS, FILTERS AND HOSES; PERFORM</p>

ICONS	Ch26 Exhaust Gas Recirculation Systems
 The image contains two icons. On the left is the ASE NATEF logo, which features a blue gear-like shape with 'ASE' inside, followed by the text 'We Support NATEF'. On the right is a yellow square icon containing a black silhouette of a car and a wrench.	<p>NECESSARY ACTION.</p> <p>ON-VEHICLE NATEF TASK: INSPECT AND TEST ELECTRICAL/ELECTRONIC SENSORS, CONTROLS, AND WIRING OF EXHAUST GAS RECIRCULATION (EGR) SYSTEMS; PERFORM NECESSARY ACTION.</p>