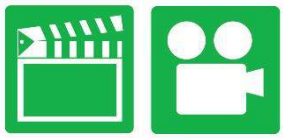
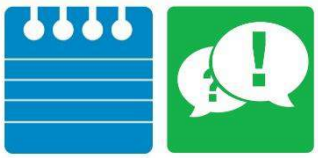
Automotive Electrical & Engine Performance 7/E

Chapter 34 Fuel Pumps, Lines, & Filters

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	**This course or class covers Automotive Electrical & Engine Performance. 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 the chapter learning objectives to the students. 1. Discuss the purpose and function of the fuel delivery system. 2. Explain the types of fuel lines. 3. Discuss the different types of electric fuel pumps. 4. Describe the purpose and function of 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 Automotive Electrical & Engine Performance 7/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 34:Chapter Images

ICONS	Ch34 Fuel Pumps, Lines, & Filters
	**1. SLIDE 1 CH34 Fuel Pumps, Lines, & Filters**
	**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)**
	**DISCUSSION:HAVE THE STUDENTS TALKABOUT THE VARIOUS COMPONENTS USED IN FUEL DELIVERY SYSTEM.WHAT IS THE PURPOSE OF FUEL DELIVERY SYSTEMS?**
	**DISCUSSION:HAVE THE STUDENTSDISCUSS THE USE OFBAFFLES IN FUEL TANKS.ASK THEM IF THEY HAVEEVER HEARD FUEL SLOSHINGIN 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 2EXPLAINFigure 34-1** typical fuel tank installation. **3. SLIDE 3EXPLAINFigure 34-2** 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? FIGURES34-1 & 2**

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	4. **SLIDE 4EXPLAINFigure 34-3** 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:HAVE THE STUDENTS TALK ABOUT ONBOARD FUELING VAPOR RECOVERY SYSTEMS. HOW IS THIS SYSTEM DIFFERENT FROM THE RECOVERY SYSTEM USED ON GASOLINE PUMPS? FIGURE 34-3**
	5. **SLIDE 5EXPLAINFigure 34-4** Vehicles equipped with onboard refueling vapor recovery usually have a reduced-size fill tube.
	**DEMONSTRATION: SHOW FUEL TANK FILLER NECK FROM VEHICLE EQUIPPED WITH AN ONBOARD REFUELINGVAPOR RECOVERY SYSTEM, POINTING OUT REDUCED NECK SIZE &VENT. FIGURE34-4**
	6. **SLIDE 6EXPLAINFigure 34-5** fuel pickup tube is part of the fuel sender and pump assembly.
	**DEMONSTRATION: SHOW FUEL PUMP/PICKUP TUBE ASSEMBLY. POINT OUT FILTER SOCK & FUEL RETURN LINE. FIGURE34-5**
	**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.**

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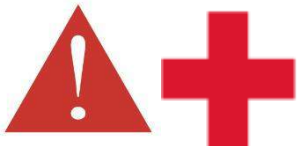
	7. **SLIDE 7EXPLAINFigure 34-6** On some vehicles equipped with an airflow sensor, a switch is used to energize the fuel pump. In the event of a collision, the switch opens and the fuel flow stops. 8. **SLIDE 8EXPLAINFigure 34-7** Ford uses an inertia switch to turn off the electric fuel pump in an accident.
	**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 34-7**
	**SOME FORD VEHICLES, MAINLY TRUCKS, HAVE FUEL PUMP INERTIA SWITCH LOCATED INSIDE CAB ON EITHER FIREWALL OR COWL SIDE PANEL.**
	9. **SLIDE 9EXPLAINFigure 34-8** 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 34-8**
	**SAFETYEXPLAIN DANGERS INVOLVED WHEN WORKING WITH FUEL SYSTEMS. SOME OF THESE SYSTEMS CAN OPERATE AT PRESSURES OF 80-100 PSI. ANY TIME FUEL LINE NEEDS TO BE DISCONNECTED, FUEL PRESSURE MUST BE RELEASED USING OEM METHOD.**
	**DISCUSSION: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?**
	10. **SLIDE 10EXPLAINFigure 34-9** Some Ford metal line connections use springlocks and O-rings. 11. **SLIDE 11EXPLAINFigure 34-10** Ford spring-lock connectors require a special tool for disassembly.

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	12. **SLIDE 12EXPLAINFigure 34-11** Typical quick-connect steps **DISCUSS FREQUENTLY ASKED QUESTION**
	**DEMONSTRATION: SHOW EXAMPLES OF FUEL LINE SPRING-LOCK FITTINGS. SHOW SPECIAL TOOLS NEEDED TO DISCONNECT THESE FITTINGS.FIGURES 34-9 TO 11** **HANDS-ON TASK: HAVE STUDENTS DISASSEMBLE AND REASSEMBLE FUEL LINE CONNECTIONS, INCLUDING SPRING-LOCK FITTINGS. FIGURES 34-9, 10, & 11**
	13. **SLIDE 13EXPLAINFigure 34-12** A roller cell-type electric fuel pump
	**DEMONSTRATION: SHOW EXAMPLES OF ROTARY FUELPUMPS AND DISCUSS HOW THEY WORK. FIGURES 34-12 & 13**
	14. **SLIDE 14EXPLAINFigure 34-13** The pumping action of an impeller or rotary vane pump
	**DISCUSSION:ASK STUDENTS TO DISCUSS ROTARY VANE FUEL PUMP SHOWN IN FIGURE 34–13. WILL PUMP BE ABLE TO PUMP MORE FUEL IF IT TURNS FASTER?**
	15. **SLIDE 15EXPLAINFigure 34-14** 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 34-14**
	**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**

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	**PUMP. FIGURES 34-14 & 15** 16. **SLIDE 16EXPLAINFigure 34-15** A cutaway view of a typical two-stage turbine electric fuel pump.
	**DISCUSS FREQUENTLY ASKED QUESTION** 17. **SLIDE 17EXPLAIN FIGURE 34–16** A typical fuel-pump module assembly, which includes the pickup strainer and fuel pump, as well as the fuelpressure sensor and fuel level sensing unit
	**DEMONSTRATION: SHOW MODULAR FUEL SENDER ASSEMBLY USED IN MODERN VEHICLES. POINT OUT THE PUMP, CONVOLUTED TUBE, & FLOAT ASSEMBLY. FIGURES 34-16**
	**DISCUSSION: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 18EXPLAINFigure 34-17** schematic showing that an inertia switch is connected in series between the fuel-pump relay and the fuel pump.
	**DISCUSSION:DISCUSS WIRING DIAGRAM SHOWN IN FIGURE 34–17. COULD INERTIA SWITCH BE PLACED ANYWHERE ELSE IN CIRCUIT AND STILL PROVIDE SAME RESULTS?**
	19. **SLIDE 19EXPLAINFigure 34-18** 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 34–18**
	**ANIMATION: FUEL FILTERS**

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        	**20. SLIDE 20EXPLAINFigure 34-19** 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. **EXPLAIN TECH-TIP** **DEMONSTRATION: SHOW LOCATION OF FUEL FILTERS ON VEHICLES. ARE ALL FILTERS LOCATED IN COMMON AREAS? FIGURE 34–19** **DEMONSTRATION: SHOW EXAMPLES OF FUEL FILTERS. SHOW SOME FILTERS FROM CARBURETED ERA& HIGH PRESSURE FILTERS USED IN FUEL-INJECTED VEHICLES. POINT OUT THAT VEHICLE WITH RETURNLESS-TYPE FUEL SYSTEM WILL MOST LIKELY HAVE FUEL FILTER INSIDE FUEL TANK. FIGURE 34–19** **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 34–19 & 20** **ON-VEHICLE NATEF TASKREPLACE FUEL FILTERS** **DISCUSSION:HAVE THE STUDENTS DISCUSS FUEL PUMP TEST PROCEDURES. WHAT DRIVABILITY PROBLEMS WOULD WARRANT A FUEL PUMP TEST?** **21. SLIDES 21EXPLAIN FIGURE 34–20** The final filter, also called a filter basket, is the last filter in the fuel system **EXPLAIN TECH-TIP** **22. SLIDE 22EXPLAIN FIGURE 34–21** (a) A funnel helps in hearing if the electric fuel pump inside the gas tank is working. (b) 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

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	**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 &INSERTING A FUNNEL INTO FILLER NECK. FIGURE 34–21**
	**23. SLIDE 23EXPLAINFigure 34-22** The Schrader valve on this General Motors 3800 V-6 is located next to the fuel-pressure regulator
	**EXPLAIN TECH-TIP**
	**24. SLIDE 24EXPLAINFigure 34-23**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 34–22 & 23. DISCUSS REST PRESSURE TEST. WHATCOULD HAPPEN IF PRESSURE LEAKS DOWNRAPIDLY?DISCUSS DYNAMIC PRESSURE TEST. IF PRESSURE DOESN'T CHANGEWHEN THROTTLE ISCYCLED, WHAT MIGHT EXIST?**
	**25. SLIDE 25EXPLAINFigure 34-24** If vacuum hose is removed from fuelpressure 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 34–24 & 25**
	**HANDS-ON TASK: GIVE STUDENTS LIST OF VEHICLES. HAVE THEM LOCATE FUEL PRESSURE SPECIFICATIONS &TEST PROCEDURE FOR EACH VEHICLE.**

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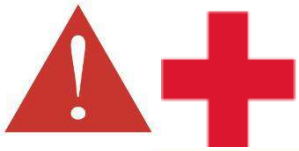
	**EXPLAIN TECH-TIP** **26. SLIDE 26EXPLAIN FIGURE 34–25** Fuel should be heard returning to fuel tank at fuel return line if fuel pump & fuel-pressure regulator are functioning correctly. **27. SLIDE 27EXPLAINFigure 34-26** A fuel-pressure reading does not confirm that there is enough fuel volume for the engine to operate correctly.
	**DISCUSSION:HAVE THE STUDENTS TALK ABOUT THE NEED FOR PROPER VOLUME OF FUEL FIGURE 34–26. WHAT ARE SOME INDICATORS OF A CLOGGED FUEL FILTER?**
	**28. SLIDES 28EXPLAIN FIGURE 34–27**Fuel should be heard returning to fuel tank at fuel return line if fuel pump & fuel-pressure regulator are functioning correctly.
	**DEMONSTRATION: DEMONSTRATE QUICK & EASY FUEL PUMP VOLUME TEST. IS THIS TEST 100% ACCURATE? FIGURE 34–26 & 27**
	**EXPLAIN TECH-TIP** **29. SLIDE 29EXPLAIN FIGURE 34–28** Removing bed from a pickup truck makes gaining access to fuel pump a lot easier
	**DISCUSSION:HAVE STUDENTS 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 34–28**
	**30. SLIDE 30EXPLAINFUEL-PUMP CURRENT DRAW TEST FIGURE 34–29** Hookup for testing fuel-pump current draw on any vehicle equipped with a fuel-pump relay
	**SAFETYEXTREME CAUTION ADVISED WHEN WORKING AROUND ANY COMPONENT OF THE FUEL SYSTEM, ESPECIALLY WHEN THE ENGINE IS HOT.**
	**ON-VEHICLE NATEF TASKINSPECT AND TEST FUEL PUMPS & PUMP CONTROL SYSTEMS FOR PRESSURE, REGULATION, AND VOLUME; PERFORM NECESSARY ACTION.**

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	**DEMONSTRATION:** EXPLAIN HOW A **CURRENT DRAW TEST** CAN INDICATE A WORN FUEL PUMP. USE FUEL PUMP CURRENT DRAW TABLE TO SHOW THAT PUMP CAN DRAW MORE OR LESS CURRENT THAN SPECIFICATIONS. SHOW HOW TO PERFORM **FUEL PUMP CURRENT DRAW TEST**.
	**ON-VEHICLE NATEF TASK**FUEL PUMP CURRENT DRAW TEST
	**ON-VEHICLE NATEF TASK**PERFORM ACTIVE TESTS OF **ACTUATORS** USING A **SCAN TOOL**; DETERMINE NECESSARY ACTION