Introduction to Automotive Service
Chapter 31 Fuel-Injection System
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. 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 this session or class.	Explain learning objectives to students. 1. Prepare for ASE Engine Performance (A8) certification test content area "C" (Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair). 2. Describe how a port fuel-injection system works. 3. Discuss the purpose and function of the fuel-pressure regulator. 4. List the types of fuel-injection systems 5. Describe the parts and operation of a gasoline fuel injection system.
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.

ICONS	Chapter 31 Fuel-Injection Systems
	1. SLIDE 1 CH31 FUEL-INJECTION SYSTEMS
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS UPDATED REGULARLY
	2. **SLIDES 2-4 EXPLAIN Electronic Fuel-Injection**
	5. **SLIDE 5 EXPLAIN Figure 31-1** Typical port fuel-injection system, indicating the location of various components. Notice that the fuel-pressure regulator is located on the fuel return side of the system. The computer does not control fuel pressure. But does control the operation of the electric fuel pump (on most systems) and the pulsing on and off of injectors
	**DISCUSSION: Have the students discuss how the PCM controls fuel injection system. What are some common components of an electronic fuel-injection system? FIGURE 31-1**
	**DISCUSSION: Have the students discuss the two types of electronic fuel-injection systems. Which type is more efficient? Discuss diagram shown in FIGURE 31–1. Why is the pressure regulator positioned after the injectors?**
	6. **SLIDE 6 EXPLAIN Figure 31-2** A dual-nozzle TBI unit on a Chevrolet 4.3-L V-6 engine. The fuel is squirted above the throttle plate where the fuel mixes with air before entering the intake manifold**.** 7. **SLIDE 7 EXPLAIN Figure 31-3** typical port fuel-injection system squirts fuel into the low pressure (vacuum) of the intake manifold, about 2 to 3 in. (70 to 100 mm) from the intake valve
	**DEMONSTRATION: Show examples of fuel injectors. Show them injectors for a port-injection system and throttle-body injection. Discuss similarity of injectors. FIGURES 31-1 to 31-3**

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	**8. SLIDE 8 EXPLAIN Figure 31-4** typical direct-injection system uses two pumps—one low-pressure electric pump in the fuel tank and the other a high-pressure pump driven by the camshaft. The high pressure fuel system operates at a pressure as low as 500 PSI during light load conditions and as high as 2,900 PSI under heavy loads.
	**DEMONSTRATION: Show the students how to use a stethoscope to listen for noises.**
	**HANDS-ON TASK: Have them use stethoscope to listen to fuel injectors on running engine.**
	**9. SLIDE 9 EXPLAIN Fuel Injectors** **10. SLIDE 10 EXPLAIN FIGURE 31-5** Cross-section of a typical port fuel-injection nozzle assembly. These injectors are serviced as an assembly only; no part replacement or service is possible except for replacement of external O-ring seals
	**DEMONSTRATION: Show fuel injectors, having them note strainer screen, the seals, and fuel discharge nozzle. Show students a central port-injection assembly from GM vehicle & point out central injector, Fuel distribution tubes, & poppet valves in each tube nozzle.**
	**DISCUSSION: Have students discuss fuel injectors design. Do injectors that have distinctive spray patterns have to be installed in a specific way? Why are deposit-resistant fuel injectors used in some applications?**
	**DISCUSSION: Have the students discuss Fuel Injector Modes Of Operation. What actually controls these modes of operation?**
	**DEMONSTRATION: Demonstrate clear flood mode operation to the students. Try this before class to make sure the vehicle will comply.**

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	**11. SLIDES 11-12 EXPLAIN Fuel-Pressure Regulator** **13. SLIDE 13 EXPLAIN FIGURE 31-6** A typical port fuel-injected system showing a vacuum-controlled fuel-pressure regulator
	**14. SLIDE 14 EXPLAIN Fuel-Pressure Regulator** **15. SLIDE 15 EXPLAIN FIGURE 31-7** An idle control unit has four wires and it uses a reversible stepper motor to regulate the amount of air bypassing the throttle plate. **16. SLIDE 16 EXPLAIN Idle Control**
	**Show ANIMATION: IAC OPERATION (Ch78) www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A16_Animation/Chapter59_Fig_59_24/index.htm
	**DISCUSSION: Have the students talk about the need for an idle control system on fuel-injected engine. What other function can this control perform? Discuss stepper motors & solenoids used for idle air control. Which of these is more accurate?**
	**DEMONSTRATION: While monitoring data on a scan tool, start engine & allow students to see steps or percentage of idle air control performed by PCM. Show examples of idle air control valves or stepper motors used on fuel-injected engines.**
	**17. SLIDE 17 EXPLAIN FIGURE 31-8** The throttle pedal is connected to the accelerator pedal position (APP) sensor. The electronic throttle body includes a throttle position sensor to provide throttle angle feedback to the vehicle computer. Some systems use a throttle actuator control (TAC) module to operate throttle blade (plate).
	**DISCUSSION: Ask the students to discuss the throttle body assembly FIGURE 80-4 for an electronic throttle control system. How is it same as & how does it differ from conventional system?**
	**HANDS-ON TASK: Show the students a throttle body from an ETC system, if available. Let them inspect throttle body, feel spring tension, and see size of DC actuator motor.**

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	**Homework:** complete Ch31 crossword puzzle: http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_31.pdf