Automotive Technology 5th Edition
Chapter 77 FUEL PUMPS, LINES, & FILTERS
Opening Your Class

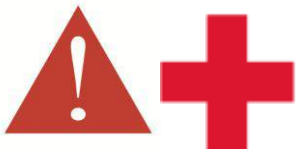
KEY ELEMENT	EXAMPLES
Introduce Content	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
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 as listed below: 1. Explain the role of fuel tanks in the fuel delivery system. 2. Discuss the different types of fuel lines. 3. Explain the different types of electric fuel pumps. 4. Describe how to test and replace fuel filters. 5. Describe how to test and replace fuel pumps.
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.

NOTE: This lesson plan is based on the 5th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 77: ATE5 Chapter Images

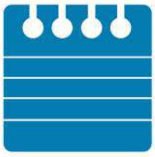
ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	1. SLIDE 1 Ch77 FUEL PUMPS, LINES, & FILTERS
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED
	**Videos**
	**DISCUSSION: Have the students talk about the various components used in fuel delivery system. What is the purpose of fuel delivery systems?**
	**DISCUSSION: Have the students discuss the use of baffles in fuel tanks. Ask them if they have ever heard fuel sloshing in a fuel tank.**
	**DEMONSTRATION: Show examples of metal & plastic fuel tanks. Discuss whether there are advantages to using tanks made from either of these materials**
	2. **SLIDE 2 EXPLAIN Figure 77-1** typical fuel tank installation. 3. **SLIDE 3 EXPLAIN Figure 77-2** A three-piece filler tube assembly. The main three parts include the upper neck, hose, and lower neck.
	**DISCUSSION: Have the students discuss the mounting position of fuel tanks. What factors are considerations in fuel tank location?** **FIGURES 77-1 & 2**
	4. **SLIDE 4 EXPLAIN Figure 77-3** view of a typical filler tube with the fuel tank removed. Notice the ground strap used to help prevent the buildup of static electricity as the fuel flows into the plastic tank. The check ball looks exactly like a ping-pong ball
	**DISCUSSION: discuss onboard fueling vapor recovery systems. How is this system different from the recovery system used on gasoline pumps?**

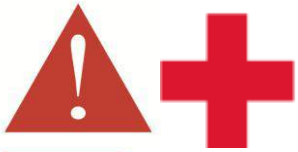
ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	5. **SLIDE 5 EXPLAIN Figure 77-4** Vehicles equipped with onboard refueling vapor recovery usually have a reduced-size fill tube.
	**DEMONSTRATION: Show a fuel tank filler neck from a vehicle equipped with an onboard refueling vapor recovery system, pointing out the reduced neck size and the vent. FIGURE 77-4**
	6. **SLIDE 6 EXPLAIN Figure 77-5** fuel pickup tube is part of the fuel sender and pump assembly.
	**DEMONSTRATION: Show fuel pump/pickup tube assembly. Point out the filter sock & fuel return line. FIGURE 77-5**
	**DEMONSTRATION: Show the students charcoal canister storage device for fuel vapors.**
	**DISCUSSION: Have the students discuss the components of an evaporative emission control system. How are fuel vapors vented?**
	**HANDS-ON TASK: Have students locate & identify fuel system components on LAB vehicle. Grade them on accuracy in identifying components and their understanding of the fuel system.**
	7. **SLIDE 7 EXPLAIN Figure 77-6** On some vehicles equipped with an airflow sensor, a switch is used to energize the fuel pump. In the event of a collision, the switch opens and the fuel flow stops.
	8. **SLIDE 8 EXPLAIN Figure 77-7** Ford uses an inertia switch to turn off the electric fuel pump in an accident.
	**DISCUSSION: Have the students discuss different types of fuel lines. What are advantages & disadvantages of different materials?**
	**DEMONSTRATION: Show Ford inertia switch used to turn off fuel pump in event of an accident. If Ford vehicle is available, trip switch by tapping on it to show students how it works FIGURE 77-7**

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	**Some Ford vehicles, mainly trucks, have fuel pump inertia switch located inside the cab on either the firewall or cowl side panel.**
	9. **SLIDE 9 EXPLAIN Figure 77-8** Fuel lines are routed along the frame or body and secured with clips.
	**DEMONSTRATION: Show examples of rigid & flexible fuel lines used on a vehicle. Discuss material, routing, & retention methods used. FIGURE 77-8**
	**SAFETY Explain the dangers involved when working with fuel systems. Some of these systems can operate at pressures of 80 to 100 psi. Any time a fuel line needs to be disconnected, fuel pressure must be released using OEM recommended method.**
	**DISCUSSION: Have the students discuss newer fuel supply systems that do not utilize a return line. What components had to be modified or changed for this system to operate properly?**
	10. **SLIDE 10 EXPLAIN Figure 77-9** Some Ford metal line connections use spring locks and O-rings. 11. **SLIDE 11 EXPLAIN Figure 77-10** Ford spring-lock connectors require a special tool for disassembly. 12. **SLIDE 12 EXPLAIN Figure 77-11** Typical quick-connect steps
	**DEMONSTRATION: Show examples of fuel line spring-lock fittings. Show special tools needed to disconnect these fittings. FIGURES 77-9 to 11**
	**HANDS-ON TASK: Have students disassemble and reassemble fuel line connections, including spring-lock fittings. FIGURES 77-9, 10, & 11**
	13. **SLIDE 13 EXPLAIN Figure 77-12** A roller cell-type electric fuel pump

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	**DEMONSTRATION: Show examples of rotary fuel pumps and discuss how they work. FIGURES 77-12 & 13**
	**14. SLIDE 14 EXPLAIN Figure 77-13** The pumping action of an impeller or rotary vane pump.
	**DISCUSSION: Ask students to discuss rotary vane fuel pump shown in Figure 77–13. Will pump be able to pump more fuel if it turns faster?**
	**15. SLIDE 15 EXPLAIN Figure 77-14** An exploded view of a gerotor electric fuel pump.
	**DISCUSSION: Ask the students to discuss the gerotor-type pump. What process does this type of pump use to pressurize fuel? FIGURES 77-14**
	**DEMONSTRATION: Show example of a gerotor type fuel pump. Explain difference between it & vane-type pump. Then, show students example of a turbine type fuel pump. FIGURES 77-14 & 15**
	**16. SLIDE 16 EXPLAIN Figure 77-15** A cutaway view of a typical two-stage turbine electric fuel pump.
	**DEMONSTRATION: Show example of a modular fuel sender assembly used in modern vehicles. Point out the pump, convoluted tube, & float assembly. FIGURES 77-16**
	**DISCUSSION: Have the students' discuss reason fuel pump modules are spring-loaded. Does fuel tank material make a difference?**
	**DISCUSSION: Have the students talk about electric fuel pump control circuits. Why are relays controlled by the PCM?**
	**18. SLIDE 18 EXPLAIN Figure 77-17** schematic showing that an inertia switch is connected in series between the fuel-pump relay and the fuel pump.

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	**DISCUSSION:** Ask the students to discuss wiring diagram shown in **FIGURE 77–17**. Could inertia switch be placed anywhere else in circuit and still provide same results?
	19. **SLIDE 19 EXPLAIN Figure 77-18** A typical fuel pulsator used mostly with roller vane-type pumps to help even out the pulsation in pressure that can cause noise
	**DISCUSSION:** Have the students discuss the **pulsators and accumulators** used in fuel supply system. Why do some experts advise removal of the pulsators in the fuel tank? **FIGURE 77–18**
	20. **SLIDE 20 EXPLAIN Figure 77-19** Inline fuel filters are usually attached to the fuel line with screw clamps or threaded connections. Fuel filter must be installed in the proper direction or a restricted fuel flow can result. 21. **SLIDE 21 EXPLAIN FIGURE 77.20** final filter, also called a filter basket, is the last filter in fuel system.
	Fuel Filters (View) (Download) Low Side Driver Control (View) (Download) Output Driver Control (View) (Download)
	**DEMONSTRATION:** Show **location of fuel filters** on vehicles in the shop. Are all filters located in common areas? **FIGURE 77–19**
	**DEMONSTRATION:** Show examples of fuel filters. Show some filters from the carbureted era, as well as modern high pressure filters used in fuel-injected vehicles. Point out that a vehicle with a returnless-type fuel system will most likely have fuel filter inside fuel tank. **FIGURE 77–19**
	**DISCUSSION:** Have the students discuss need to filter fuel before it goes through any fuel metering device, such as a carburetor or fuel injector. What do fuel filters remove? **FIGURE 77–19 & 20**
	**ON-VEHICLE NATEF TASK:** Replace fuel **filters**. **Page 246**

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	**DISCUSSION: Have the students discuss fuel pump test procedures. What drivability problems would warrant a fuel pump test?**
	**DEMONSTRATION: Show how to jar a stalled fuel pump into operation by striking the fuel tank. Why should a rubber mallet be used for this procedure? Then, show students how to listen for fuel pump operation by removing fuel cap and inserting a funnel into filler neck. FIGURE 77–21**
	22. **SLIDE 22 EXPLAIN FIGURE 77-21A** funnel helps in hearing if electric fuel pump inside gas tank is working. 23. **SLIDE 23 EXPLAIN FIGURE 77.21B** If the pump is not running, check the wiring and current flow before going through the process of dropping the fuel tank to remove the pump 24. **SLIDE 24 EXPLAIN Figure 77-22** The Schrader valve on this General Motors 3800 V-6 is located next to the fuel-pressure regulator. 25. **SLIDE 25 EXPLAIN Figure 77-23** fuel system should hold pressure if the system is leak free
	**DISCUSSION: Discuss Pressure-Testing Fuel Pump. If pressure is correct at idle, will it also be correct under load? FIGURE 77–22 & 23. Discuss rest pressure test. What could happen if pressure leaks down rapidly? Discuss dynamic pressure test. If pressure doesn't change when throttle is cycled, what problems might exist?**
	26. **SLIDE 26 EXPLAIN Figure 77-24** If vacuum hose is removed from fuel pressure regulator when the engine is running, fuel pressure should increase. If it does not increase, then fuel pump is not capable of supplying adequate pressure or fuel-pressure regulator is defective. If gasoline is visible in the vacuum hose, the regulator is leaking and should be replaced
	**Presence of fuel in vacuum line to regulator can mean only one thing—diaphragm is leaking. This can cause multiple drivability problems and DTCS: FIGURE 77–24 & 25**

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
 	**HANDS-ON TASK:** Give students a list of Vehicles. Have them use reference materials to **locate fuel pressure specifications & test procedure** for each vehicle. 27. **SLIDE 27 EXPLAIN FIGURE 77-25** Fuel should be heard returning to the fuel tank at the fuel return line if the fuel pump and fuel-pressure regulator are functioning correctly 28. **SLIDE 28 EXPLAIN Figure 77-26** A fuel-pressure reading does not confirm that there is enough fuel volume for the engine to operate correctly. 29. **SLIDE 29 EXPLAIN Figure 77-27** A fuel system tester connected in series in the fuel system so all of the fuel used flows through the meter which displays the rate-of-flow and the fuel pressure. 30. **SLIDE 30 EXPLAIN FIGURE 77-28** Removing the bed from a pickup truck makes gaining access to the fuel pump a lot easier
 	**DISCUSSION:** Have the students talk about the need for proper volume of fuel **FIGURE 77–26**. What are some indicators of a clogged fuel filter? **DEMONSTRATION:** Demonstrate quick & easy fuel pump volume test (**TECH-TIP PG 872**). Is this test 100% accurate? **FIGURE 77–26 & 27**
 	**SAFETY EXTREME CAUTION** advised when working around any component of the fuel system, especially when the engine is hot. **DISCUSSION:** discuss whether removing bed from a pick-up truck might make it easier to replace a fuel pump. If tank was completely full of fuel, would this procedure help? **FIGURE 77–28**
	**ON-VEHICLE NATEF TASK:** Inspect and test **fuel pumps & pump control** systems for pressure, regulation, and volume; perform necessary action. **Page 244**
	31. **SLIDE 31 EXPLAIN Figure 77-29** Hookup for testing fuel-pump current draw on any vehicle equipped with a fuel-pump relay.

ICONS	Chapter 77 Fuel Pumps, Lines, & Filters
	**DEMONSTRATION:** Explain how a current draw test can indicate a worn fuel pump. Use fuel pump current draw table to show that a pump can draw more or less current than specifications. Show students how to perform the Fuel Pump Current Draw Test.
	**ON-VEHICLE NATEF TASK:** Fuel Pump Current Draw Test. Page 245
	**ON-VEHICLE NATEF TASK:** Perform active tests of actuators using a scan tool; determine necessary action. Page 247
	Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)