Advanced Engine Performance Diagnosis 6/E

Chapter 17 MAP/BARO SENSORS

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 the chapter learning objectives to the students. 1. Discuss purpose and function of manifold absolute pressure (MAP) sensors. 2. Explain the PCM uses of MAP sensors. 3. Explain the purpose and function of barometric pressure (BARO) sensors. 4. List the methods that can be used to test MAP sensors
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 Advanced Engine Performance Diagnosis 6/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 17: Chapter Images

ICONS	Ch17 MAP/BARO SENSORS
	**1. SLIDE 1 CH17 MAP/BARO SENSORS**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED** **Engine Controls (284 Links)**
	
	**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 17-1** (a) As an engine is accelerated under a load, the engine vacuum drops. This drop in vacuum is actually an increase in absolute pressure in the intake manifold. A MAP sensor senses all pressures greater than that of a perfect vacuum. (b) The relationship between absolute pressure, vacuum, and gauge pressure.
	**DISCUSSION: HAVE THE STUDENTS DISCUSS INTAKE MANIFOLD PRESSURE. HOW AND WHY DOES THROTTLE ANGLE AFFECT INTAKE MANIFOLD VACUUM? DISCUSS THE DIFFERENCE BETWEEN PSIG & PSIA. HOW IS A PERFECT VACUUM INDICATED IN GAUGE PRESSURE? HOW IS ATMOSPHERIC PRESSURE, OR BAROMETRIC PRESSURE, INDICATED IN ABSOLUTE PRESSURE?** **FIGURE 17-1**
	**DISCUSSION: HAVE THE STUDENTS DISCUSS THE DIFFERENCE BETWEEN MAP, BARO, & BMAP SENSORS. IS THERE ANY ADVANTAGE TO USING SEPARATE MAP & BARO SENSORS?**

ICONS	Ch17 MAP/BARO SENSORS
	3. **SLIDE 3 EXPLAIN Figure 17-2** A clear plastic MAP sensor used for training purposes showing the electronic circuit board and electrical connections
	**DEMONSTRATION: SHOW WHAT A MAP SENSOR LOOKS LIKE AND DISCUSS WHERE IT CAN BE FOUND ON MOST VEHICLES. FIGURE 17-2**
	**DISCUSSION: HAVE THE STUDENTS COMPARE AND CONTRAST DIFFERENT TYPES OF PRESSURE SENSORS (SILICON DIAPHRAGM, CAPACITOR CAPSULE, & CERAMIC DISC). WHICH IS MOST COMMONLY USED DESIGN FOR A MAP SENSOR?**
	4. **SLIDE 4 EXPLAIN Figure 17-3** MAP sensors use three wires: 1. 5-volt reference from the PCM 2. Sensor signal (output signal) 3. Ground. A DMM set to test a MAP sensor. (1) Connect the red meter lead to the V meter terminal and the black meter lead to the COM meter terminal. (2) Select DC volts. (3) Connect the test leads to the sensor signal wire and the ground wire. (4) Select hertz (Hz) if testing a MAP sensor whose output is a varying frequency; otherwise keep it on DC volts. (5) Read the change of voltage (frequency) as the vacuum is applied to the sensor. Compare the vacuum reading and the frequency (or voltage) reading to the specifications.
	**DISCUSSION: HAVE THE STUDENTS DISCUSS FREQUENCY. WHAT IS FREQUENCY? HOW IS IT MEASURED?**
	**HANDS-ON TASK: HAVE THE STUDENTS USE A DMM TO MONITOR MAP SENSOR FREQUENCY. FIGURE 17-3**
	5. **SLIDE 5 EXPLAIN Figure 17-4** A waveform of a typical digital MAP sensor.
	**DEMONSTRATION: SHOW THE STUDENTS HOW TO USE A DSO TO MONITOR MAP SENSOR FREQUENCY. SHOW THEM HOW FREQUENCY CHANGES WITH CHANGES IN ENGINE LOAD. FIGURE 17-4**

ICONS	Ch17 MAP/BARO SENSORS
	6. **SLIDE 6 EXPLAIN Figure 17-5** Shown is the electronic circuit inside a ceramic disc MAP sensor used on many Chrysler engines. The black areas are carbon resistors that are applied to the ceramic, and lasers are used to cut lines into these resistors during testing to achieve the proper operating calibration
	**DISCUSSION: HAVE STUDENTS DISCUSS EGR SYSTEM OPERATION. HOW COULD A LEAKING EGR PINTLE AFFECT MAP SENSOR READINGS?**
	7. **SLIDE 7 EXPLAIN Figure 17-6** Altitude affects the MAP sensor voltage.
	**EXPLAIN TECH-TIP ON PAGE 237**
	**DISCUSSION: HAVE THE STUDENTS DISCUSS HOW INTAKE MANIFOLD VACUUM LEAKS AFFECT MAP SENSOR READINGS. HOW MIGHT THIS PROBLEM IMPACT FUEL ECONOMY AND EMISSIONS?**
	**DISCUSS REAL WORLD FIX**
	**OLDER GM PRODUCTS THAT USED MAP & BARO SENSORS USED DIFFERENT COLOR CONNECTORS TO HELP TECHNICIANS TELL ONE FROM OTHER.**
	**DISCUSSION: HAVE THE STUDENTS DISCUSS WHAT A BARO SENSOR DETECTS. HOW DOES A REDUCTION IN BAROMETRIC PRESSURE AFFECT ENGINE OPERATION?**
	**EXPLAIN TECH-TIP ON PAGE 239**
	**HANDS-ON TASK: HAVE THE STUDENTS USE A SCAN TOOL TO MONITOR MAP SENSOR OPERATION.**
	8. **SLIDE 8 EXPLAIN** Testing MAP Sensor **Figure 17-7** hand-operated vacuum pump

ICONS	Ch17 MAP/BARO SENSORS
    	**DEMONSTRATION:** USE A VACUUM PUMP HOOKED UP TO MAP SENSOR & SCAN TOOL TO SHOW STUDENTS HOW CHANGES IN ENGINE LOAD (MANIFOLD VACUUM) AFFECT PULSE WIDTH (AIR-FUEL MIXTURE). **FIGURE 17-7** **DISCUSSION:** HAVE THE STUDENTS DISCUSS HOW INCREASES AND DECREASES IN FUEL RAIL PRESSURE AFFECT INJECTOR PULSE WIDTH. WHY DOES THIS HAPPEN? **ON-VEHICLE NATEF TASK** INSPECT AND TEST **MAP SENSOR** USING A GMM)/(DSO); PERFORM NECESSARY ACTION